Taskforce on Nature-related Financial Disclosures

Guidance on the identification and assessment of nature-related issues: The LEAP approach

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Contents

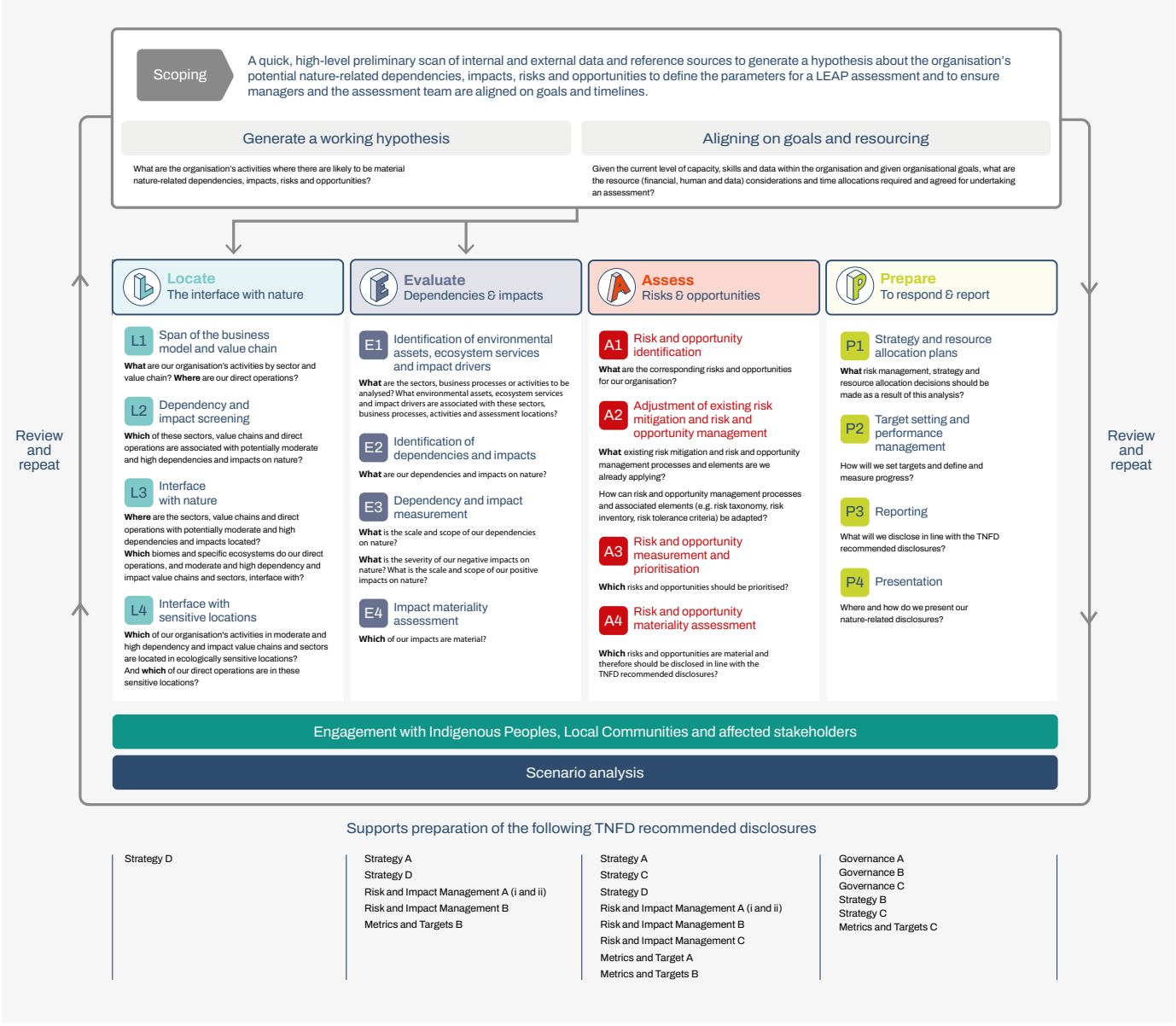
1. Introduction

From the outset of the TNFD's work, market participants indicated that accessible guidance outlining how to identify, assess, manage and disclose nature-related issues would be a welcome complement to the TNFD's recommended disclosures. In response, the TNFD has worked with knowledge partners and providers of relevant existing frameworks to develop an integrated approach for the assessment of nature-related issues. It is designed for use by organisations of all sizes and across all sectors and geographies. This integrated assessment approach is called the LEAP approach, or 'LEAP' for short (Locate, Evaluate, Assess and Prepare).

LEAP is designed to be used by an internal project team in your organisation and involves four phases:

- **Locate** your interface with nature;
- **Evaluate** your dependencies and impacts on nature;
- **Assess** your nature-related risks and opportunities; and
- **Prepare** to respond to, and report on, material nature-related issues, aligned with the TNFD's recommended disclosures.

Figure 1: The LEAP approach



Wherever possible, the TNFD has avoided creating new or different approaches. It has instead drawn on existing high-quality assessment methodologies and tools that are already used by market participants. By design, LEAP builds on, and is consistent with, existing assessment frameworks including the Natural Capital Protocol developed by the Capitals Coalition and the target setting methods developed by the Science Based Targets Network (SBTN). It is also consistent with the materiality assessment approach used by the International Sustainability Standards Board (ISSB) and the impact materiality assessment approaches used by the GRI and in the European Sustainability Reporting Standards (ESRS). It signposts to well-regarded scientific data sets and assessment tools including those provided by the International Union for Conservation of Nature (IUCN), Stockholm Resilience Centre, UN Statistics Division, UN Environment Programme World Conservation Monitoring Centre (UNEP-WCMC), WWF and others.

Over 240 institutions have pilot tested the LEAP approach, helping to inform the guidance in this document from a practitioner's perspective.

The organisations who have produced the main frameworks, tools and data sources used are identified in Figure 2. These resources are signposted throughout this guidance, with brief descriptions of how they may be used and links to the original sources for more detail. As new frameworks, tools and data sources are developed, the TNFD will add and signpost these in periodic updates to this guidance.

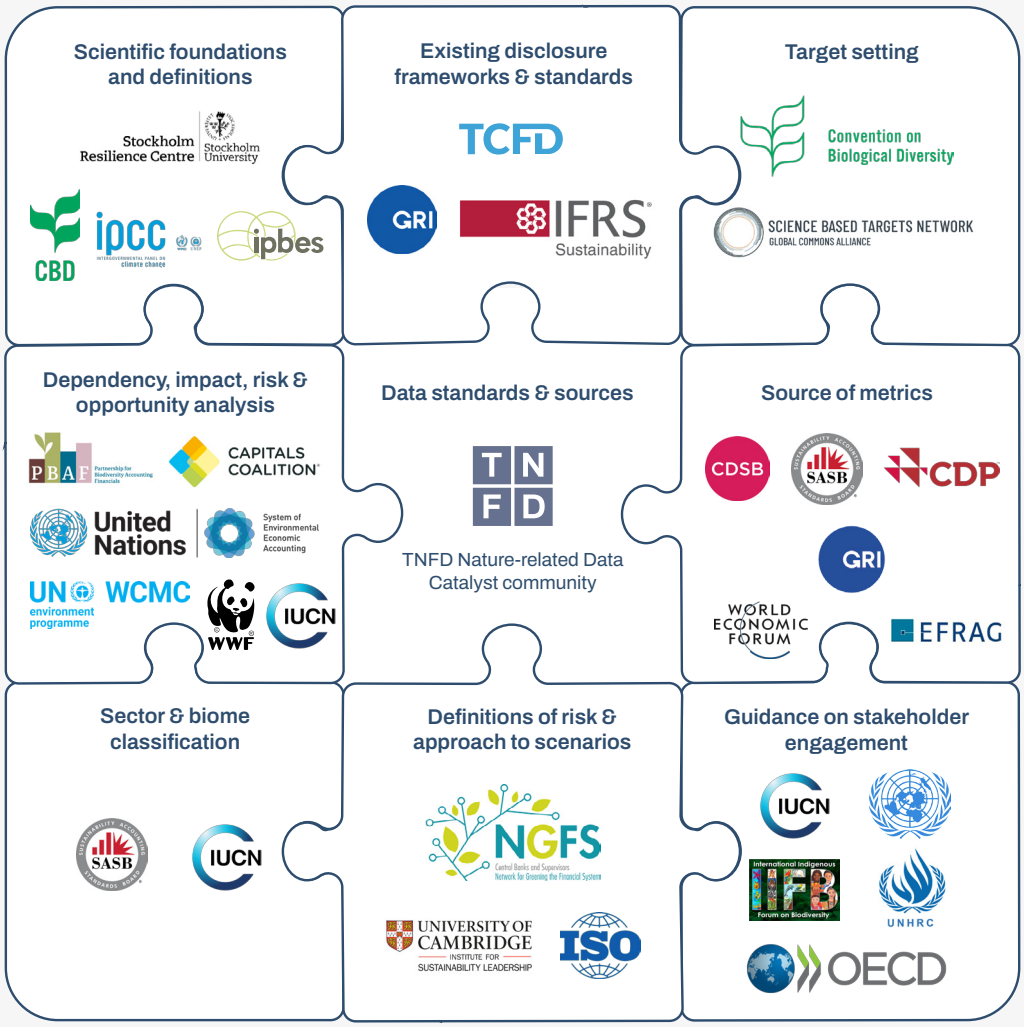
In addition to the close collaboration with knowledge partners in producing this guidance, over 240 organisations have pilot tested draft versions of the LEAP approach over the TNFD's two-year design and development phase. This has played an instrumental role in the refinement of LEAP. Pilot testers ranged from listed global multinational corporations and financial institutions to privately-owned companies and Indigenous-led community enterprises. They spanned different geographies, market sectors and biomes around the world. Case studies are provided throughout this guidance to highlight the approach taken by pilot testers to implement different components of LEAP.[1]

The Taskforce would like to thank all the organisations who contributed to the development of this LEAP guidance through their expertise, pilot testing and feedback.

The Taskforce intends to update this document as and when needed with additional insights and refinements. Users can track different versions by referring to the version number on the front cover and the version update log at the end of this document. The Taskforce welcomes ongoing feedback on the LEAP approach to support improvements over time.

1 The case studies on the LEAP approach have been authored by TNFD based on publicly available information or from piloting insights. Some have been adapted from existing reports to highlight their alignment with the LEAP process.

Figure 2: TNFD's additional guidance builds on existing frameworks, methods and tools



1.1. The use case for LEAP

LEAP is an internal due diligence assessment process. Use of LEAP is optional and not required to make the disclosures recommended by the TNFD. If your organisation already has an equivalent due diligence process for nature-related issues, it can continue to use that to inform its TNFD-aligned disclosure statements and use LEAP as a checklist to ensure that the process adequately addresses nature-related issues, in line with the TNFD's recommended disclosures.

It is clear from pilot testing that many organisations that do not have formal disclosure requirements have still found that using the LEAP approach is helpful for the identification and assessment of their nature-related issues. This has helped them take effective action to better manage their impacts, dependencies and risks and identify new opportunities.

1.2. The LEAP design principles

LEAP has been designed and developed with four overarching considerations in mind:

- As with any due diligence process, the TNFD encourages users to **scope** their LEAP assessment before commencing, to understand from the outset their potential cost, time and data availability constraints;
- The team of analysts undertaking a LEAP assessment are encouraged to **consult with relevant stakeholders** as they work their way through the LEAP approach and to draw on third-party expert advice, as and when needed;
- LEAP is designed as an **iterative process** – across business locations, across business lines for corporates, and across investment portfolios and asset classes for financial institutions – in line with established risk management processes and corporate reporting cycles; and
- LEAP is intended to be **flexible in its application**. The TNFD describes LEAP as an 'approach' with assessment 'components' not as a 'process' with 'steps' that must be followed in a strict order. It is clear from pilot testing that the way in which some financial institutions might use LEAP is different from the way corporates might use LEAP. While the guidance below is laid out across 16 components from L1 to P4, it is not necessary to use them strictly in sequential order.

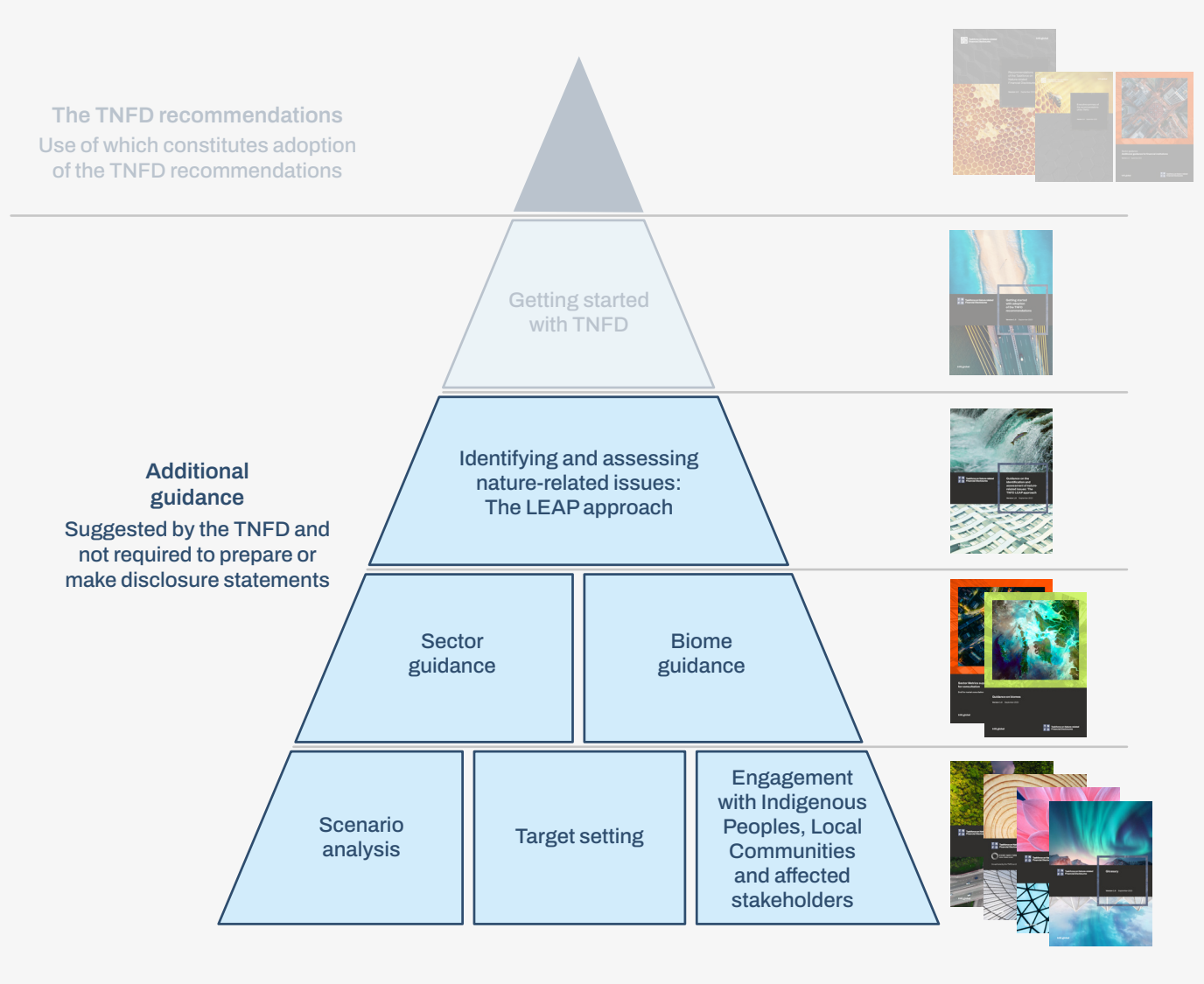
LEAP is an internal due diligence assessment process. Use of LEAP is optional and not required to make the disclosures recommended by the TNFD.

1.3. How to use this document and supporting guidance

This document provides detailed guidance on how to undertake each component of the LEAP assessment approach. It is designed for use by the internal project team in your organisation tasked with undertaking an assessment of the organisation's nature-related issues (referred to as a LEAP assessment team). As outlined above, a step-by-step process may prove useful for most organisations, but pilot testing has shown that some businesses, particularly financial institutions with large, global investment portfolios, may not find it useful to use every component of the LEAP approach or follow them in a linear sequence because of the nature of their business. We encourage all organisations to use the components of LEAP in a way that best suits the needs of their business and their due diligence requirements.

A summary of the LEAP approach is provided in Figure 1. This guidance is also supported by, and should be used in conjunction with, other additional guidance documents provided by the TNFD as shown in Figure 3.

Figure 3: Further TNFD additional guidance for use in conjunction with LEAP guidance



2. Foundations for understanding nature and nature-related issues

Before undertaking an assessment using the LEAP approach, we encourage LEAP assessment teams and their senior sponsors first to familiarise themselves with the core concepts for understanding nature from the perspective of business and finance.

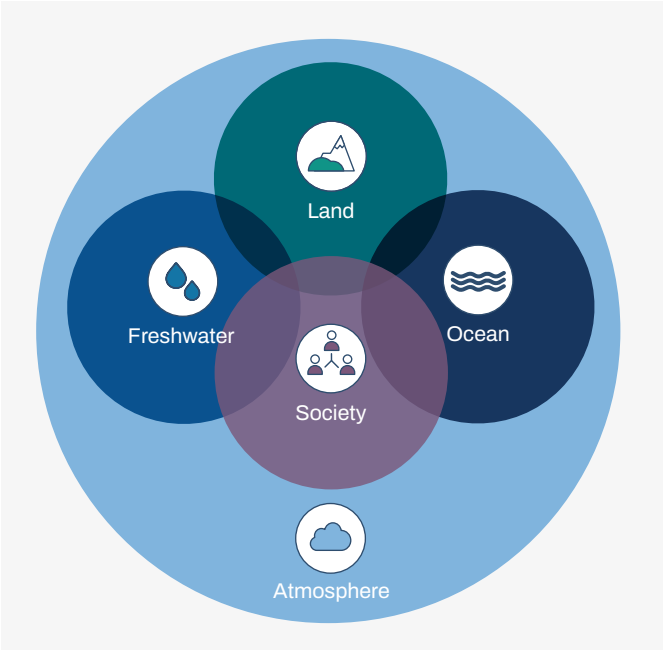
The Taskforce has worked closely with the world's leading scientific and conservation organisations to ensure the TNFD's guidance draws on authoritative and consensus-based definitions as the foundation of a market-accessible language system for understanding nature. The definitions have been refined based on feedback and are provided in the TNFD glossary.

2.1. Understanding nature

Nature refers to the natural world, emphasising the diversity of living organisms, including people, and their interactions with each other and their environment.[2] It is made up of four **realms**: land, ocean, freshwater and atmosphere (Figure 4).[3] These are major components of the natural world that differ fundamentally in their organisation and function. The four realms provide an entry point for understanding how organisations and people depend, and have impacts, on nature. The TNFD's biome guidance is organised around the four realms.

Biodiversity refers to the variability among living organisms across these realms. It is an essential and integral characteristic of nature that enables ecosystems to be productive, resilient and able to adapt.[4]

Figure 4: Nature's four realms – Land, ocean, freshwater and atmosphere



Society lies at the centre of the framework, interacting with and across all four realms. This includes people, corporates and financial institutions, all of whom depend and have impacts on nature. Members of society contribute to, and are affected by, nature loss. This reflects that people are part of nature, not separate from it. The interactions of **Indigenous Peoples and Local Communities** with nature are particularly significant (see Box 1).

2 Díaz, S. et al. (2015) The IPBES conceptual framework – connecting nature and people.

3 SBTN (2023) SBTN Glossary of Terms. The inclusion of atmosphere reflects the importance of air quality and the close association between climate- and nature-related risks and opportunities, while acknowledging that links with climate mitigation and adaptation occur across all realms.

4 Dasgupta, P. (2021) The economics of biodiversity: The Dasgupta Review.

Box 1: The importance of Indigenous Peoples and Local Communities

Indigenous Peoples and Local Communities have proven highly effective in the protection of ecosystems through their knowledge, community-led practices and institutions. Indigenous Peoples and Local Communities make up less than 5% of the world's population and manage less than half of terrestrial landscapes and a third of inland waters,[5] yet they have succeeded in protecting 80% of our global biodiversity.[6] Biodiversity declines 30% less and 30% slower in Indigenous lands than in lands not managed by Indigenous Peoples.[7] At the same time, Indigenous Peoples and Local Communities' close relation with nature – for cultural, social and spiritual reasons, for their well-being, and for access to food, shelter and water – makes them particularly susceptible to adverse impacts from nature loss.

In recognition of this, the TNFD has developed additional guidance on engagement by corporates and financial institutions with Indigenous Peoples, Local Communities, affected and other stakeholders for the assessment, management and disclosure of nature-related dependencies, impacts, risks and opportunities.

The TNFD defines **natural capital** as the stock of renewable and non-renewable natural resources such as plants, animals, air, water, soils and minerals that combine to yield a flow of benefits to people.[8] Natural capital consists of stocks of **environmental assets** – naturally occurring living and non-living components of the earth, such as forests, wetlands, coral reefs and agricultural areas.[9] Ecosystem assets are a sub-set of environmental assets that relate to diverse ecosystems.

An **ecosystem** is a dynamic complex of plant, animal and microorganism communities and the non-living environment that interacts as a functional unit.[10]

Ecosystems are classified into **biomes**, which can be thought of in simple terms as types of ecosystem. Biomes are global-scale zones, generally defined by the type of plant life that they support in response to average rainfall and temperature patterns.[11] Examples are rivers and streams, tropical forests and grasslands.

Ecosystems produce flows of benefits to people and the economy, or **ecosystem services**. Ecosystem services form the basis for understanding corporate dependence on natural capital and are crucial for corporate risk management. Any depreciation in natural

5 WWF et al. (2021) The State of Indigenous Peoples' and Local Communities' Lands and Territories: A technical review of the state of Indigenous Peoples' and Local Communities' lands, their contributions to global biodiversity conservation and ecosystem services, the pressures they face, and recommendations for actions.

6 Garnett, S. T. et al. (2018) A spatial overview of the global importance of Indigenous lands for conservation. Nature Sustainability, 1(7), 369–374.

7 Purvis, A. et al. (2019) IPBES Global assessment report on biodiversity and ecosystem services – Chapter 2.2 Status and Trends – Nature.

8 Capitals Coalition (2016) Natural Capital Protocol. The TNFD framework focuses on the renewable – or living – elements of nature. Non-living resources, including energy and minerals, are only considered in the TNFD framework to the extent that they affect the health of living nature.

9 The TNFD aligns with the UN System of Environmental-Economic Accounting Ecosystem Accounting (UN SEEA EA) in its definitions and list of environmental assets and ecosystem assets. United Nations et al. (2021) System of environmental-economic accounting – Ecosystem accounting.

10 Adapted from UN et al. (2021a) System of environmental-economic accounting – Ecosystem accounting.

11 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (2019) Global assessment report on biodiversity and ecosystem services.

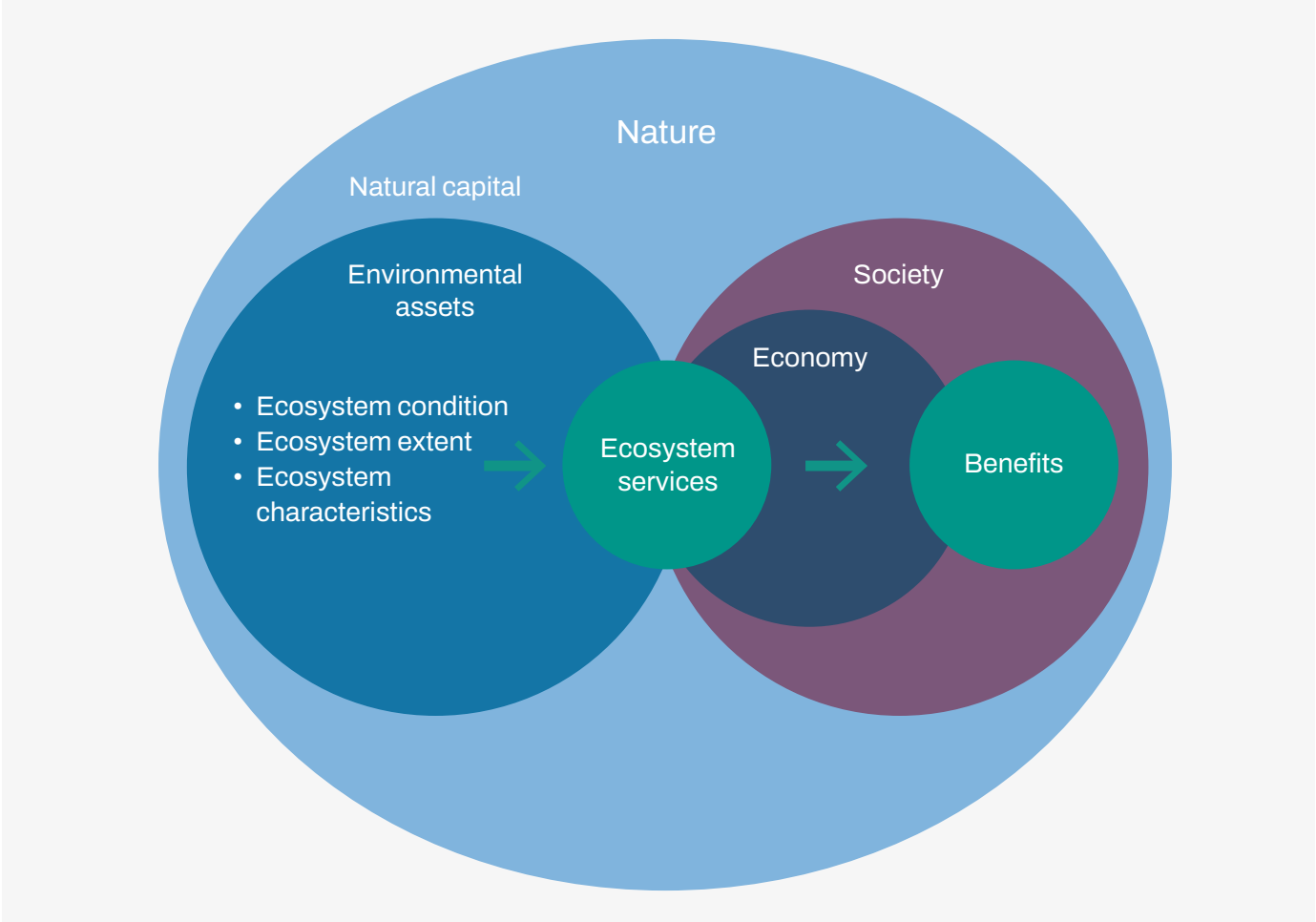
capital will have a negative effect on the provision of **ecosystem services**.

Ecosystem services fall into three categories:

- **Provisioning services** represent the flow of benefits that are extracted or harvested from ecosystems, such as timber and fuel wood from a forest or freshwater from a river.
- **Regulating and maintenance services** are those ecosystem services resulting from the ability of ecosystems to regulate biological processes and to influence climate, hydrological and biochemical cycles, and thereby maintain environmental conditions beneficial to individuals, organisations and society. For example, air filtration by trees, storm surge protection provided by mangroves, and pollination as a service provided by bees. These services are essential for the productivity and resilience of organisations and society.
- **Cultural services** are the experiential and intangible services related to the perceived or actual qualities of ecosystems, where their existence and functioning contributes to a range of cultural benefits. For example, the recreational value of a forest or coral reef for tourism, or the spiritual value of certain trees or landscapes. Organisations may rely on these directly (e.g. tourism value) or indirectly (e.g. benefits for employee wellbeing).

How nature, society and the economy fit together, with environmental assets providing ecosystem services that benefit business and wider society, is illustrated in Figure 5.

Figure 5: Nature, business and society



Box 2 provides more detailed definitions of these key concepts for understanding nature.

Box 2: Concepts for understanding nature

Nature: The natural world, emphasising the diversity of living organisms, including people, and their interactions with each other and their environment.

Realms of nature: Land, ocean, freshwater and atmosphere. These are major components of the natural world that differ fundamentally in their organisation and function.

Biodiversity: The variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part. This includes diversity within species, between species and of ecosystems.

Biome: Global-scale zones, generally defined by the type of plant life that they support in response to average rainfall and temperature patterns. Examples are tundra, coral reefs or savannas.

Ecosystem: A dynamic complex of plant, animal and microorganism communities and the non-living environment, interacting as a functional unit.

Environmental assets: The naturally occurring living and non-living components of the Earth, together constituting the biophysical environment, which may provide benefits to humanity.

Ecosystem assets: A sub-set of environmental assets that relate to diverse ecosystems.

Ecosystem services: The contributions of ecosystems to the benefits that are used in economic and other human activity.

Natural capital: The stock of renewable and non-renewable natural resources such as plants, animals, air, water, soils and minerals that combine to yield a flow of benefits to people.

Sources: CBD (1992) Convention on Biological Diversity, Article 2. Use of Terms; Keith, D. A. et al. (eds.) (2020) IUCN Global Ecosystem Typology 2.0: descriptive profiles for biomes and ecosystem functional groups; IPBES (2019) Global assessment report on biodiversity and ecosystem services; UN et al. (2021) System of environmental-economic accounting – Ecosystem accounting.

A comprehensive typology of realms, biomes, environmental assets and ecosystem services is provided in Figure 6, building on the IUCN Global Ecosystem Typology[12] and UN System of Environmental-Economic Accounting (SEEA) – Ecosystem Accounting. Nature can be understood through a set of biomes, categorised into four realms. Nature can also be understood as a set of assets that provide ecosystem services. The TNFD additional guidance by sector and biome is structured around these fundamental core concepts.

12 Keith, D. A. et al. (eds.) (2020) IUCN Global Ecosystem Typology 2.0: descriptive profiles for biomes and ecosystem functional groups. The numbers in brackets for each biome refer to the correct alphanumerical code from the GET. In some cases, the terms used here for biomes have been simplified from GET to aid understanding. The GET is the basis for the UN SEEA.

Figure 6: Fundamental concepts for understanding nature: Realms, biomes, environmental assets and ecosystem services

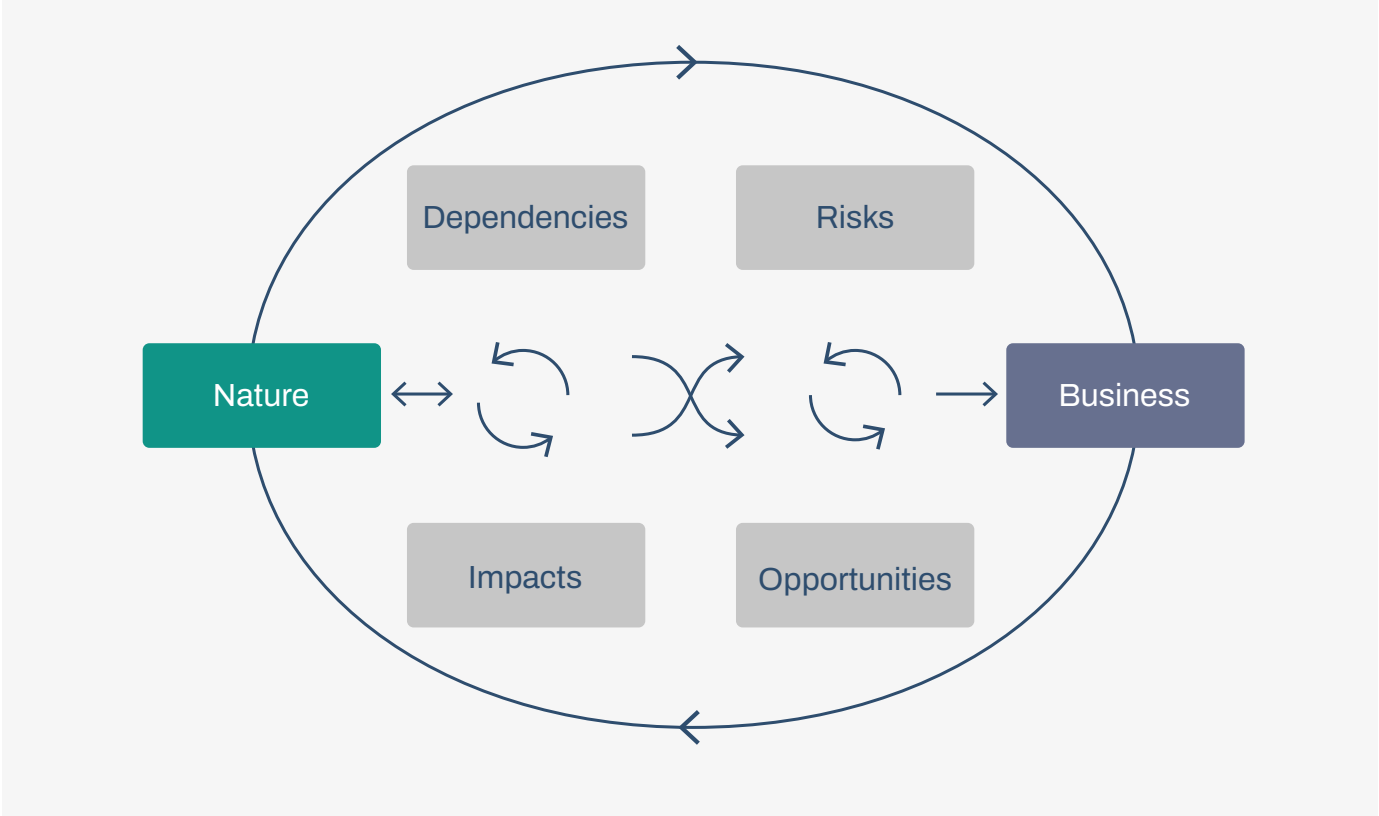
2.2. Nature-related issues

Organisations have dependencies and impacts on nature, which give rise to nature-related risks and opportunities (Figure 7). These four concepts are collectively referred to by the TNFD as 'nature-related issues' and include:

- **Dependencies** – of the organisation *on nature*;
- **Impacts** – *on nature* caused, or contributed to, by the organisation;
- **Risks** – *to the organisation* stemming from their dependencies and impacts; and
- **Opportunities** – *for the organisation* that benefit nature through positive impacts or mitigation of negative impacts on nature.

It is essential to evaluate your organisation's dependencies and impacts on nature, to assess the risks and opportunities to your organisation. Assessments should cover all four types of nature-related issues, as well as your organisations' responses to them.

Figure 7: Nature-related dependencies, impacts, risks and opportunities



2.2.1. Nature-related dependencies and impacts

Organisations' business activities depend on reliable and cost-effective access to ecosystem services. This dependence in turn affects investors' perceptions of the business' value. Organisations also have impacts on ecosystems and their provision of ecosystem services. These impacts may be positive or negative. Dependencies and impacts interact and compound over time, as negative impacts undermine the availability of ecosystem services on which organisations may also depend.

Box 3: Definitions of dependencies and impacts

Dependencies

Dependencies are aspects of environmental assets and ecosystem services that a person or an organisation relies on to function. A company's business model, for example, may depend on the ecosystem services of water flow, water quality regulation and the regulation of hazards like fires and floods; provision of suitable habitat for pollinators, who in turn provide a service directly to economies; and carbon sequestration.

Impacts

Impacts refer to a change in the **state of nature** (quality or quantity), which may result in changes to the capacity of nature to provide social and economic functions. Impacts can be positive or negative. They can be the result of an organisation's or another party's actions.

Impacts may be:

- Direct – a change in the state of nature caused by a business activity with a direct causal link;
- Indirect – a change in the state of nature caused by a business activity with an indirect causal link (e.g. indirectly caused by climate change generated by greenhouse gas emissions); and/or
- Cumulative – a change in the state of nature (direct or indirect) that occurs due to the interaction of activities of different actors operating in a landscape or freshwater/marine area.

Sources: Science Based Targets Network (2023) SBTN Glossary of Terms; Capitals Coalition (2016) The Natural Capital Protocol; Climate Disclosure Standards Board (2021) Application guidance for biodiversity-related disclosures.

Consistent with the Natural Capital Protocol, the TNFD recommends that dependencies and impacts are identified and measured using dependency and impact pathways that consider:

- **Impact drivers** and **external factors**;
- Changes to the **state of nature**; and
- Changes to the availability of **ecosystem services**.

A **dependency pathway** describes how a particular business activity depends upon ecosystem services and specific features of natural capital (stocks of environmental assets). It identifies how observed or potential changes in natural capital (caused by specific business activities and external factors) affect the costs and/or benefits of doing business.

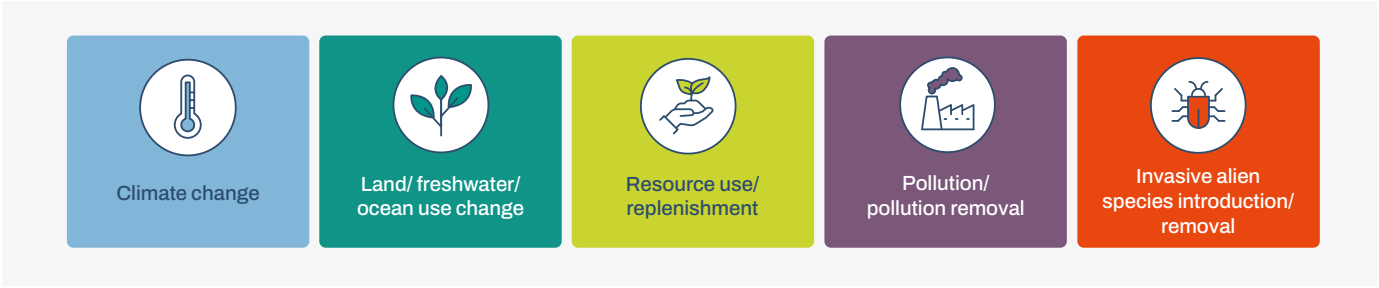
An **impact pathway** describes how, as a result of a specific business activity, a particular impact driver can lead to changes in natural capital (stocks of environmental assets) and flows of ecosystem services, and how these changes affect different stakeholders.

Organisations can refer to the Natural Capital Protocol and accompanying guidance[13] for further details of dependency and impact pathways.

Impact drivers are measurable quantities of a natural resource that are used as an input to production and measurable non-product outputs of a business activity that affects nature.

Impact drivers are categorised into the five drivers of nature change (see Figure 8 and Table 1). Impacts can be positive or negative. A single impact driver may be associated with multiple impacts (changes to the state of nature). For example, greenhouse gas emissions affect multiple ecosystems.

Figure 8: The five drivers of nature change



13 Capitals Coalition (2016) Nature Capital Protocol; Capitals Coalition: Guides and supplements.

Table 1: Impact drivers, mapped against the five drivers of nature change

Drivers of nature change (IPBES)	Categories of impact driver and external driver of change	Examples
Land, freshwater and ocean use change	**Business inputs** Land ecosystem use e.g. area of forest plantation Freshwater ecosystem use e.g. area of dams and flood barriers Ocean ecosystem use e.g. area of seabed mining	Area of agriculture by type Area of forest plantation by type Area of open case mine by type Area of wetland, ponds, lakes, streams, rivers or peatland necessary to provide ecosystem services such as water purification, fish spawning Areas of infrastructure necessary to use rivers and lakes such as bridges, dams and flood barriers Area of aquaculture by type Area of seabed mining by type
Climate change	**Business outputs** Greenhouse gas (GHG) emissions	Volume of carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, hydrofluorocarbons and perfluorocarbons

Drivers of nature change (IPBES)	Categories of impact driver and external driver of change	Examples
Pollution/pollution removal	**Business outputs** Non-GHG air pollutants Water pollutants Soil pollutants Solid waste Disturbances	Volume of fine particulate matter ($PM_{2.5}$) and coarse particulate matter (PM_{10}), volatile organic compounds, mono-nitrogen oxides, sulphur dioxide, carbon monoxide Volume discharged to receiving water body of nutrients (e.g. nitrates and phosphates) or other substances (e.g. heavy metals and chemicals) Volume of waste matter discharged and retained in soil over a given period Volume of waste by classification (e.g. non-hazardous, hazardous and radioactive), by specific material constituents (e.g. lead, plastics) or by disposal method (e.g. landfill, incineration, recycling, specialist processing) Decibels and duration of noise at site of impact Lumens and duration of light at site of impact
Resource use/ replenishment	**Business inputs** Water use Other resource use	Volume of groundwater consumed Volume of surface water consumed Volume of mineral extracted Volume of wild-caught fish by species Number of wild-caught mammals by species

Drivers of nature change (IPBES)	Categories of impact driver and external driver of change	Examples
Invasive alien species introduction/removal	**Business outputs** Introduction of invasive alien species*	
*Invasive alien species are not yet included within the Natural Capital Protocol and associated guidance on biodiversity. However, they are included as an impact driver within the Align recommendations on biodiversity measurement and valuation. See the Align project.		
Sources: Adapted from IPBES (2019) Global assessment report on biodiversity and ecosystem services and Capitals Coalition (2016) Natural Capital Protocol.		

2.2.2. External factors

External factors include both significant natural forces and human activities outside the organisation that affect the state of nature. These could include a natural disaster or the pollution released by another organisation. Frameworks such as PESTLE (Political, Economic, Social, Technological, Legal and Environmental) and STEEP (Social, Technology, Economic, Environmental and Policy) can be useful to identify broad categories of external factors, as outlined in the TNFD scenario guidance.

2.2.3. Changes to the state of nature

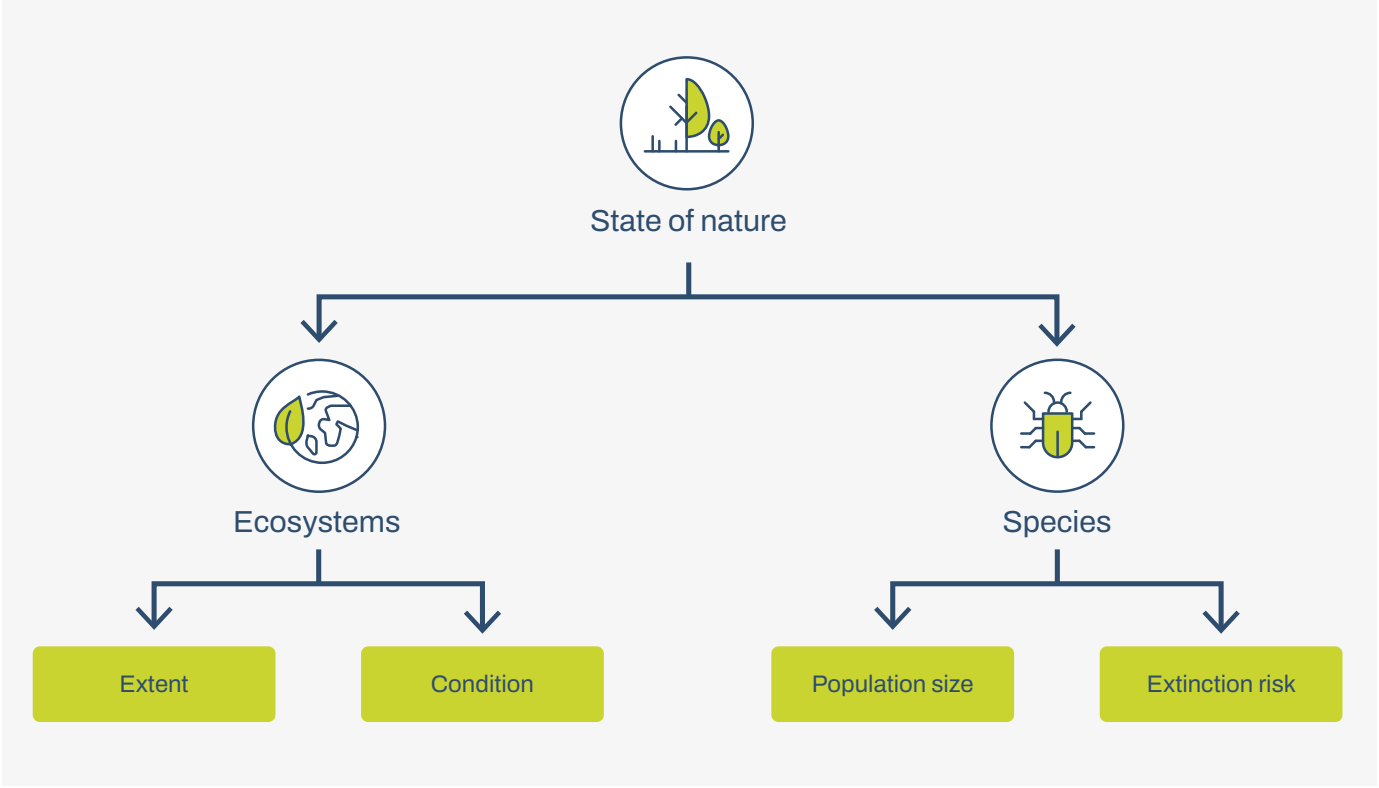
As illustrated in Figure 9, changes to the state of nature can be positive (enhancement) or negative (degradation), and refer to changes to:

- The condition and extent of the ecosystem assets; and
- Species population size and extinction risk.[14]

Further guidance on measuring the state of nature, including ecosystem condition and species, is provided in Annex 2.

14 Adapted from United Nations et al. (2021) System of environmental-economic accounting – Ecosystem accounting.

Figure 9: Components of state of nature measurement



Box 4: Examples of dependency and impact pathways

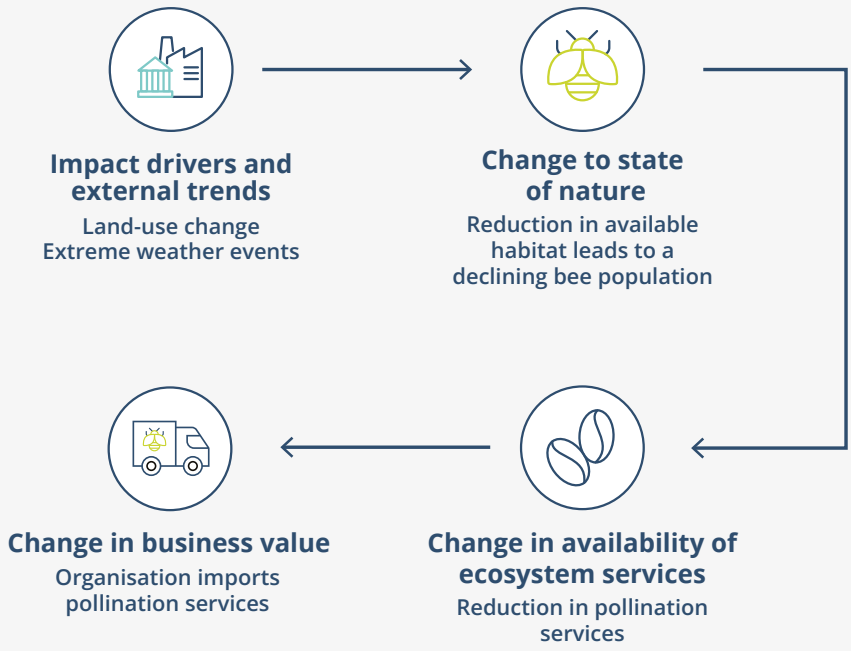
Dependency pathway example

A coffee production company has a dependency on the ecosystem service of pollination by a wild bee population that lives around its suppliers' coffee farms and the underlying environmental asset supporting this population (the forest providing habitat for the population of bees). This bee population and pollination service are affected by human-induced land-use change.

The related dependency pathway leading to a change in value for the organisation includes:

- **External factors:** Neighbouring farmers are expanding their fields;
- **Change in the state of nature:** This expansion reduces the extent of the ecosystem that supports the bee population, leading to a decline in the number of bees;
- **Value of dependencies:** Changes in the state of nature affect the business dependency with costs and benefits to the organisation:
  - **Change in ecosystem service provision:** This decline in the bee population leads to a reduction in the pollination service that the organisation depends on;
  - **Change in the costs or revenue for the business:** The coffee suppliers' yields fall, so the coffee production company faces increased costs in finding additional suppliers or paying a higher price for coffee to meet the cost of importing pollinators.

Figure 10: Example of a dependency pathway



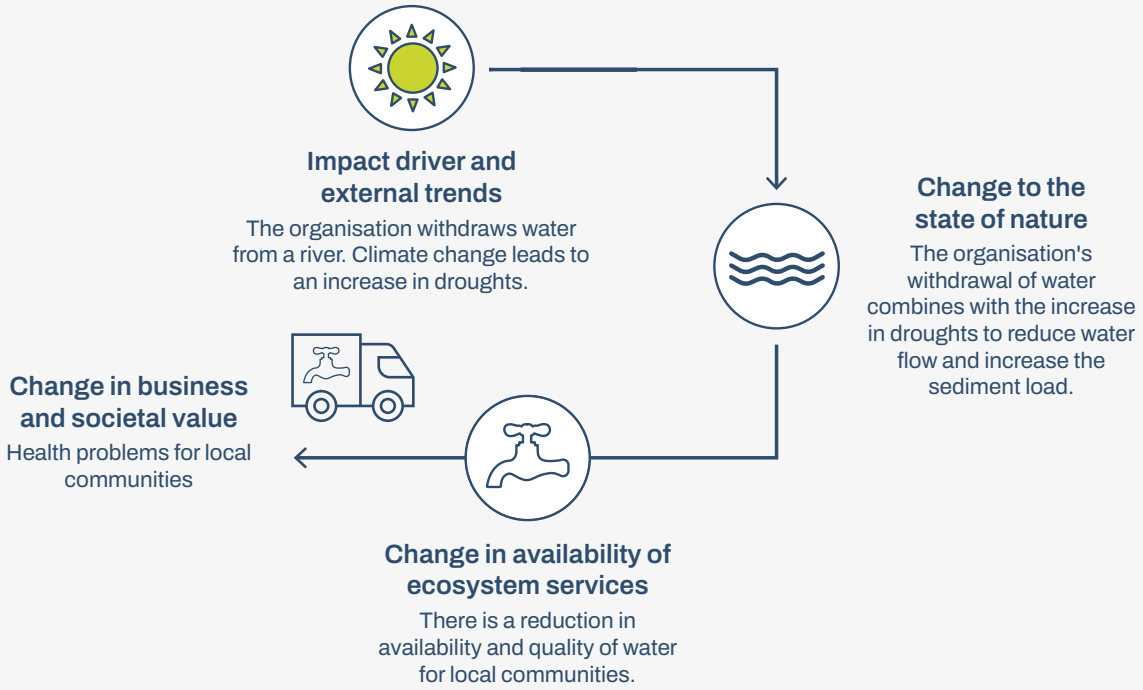
Source: Capitals Coalition (2016) Natural Capital Protocol.

Impact pathway example

An organisation extracting water from a local freshwater river has an impact pathway that includes:

- **Impact driver and external factors:** The company extracts water to cool machinery and plants. Climate change is also increasing the frequency of droughts;
- **Change in the state of nature:** The impact driver and external factors lead to a reduction in the flow of water in the river, leading to increased sediment load;
- **Change in ecosystem services:** This leads to a decline in water flow and quality, reducing the availability of clean water for the business and local communities; and
- **Change in societal and business value:** Change in availability of water creates health problems for local communities.

Figure 11: Example of an impact pathway



Source: Capitals Coalition (2016) Natural Capital Protocol.

Understanding positive impacts

Organisations can have positive impacts on nature as well as negative. For example, business processes and innovations can enable an organisation to support nature conservation and restoration, engage in regenerative agriculture and cultivate biotic material, such as in forestry and seaweed farming. Reducing negative impacts on nature is not the same as having a positive impact on the state of nature and its resilience.

The TNFD's approach recognises both negative and positive impacts, as included in the suggested set of assessment metrics to support application of the LEAP approach. Figure 12 below highlights some business models and innovations that can be considered as part of using the LEAP approach.

Figure 12: Business models and innovations related to negative and positive impacts

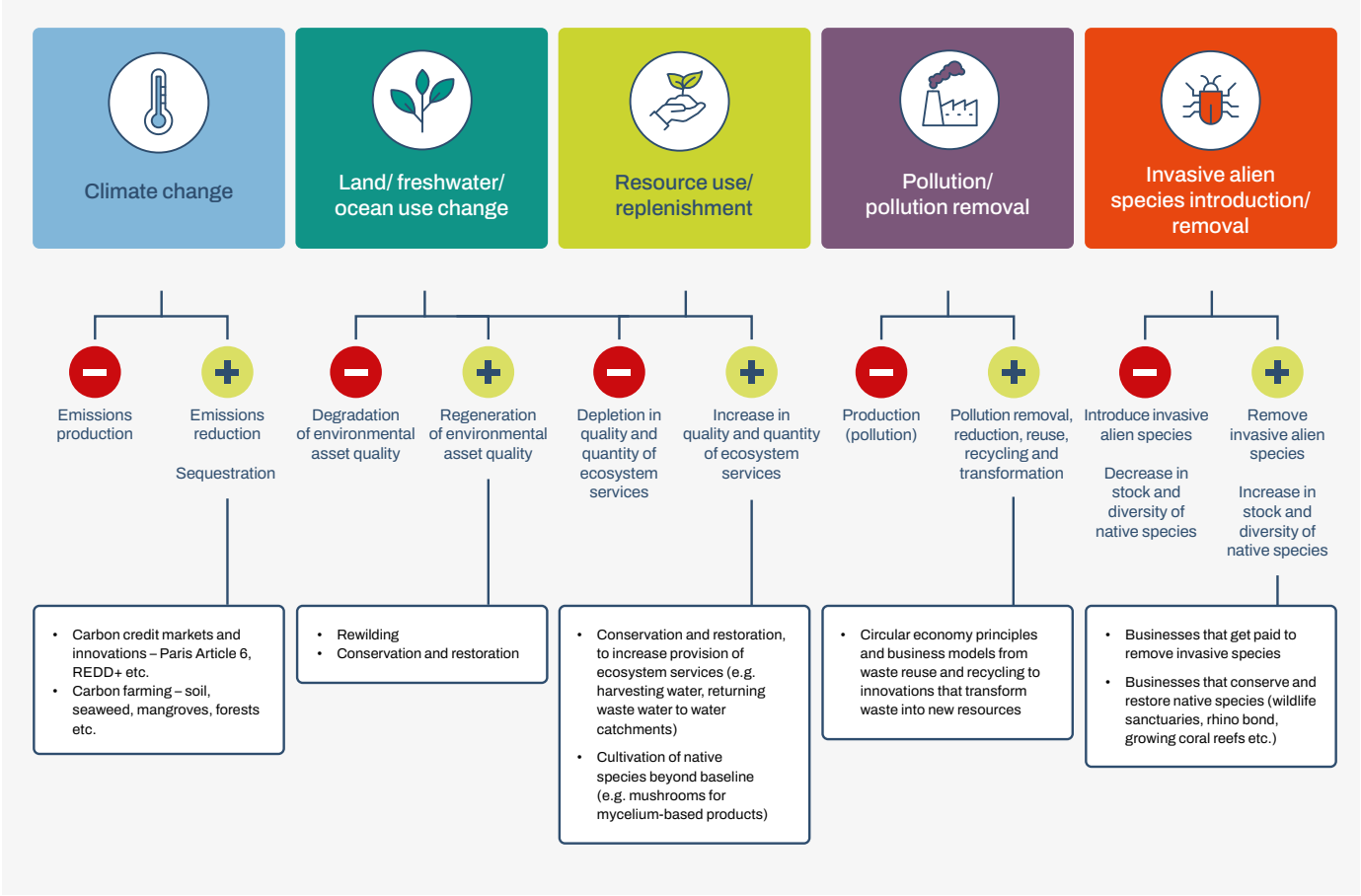
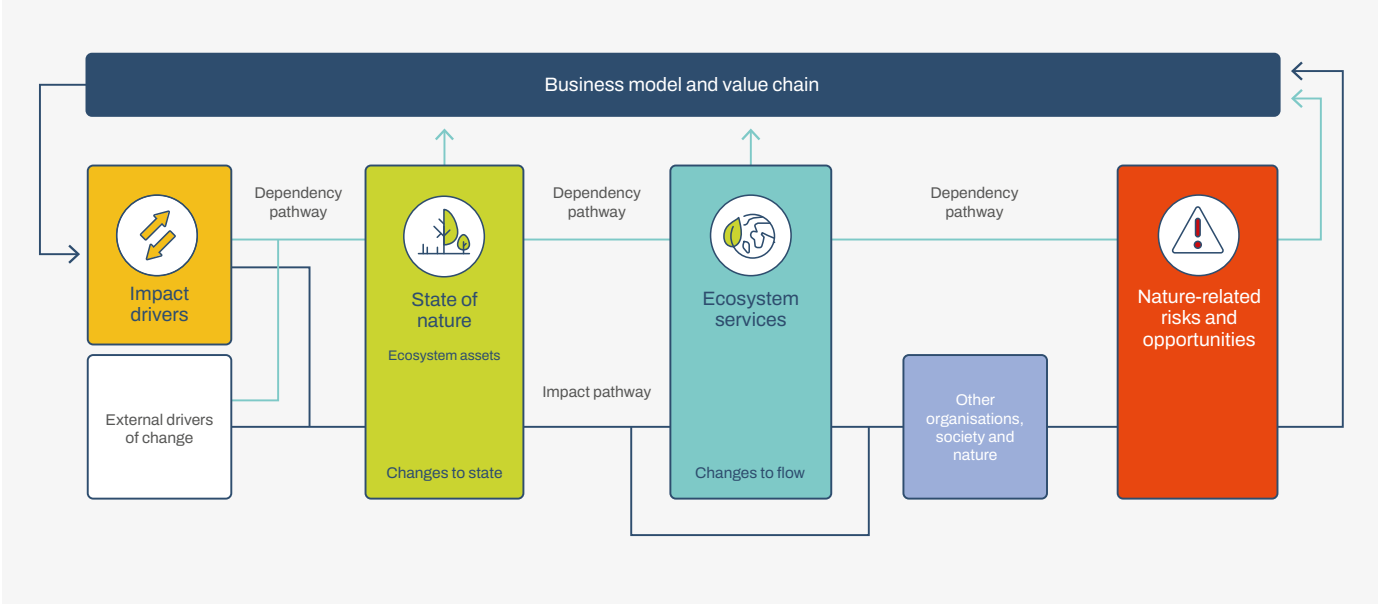


Figure 13: Connections between dependencies and impacts on nature and nature-related risks and opportunities – Impact and dependency pathways



2.2.4. Nature-related risks and opportunities

Nature-related risks and opportunities arise from an organisation's dependencies and impacts on nature (Figure 13).

The TNFD's risk and opportunity definitions are consistent with the International Organization for Standardization (ISO) 31000 Risk Management Guidelines, according to which risk is the 'effect of uncertainty on objectives', and an effect is a positive or negative deviation from what is expected.[15]

Nature-related risks

In line with ISO, the TNFD defines nature-related risks as potential threats (effects of uncertainty) posed to an organisation that arise from its and wider society's dependencies and impacts on nature.[16] Such risks can be physical risks, transition risks or systemic risks.

Nature-related physical risks

Nature-related physical risks are risks to an organisation that result from the degradation of nature and consequential loss of ecosystem services. These risks can be acute or chronic (Table 2). Nature-related physical risks arise as a result of changes in the biotic (living) and abiotic (non-living) conditions that support healthy, functioning ecosystems. These risks are usually location-specific.

15 International Organization for Standardization (2018) ISO 31000, Risk Management – Guidelines.

16 Climate Disclosure Standards Board (2021) Application guidance for biodiversity-related disclosures; Task Force on Climate-related Financial Disclosures (2017) Recommendations of the Task Force on Climate-related Financial Disclosures; NGFS (2023) Nature-related Financial Risks: A conceptual framework to guide action by Central Banks and Supervisors; Financial Stability Board (2022) FSB Supervisory and Regulatory Approaches to Climate-related Risks Final report; International Association of Insurance Supervisors (2021) Application Paper on the Supervision of Climate-related Risks in the Insurance Sector; Organisation for Economic Co-operation and Development (2023, forthcoming) A prudential framework for assessing nature-related financial risks: identifying and navigating biodiversity risks.

Table 2: Categories of nature-related physical risks

Category	Description
Acute risks	Occurrence of short-term, specific events that change the state of nature. For example, oil spills, forest fires or pests affecting a harvest.
Chronic risks	Gradual changes to the state of nature. For example, pollution stemming from pesticide use or climate change.

Table 3: Categories of nature-related transition risks

Category	Description
Policy	Changes in the policy context due to new (or enforcement of existing) policies associated with creating positive impacts on nature or mitigating negative impacts on nature.
Market	Changing dynamics in overall markets, including changes in consumer preferences, which arise from other risk categories as a result of changing physical, regulatory, technological and reputational conditions and stakeholder dynamics. For example, the market value of a company is affected by assets that have decreased in value because there is insufficient freshwater for the production process, or the value of the business production process is reduced by the emergence of new technologies that require less water to operate.
Technology	Substitution of products or services with a reduced impact on nature and/or reduced dependency on nature. For example, the replacement of plastics with biodegradable containers.
Reputational	Changes in perception concerning an organisation's actual or perceived nature impacts, including at the local, economic and societal level. This can result from direct company impacts, industry impacts and/or impacts of activities upstream and/or downstream in a value chain.
Liability	Liability risks arise directly or indirectly from legal claims. As laws, regulations and case law related to an organisation's preparedness for nature action evolves, the incident or probability of contingent liabilities arising from an organisation may increase.[17]

17 Adapted from Task Force on Climate-related Financial Disclosures (2021) Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures, Appendix Table A1.3

Nature-related transition risks

Nature-related transition risks are risks to an organisation that result from a misalignment of economic actors with actions aimed at protecting, restoring and/or reducing negative impacts on nature. These risks can be prompted, for example, by changes in regulation and policy, legal precedent, technology or investor sentiment and consumer preferences. Categories of nature-related transition risks include policy risk, market risk, technology risk, reputational risk and liability risk (Table 3).[18]

Nature-related systemic risks

Nature-related systemic risks are risks to an organisation that arise from the breakdown of the entire system, rather than the failure of individual parts. These risks are characterised by modest tipping points combining indirectly to produce large failures, where one loss triggers a chain of others, and prevents the system from reverting to its prior equilibrium (Figure 14).[19]

There are two categories of nature-related systemic risk:

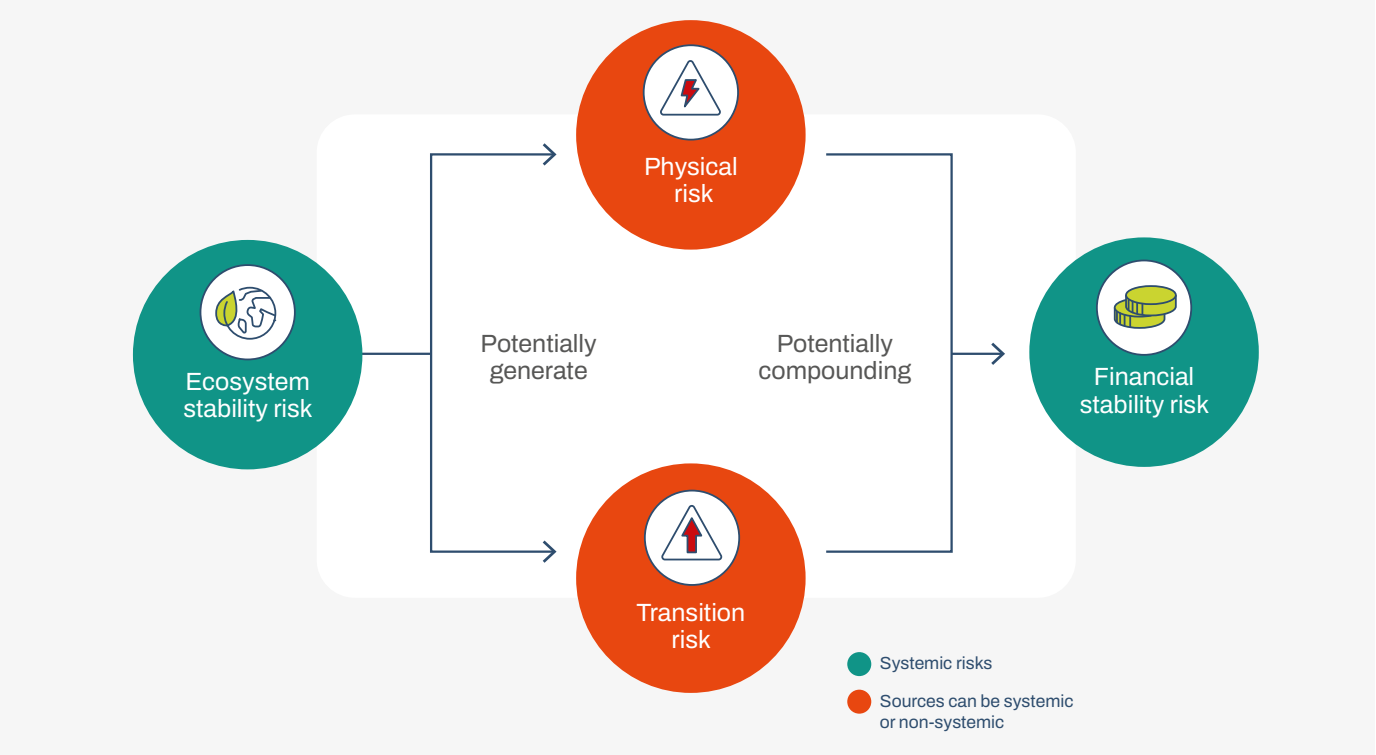
- Ecosystem stability risk: Risk of the destabilisation of a critical natural system, so it can no longer provide ecosystem services in the same manner as before. For example, tipping points are reached and regime shifts and/or ecosystem collapses occur that generate forms of physical and/or transition risk.
- Financial stability risk: Risk that a materialisation and compounding of physical and/or transition risk leads to the destabilisation of an entire financial system.

Systemic risks are of significant interest to policy makers and market regulators because of their potential to cause sudden disruption to societies, economies and the functioning of financial markets. But they also need to be considered by businesses given the potential for them to have unforeseen and significant financial implications for the business.

18 Consistent with the TCFD, liability risk is included as a sub-category of transition risk. That is, potential financial losses stemming directly or indirectly from legal claims. A recent body of work has suggested that the specific characteristics of liability risk – as both a consequence of transition-related actions and a driver of transition – may mean it warrants separate consideration for organisations. Other work has suggested liability risk is associated with both transition and physical risks and could be a sub-set of both physical and transition risk categories. See Network for Greening the Financial System (2019) A call for action: climate change as a source of financial risk; Network for Greening the Financial System (2021) Climate-related litigation: raising awareness about a growing source of risk; Network for Greening the Financial System (2023) Nature-related Financial Risks: A conceptual framework to guide action by Central Banks and Supervisors; Organisation for Economic Co-operation and Development (2023, forthcoming) A prudential framework for assessing nature-related financial risks: identifying and navigating biodiversity risks.

19 Goldin, I. and Mariathasan, M. (2014) The Butterfly Defect: how globalisation creates systemic risks and what to do about it; International Risk Governance Council (2018) IRGC Guidelines for the Governance of Systemic Risks; Kaufmann, G. and Scott, K. (2003) What Is Systemic Risk, and Do Bank Regulators Retard or Contribute to It? The Independent Review VII(3), 371–391; Network for Greening the Financial System (2023) Nature-related Financial Risks: A conceptual framework to guide action by Central Banks and Supervisors; Organisation for Economic Co-operation and Development (2023) A supervisory framework for assessing nature-related financial risks: Identifying and navigating biodiversity risks.

Figure 14: Nature-related risk categories



Nature-related risks can result from both dependencies and impacts on nature through:

1. Changes to the state of nature itself, caused by business impact drivers or external factors;
2. Changes to the flow of ecosystem services associated with the changes to the state of nature; and
3. Impacts to society resulting from business impacts on nature that may affect the organisation, for example, through lack of access to land due to damaged stakeholder relations, or damage to reputation following the release of pollutants that affect the health of local communities.

Nature-related opportunities

Nature-related opportunities are activities that create positive outcomes for organisations and nature through positive impacts or mitigation of negative impacts on nature. TNFD opportunity categories are split into those related to business performance and those related to sustainability performance (see Figure 15). These two categories are not mutually exclusive.

Nature-related opportunities can occur:

- When organisations avoid, reduce, mitigate or manage nature-related risks, for example, connected to the loss of nature and its associated ecosystem services that the organisation and society depend on; or
- Through the strategic transformation of business models, products, services, markets and investments that actively work to halt or reverse the loss of nature, including the implementation of conservation, restoration and nature-based solutions, or support for them through financing or insurance.[20]

20 The International Finance Corporation (2023) Biodiversity Finance Reference Guide provides an indicative list of investment activities that contribute to protecting, maintaining, or enhancing biodiversity and ecosystem services and sustainably managing living natural resources through the adoption of practices that integrate conservation needs and sustainable development.

Categories of opportunities for **impact mitigation** (reducing negative impacts on nature) include:

- Circular economy measures that reduce, reuse, recycle and share materials (reducing pressure on nature from resource extraction); and
- Waste prevention, pollution prevention and control, and manufacturing of products that reduce pollution harmful to nature (reducing pressure on nature from waste production).

Categories of opportunities for **positive impact** (conserving, regenerating and restoring nature and its services) including:

- Actions to increase the health, integrity, function and productivity of an ecosystem or its components; and
- Sustainable production and operation practices that conserve, enhance and restore ecosystems and their biodiversity, including nature-based solutions.

Figure 15: Nature-related opportunity categories

Responding to nature-related risks and opportunities: The mitigation hierarchy

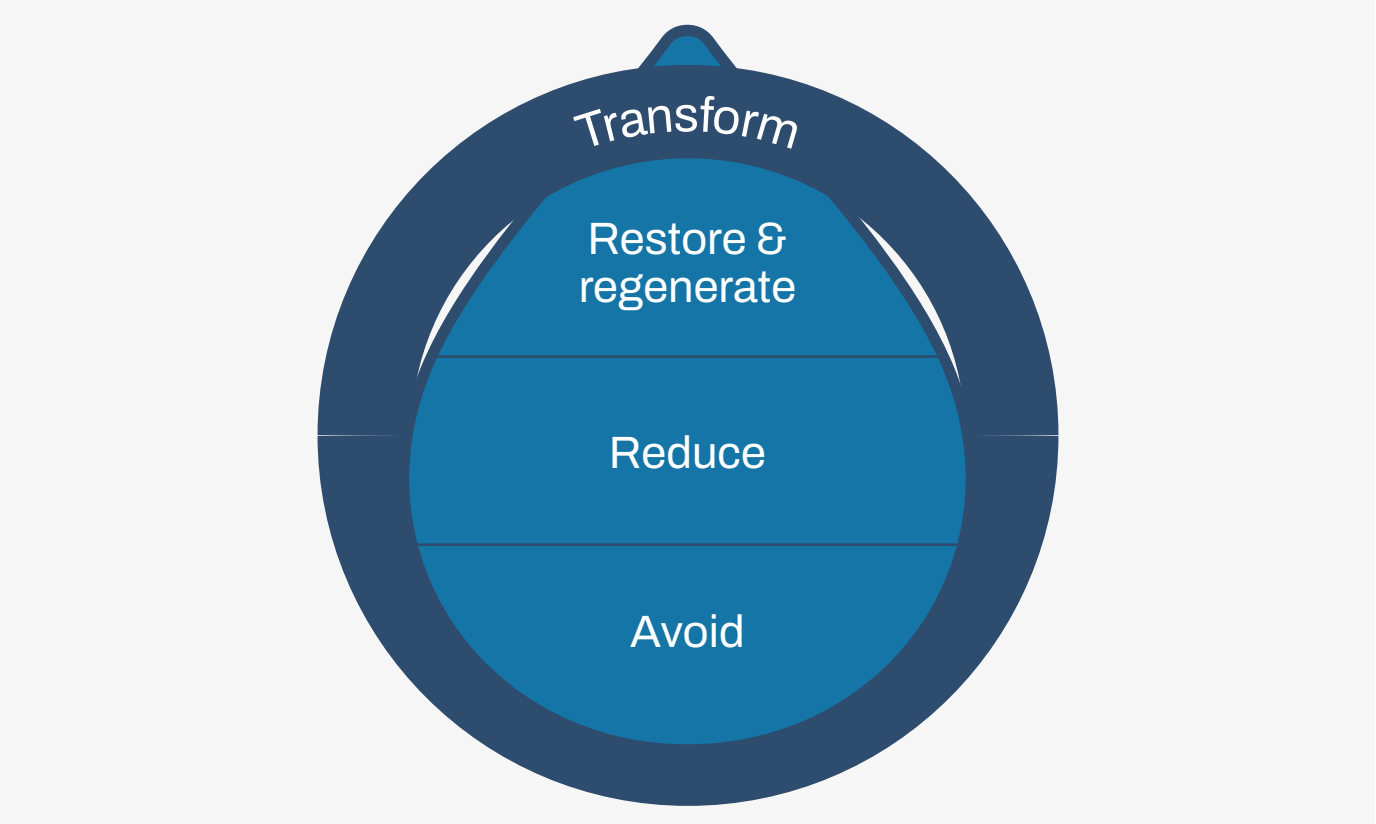
In responding to risks and opportunities, business actions that avoid or minimise negative impacts on nature should be prioritised over the pursuit of restoration efforts or mitigation of existing damage through reconstructive or compensatory measures. This is in line with mitigation hierarchy principles such as the SBTN AR3T framework.[21]

The AR3T framework includes four types of actions that should be followed sequentially:

- **Avoid:** Prevent negative impacts from happening in the first place; eliminate negative impacts entirely;
- **Reduce:** Minimise negative impacts that cannot be fully eliminated;
- **Regenerate:** Take actions designed within existing land/ocean/freshwater uses to increase the biophysical function and/or ecological productivity of an ecosystem or its components, often with a focus on a few specific ecosystem services; and
- **Restore:** Initiate or accelerate the recovery of an ecosystem with respect to its health, integrity and sustainability, with a focus on permanent changes in state.

It further includes **transformative action**, which covers the ways organisations can contribute to needed systemic change inside and outside their value chains.

Figure 16: SBTN AR3T framework



Source: Science Based Targets Network (2023) Step 4. Act

21 Adapted from: WWF (2022) A Biodiversity Guide for Business; Science Based Targets Network (2023) Step 4. Act

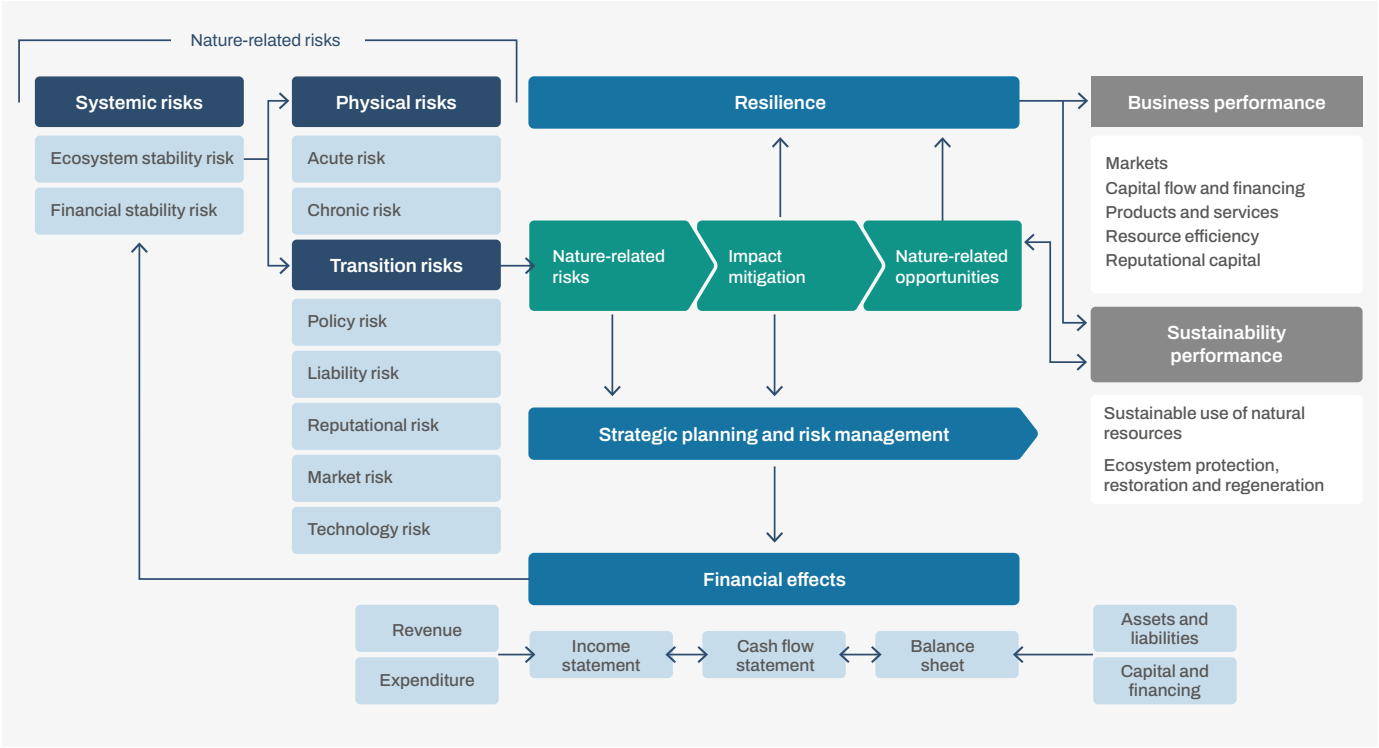
2.3. Understanding financial effects on the organisation

Nature-related risks and opportunities have financial effects on an organisation through changes to:

- Revenue, expenses and capital expenditure;
- Access to and cost of capital (through, for example, re-ratings of its credit risk or insurance premiums); and
- Carrying amount of assets and liabilities on the balance sheet.

These transmission channels can have a positive or negative effect on credit, operational, market, liquidity, liability, reputational and strategic risk (Figure 17).

Figure 17: Links between nature-related risks and opportunities, business performance and financial effects on an organisation



3. Scoping a LEAP assessment

3.1. Why

Internal due diligence processes like LEAP require the support of an internal senior management champion (a committee or individual) and a dedicated project team.

Early alignment between management and the LEAP assessment team on the scope and resources to be committed for the LEAP assessment is vital before any in-depth analytical work commences.

3.2. What

The TNFD recommends that the management and project teams draft and agree to a simple terms of reference document outlining the agreed parameters of the LEAP assessment to be undertaken. This will help to ensure alignment on goals, expected outcomes and timelines, and consequent resourcing and budget requirements. That assessment should be based on:

- A quick, high-level, preliminary scan of internal and external data and reference sources to generate a hypothesis about the organisation's potential nature-related dependencies, impacts, risks and opportunities; and
- A determination of where likely skills and data gaps lie and how those gaps will be addressed to complete the scoped assessment successfully.

The key to effective scoping is not to invest too much time or resources in any initial research and data scan as the scoping process is only designed to define the parameters of the assessment to follow. Some pilot testing organisations found it easy to get pulled into detailed analysis at the scoping stage, which runs the risks of pre-empting the assessment itself.

Objective

To align senior management and a designated LEAP assessment team on the parameters of the assessment to be undertaken, including the aspects of the business model and value chain to be assessed and the resources to be provided to undertake the assessment.

Desired outputs

- Strong internal support to proceed with an assessment based on an agreed terms of reference and commensurate budget and resources; and
- A working hypothesis about the organisation's potential nature-related issues to focus the assessment.

Practical tips from pilot testers

- Stay high level and avoid the temptation to dive into the data at this stage.
- In addition to scanning the organisation's potential nature-related issues, also scan for potential skill and data gaps that will inform resourcing decisions.

3.3. Guiding questions

The TNFD recommends that all organisations consider two high-level guiding questions to help ensure alignment on goals and expected outcomes of a LEAP assessment.

1. **Generate a working hypothesis:** What are the organisation's business processes and activities where there are likely to be material nature-related dependencies, impacts, risks and opportunities?
2. **Align on goals and resourcing:** 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?

3.3.1. Generate a working hypothesis

(1) Generate a working hypothesis	*What are the organisation's activities where there are likely to be material nature-related dependencies, impacts, risks and opportunities?*

Supporting questions:

- Does the organisation (and the assessment team) have a foundational understanding of nature-related dependencies, impacts, risks and opportunities?
- What activities and/or assets are in the organisation's upstream and downstream value chains?
- In which sectors, value chains and/or geographies does the organisation have a presence?
- How much revenue, expenditure or earnings is associated with each of these activities and assets? By sector, value chain and/or geography?

A key purpose of scoping is to create a shared internal understanding of the organisation's goals and objectives for a nature-related assessment. It should take into consideration the organisation's approach to materiality based on an understanding of its regulatory reporting requirements and the information needs of its capital providers and other stakeholders. Scoping should generate a working hypothesis as a basis for enquiry and a focus for where to prioritise the organisation's time and resources.

The Locate phase of LEAP has been designed to enable prioritisation and focus, starting with all potentially assessable sectors and activities, value chains and geographies and ending with those most likely to be associated with material nature-related dependencies, impacts, risks and opportunities.

Identifying assets and activities in direct operations and value chains

Your organisation needs to start by understanding the key components of its direct operations and upstream and downstream value chains. For corporates and financial institutions the entry point to this assessment will vary.

- **For corporates:** This may be assessed by organisational unit, product line, process or activity using asset-level data from internal sources and from other due diligence processes for value chain asset locations;
- **For financial institutions:** It will be important to consider financed, facilitated, investment and/or insured activities and assets which may be most appropriate to assess by sector, geography and asset class.

For corporates: Some companies that pilot tested the LEAP approach have found it difficult to source reliable internal and external asset-level data across their value chains, as this is not commonly asked as part of the supplier onboarding process. Other pilot testers found their organisations had already gathered this data to support other due diligence activities, such as greenhouse gas emissions accounting or human rights related reporting (for compliance with modern slavery legislation, for example).

Identifying where nature-related issues might exist across the business model and value chain

LEAP assessment teams and their organisations can increase their understanding of the relationship between business and nature and the key concepts that underpin an assessment of nature-related issues, building on Section 2 of this document and the resources referenced there.

Nature-related dependencies, impacts, risks and opportunities exist across every organisation's business model and value chain. For any organisation, its potentially material nature-related issues could be associated with products, processes or activities that are not the core focus of its business strategy. For larger multinational corporates and financial institutions, a prioritisation process is essential. For example:

- A global food and beverage company will potentially have hundreds of key supply chains for ingredients and potentially thousands of locations around the world from which it sources those inputs.
- A global financial institution, such as a pension fund, asset manager or insurance company, will deploy capital into companies with supply chains that cover most of the world's economic activity.

The Locate phase of LEAP has been designed to enable the prioritisation process, starting with all potentially assessable sectors and activities, value chains and geographies and ending with those most likely to be associated with material nature-related dependencies, impacts, risks and opportunities.

To start the prioritisation process in the scoping phase, the TNFD recommends that LEAP assessment teams focus their attention and resources on three filters or lenses:

- **Sector:**
  - **For corporates:** In which sectors do our business model and value chain partners operate?
  - **For financial institutions:** In which sectors do we allocate capital or provide products and services?
- **Value chains:** In which upstream and downstream value chains do we participate?
- **Geography:** Where are the geographic locations of our direct operations and, where easily possible to identify, those of our value chain partners?

To assist with scoping the assessment, a LEAP assessment team is encouraged to familiarise itself with some of the filtering tools recommended for the Locate phase and use these to undertake a quick, high-level scan across sectors, value chains and specific geolocations for potential areas of medium to high levels of nature-related dependency and impact.

At this scoping stage, the team should use the filtering tools for a basic scan only to help inform and create the team's working hypothesis, rather than conducting any deeper analysis. The team will return to these filters and tools in the Locate phase to undertake a more detailed analysis using the data they have assembled, including third-party subject matter experts or data sources if necessary.

Do a high-level scan for potential areas of medium to high levels of nature-related dependencies and impacts using the three filters – sectors, value chains and geographic locations – in order to form working hypotheses for the scope of the assessment.

3.3.2. Aligning on goals and resourcing

(2) Goals and resource 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?*

Supporting questions:

- What are the organisation's goals and expected outcomes from a LEAP assessment?
- What is the organisation's approach to materiality? Who are the key stakeholders for TNFD-aligned corporate reporting and what information will be material to them?
- What level of assessment is feasible or appropriate at this time given the complexity of the organisation's value chain? Should it be by product, process, input, business unit or site?
- What are the baselines and time periods for the analysis?
- What are the current limitations and/or constraints of the assessment? For example, skills, data, financial resources; and
- Where is it appropriate to place the boundaries around an analysis? What are the relevant business activities, sectors, geographies and biomes?

Defining goals and expected outcomes

Nature-related dependencies, impacts, risks and opportunities affect all organisations of all types and sizes. For example:

- A **small family-owned farming business** that supplies produce into the national market has a dependency on the availability and quality of groundwater. This generates risks for the organisation as others also exploit and/or pollute that water resource and wider changes to nature in the watershed affect the rate at which the resource is replenished and purified. Farmers are also at the forefront of significant potential nature-related opportunities, such as regenerative agricultural practices and business models that could reduce yield volatility in the face of extreme weather events, reduce input costs and open up access to new markets; or
- A **global financial institution** may have less exposure to any single physical risk because of its highly diversified investment portfolio, but it may face potentially material transition risk if much of its portfolio is associated with financing activities where growth is linked to illegal deforestation, for example, rapidly changing customer expectations, or transition alignment expectations among institutional investors.

A LEAP assessment may therefore help any organisation achieve one or more of the following management priorities:

1. **Inform management decision making** about corporate strategy and resilience in the face of nature-related issues, including necessary mitigation and adaptation measures and the identification of new investment or growth opportunities in nature-based solutions;
2. **Help achieve a particular corporate goal** aligned with its mission and values, such as aligning with the targets and goals of the Kunming-Montreal Global Biodiversity Framework (GBF);
3. **Support voluntary or regulated corporate reporting** requirements (i.e. compliance reporting) and use of the TNFD recommended disclosures; and
4. **Meet the changing information needs of investors** that may go beyond the information set out in standard corporate reporting.

All organisations are therefore encouraged to identify and assess their nature-related issues, irrespective of whether they have formal corporate reporting requirements to external investors and other stakeholders.

Approach to materiality

Those organisations that are conducting a LEAP assessment to inform and support their corporate reporting should make their approach to materiality a key consideration when scoping a LEAP assessment. The TNFD's General Requirements ask that report preparers clearly state their approach to materiality and require that it be applied consistently across all disclosures. This approach will have a bearing on the breadth and depth of the due diligence necessary, given the range of information required for different disclosure statements. The TNFD provides further guidance on materiality in its Recommendations.

Time horizons for the assessment

The TNFD Recommendations, consistent with ISSB's IFRS-S1 General Requirements for Disclosure of Sustainability-related Financial Information, ask report preparers to describe how they define short, medium and long term dependencies, impacts, risks and opportunities. These definitions will have a significant bearing on the scope of any LEAP assessment.

The chosen time horizon relates to the time over which nature-related issues are identified and assessed. This should be sufficiently long to take account of the full range of material nature-related risks. The ISSB notes that short, medium and long term time horizons can vary between entities and depend on many factors, including industry-specific characteristics, such as cash flow, investment and business cycles, the planning horizons typically used in an entity's industry for strategic decision-making and capital allocation plans, and the time horizons over which users of general purpose financial reports conduct their assessments of entities in that industry.[22]

Organisations may also want to refer to the timeframes agreed in the Kunming-Montreal Global Biodiversity Framework (GBF): 2030 for 'halting and reversing nature loss' and 2050 for 'living in harmony with nature'. The TNFD guidance on scenario analysis provides further information on time horizons for risk assessment.

Organisations should also identify a baseline year for the assessment. The choice of baseline will depend on the business context. For example, for screening risks, the baseline will often be the situation at the time of the first risk screening. As risk screening can be periodically repeated, the baseline will offer a good basis for assessing how risks have evolved. For measuring impacts, baselines can consider the time business activities begin, but there is often a need to account for historic impacts, particularly for land use change that may occur prior to – but be driven by – business activities. The selection of a baseline needs to be justified (be transparent and supported with sufficient evidence). Often multiple baselines may be required to capture changes in relation to different time scales.[23]

Knowledge, capacity, data and financial cost considerations

The interest and willingness to conduct a LEAP assessment will inevitably be constrained by knowledge gaps, internal capacity limits, data gaps and the costs associated with assessment.

The TNFD, like ISSB's IFRS-S1 General Requirements for Disclosure of Sustainability-related Financial Information, acknowledges that these considerations should be key components of any well scoped LEAP assessment. Limits on internal knowledge, capacity constraints and data gaps can be mitigated by engaging external subject matter experts and third-party data providers, but this of course increases costs.

22 See International Sustainability Standards Board (2023) IFRS S1 General Requirements for Disclosure of Sustainability-related Financial Information.

23 UNEP-WCMC et al. (2022) Recommendations for a standard on corporate biodiversity measurement and valuation. Aligning accounting approaches for nature, Section 4.2.

How these constraints are managed, and any trade-offs made, should be clearly articulated in the terms of reference document that is agreed between the senior management sponsor and the LEAP assessment team. This will help to support robust risk management disclosures aligned with the TNFD's recommendations.

"An entity need not undertake an exhaustive search for information to identify sustainability-related risks and opportunities that could reasonably be expected to affect the entity's prospects. The assessment of what constitutes undue cost or effort depends on the entity's specific circumstances and requires a balanced consideration of the costs and efforts for the entity and the benefits of the resulting information for primary users. That assessment can change over time as circumstances change."

ISSB's IFRS-S1, Paragraph B10.

Box 5: Value chain mapping and data gathering to identify risks and opportunities – Blackmores

Blackmores is a leading Australian natural health products company manufacturing vitamin, mineral and nutritional supplements for markets across the Asia Pacific region. It completed its first nature-related risk and opportunity assessment of a key herbal ingredient that covered the end-to-end value chain from farming of the raw ingredient to distribution. This was bolstered by three separate nature risk and opportunity assessments of Blackmores' key facilities in Australia using LEAP guidance.

Blackmores' supply chain covers more than 1,000 ingredients sourced from 36 countries and the company engages with 172 suppliers, many sourcing for multiple locations. The ingredient selected to pilot the whole value chain nature-related risk assessment was chosen because of its economic value to the business, Blackmores' strong relationship with the supplier and the fact it originated from an agricultural source. It was also informed by insights from Blackmores' climate resilience action plan and from a scientific literature review the Blackmores Institute published on the impacts of climate change on natural medicine.

To support data gathering across the supply chain, Blackmores leveraged existing data sharing arrangements with suppliers. It already maps suppliers by locations to inform its human rights risk assessment and meet modern slavery reporting requirements and was able to utilise this data and data gathering arrangements with suppliers to support the identification of likely nature-related hotspots. The principal supplier was engaged to help identify the relevant upstream offshore locations, including the growing region and the main material processing facility neighbouring the growing region.

For each location, an assessment of ecosystem importance was conducted based on proximity to priority locations with high biodiversity or conservation significance (e.g. key biodiversity areas). A high-level evaluation of ecosystem integrity was also completed using these global mapping tools. This step helped to flag areas where value chain activities could have potentially significant dependencies and/or impacts.

To gather the required data for the risk assessment, the team developed two questionnaires: one for the supplier and one for its internal manufacturing/ distribution team. The questions aimed to help identify the potential nature-related dependencies and impacts across the value chain.

Together, the information was used to inform a detailed analysis of the material impacts and dependencies for each of the value chain stages that may give rise to nature-related risks and opportunities, based on responses to the questionnaires, ENCORE, IBAT and desktop research.

With the support of an external consulting firm, Pollination, the LEAP assessment team then layered data to develop an extensive register of nature-related dependencies and impacts, and their translation into commercially relevant risks and opportunities.

The team produced detailed value chain maps and started developing education and information tools to bring key suppliers on the journey. Nature-related risks and dependencies are not well understood and supplier engagement throughout this process – including through webinars, development of video content or one on one knowledge exchanges – was fundamentally important.

Blackmores then developed a series of risk and opportunity insights by using its climate resilience Financial Sensitivity Model to determine the impact various nature risk scenarios could have on future revenues. Although the assessment was conducted on one ingredient, the insights were applicable to the broader business.

The findings helped validate Blackmores' starting hypothesis that the highest concentration of nature-related physical risks is likely to occur at the farming stage, relating to soil quality, climate regulation and flood risk, which have the potential to increase on-farm costs that may be passed onto Blackmores and disrupt raw material supply. It was also clear that both the supplier's refining facilities and Blackmores' own operations have impacts on nature, leading to transition risks associated with changing regulations regarding water, emissions and waste disposal.

Supplier engagement was an important part of the risk assessment processes, as this helped to accurately understand the implementation of mitigation activities or practices that might increase concern. The ability to leverage existing human rights risk assessment activities and data helped to integrate workstreams and save costs. Blackmores collects data on human rights, nature and climate emissions, creating a holistic risk assessment and Supplier ESG scorecard. This process also helped Blackmores to identify opportunities as well as risks.

Source: Blackmores

3.4. Desired outputs from scoping

The scoping exercise should produce a terms of reference document that includes:

- A short statement outlining the working hypothesis about the expected sectors and activities, value chains and geographies, as well as character, of the organisation's *potentially material* nature-related dependencies, impacts, risks and opportunities. It should set out where the LEAP assessment team proposes to focus more detailed evaluation and assessment through the four phases of LEAP, with the ultimate objective of the assessment (and reporting where relevant) of those nature-related issues that are material to the organisation; and
- A set of agreed parameters for the organisation's LEAP assessment, including:
  - The timeline and milestones for the assessment;
  - The internal staff and external human resources to be assembled as the project team;
  - Other organisational officials who will be required to contribute to the assessment process;
  - Likely sources of knowledge and data and how any gaps will be addressed, if possible, through the assessment phases; and
  - A budget to ensure full alignment on the assessment costs involved.

Having secured senior management approval to proceed based on the terms of reference, the organisation will be able to move to the Locate phase of the LEAP approach.

At the end of the LEAP assessment, the organisation should review its scoping exercise to reflect on whether its original working hypothesis was robust and whether there are any learnings that should be incorporated into the next LEAP assessment for the following reporting cycle.

At the end of the LEAP assessment, the organisation should review its scoping exercise to reflect on whether its original working hypothesis was robust and whether there are any learnings that should be incorporated into the next LEAP assessment for the following reporting cycle.

Box 6: Identifying resources and time allocation to implement the TNFD framework – AXA Climate

AXA Climate is part of the AXA Group, and one of the entities piloting the TNFD framework.

AXA Climate has found that streamlining the initial analysis can be achieved through automation, but it is essential to gather key information beforehand, such as the precise location of the company's activities and existing environmental studies. By starting with available data and information, it became easier to identify areas where additional internal or external metrics may be required.

To save time, AXA Climate recommends leveraging the expertise of teams involved in **previous work related to climate, water, and waste management** within the company. The knowledge and research accumulated in these areas proved valuable for conducting the nature and biodiversity analysis.

To effectively progress to the risk analysis phase and develop mitigation roadmaps, it is crucial to engage in a collaborative co-construction process. **This requires close collaboration and input from both corporate responsibility and risk management teams** to ensure that the metrics used align appropriately with specific activities. Allocating sufficient time and resources for this co-construction process is essential to ensure that the resulting analysis and roadmaps accurately reflect a company's risks, impacts, and opportunities related to nature and biodiversity.

Overall, conducting the nature and biodiversity review should not require a significant investment of time and resources. **However, building a mitigation and adaptation roadmap requires long-term commitment from the company, along with dedicated resources**.

These assessments can be ranked according to the magnitude of potential impacts of these dependencies on business. The objective of this more detailed analysis is to move from a sectoral materiality analysis to a more granular and asset-centric materiality analysis.

Source: AXA Climate (2023) TNFD 101: An illustrated guide to the future of nature reporting.

3.5. Resources for scoping

Organisations may consider the following non-exhaustive list of references to support their scoping discussions and decisions.

Mapping asset and activity level data	The TNFD recommends mapping asset and activity data to the SASB sector classification, the Sustainable Industry Classification System (SICS).
Scanning for potentially material nature-related issues	The following references may be helpful for undertaking a quick, high-level scan of your organisation's business model and value chain with respect to nature-related issues. The LEAP project team should also familiarise itself with tools and methods outlined in the Locate phase. Further details on these and other tools are outlined in the TNFD Tools Catalogue. • Allianz – Measuring and managing environmental exposure: A business sector analysis of natural capital risk • ENCORE • Finance for Biodiversity – The Climate-Nature Nexus • Integrated Biodiversity Assessment Tool (IBAT) • The Netherlands Enterprise Agency – Biodiversity Footprint for Financial Institutions: Exploring Biodiversity Assessment in 4 cases • Partnership for Biodiversity Accounting Financials • Science Based Targets Network Materiality Screening Tool • Swiss Re Institute BES Index – Biodiversity and Ecosystem Services: A Business Case for Re/insurance • UNEP, UNEP FI and Global Canopy – Beyond 'Business as Usual': Biodiversity Targets and Finance. Managing biodiversity risks across business sectors • UN Environment Programme World Conservation Monitoring Centre & UN Environment Programme Finance Initiative – Prioritising Nature-related Disclosures • World Economic Forum (WEF) – Nature Risk Rising
Case studies of nature-related issues	• Capitals Coalition Case Studies database • CISL – Integrating Nature: The Case for Action on Nature-related Financial Risks • Monetary Authority of Singapore – Information Papers on Environmental Risk Management • NGFS – Central Banking and Supervision in the Biosphere: An Agenda for Action on Biodiversity Loss, Financial Risk and System Stability • UNEP FI – Guidance on Biodiversity Target-Setting

4. Locating the organisation's interface with nature

4.1. Why

The Locate phase of LEAP encourages organisations to filter and prioritise potential nature-related issues using three filters: sector, value chain and geography.

Nature-related dependencies and impacts – the ultimate sources of risks and opportunities – are location-specific. Location therefore matters greatly for the identification, assessment and management of nature-related risks and opportunities for your organisation. Ultimately, the business model and value chain activities of every corporate and financial institution trace back to an interface with nature in a particular place.

Nevertheless, tracing every business and financed activity back to a specific place is complex. Gathering and disclosing data and insights on every issue in every location is not feasible or proportionate, particularly for financial institutions. The Locate phase therefore helps organisations filter and prioritise.

A sub-set of your organisation's interfaces with nature may include dependencies and impacts in ecologically sensitive geographic locations (contributing to illegal deforestation or illegal overfishing for example). These sensitive locations may expose the organisation to elevated risks (both physical and transition) and opportunities that may not yet be captured by standard risk management processes. For example, areas with rapid decline in ecosystem integrity may face elevated systemic risks and areas of high biodiversity may present elevated reputational or liability risks.

As a result, it is critical that organisations pay particular attention to any ecologically sensitive locations where their business model or value chain may have an impact or dependency on nature and this phase of LEAP provides a basis for making that assessment.

Objective

To identify an organisation's potentially material sources of nature-related dependencies, impacts, risks and opportunities. This is designed to help focus more detailed due diligence through the Evaluate and Assess phases of LEAP.

Key outcomes

- Solid understanding of moderate and high nature-related dependencies and impacts filtered by sector, value chain (upstream and downstream) and geography;
- A list and/or map of ecologically sensitive locations that the organisation operates in, and a broader set of assessment locations to take into the Evaluate phase of LEAP; and
- Understanding of the proportion of the business model, value chains and/or capital portfolio assessed for its interface with nature.

Practical tips from pilot testers

- Apply the sector, value chain and geographic location filters that are relevant to your business model, value chain and financial portfolios. It might be useful to apply all three or only one.
- Financial institutions should start by analysing their portfolios.

4.2. What

Starting with the working hypothesis from the scoping exercise, the organisation is now ready to conduct a more detailed analysis to identify with greater precision the sectors, value chains and geographic locations where it is likely to have moderate and high dependencies and impacts on nature.

Analysis in the Locate phase involves the application of these prioritisation filters – sector, value chain and geography – to help organisations arrive at an informed, evidence-based view of the sources of potentially material nature-related dependencies, impacts, risks and opportunities in their direct operations and upstream and downstream value chains. This is followed by analysis of locations declared, or known to be, ecologically sensitive.

Some small and medium-sized enterprises will interface with nature in a relatively small number of locations, but large multinational corporates and global financial institutions may interface with nature in thousands of locations through their value chain activities. Across such complex value chains (upstream and downstream), the precise location of the points of interface with nature may be uncertain or difficult to ascertain based on currently available data. Completing due diligence on every location in their direct, upstream and downstream activities every year and subject to third-party assurance of those findings may be impossible for many organisations.

It is critical that organisations pay particular attention to any sensitive locations where their business model or value chain may have an impact or dependency.

- **For corporates:** The Taskforce recommends that you identify the geographic locations of your direct operations using internal asset-level data and, in parallel, start a dialogue with your upstream suppliers and downstream customers to seek data about the geographic location of their operations to support greater visibility, traceability and future analysis across upstream and downstream value chains.
- **For financial institutions.** It is suggested to start by focusing on your portfolios. Heatmapping is one technique to identify qualitatively potential or actual exposure to nature-related risk, revealing whether activities materially depend on or impact nature, and potential portfolio exposure to a range of nature-related dependencies and impacts across sectors. Further guidance on heatmapping is provided in Annex 4 of this guidance.

The TNFD recommends a number of tools and resources that a LEAP assessment team can use to guide its analysis. These are recommendations only. Every business model and value chain is unique and the LEAP assessment teams should explore other relevant tools and resources that may be relevant to their business.

4.3. Guiding questions

The following high-level questions should guide analysis in the Locate phase:

L1: Span of the business model and value chain – What are our organisation's activities by sector, value chain and geography? Where are our direct operations?

L2: Dependency and impact screening – Are any of these sectors, value chains and direct operations associated with potentially moderate and high dependencies and impacts on nature?

L3: Interface with nature – 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, and moderate and high dependency and impact value chains and sectors, interface with?

L4: Interface with sensitive locations – For our organisation's activities in moderate and high dependency and impact value chains and sectors,

which of these are in ecologically sensitive locations? And which of our direct operations are in these sensitive locations?

4.4. L1: Span of the business model and value chain

L1: Span of the business model and value chain	What are our organisation's activities by sector, value chain and geography? Where are our direct operations?

The first task for any LEAP assessment team is to develop an understanding of the parts of the organisation's business model and value chain that were selected for assessment during the scoping exercise. This will enable the LEAP assessment team to filter these and to prioritise where they might locate sources of moderate and high nature-related dependencies and impacts in L2.

Supporting questions:

- Sector:
  - **For corporates:** In which sectors do our business model and value chain partners operate?
  - **For financial institutions:** In which sectors do we allocate capital or provide products and services?
- Value chains: In which upstream and downstream value chains do we participate?
- Geography: Where are the geographic locations of our direct operations?

Identifying sector and economic activities

There are standard classifications of economic activities that enable the classification of entities according to the activity they carry out. Aligned with ISSB guidance, the TNFD recommends using the SASB sector classification (SICS).[24] Your organisation, however, should consider which sector classification will be most relevant, given its jurisdiction and activities.

Value chain

When identifying which value chains it participates in, the organisation should consider the scope and constituent elements of each value chain, both upstream and downstream. This will cover commodities used, products and processes.

The organisation should also consider its goals for the assessment, including the priorities of investors and other stakeholders, as identified in the Scoping phase.

Geography

The organisation should identify the geographic location of its direct operations using internal asset-level data. Organisations should be able to locate all sites in their direct operations, as this information is likely to be readily available. The organisation should aim to be as precise as possible in identifying locations, using GPS coordinates and/or polygons where possible.

Start by identifying the geographic location of the organisation's direct operations and assess the coverage and quality of the organisation's value chain asset-level data from other due diligence activities.

- **For financial institutions and other professional services businesses:** This refers to their offices and other operational locations. These may have dependencies and impacts on nature that create operational risks and opportunities for the organisation.

24 SASB. Find your industry.

Box 7: Locating nature-related upstream impacts for a professional services firm – Accenture

Accenture, a global professional services company, conducted a LEAP pilot to provide insights into areas including the priority locations for direct operations and upstream value chain activities, and the potential impacts and dependencies associated with its UK and Ireland (UKI) operations. The pilot was focused on direct operations and upstream (supplier) value chain operations.

The pilot team first scoped-in a list of direct operation locations, prioritised based on proximity to areas of high biodiversity importance (e.g. relative proximity to protected areas, Key Biodiversity Areas, and vulnerable, endangered and critically endangered species, coupled with their relative STAR scores, from IBAT). Next, the team produced a heatmap (see below) of potential nature-related impacts and dependencies in upstream operations, drawing on data from the ENCORE tool. A scatter graph (see below) was then created to show the potential materiality of different procurement categories against financial spend.

Lack of Tier N supplier information (i.e. information on the location of Tier N suppliers or input material sourcing beyond Tier 1 suppliers) is a common client challenge. Accenture used the pilot to test an approach for a spend-based life cycle assessment analysis for the upstream value chain. They explored two tools, BioScope and OpenLCA (both based on EXIOBASE), for this phase. EXIOBASE, a multi-regional environmentally extended input-output database that can be used to estimate environmental impacts based on sector and geography, enables users to select commodities and resources purchased from 163 sectors in 44 countries, and five rest of world regions. The scoped-in spend categories were mapped using the inputs required by the tools to process the assessment, such as the amount spent on different commodities procured. This assessment provided a quantitative view of both the most impacted countries around the globe and the spend categories that contribute to this impact.

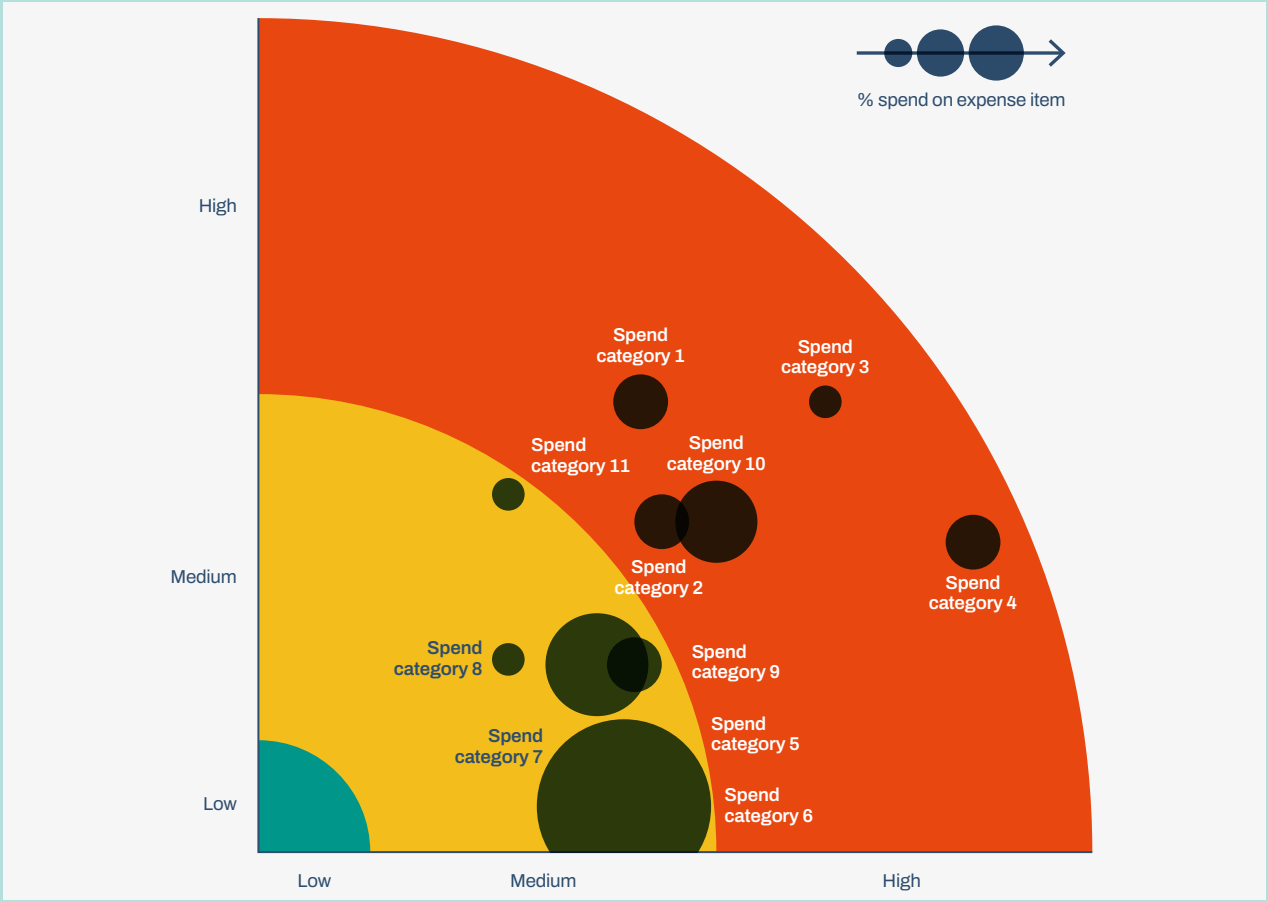
Aligned with the L4 component of LEAP, the team then assessed the current integrity and importance of natural ecosystems at a country level using global datasets from the UK's National History Museum's Biodiversity Intactness Index and the World Resources Institute's Aqueduct Water Risk Atlas. This helped narrow down the focus to priority countries, which have low ecosystem integrity and high water stress. Both datasets were found to be easy to interpret and process.

To identify priority sites for further evaluation, the team mapped the regions identified above to their probable or specific Tier N supplier locations. To do this, the pilot team conducted a literature review to validate prioritised locations across the supply chain. This involved reviewing sustainability and other reports, such as Securities and Exchange Commission (SEC), published by Tier 1 suppliers to assess their supply chain, followed by research into the locations of suppliers, progressing where possible to Tier N supplier locations using, for example, databases of mining locations.

Illustrative heatmap of exposure to nature-related impacts and dependencies (sample – not real data)

Drivers of nature change (IPBES)	Land, freshwater and ocean use change			Climate change	Pollution / pollution removal					Resource use / replenishment	
Sectors (ENCORE Classification)	Freshwater ecosystem use	Terrestrial ecosystem use	Marine ecosystem use	GHG emissions	Disturbances	Non-GHG air pollutants	Soil pollutants	Solid waste	Water pollutants	Water use	Other resource use
Airlines											
Wireless telecommunication											
Railroads											
Research & Consulting Services											
Hotels, Resorts & Cruise Lines											
Home furnishings											
HR & Employment services											
Environmental & Facilities services											
Integrated telecommunication											
Paper products											
Technology hardware, storage & peripherals											

Illustrative TNFD-guided materiality analysis (sample – not real data)



Source: Accenture (2023)

4.5. L2: Dependency and impact screening

L2: Dependency and impact screening	*Which of these sectors, value chains and direct operations are associated with potentially moderate and high dependencies and impacts on nature?*

In L2, the organisation should consider which sectors, direct operations, value chains and elements of its value chains present moderate or high dependencies and impacts on nature. To identify potentially moderate and high dependencies or impacts for sectors, value chains and direct operations, the organisation can compare the sectors and value chains identified in L1 with those identified in credible reference sources as having moderate and high dependencies and/or impacts on nature.

A range of data and tools exist to support this analysis and have been successfully used by pilot testing organisations. These include:

- ENCORE; and
- SBTN's High Impact Commodity List and Materiality Screening Tool.

The organisation can compare the activities and commodities identified in L1 with the lists provided by ENCORE and SBTN and identify those that appear to be most likely to be associated with moderate and high nature-related dependencies and impacts. This can be supplemented and guided by other information held by the organisation and consider its wider organisational, investor and other stakeholder priorities. Organisations that wish to go deeper to get a fuller picture of potential value chain issues may also consider tools such as:

- The CDP Water Impact Index;
- The Integrated Biodiversity Assessment Tool (IBAT);
- Trase;
- The WWF Biodiversity Risk Filter; and
- Heatmaps, which are a popular approach used by both corporates and financial institutions to capture this analysis. Figure 18 shows an illustrative output from a heatmapping exercise. Further guidance on heatmapping is provided in Annex 4 on risk assessment methods.

Look beyond the sources recommended by the TNFD, particularly sector or biome specific sources and data sets of particular relevance to the organisation's business model and value chain.

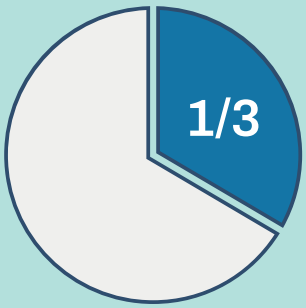
Figure 18: A heatmap can help identify sectors where there is exposure to nature-related issues

	Dependencies		Impacts						
			Land use	Water use	Pollution				Low – High
SASB Sectors	Soil quality	Water quality	Land use	Water use	Air pollution	Solid waste pollution	Soil pollution	Water pollution	AUM (% of total)
1 Agricultural products and tobacco	High	High	High	High	Low	Low	High	High	2%
2 Consumer goods	Low	Low	Low	High	Moderate	Low	Moderate	Moderate	5%
3 Extractives and minerals processing	Low	Moderate	High	High	High	High	Moderate	High	14%
4 Financials	Low	Low	Low	Low	Low	Low	Low	Low	16%
5 Food and beverage (ex. agriculture and tobacco)	Low	Moderate	Low	High	Low	Moderate	Low	Low	11%
6 Health care	Low	High	Low	High	Low	Moderate	High	High	6%
7 Infrastructure (ex. utilities and generators)	Low	High	High	Low	Low	High	Low	Low	2%
8 Renewable resources and alternative energy	Low	High	Low	High	Low	Low	High	High	3%
9 Resource transformation	Low	Low	Low	High	Moderate	High	High	High	6%
10 Services	Low	Low	Low	Moderate	Low	Low	Moderate	High	12%
11 Technology and communications	Low	Low	Low	Low	Low	Low	High	High	15%
12 Transportation	Low	Low	Moderate	High	Moderate	Moderate	High	High	5%
13 Utilities and electricity generators	High	High	High	High	High	High	High	High	3%

AUM: Assets under management

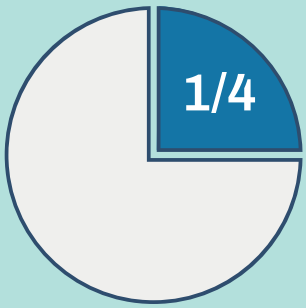
Box 8: Sector-based Locate analysis for asset managers – Robeco

Robeco, the Netherlands-based international asset manager managing over €176bn of ESG-integrated assets, conducted a heatmap assessment using ENCORE data to understand the exposure of its investments to sectors with a high or very high impact on nature and dependency on ecosystem services. It focused its LEAP assessment on two asset classes – fixed income and equities. This analysis allowed Robeco to identify sub-industries with the highest exposure to dependencies on ecosystem services and impacts on key drivers of biodiversity loss. The results were compared to the findings from research by the Dutch and French central banks and other peers in the industry and found to be broadly in line. The insights from the team's ENCORE analysis are highlighted below.



AUM in sectors with high/very high impacts on key drivers of biodiversity loss:

- Airlines and airport services
- Marine ports
- Agricultural products
- Oil and gas



AUM in sectors with high/very high dependency on at least one ecosystem service:

- Agricultural products
- Forest products
- Electric utilities
- Water utilities
- Packed foods and meat
- Apparel

Source: Robeco (2022) Five things you need to know about biodiversity investing" with "Five things you need to know about biodiversity investing, 14.

Source: Robeco (2022) Robeco's approach to biodiversity, 11.

While ENCORE was a useful first step in mapping its exposure to biodiversity risks, Robeco found two key limitations: sovereign issuers are not covered and ENCORE data cannot be used to understand how individual companies impact and depend on nature.

In response, Robeco has been monitoring the developments of ESG datasets to gather information on company-level exposure to impacts and dependencies within value chains. However, this data still lacks insights into companies' responses to existing nature-related risks, such as taking mitigating and remedial action. Therefore, Robeco created its own biodiversity investment framework to assess companies' nature-related impacts. The framework contains indicators based on the drivers of nature loss identified by Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) (excluding invasive species) and is consistent with the TNFD approach.

Companies are scored based on how they are contributing to or relieving pressure on the drivers through their products, direct operations and value chains. The assessment also evaluates how well the company manages biodiversity on the land under its responsibility, namely whether the company has appropriate biodiversity management plans in place for its sensitive locations. This helps to better reflect the de facto pressure on land use that is exerted by the company in question. Company scores enabled Robeco to differentiate between leaders and laggards with regards to their contribution and efforts to relieve pressures on drivers of biodiversity loss.

Source: Robeco (2022) Robeco's approach to biodiversity.

4.6. L3: Interface with nature

L3: Interface with nature	*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, and moderate and high dependency and impact value chains and sectors, interface with?*

4.6.1. Identifying locations

Having undertaken the screening and/or heatmapping in L2, the organisation should identify the geographic locations of the screened activities, where not already done.

The TNFD recognises that data dependencies across value chains for both corporates and financial institutions may be significant and this may take some time to address over several reporting cycles (Box 12).

- **For financial institutions:** The TNFD recognises that you may only be able to identify the geographic locations of your clients or financed activities for the areas flagged as potentially important by the heatmapping exercise at a relatively high level, such as by country.

Analytical precision will need to be balanced against the cost of gathering information required to be able to undertake the subsequent analysis in LEAP. Some data may already exist as a result of other internal due diligence or compliance reporting, such as compliance with modern slavery legislation or Know Your Customer checks. Organisations should take a proportionate approach and consider the information that is actually required to be able to undertake analysis that is sufficiently robust for the identified goals and expected outcomes of the assessment, and report users' needs. It is also important to consider whether this information can be independently assured.

For example, in some cases, it may be sufficient to trace a commodity to the landscape where it is produced, rather than to the individual farm, as nature-related issues will be common for that commodity across the landscape. In other cases, the organisation may need to be more precise. For downstream issues, organisations may only be able to identify the market in which the product has been placed. This may also be sufficient to be able to understand the risks and opportunities the organisation faces in that market.

Organisations are encouraged over time to deepen their understanding of the geographic location of their activities in direct operations and upstream and downstream value chains as the basis for a more comprehensive assessment of potentially material dependencies, impacts, risks (both physical and transition) and opportunities.

- **For corporates:** This includes offices, sites and product life cycles.
- **For financial institutions:** This includes financing and insurance provided to individual entities in portfolios.

The TNFD recommends that organisations – primarily corporates, but also financial institutions involved in project finance, for example – seek to understand their areas of influence[25] around the locations where they have activities (Box 9). Organisations should revisit this after having completed the Evaluate phase.

25 SBTN (2020) Initial Guidance for Business.

Box 9: Areas of influence

Nature-related impacts can arise beyond the immediate site boundary of an activity. Corporates (and financial institutions involved in project finance) should seek to understand areas of influence, noting that the size of the area may vary, depending on the nature of its activities and/or assets, and on the biome, and is often larger than the footprint of the site itself. It includes areas in which nature is subject to direct and indirect impacts that may be positive or negative, depending on the site activity. When an organisation's area of influence overlaps with those of other organisations, cumulative impacts should also be considered. A comprehensive approach to outlining a project's area of influence is included in several good practice guidelines, such as IFC Performance Standard 6 and the Good Practices for the Collection of Biodiversity Baseline Data.[26]

4.6.2. Identifying biomes and ecosystems

The identification of relevant biomes and ecosystems is critical for the Evaluate phase of LEAP but the approach to identifying relevant biomes and ecosystems will vary for corporates and financial institutions:

- **For corporates:** Having identified the geographic locations of its direct operations (L1) and moderate and high dependency and impact value chains and sectors, corporates can identify the relevant biomes and ecosystems they are interfacing with in these – or other – locations.
- **For financial institutions:** Having undertaken an initial scan of potentially material nature-related issues in its portfolios through heatmapping in L2, financial institutions can start to consider which geographies are relevant to the medium and high impact sectors identified, and which biomes or ecosystems (e.g. peatlands in Indonesia) are relevant to the activities of interest in those geographies. Box 11 provides an example of Locate analysis by an asset manager, based on a pilot by Storebrand focused on analysis of the agriculture sector and deforestation in Indonesia.

Box 10: Recap – Key definitions

Ecosystem: A dynamic complex of plant, animal and microorganism communities and the non-living environment, interacting as a functional unit.

Biome: Global-scale zones, generally defined by the type of plant life that they support in response to average rainfall and temperature patterns. Examples are tundra, coral reefs or savannas.[27] In the Global Ecosystem Typology, a biome is a component of a realm united by one or a few common major ecological drivers that regulate major ecological functions. Biomes are derived from the top-down by subdivision of realms (Level 1) – refer to the Global Ecosystem Typology for more detail if needed.

Environmental assets: The naturally occurring living and non-living components of the Earth, together constituting the biophysical environment, which may provide benefits to humanity.

For more information see Section 2.

Sources: Convention on Biological Diversity (1992) Convention on Biological Diversity, Article 2. Use of Terms; Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (2019) Global assessment report on biodiversity and ecosystem services; United Nations (2021) System of environmental-economic accounting – Ecosystem accounting.

26 Gullison, R. E. et al. (2015) Good Practices for the Collection of Biodiversity Baseline Data; International Finance Corporation (2012) Performance Standard 6 Biodiversity Conservation and Sustainable Management of Living Natural Resources.

27 Keith, D. A. et al. (eds.) (2020) IUCN Global Ecosystem Typology 2.0: descriptive profiles for biomes and ecosystem functional groups.

As outlined in Section 2, the TNFD has adopted the IUCN Global Ecosystem Typology as the reference set of biomes, in line with the UN SEEA. These are summarised in the lefthand side of Figure 19 and mapped to the four realms of nature, with reference lists of environmental assets and ecosystem services. LEAP assessment teams can use this as a reference look-up guide to the biomes, environmental assets and ecosystem services most likely to be relevant to their business model and value chain.

Figure 19: Fundamental concepts for understanding nature

Sources: International Union for Conservation of Nature (2023) IUCN Global Ecosystem Typology and United Nations et al. (2021) System of environmental-economic accounting – Ecosystem accounting; Keith, D. A. et al. (eds.) (2020) IUCN Global Ecosystem Typology 2.0: descriptive profiles for biomes and ecosystem functional groups.

Note: The numbers in brackets for each biome refer to the correct alphanumerical code from the GET. In some cases, the terms used here for biomes have been simplified from GET to aid understanding. The GET is the basis for the UN SEEA.

Other relevant tools are available in the TNFD Tools Catalogue. A non-comprehensive list of other tools that may be useful for identifying which biomes and ecosystems your organisation's activities and assets interface with includes:

- Global Map of Ecoregions;
- Integrated Biodiversity Assessment Tool (IBAT);
- Critical Habitat Screening Layer (UNEP-WCMC);
- Ocean+;
- Global Forest Watch;
- Trends.Earth;
- HabitatMapper; and
- Resource Watch.

To support more detailed Locate analysis, the TNFD provides additional Biome Guidance.

Box 11: An asset manager's Locate analysis for deforestation risk – Storebrand

Storebrand is one of the largest private asset managers in the Nordic region, with over NOK 1,000 billion invested in more than 5,000 companies around the world.

Deforestation has been an early area of focus for Storebrand's nature-related activities, with a zero-deforestation policy implemented in 2019 and a target of zero deforestation in the investment portfolios by 2025. As part of this commitment, Storebrand will not knowingly finance operations that are illegal, fail to protect high conservation value land, or violate the rights of workers and local people. By conducting an analysis that makes supply chains with high deforestation exposure (e.g. agricultural commodities) more transparent, Storebrand is able to directly engage companies with potential high conversion impacts or inadequate safeguards, and over time, divest from those that fail to comply with the organisation's policy.

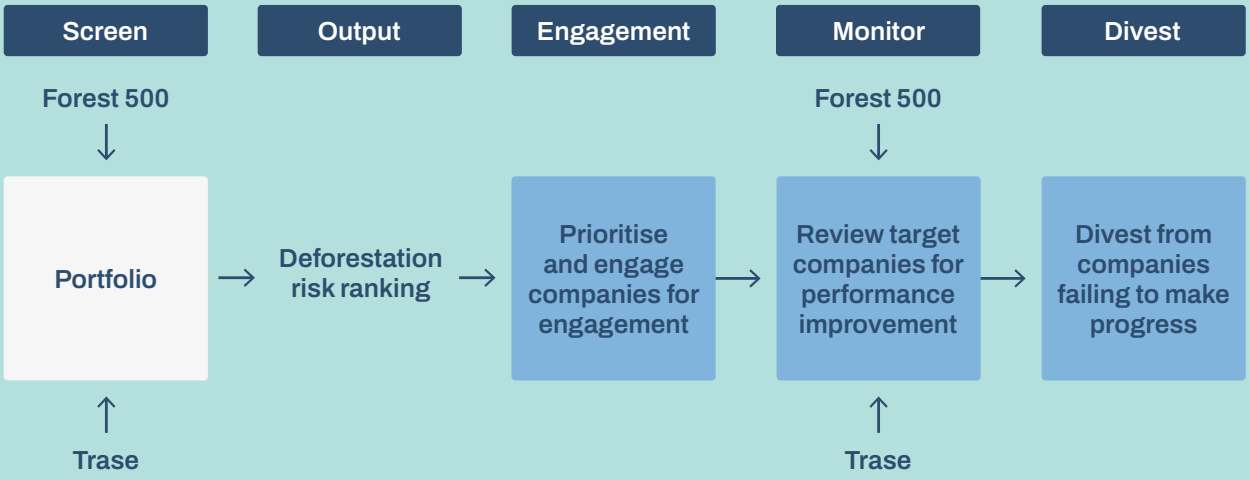
Storebrand made the decision to begin with deforestation risk within its portfolios because, despite the complexity of supply chains of high deforestation risk commodities, there is a more mature landscape of tools and partnerships when compared with other nature-related impacts.

"To fulfil our commitment to eliminate commodity-driven deforestation from our portfolio by 2025, we need quality data on companies' exposure to and management of deforestation. We have found that using a combination of data from Forest 500 and Trase allows us to identify companies at risk in our portfolio and to develop company-specific engagement strategies."

Vemund Olsen – Senior Sustainability Analyst, Storebrand Asset Management

Financial data providers do not offer comprehensive data on deforestation or conversion, meaning alternative approaches are needed to understand exposure to deforestation. The first step for Storebrand was to identify a list of companies that may be exposed to deforestation through production, trade, use or financing of forest-risk commodities. For this purpose, Storebrand screened its portfolios against the Forest 500, which includes 350 companies and 150 financial institutions with high exposure to, or influence on, forest-risk commodity supply chains. This portfolio screening showed that Storebrand was mostly exposed to deforestation through companies with indirect links to deforestation through their supply chains or financing, but also some major commodity traders that might potentially have a more direct link to deforestation.

The next step was to unpack complex agricultural supply chains to locate sourcing regions of investee companies within Storebrand's portfolios, and to understand where these sourcing regions intersect with areas at high risk of deforestation. Storebrand uses the Trase tool to trace deforestation exposure in commodity supply chains and to estimate deforestation impact associated with soft commodity producers and traders in their portfolios.



Source: Trase Insights (2021) Storebrand Asset Management Deforestation Risk Assessment

To select companies for direct engagement, Storebrand subsequently used results from the Forest 500 (F500) assessment to categorise companies into three groups: green, yellow and red:

- Green: companies that score over 80 points in the F500 ranking or have demonstrated compliance with Storebrand's deforestation policy;
- Yellow: companies that score 80-40 points in F500; and
- Red: companies that score below 40 points in F500, or have been unwilling to make necessary improvements through active engagement.

This Locate analysis highlighted that data challenges remain, especially around data on the deforestation impact of companies. Neither Trase nor Forest 500 provide data on deforestation impact throughout the entire value chain. Trase is limited to producers, exporters and first importers of commodities, and does not estimate deforestation footprints of downstream companies like retailers. This means bottom-up company by company analysis is still often required to get the granularity of information investors need. Storebrand found that CDP Forest has more granular, self-reported data from companies, which is very useful for company and portfolio analysis.

Trase Insights (2021) Storebrand Asset Management deforestation risk assessment

Box 12: A company's Locate analysis for deforestation risk – Nestlé

Nestlé, the largest publicly held food company in the world measured by revenue with over 2,000 brands sold in over 180 countries, has set out to create deforestation-free supply chains and contribute to the restoration of the natural ecosystems on which it depends across its business by 2025.

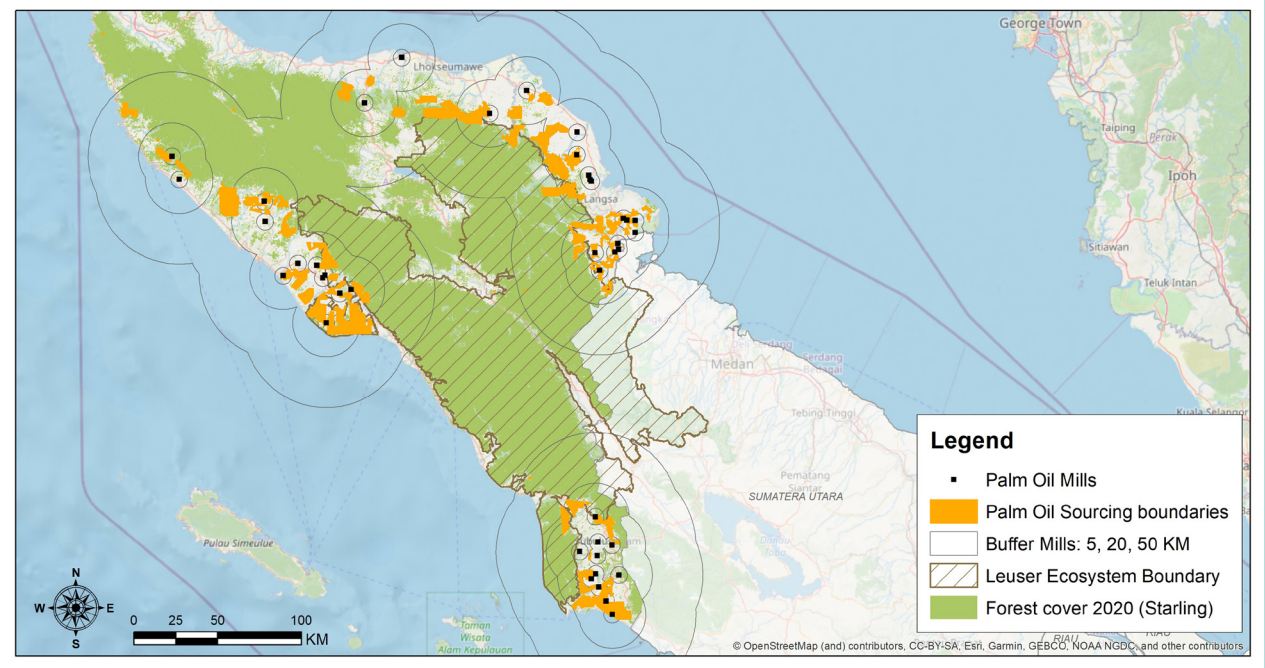
As of 2021, Nestlé has already traced 97% of its palm oil to the mill level and 68% to the plantation. Supplier mills have been identified through communication with suppliers and paper-based verification methods, with data on palm oil sourcing locations showing particular prevalence of Indonesian and Malaysian palm oil. While mapping to the mill level is an important first step in understanding supply chain deforestation impacts, identifying upstream locations at the farm and plantation level enables a more accurate analysis of risk.

To do so, Nestlé has overlaid spatial data on the provinces from which palm oil was sourced with spatial data on global deforestation fronts and forest degradation areas related to intact forest landscapes. The map below shows high priority areas, mapped to the regional and provincial level.

The Aceh Province in Indonesia was identified as one priority region. Nestlé used a supply shed approach to locate farms and plantations that are linked to supplier mills. This involved communicating with the mill to first determine whether or not sourcing boundary data was available and then gathering information to predict the radius of sourcing boundaries. From this analysis, Nestlé identified:

- Available sourcing boundaries with confirmed links to mills across its supply chains;
- Available sourcing boundaries without confirmed links to mills in its supply chains, but that could enter its supply chain in the future; and
- A 5km, 20km and 50km radius around mills in its supply chain, for which there were no identified sourcing boundaries.

This information allowed Nestlé to map predicted and confirmed sourcing boundaries associated with all supplier mills in the Aceh Province, as shown in the map below:



Source: Nestlé (2020) Palm Oil Forest Footprint Aceh Province Analysis, page 3

Nestlé overlaid sourcing boundaries with available data on forested areas (Starling Satellite), peatlands (Indonesian Ministry of Environment and Forestry) and customary lands (Ancestral Domain Registration Agency, BRWA). This enabled a better understanding of where sourcing areas overlap with areas of high deforestation risk, conversion risk, or associated human rights impacts.

This analysis revealed three interesting insights relevant to forest ecosystems, peat ecosystems and customary lands, with implications for both conversion risk and human rights. Although not all areas at risk were directly associated with Nestlé's palm supply chains, this exercise highlighted areas of forest, peat and customary lands that could enter Nestlé's supply chains in the future.

Source: Nestlé Our palm oil transparency dashboard

4.7. L4: Interface with sensitive locations

L4: Interface with sensitive locations	*For our organisation's activities in moderate and high dependency and impact value chains and sectors, which of these are in ecologically sensitive locations? And which of our direct operations are in sensitive locations?*

Organisations may have significant dependencies and impacts and/or face elevated nature-related risks and opportunities in business locations that are also ecologically sensitive locations.

- **For corporates:** Building on the assessment in L1 to L3, corporates should assess whether activities are geographically located in ecologically sensitive locations: (i) anywhere in their direct operations; and (ii) in their assessed moderate and high dependency and impact value chains and sectors.
- **For financial institutions:** Financial institutions should look at the interfaces of their clients and investees with sensitive locations – as well as considering their direct operations. They may draw on external providers to undertake their analysis as well as information directly from clients and investees. The Storebrand case study (Box 11) highlights this type of analysis.

Sensitive locations are defined by TNFD as:

- Areas important for biodiversity, including species; and/or
- Areas of high ecosystem integrity; and/or
- Areas of rapid decline in ecosystem integrity; and/or
- Areas of high physical water risks; and/or
- Areas of importance for ecosystem service provision, including benefits to Indigenous Peoples, Local Communities and stakeholders.

Table 4 provides greater detail on these five criteria defining sensitive locations, including recommended reference datasets that can be used by a LEAP assessment team to get started with its identification of any sensitive locations meeting one or more of these criteria. Only one criterion needs to be met to constitute a sensitive location.

These are only example datasets to provide some consistency of analytic approach. The list provided is not exhaustive and there may be other reference sources and datasets that a LEAP assessment team might consider, depending on the specifics of the organisation's business model and value chains. Relevant information may also be found in national and regional-level data. In addition, stakeholder engagement and judgement are critical to this assessment, based on the unique business model of the organisation and its interface with nature.

Table 4: Criteria for sensitive location identification and reference datasets[28]

Area	Criteria	Recommended metrics and reference datasets
Biodiversity importance	Areas of biodiversity importance include, but are not limited to:	
	• Areas protected through legal or other effective means, for example, areas designated as protected areas according to local, national, regional and/or international conventions and agreements, and/or areas conserved through other effective area-based conservation measures (OECMs).	• World Database on Protected Areas (WDPA) and other effective area-based conservation measures (OECMs) that include both legally protected areas of all IUCN management categories and areas recognised by international and regional conventions and agreements (e.g. natural and mixed World Heritage sites, Ramsar Wetlands of International Importance, Natura 2000 sites, regional seas agreements).
	• Areas scientifically recognised for importance for biodiversity.	• Key Biodiversity Areas (that include IPAs, AZEs, IBAs); • Ecologically or Biologically Significant Marine Areas (EBSAs); and • Important Marine Mammal Areas: IMMA e-Atlas – Marine Mammal Protected Areas Task Force.
	• Areas important for species, including threatened species (Critically Endangered, Endangered and Vulnerable at global and/or national and/or regional levels), and/or congregatory, migratory and/or range-restricted or endemic species.	• IUCN Red List of Threatened Species; • Minimum threshold for the Species Threat Abatement and Restoration (STAR) metric; and • Ocean+ Data Viewer marine biodiversity spatial datasets.

28 Areas identified as critical habitat (based on IFC PS6 definition) and high conservation value and high carbon stock areas would meet some of the criteria. These are areas that are not mapped globally, although screening layers exist to support an understanding of where they are likely to occur.

Area	Criteria	Recommended metrics and reference datasets
Biodiversity importance	• Areas containing ecosystems that are rare or very localised, highly threatened, important for ecosystem connectivity, and/or associated with key evolutionary processes. • Areas important for ecological connectivity – including important ecological corridors, areas and routes that are important for seasonal migratory patterns and areas that provide adaptive space for species to spread across a landscape in the face of changing environmental conditions.	• IUCN Red List of Ecosystems, seamounts or coastal upwellings; • Ocean+ Habitat datasets such as mangroves, seagrasses, coral reefs; • World Database of Ecological Corridors (upcoming); • Eurasian African Bird Migration Atlas; and • Atlas on Migratory Ungulates (under development by Global Initiative on Ungulate Migrations (GIUM)).
Ecosystem integrity	Ecosystem integrity refers to the extent to which the composition, structure and function of an ecosystem falls within the natural range of variation. It should be characterised at a landscape scale, using an appropriate area of assessment, such as an ecoregion. **High integrity locations** (both at global scale, and relative to the integrity in the surrounding landscape) are those that may contain large opportunities for safeguarding stocks of environmental assets and maintaining ecosystem service provision, both locally and globally. **Areas of rapid decline** in integrity represent areas with declining resilience of ecosystem service provision, high exposure to an organisation's dependency-related risks, and potentially at risk of ecological tipping points. This could include areas that have declined to a low state of integrity.	Metrics and datasets that assess all components of ecosystem integrity (composition, structure and function): • EII – Ecosystem Integrity Index; and • IUCN Red List of Ecosystems database. Metrics and datasets that assess selected components of ecosystem integrity: • EAI – Ecosystem Area Index; • EHI – Ecosystem Health Index; • ErII – Ecoregion [Ecosystem] Intactness Index; and • The Natural History Museum – Biodiversity Intactness Index (BII). See additional guidance on the measurement of state of nature in Annex 2 for further guidance on the measurement of ecosystem condition and integrity.

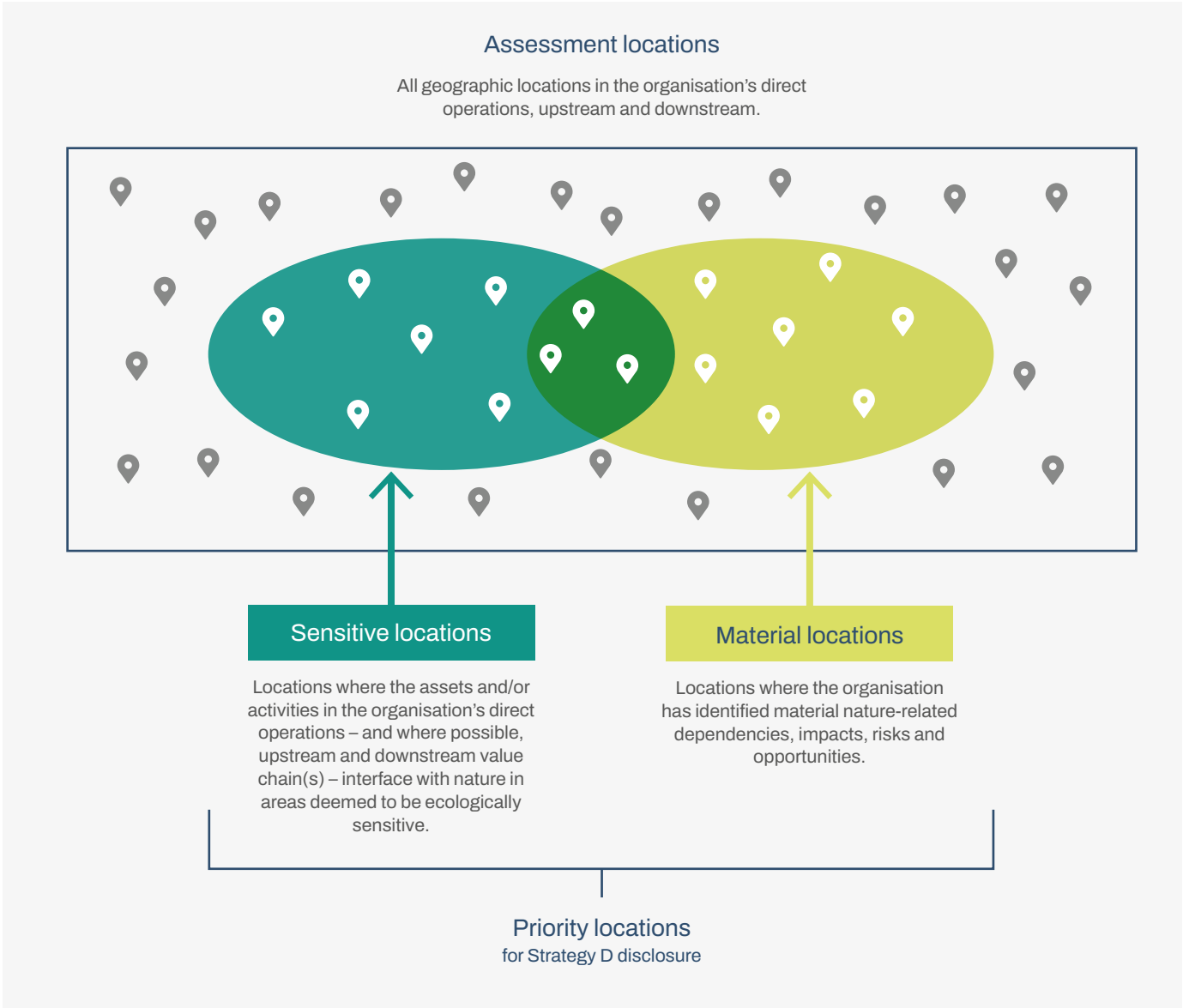
Area	Criteria	Recommended metrics and reference datasets
Ecosystem service delivery importance	• Areas important for delivery of ecosystem service benefits, including to Indigenous Peoples and Local Communities. These include areas in which healthy ecosystems and biodiversity support local livelihoods, areas in which biodiversity and ecosystem services are important for the realisation of human rights, areas that have been traditionally owned, occupied or otherwise used and/or acquired by Indigenous Peoples and Local Communities, and areas of biocultural importance to Indigenous Peoples and Local Communities.	• Indigenous Peoples' and community-conserved territories and areas (ICCAs); • Global Land Governance Index LANDex Indicators; • The Indigenous Navigator; • LandMark (also available in the Global Forest Watch map); • ENCORE (that contains hotspots of natural capital depletion spatial layers); • InVEST (quantifies, maps and values ecosystem services); • TESSA; • Ocean Wealth (maps ocean ecosystem services); and • Critical Natural Asset layers.
Water physical risk	• Area of known high physical water risk, including limited water availability, flooding and poor quality of water. This also includes marine areas with high levels of land-based pollution.	• WRI Aqueduct Water Risk Atlas and Tools; • WWF Water Risk Filter; and • Ocean+ for information on marine biodiversity and critical marine and coastal habitats.

Organisations should not seek to use a rigid, formulaic approach to identifying sensitive locations and rather use judgement based on an understanding of the specific characteristics of the organisation and its activities. The locations where an organisation interfaces with nature vary over time. The sites and associated areas of influence are particularly variable in certain ecosystems, for example, in freshwater and marine biomes. Organisations should review which locations meet the criteria for sensitive locations after completing the Evaluate phase and each time they assess their nature-related issues.

Box 13 provides a case study for how a piloting organisation, Iberdrola, approached this.

As new tools and sources emerge over time, the TNFD will update the list of these reference tools and sources as part of its TNFD Tools Catalogue.

Figure 20: Assessment of priority locations: sensitive and material locations



Box 13: Identifying sensitive locations – Iberdrola

Iberdrola is a multinational electric utilities company and the world's largest producer of wind power. To conduct a LEAP assessment, it mapped its locations and operations for both operational projects as well as projects under construction.

Iberdrola combined its asset data with a range of nature datasets to identify potential sensitive locations as defined by the LEAP approach. It first collected data on the environmental surroundings of assets (e.g. Ramsar Wetlands, Natura 2000 sites), disaggregated them by the type of technology used for each asset, and calculated the length and area of the ecosystem affected. Iberdrola also drew from the IUCN Red List, as well as national and regional threat lists, to identify vulnerable species and their associated threat categories across the six regions where it has facilities (figure below). This helped Iberdrola understand regions where it has assets interfacing with hotspots for endangered species.

IUCN Red List of Threatened Species					
	Critically endangered (CR)	Endangered (EN)	Vulnerable (VU)	Near Threatened (NT)	Least Concern (LC)
Spain	8	20	41	53	561
United Kingdom	2	4	8	12	120
United States/ Canada	2	13	12	11	39
Brazil	4	17	33	34	584
Mexico	0	4	6	12	306
Iberdrola Energía International IEI	0	26	10	105	
Totals	16	55	100	113	1,393

Source: Iberdrola (2022) Biodiversity Report, page 42

This remotely collected data was complemented by existing internal field-based studies that assessed the facilities surrounding Iberdrola's projects prior to project approval. Criteria for field assessments vary between projects, but include bird sightings, endemic species studies or habitat characterisation studies.

Using the results of this asset location mapping, Iberdrola identified which sectors and assets are operating in sensitive locations. By taking a sectoral lens, Iberdrola was able to consider how business processes differ across different sections of the value chain, and therefore better conduct a full LEAP assessment.

Technology	Location with respect to the protected area	Affected area length	Degree of protection
Hydroelectric power plants – Reservoirs	Interior	31,505 ha	Biosphere reserves, Ramsar Wetlands, Natura 2000 Network, National Parks and Natural Parks
Power lines	Interior	19,315 km	Natura 2000 Network, Ramsar Wetlands, National Parks, Natural Parks, Biosphere Reserves
Substations	Interior	131 units	Natura 2000 Network, Ramsar Wetlands, National Parks, Natural Parks, Biosphere Reserves
Transformer stations	Interior	8,425 units	Natura 2000 Network, Ramsar Wetlands, National Parks, Natural Parks, Biosphere Reserves
Onshore wind farms	Interior	568 ha	Natura 2000 Network, Important Bird and Biodiversity Areas
Nuclear power plants	Interior	82 ha	Natura 2000 Network
	Adjacent	3 units	Nature 2000 Network and Important Bird and Biodiversity Areas
Thermal power plants	Adjacent	6 units	Natura 2000 Network, Protected Landscapes, Biosphere Reserves and Marine Protected Areas

Source: Iberdrola (2022) Biodiversity Report, page 39

4.8. Desired outputs from the Locate phase

After completing the Locate phase, corporates and financial institutions should each have the following outputs:

For corporates:	For financial institutions:

• A list of potentially material activities in the business model and value chain (L2); and
• A list and/or map of assessment locations. This includes:
  • All sensitive locations: Locations where the organisation has activities and/or assets in its direct operations and value chains that meet the TNFD criteria for sensitive locations (L4); and
  • Other locations where the organisation has potentially material nature-related dependencies, impacts, risks and opportunities.
	• A heatmap of potentially material sectors (L2);
	• High-level geographies of potentially material sectors, and analysis of the types of ecosystem or biome likely to be associated with these sectors and geographies (L3); and
	• An analysis (most likely by portfolio) of its clients/ investees' interface with sensitive locations.

Throughout the LEAP approach, the organisation may find there are potentially relevant locations that were not initially captured in the Locate phase. The organisation should then revisit this phase to add the missing sectors, value chains and geographic locations, and revisit its list of assessment locations.

4.9. Resources to support the Locate phase

There are a range of data, tools and methods that can be used to inform the Locate phase. Further tools are available in the TNFD Tools Catalogue.

These include, but are not limited to:

- Internal or external data on the location of the organisation's physical assets and operations;
- Internal data on the organisation's value chain locations, both upstream and downstream (this might have been collected for other due diligence activities such as compliance with modern slavery legislation or KYC due diligence procedures);
- External data sources and online mapping tools identifying the location of ecosystems and ecosystem types (i.e. biome);
- Other spatial nature-related data measuring ecosystem integrity, biodiversity importance and physical water risks, such as measures of critical habitats, protected areas, key biodiversity areas, stressed watersheds and endangered species (see Table 4); and
- Heatmapping tools to help identify locations of potentially material nature-related dependencies, impacts, risk and opportunities.

4.9.1. Public availability versus fee-for-service considerations

Most of the tools and datasets listed are publicly available, but some are provided on a fee-for-service basis. The lists are not exhaustive. Compendiums of useful data have been developed by the European

Business and Biodiversity Platform,[29] WWF[30] and UNEP-WCMC and the Finance for Biodiversity Initiative.[31] The TNFD recognises that data availability will vary across geographies, biomes and sectors. As such, criteria will need to be developed to reflect data availability.

4.9.2. Considerations for use of spatial datasets

The TNFD recommends that geographic locations should be analysed using both economy-wide spatial data and sector-specific data. In addition, your LEAP assessment team should first consult global databases, which can be supplemented with national level datasets. These are important to understand national and regional priorities for which spatial data may be available.

When using global datasets to identify sensitive locations, the TNFD cautions organisations to be aware that datasets vary in quality, and some may be out of date or represent information at an inappropriate spatial scale. The TNFD supports the use of high-level screening models to identify sensitive locations, understanding that organisations may have concerns about practicality and resource requirements. However, the models used, their limitations and the assumptions made in the process should be made transparent.

Improving the quality and availability of spatial data is an ongoing priority focus for the TNFD, which is working with a wide range of partner organisations to do so. The TNFD is continuing to evaluate the possible introduction of a confidence indicator, and/or criteria for users to assess the suitability of data in their circumstances, to assist both report preparers and users in the assessment and disclosure of nature-related dependencies, impacts, risks and opportunities.

While a number of leading scientific and data organisations are developing new tools and datasets for assessing the integrity and condition of ecosystems, there is currently no single global reference to make this determination. As a result, the TNFD encourages organisations to use a number of different tools and datasets to triangulate an understanding of ecosystem integrity and condition so they can identify potential priority locations. Annex 2 provides further guidance on measurement of ecosystem condition and related tools and reference sources.

> The TNFD encourages organisations to use a number of different tools and data sets to triangulate an understanding of ecosystem integrity and resilience.

While the TNFD recognises that current data constraints may mean that early attempts at undertaking this analysis are limited to direct organisational assets and operations, it encourages all organisations to assess related upstream and downstream locations as soon as practicable, given data availability.

29 EU Business and Biodiversity Platform (2022) Biodiversity measurement approaches for businesses and financial institutions. Thematic report: Biodiversity data.

30 WWF, World Bank Group and Global Canopy (2020) Geospatial ESG. The emerging application of geospatial data for gaining environmental insights on the asset, corporate and sovereign level.

31 UNEP-WCMC and Finance for Biodiversity Initiative (2022) The Climate Nature Nexus. An investor guide to expanding from climate to nature data.

5. Evaluating nature-related dependencies and impacts

This Evaluate phase guidance is consistent with the Natural Capital Protocol (the Protocol for short) developed by the Capitals Coalition. Organisations are recommended to refer to the Natural Capital Protocol for further details.[32]

5.1. Why

An organisation's nature-related risks and opportunities arise from dependencies and impacts on nature, as outlined in Section 2. Analysis of dependencies and impacts is therefore an essential first step to understanding the risks and opportunities the organisation faces. For financial institutions, this essential first step concerns the dependencies and impacts of its portfolio companies.

Organisations depend on the reliable and cost-effective provision of ecosystem services from nature that are essential to their business processes and those of the organisations in their value chains, including portfolio companies for financial institutions. These ecosystem services underpin the organisation's cashflows and therefore its enterprise value as assessed by investors and other capital providers. Nature loss can undermine the delivery of these services, creating risks for a corporate and its capital providers.

Organisations also have impacts on nature and the provision of ecosystem services. These impacts may be positive or negative. An organisation's negative impacts on nature can undermine the provision of ecosystem services on which the organisation and others depend and create both physical and transition risks.

Objective

To develop an understanding of the organisation's potentially material dependencies and impacts on nature.

Desired outputs

- A list of relevant environmental assets and ecosystem services;
- A list of the organisation's dependencies and impacts on nature;
- Analysis of potentially material dependencies and impacts on nature; and
- A list of material dependencies and impacts (for disclosure using an impact materiality approach such as GRI and incorporated into the ESRS in Europe).

Practical tips from pilot testers

- Source a range of skills and expertise including internal and external experts; and
- Set feasible goals and build up over time.

In short, today's impacts can shape tomorrow's dependencies and the future ability of the organisation to produce its goods and services and ultimately generate cashflows. Negative impacts on nature erode the health and resilience of nature and its ability to provide ecosystem services. Conversely, contributing positively to the health and resilience of nature can secure and enhance the flow of ecosystem services on which the organisation and its value chain partners depend.

32 Capitals Coalition (2016) Natural Capital Protocol.

- **For corporates:** A LEAP assessment team identifies, analyses and measures the environmental assets and ecosystem services on which it depends and from which its business processes generate value. This includes its upstream and downstream value chains. The LEAP assessment team also identifies and analyses the impact drivers its organisation has that affect environmental assets and the provision of ecosystem services and could affect its dependencies and wider society.
- **For financial institutions:** A LEAP assessment team identifies and analyses the impacts and dependencies of the companies/activities in its portfolios. For large portfolios, this analysis focuses on key companies/ activities within priority sectors and companies with activities that are in, or have impacts and dependencies on, sensitive locations as an initial focus.

The complex interplay between an organisation's own dependencies and impacts and those of others in society and external factors underscores the need for engagement with stakeholders (see TNFD guidance on engagement). This is needed in the Evaluate phase to identify costs and benefits to society (relevant to determining impact materiality in E4). It is also relevant in the Assess phase to understand how dependencies and impacts on nature, and resulting costs and benefits to society, create potentially material risks and opportunities for the organisation.

5.2. What

Based on the approach in the Protocol, the Evaluate phase involves a LEAP assessment team moving from the sectors, value chains and locations associated with potentially material nature-related dependencies and impacts, and sensitive locations identified in L2, L3 and L4 to a more detailed description and evaluation of those dependencies and impacts. The project team may also create a list of specific impacts on nature that are deemed material using an impact materiality approach (for example, for disclosure aligned with the use of GRI Standards or the European Sustainability Reporting Standards), and dependencies and impacts that are likely to be the basis for material risks and opportunities for the organisation to be considered further in the Assess phase of LEAP.

- **For corporates:** The starting point for the identification of dependencies and impacts on nature should be the understanding of activities associated with business processes, building on the hypothesis identified in the Scoping phase and the initial screening in L2, as well as the assessment locations identified in L3 and L4.
- **For financial institutions:** The focus should start with understanding the dependencies and impacts of the companies in their portfolios, and the magnitude of these dependencies and impacts within the context of the management efforts undertaken by portfolio companies.

The detailed assessment of dependencies and impacts in the Evaluate phase may identify new sectors, activities, value chains and locations that were not picked up in the Locate phase, for example, where the dependency or impact takes place beyond the organisation's site boundary. Where this is the case, organisations should revisit their assessment in L3 and L4. Evaluate and Locate should be undertaken iteratively.

The Evaluate phase provides the due diligence and evidence base for disclosing material dependencies and impacts on nature and the basis for subsequent detailed risk and opportunity assessment in the Assess phase.

5.3. Guiding questions

How corporates and financial institutions work their way through the Evaluate phase may vary based on the granularity of geographic locations generated in the Locate phase. As such, there is some variation in the guiding questions for corporates and financial institutions to accommodate different approaches through the Evaluate phase.

	Corporates	Financial institutions
E1. Identification of environmental assets, ecosystem services and impact drivers	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 processes, activities and assessment locations?	What are the companies/activities in our portfolios that are in sectors, geographies and sensitive locations identified? What are the environmental assets, ecosystem services and impact drivers associated with these companies/activities?
E2. Identification of dependencies and impacts	What are our dependencies and impacts on nature?	What are our dependencies and impacts on nature resulting from the dependencies and impacts of these companies in our portfolios?
E3. Measurement of dependencies and impacts	**Dependency measurement –** What is the scale and scope of our dependencies on nature? **Impact measurement –** What is the severity of our negative impacts on nature? What is the scale and scope of our positive impacts on nature?	**Dependency measurement –** What is the scale and scope of our dependencies on nature as a result of the dependencies of our portfolio companies? **Impact measurement –** What is the severity of their negative impacts on nature? What is the scale and scope of their positive impacts on nature?
E4. Determination of impact materiality	Which of the identified impacts are material?	Which of the identified impacts are material?

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

	For corporates	For financial institutions
E1: Identification of environmental assets, ecosystem services and impact drivers	What are the business processes and activities to be analysed? What environmental assets, ecosystem services and impact drivers are associated with these business processes, activities and assessment locations?	What are the companies/activities in our portfolios that are in sectors, geographies and sensitive locations identified? What are the environmental assets, ecosystem services and impact drivers associated with these companies/activities?

- **For corporates:** Building on the analysis in the Locate phase, the LEAP assessment team can engage line/site managers, suppliers (upstream) and customers (downstream) to produce:
  - A list of business activities and processes;
  - A list of impact drivers that are associated with these business activities and processes; and
  - A list of applicable environmental assets and ecosystem services.
- **For financial institutions:** Building on the analysis in the Locate phase, the LEAP assessment team can engage companies in their portfolios to produce:
  - A list of business activities and processes in the identified priority sectors;
  - A list of impact drivers that are associated with these business activities and processes; and
  - A list of applicable environmental assets and ecosystem services in the identified geographies and sensitive locations.

Organisations can start with the sectors, activities and value chains identified in L2, or the assessment locations identified in L3 and L4, or do both in parallel. If starting with sectors, activities and value chains, organisations should move to location-specific analysis as they proceed through the Evaluate phase, identifying specific environmental assets their activities interface with.

- **For corporates:** When considering locations, corporates should recognise in their analysis that impacts and dependencies can occur in locations at a distance from where business processes and activities occur.
- **For financial institutions:** This analysis will centre on mapping impact drivers, environmental assets and ecosystem services to those companies based in the priority sectors and business processes identified in their portfolios, drawing on the results of the analysis in the Locate phase.

In order to assess their business activities and processes and develop lists for each assessment location, organisations may find it useful to use the categorisation in the SBTN Materiality Screening Tool,[33] sub-industries in ENCORE and the TNFD biome guidance.

Identifying relevant impact drivers

- **For corporates:** The TNFD recommends that LEAP assessment teams in corporates qualitatively identify their impact drivers for each assessment location and associated with their business activities. This covers the organisation's direct operations, upstream and downstream. Organisations should list the main

33 Science Based Targets Network (2023) Materiality Screening Tool.

impact drivers that they, or entities upstream and downstream in their value chain, are responsible for.

- **For financial institutions:** Financial institutions should analyse the impact drivers that are commonly associated with sectors and their typical business activities and processes, based on what was identified in their portfolios as priorities for analysis in the Locate phase.

When listing impact drivers that are associated with business activities and processes for each location or sector, organisations should refer to the list of impact drivers in Table 5, although this is not exhaustive. Other impact drivers that are also relevant to the organisation, but not included in that table, should also be considered. Organisations may wish to refer to the Natural Capital Protocol,[34] which provides examples of impact drivers, and the TNFD biome guidance for impact drivers associated with specific biomes.

Table 5: Impact drivers, by driver of nature change

Driver of nature change	Impact driver
Land/freshwater/ocean-use change	Land-use change
	Freshwater-use change
	Ocean-use change
Climate change	Greenhouse gas emissions
Resource use/replenishment	Water use
	Other resource use
Pollution/pollution removal	Non-GHG air pollution
	Water pollution
	Soil pollution
	Waste
	Disturbances
Invasive species and other	Biological alterations

34 Capitals Coalition (2016) Natural Capital Protocol.

Organisations may find it useful to compare the list of business activities identified in E1 with the impact drivers identified for each business production process, activity and sector in the SBTN Materiality Screening Tool[35] to identify which impact drivers are likely to be present.

Identifying relevant environmental assets and ecosystem services

For listing environmental assets and ecosystem services associated with each location, organisations should refer to Section 2 of this document, which provides a comprehensive list of types of environmental assets and ecosystem services to which organisations can refer to complete this component.

- **For financial institutions:** Depending on the degree of specificity possible and desirable for understanding potentially material dependencies and impacts, financial institutions can list the environmental assets and ecosystem services in the high-level geographies and sectors identified as priorities in their portfolio. Financial institutions may find the ENCORE tool useful to provide lists of dependencies on ecosystem services by sector and sub-industry. The Global Ecosystem Typology website provides functionality that can be useful to identify biomes and ecosystems in the high-level geographies and sensitive locations identified as priorities in the financial institution's portfolio.

Organisations may wish to refer to tools like ENCORE, which rates the usual dependency of certain sectors on specific ecosystem services as evidence for which ecosystem services might be prioritised.

5.5. E2: Identification of dependencies and impacts

	For corporates	For financial institutions
E2: Identification of dependencies and impacts	What are our dependencies and impacts on nature?	What are our dependencies and impacts on nature resulting from the dependencies and impacts of these companies in our portfolios?

5.5.1. Supporting questions

- **External factors:** What are the external factors affecting our business processes and activities, and each assessment location?
- **Ecosystem service provision:** What ecosystem services do our business processes and activities depend on? What ecosystem services do we and others depend on in our assessment locations?
- **Changes to the state of nature:** What changes to the state of nature are our impact drivers and the external factors in our assessment locations and area of influence contributing to? What might this mean for nature's capacity to provide ecosystem services in the future?
- **Identification of dependencies and impacts:** What are our identified dependencies and impacts associated with each assessment location?
- **Dependency and impact pathways:** How do these changes fit together to form dependency and impact pathways, including consideration of interactions between them?

For financial institutions, these questions primarily relate to the business processes, activities and locations of their portfolio companies.

35 Science Based Targets Network (2023) Materiality Screening Tool.

5.5.2. Understand the key elements of dependencies and impacts

In E2, building on the conceptual foundations set out in Section 2, your organisation should bring together the key elements of dependencies and impacts. Namely:

- A list of impact drivers (prepared in E1);
- A list of external factors for consideration, including both natural forces and human activities. This is particularly important when considering your business dependencies;
- A list of ecosystem services the organisation and others (for financial institutions, this includes their portfolio companies) depend on (prepared in E1); and
- An understanding of how the impact drivers and external factors can influence the state of nature and consequently ecosystem service provision for the organisation and others, recognising these may be beyond the organisation's site boundary. This can be done using the guidance on dependency and impact pathways provided in the Natural Capital Protocol (see Box 14).[36]

For both corporates and financial institutions, the E2 component of LEAP is about developing a higher degree of granularity and insight about potentially material dependencies and impacts (for financial institutions, with respect to their portfolio companies).

Box 14: Impact and dependency pathways

Dependency and impact pathways are fundamental to evaluating dependencies and impacts on nature, as set out in the Natural Capital Protocol.[37]

Impact pathway

An impact pathway describes how, as a result of a specific business activity, a particular impact driver can lead to changes in natural capital (stocks of environmental assets) and flows of ecosystem services, and how these changes affect different stakeholders. It broadly involves the following steps:

- Identify/measure impact drivers;
- Identify/measure changes in the state of nature:
  - Identify/measure changes in nature associated with your business activities and impact drivers;
  - Identify/measure changes in nature associated with external factors;
  - Assess trends affecting the state of nature; and
- Value impacts:
  - Identify/measure changes in ecosystem service provision (qualitative/ quantitative/monetary valuation).

36 Capitals Coalition (2016) Natural Capital Protocol.

37 For further details, organisations should refer to Steps 04-07 of the Natural Capital Protocol. Capitals Coalition (2016) Natural Capital Protocol. Financial institutions may find it helpful to refer to the Protocol Finance Sector Supplement. Capitals Coalition (2018) Connecting finance and natural capital: A supplement to the Natural Capital Protocol.

Dependency pathway

A dependency pathway describes how a particular business activity depends upon ecosystem services and specific features of natural capital (stocks of environmental assets). It identifies how observed or potential changes in natural capital (caused by specific business activities and external factors) affect the costs and/or benefits of doing business. It broadly involves the following steps:

- Identify/measure dependencies (on ecosystem services and associated environmental assets);
- Identify/measure changes in the state of nature:
  - Identify changes in nature associated with your business activities and impact drivers;
  - Identify changes in nature associated with external factors;
  - Assess trends affecting the state of nature; and
- Value dependencies:
  - Identify/measure changes in ecosystem service provision (qualitative/ quantitative/monetary valuation).

Valuation appears as the final step of each of these pathways. It is a way to provide comparable information across the dependencies and impacts to support decision making. Measurement quantifies changes, but valuation provides an understanding of their relative importance. Further guidance on valuation is provided in Annex 3.

5.5.3. Consideration of external factors

Qualitatively describe the external factors affecting the state of nature in the assessment locations and areas of influence.

The state of nature in any particular location is shaped not only by the organisation's impacts but by those of others, as well as a range of other factors external to the organisation. External factors include natural forces, such as rivers changing routes or geological activity, and human activities beyond the business, such as climate change, land-use change, increased water use and pollution. As part of their assessment of dependencies and impacts, organisations should consider external factors that already affect, or could affect, the state of nature and the environmental assets and ecosystem services on which they depend. For example, a drought caused by climate change or overuse of water by another company could affect the availability of the supply of regular freshwater to a farm operation.

External factors are also relevant for impacts as they could interact with the organisation's impact drivers to create tipping points or cumulative impacts. For example, a small food-processing business may have relatively minor impacts on freshwater availability today, but development of irrigated farming in the region could mean the company's water use becomes much more significant in a local context, due to changing supply and demand conditions.

Organisations may need to look beyond their immediate site to identify relevant external factors at a regional, national or even global level. For example, another industry may be adding pollution to a river far upstream that is affecting the environmental assets where the organisation or its value chain partners are operating.

Organisations can source and review external government or academic reporting on the state of nature in particular locations to help understand potential external factors of relevance to their analysis.

Organisations may also find it useful to refer to the Political, Economic, Social, Technological, Legal and Environmental (PESTLE) or Social, Technology, Economic, Environmental and Policy (STEEP) frameworks[38] and use scenario analysis to explore a range of external factors, as outlined in the TNFD scenario guidance.

When the organisation can identify where the activities of other businesses are likely to be driving nature change, the SBTN Materiality Screening Tool may again be useful to identify external factors.[39]

5.5.4. Changes in the state of nature

Describe how the identified external factors and organisation's impact drivers could lead to changes in the state of nature.

Organisations should consider how the combination of their own impact drivers and external factors could lead to changes in the state of nature. This requires consideration of whether impact drivers and external factors may, currently or in the future, collectively affect environmental assets, considering ecosystem extent and condition, species population and species extinction risks as outlined in Section 2 and Annex 2 of this document.

While various tools, metrics and reports provide useful resources (see Section 5.9 and Annex 2), there is not yet a comprehensive, methodologically consistent global reference source describing linkages between drivers of nature change, changes to the state of nature and changes to the availability of ecosystem services. Organisations therefore need to form their own assessment of the state of nature in locations relevant to their LEAP due diligence. In some cases, the assessment may require an understanding of potential ecosystem tipping points (Box 15).

The TNFD encourages organisations to start forming this assessment by drawing on analysis in L3, which identified the locations associated with their high and moderate impacts and dependencies and L4, which identified sensitive locations where their business model and value chain interface with nature deemed to be ecologically sensitive.

The TNFD encourages organisations to use the information they have available to them from their own data, from scientific and NGO sources (potentially including available modelling), and through their engagement with Indigenous Peoples, Local Communities, affected and other stakeholders to build their understanding over time and to triangulate an understanding of the changes occurring in each assessment location. The TNFD recognises that initial descriptions of these linkages set out in E2 may be high level, revealing knowledge gaps that require further investigation in future rounds of analysis.

Organisations should consider the timing of when impact drivers and external factors are likely to result in changes to the state of nature, including frequency, any time lags, cumulative impacts, possible timing of thresholds and tipping points, and the likelihood of this change occurring and over what geographical scale. For example:

- Some impacts from climate change happen over long timeframes (over 100 years);
- Planting trees in upland areas can reduce soil erosion and sedimentation of water bodies downstream, with results observable within a decade; or
- Fish populations in marine protected areas, or where fishing communities have taken coordinated voluntary action to avoid fishing in particular areas, have been known to restock rapidly, in five to 10 years or less.

38 In its Guidance on Scenario Analysis for Non-Financial Companies, the TCFD suggests the use of these types of analyses to identify forces of consequence that may vary by scale, highlighting that they are commonly used to gain insight into developments in the external environment during times of uncertainty.

39 Science Based Targets Network (2023) Materiality Screening Tool.

At this stage, organisations should also review any evidence available about thresholds for the level of impact that the ecosystems affected by the organisation's impact drivers can endure. This should be science-based, consider cumulative impacts, include both unacceptable levels and desirable levels, and be location and context specific.

Box 15: Thresholds and tipping points

Organisations analysing their dependencies and impacts should consider the potential for threshold effects and tipping points.

The relationship between impact drivers and external factors, changes in the state of nature and availability of ecosystem services will not always be smooth. In some cases, the accumulation of impact drivers and external factors can reach a point that triggers a sudden, rapid acceleration in the changes to the state of nature and availability of ecosystem services. When a threshold effect or tipping point is present, the ecosystem will no longer naturally return to its previous state once the driver of change has abated. It will instead move to a new steady state, with an altered availability of ecosystem services. This can mean that quantitatively small impact drivers can lead to large shifts in the availability of ecosystem services over an extended period. Organisations interfacing with ecosystems approaching thresholds and tipping points may therefore face elevated risks.

Tipping points are not always straightforward to identify but may be indicated by a slowdown in the recovery time from small shocks, such as a brief drought, warmer than usual winter or small outbreak of predatory insects.

Key definitions

Threshold – The point at which a relatively small change in external conditions causes a rapid change in an ecosystem. When an ecological threshold has been passed, the ecosystem may no longer be able to return to its state by means of its inherent resilience.

Threshold effect – Harmful or fatal effect of a small change in environmental conditions that exceeds the limit of tolerance of an organism or population of a species.

Tipping point – A level of change in system properties beyond which a system reorganises, often abruptly, and does not return to the initial state even if the drivers of the change are abated.

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services IPBES Glossary

Useful guidance on thresholds is available through the concept of planetary boundaries and online databases of tipping points,[40] as well as on specific issues such as pollutants through national legislation and Pollutant Release and Transfer Registers.[41] Where quantitative thresholds are available, this will act as a useful input to E3 and E4.

40 Steffen, W. et al. (2015). Planetary boundaries: Guiding human development on a changing planet. Science 347: 736, 1259855; Stockholm Resilience Centre. Regime Shifts DataBase; Resilience Alliance and Santa Fe Institute (2004) Thresholds and alternate states in ecological and social-ecological systems.

41 Department of Environment Food and Rural Affairs (2022) UK Pollutant Release and Transfer Register. Threshold List.

5.5.5. Ecosystem service provision

Describe which ecosystem services your business processes and activities depend on. Describe which ecosystem services identified in E1 other stakeholders may depend on. Describe how the changes in the state of nature identified could lead to changes in ecosystem service provision.

The organisation will have identified the ecosystem services present in each location in E1.

- **From a dependency pathway perspective**, the organisation should review which of these ecosystem services the organisation depends on for its business activities, and any ecosystem services that are provided by environmental assets in other locations. For example, a clean, regular freshwater supply may depend on the health of forests far upstream.
- **From an impact pathway perspective**, it is also necessary to identify which ecosystem services other stakeholders depend on, recognising these may arise in the wider area of influence beyond an organisation's site boundary.[42]

The organisation should then be able to identify which environmental assets support the flow of those ecosystem services.

At this stage, an inventory of identified ecosystem services, identified by who depends on the ecosystem service (the organisation, other stakeholders) and which environmental assets support the flow of ecosystem services is sufficient.

While environment assets such as forests and rivers are location based, and the activities of your organisation and its value chain may have impacts on environmental assets in those same locations, those activities may also have impacts on assets and ecosystem services that are far away from those locations. For example, air and water pollution impacts or the impacts on migratory bird populations could be felt far away. As such, organisations need to consider the impact they have on environmental assets and ecosystem services at different scales:

1. In the specific geolocation (GPS coordinates or polygon) of their direct operations and those of their value chain;
2. In the area of influence around those locations (see Box 9 in Section 2); and
3. Outside the area of influence where their activities may have impacts or dependencies on nature.

Organisations can refer to the TNFD biome guidance for typical ecosystem services in the biomes covered and to SBTN guidance on science-based targets for nature for consideration of impact drivers (called 'pressures' in SBTN guidance) that may have impacts outside the area of direct operations.

The organisation should seek to understand qualitatively how changes in the state of the environmental assets are likely to affect the flow of services available, and the likelihood of these changes occurring.[43] Table 6 contains examples of how changes to the state of environmental assets are connected to the provision of ecosystem services.

In linking business activities to ecosystem services, the organisation may wish to refer to the ecosystem service dependencies provided in the ENCORE tool by sector and sub-industry.[44]

42 UNEP-WCMC et al. (2022) Recommendations for a standard on corporate biodiversity measurement and valuation. Aligning accounting approaches for nature.

43 UNEP-WCMC et al. (2022) Recommendations for a standard on corporate biodiversity measurement and valuation. Aligning accounting approaches for nature.

44 The ENCORE tool uses a slightly different categorisation of ecosystem services from that recommended by the TNFD. ENCORE uses the Common International Classification of Ecosystem Services, whereas the TNFD uses United Nations et al. (2021) System of environmental-economic accounting – Ecosystem accounting. A crosswalk is available if required from United Nations et al. (2021) System of Environmental-Economic Accounting—Ecosystem Accounting (SEEA EA), Online supplement: Ecosystem Services Reference List Crosswalk to Selected Ecosystem Services Classifications and Typologies.

Table 6: Examples of changes in the state of nature affecting the provision of ecosystem services

Ecosystem service	Change in the state of environmental asset affecting the flow of ecosystem service
Soil and sediment retention	Siltation of a hydropower reservoir
Water supply	Diversion or desiccation of a river that provided a source of process water
Soil quality regulation	Acid rain affecting soil fertility
Biomass provisioning	Forest fires destroying raw material (fibre) inputs
Storm mitigation, flood mitigation	Loss of mangrove habitat resulting in reduced protection from extreme weather events
Nursery population and habitat maintenance	Reduction in bird populations resulting in increased insect damage to crops
Solid waste remediation and air filtration	Loss of vegetation cover and natural dust suppression
Various cultural services	Loss of iconic species, habitats and attractive landscapes

Source: Adapted from Capitals Coalition (2016) Natural Capital Protocol

5.5.6. Prioritising dependencies and impacts

To arrive at a final list of potentially material dependencies and impacts, the LEAP assessment team may wish to consider producing a probability-weighted estimate of the changes in the state of nature and ecosystem services that they have identified. This could be a qualitative or quantitative assessment, depending on the data and the resources and capabilities available to the organisation. That probability assessment can then help to identify high, medium or low levels of potential materiality for each identified dependency and impact for each assessment location.

E2 should conclude with the LEAP assessment team having a list of dependencies and impacts – by location for corporates; and by sectors or geographies for financial institutions and for specific geographic locations where possible – ranked on a high/medium/low qualitative scale. In component E3, dependencies and impacts assessed as high and medium will be measured quantitatively, where possible.

5.6. E3: Dependency and impact measurement

	Corporates	Financial institutions
E3: Dependency and impact measurement	**Dependency measurement** – What is the scale and scope of our dependencies on nature? **Impact measurement** – What is the severity of our negative impacts on nature? What is the scale and scope of our positive impacts on nature?	**Dependency measurement** – What is the scale and scope of our dependencies on nature as a result of the dependencies of our portfolio companies? **Impact measurement** – What is the severity of their negative impacts on nature? What is the scale and scope of their positive impacts on nature?

In E1 and E2, the organisation identified and described its dependencies and impacts, including:

- Identification of the impact drivers, environment assets and ecosystem services of relevance for each assessment location;
- Consideration of external factors, including potentially through scenario analysis;
- Consideration of the ecosystem services the organisation and others depend on; and
- Consideration of current and potential future changes in the state of nature at each assessment location.

In E3, the organisation moves to measuring these dependencies and impacts.

- **For corporates:** Component E3 enables the corporate to measure the scale and scope of their dependencies and impacts on nature. They can do this by quantifying impact drivers, changes to the state of nature and changes to ecosystem service provision using the assessment metrics provided by the TNFD (Annex 1). These will also include the timing, extent and likelihood of the dependency or impact, and will be mapped back to assessment locations.
- **For financial institutions:** Component E3 will involve gathering data and information to evaluate the scale of their portfolio companies' dependencies and impacts on nature, taking account of those companies' management and mitigation strategies. This analysis may require engagement with companies and/or acquisition of external relevant data. Financial institutions will select a number of companies/activities for which additional due diligence is needed for a thorough LEAP analysis. Through this process, a financial institution will develop a global view of the impacts and dependencies of its portfolios. Where data from companies is not yet globally available, a footprinting approach using data providers can help, bearing in mind the limitations of such approaches set out in the TNFD Additional Guidance for Financial Institutions.

This sets the foundations for LEAP assessments for report preparers through two materiality lenses:

- An assessment meeting the material information needs of capital providers consistent with the ISSB Standards and TCFD recommendations, with a focus on risk management and how dependencies and impacts on nature create risks and opportunities for an organisation's financial position and prospects (undertaken in the Assess phase); and
- An assessment meeting the material information needs of stakeholders focused on impacts, aligned with a broader materiality approach, reporting against both the ISSB and the GRI standards (impact materiality assessment is undertaken in E4).

Note – Guidance on the TNFD's recommended disclosure requirements can be found in the TNFD Recommendations.

The challenge of measuring dependencies and impacts

The Taskforce recognises that it can be difficult to quantify all identified dependencies and impacts due to data limitations, particularly around traceability through value chains.

In some cases, measurement of impact drivers, the state of nature and ecosystem services at sources upstream and downstream will require detailed tracing of products to the original production site or place of final disposal. However, in others, at least in the initial stage, tracing may be to the landscape, regional or country level, with sample data, industry or commodity averages being used to estimate dependencies and impacts. The level of tracing required, and which variables need quantification will depend on the level of detail users of the disclosures need to be able to make capital allocations and other decisions, and the information the organisation requires to be able to take action.

For example, it may be that the organisation judges that it is sufficient to know that its palm oil comes from a region known to have a high risk of tropical deforestation to understand in broad terms the risks and opportunities it faces, and the dependencies and impacts the processes are likely to have. This level of information may enable the organisation to decide that it wants to review its sourcing procedures and ensure its palm oil from the region is certified to a high standard in response to the dependencies, impacts, risks and opportunities identified.

Alternatively, it may want further reassurance on the performance of its farmers, particularly if it knows there is substantial variation in the sourcing region or decides that an absence of traceability carries unacceptable risks to the organisation. This could mean tracing all the way to the originating farmer and measuring the state of nature at the farm level. The appropriate level of detail will depend on the company's individual circumstances, including its strategy, and the purpose of the assessment.

This tracing will take time, and organisations should start with a small number of highly material issues and expand the scope of disclosures across all material issues. It is, however, important to describe qualitatively material issues, where they cannot be quantified.

Choose indicators and metrics to measure the variables of interest.

Having determined what the organisation wants to measure, the organisation needs to choose indicators and metrics to undertake this measurement. The TNFD provides a set of recommended assessment metrics to help get LEAP assessment teams started (Annex 1), while acknowledging that every business is unique and assessment teams should consider other relevant metrics beyond those recommended by the Taskforce.

Measurement can be:

- Qualitative (e.g. high, medium or low rates of pollution); or
- Quantitative, such as the tonnes of different pollutants emitted, cubic metres of water consumed per day or hectares of habitat converted.

Qualitative assessment can be useful to understand the linkages between impact drivers and impacts. A good understanding of these values can help to develop impact pathways. The understanding of these connections may be useful for understanding management options and effects.

The TNFD assessment metrics take into account the following considerations:

1. **A range of relevant indicators and metrics:** Metrics should include, where possible, an absolute figure, the rate of change and an intensity or efficiency ratio. Metrics should be location-specific and at the right organisational level (product, site, corporate-level) to provide useful insights. This desire for breadth needs to be balanced against organisational capacity to complete the assessment;
2. **Relevance and decision usefulness:** Metrics need to be relevant and decision-useful to the audience of the LEAP assessment and, eventually, for any disclosures made based on the LEAP assessment. At this stage, the recipients of the LEAP assessment will include internal senior management, but the eventual recipients will be external stakeholders, including the primary users of the organisation's financial and sustainability reports for whom material information needs to be disclosed. For this reason, the TNFD's recommended disclosure metrics are a sub-set of the larger set of suggested assessment metrics;
3. **Scientific soundness and use of metrics for other frameworks and reporting:** Metrics should have a strong scientific evidence base. Adoption by other frameworks and reporting standards provides a useful signal that the indicator or metric is science-based and considered decision-useful;
4. **Coverage of all relevant realms of nature:** Indicators should cover all relevant realms of nature (land, freshwater, ocean, atmosphere);
5. **Scalability:** Metrics should be scalable and able to be applied at different levels across sectors and locations, and to measure performance against targets; and
6. **Baselines and reference states:** State of nature metrics should, wherever possible, compare the current ecosystem condition to a baseline and reference state. Rate of change metrics should be compared to a starting baseline. This is defined as the starting point or benchmark against which changes in the state of nature attributed to a business activity can be compared.

Annex 1 and Annex 2 provide more details on assessment metrics for impact drivers, changes to the state of nature and changes to ecosystem services as key elements of dependency and impact pathways. Illustrative indicators are provided in Table 7.

Table 7: Dependency and impact metrics categories with illustrative indicators

Dependency & impact metrics category	Sub-category 1	Sub-category 2	Indicator – Illustrative example
Impact drivers	Land/water/ocean use change	Land ecosystem use	Extent of land use change
		Freshwater ecosystem use	Extent of freshwater area use change
		Ocean ecosystem use	Extent of ocean area use change
	Climate change	Greenhouse gas emissions	Greenhouse gas emissions
	Pollution/pollution removal	Non-GHG air pollution	Non-GHG air pollutants by type
		Soil pollution	Pollutants released to soil by type
		Water pollution	Wastewater discharged
		Waste	Waste generation and disposal
		Disturbances	Light and noise pollution
	Resource use/replenishment	Water use	Water withdrawal and consumption
		Other resource use	Quantity of high-risk natural commodities sourced
	Invasive alien species and other	Biological alterations	Measures against unintentional introduction of invasive alien species

Dependency & impact metrics category	Sub-category 1	Sub-category 2	Indicator – Illustrative example
State of nature	Ecosystems	Extent	Habitat cover
		Condition	Ecosystem condition by type of ecosystem
	Species	Population size	Species population size
		Extinction risk	Mean species extinction risk
Ecosystem services	Provisioning	Biomass provisioning	Weight of provisioned assets
		Water supply	Water withdrawal
	Regulating and maintenance	Water purification/ flow regulation/ maintenance	Water flow regulated
		Soil quality regulation/soil and sediment retention/solid waste remediation	Soil retained
		Pollinations/pest and disease control/nursery population/ habitat maintenance	Area of habitat providing services
		Flood or storm mitigation/ noise attenuation	Number of properties in low-risk categories
		Global or local climate regulation/rainfall pattern regulation/air filtration	Tonnes of GHG retained
	Cultural	Recreation/visual amenity/ scientific and education/ spiritual, artistic, symbolic	Number of visits for cultural purposes

5.6.1. Measuring impact drivers

Prioritising impact drivers for measurement

Organisations will have identified a set of impact drivers linked to dependencies and impacts in E1. Continuing to focus on those that relate to high and moderate dependencies and impacts, the LEAP assessment team should select impact drivers for measurement that reflect the cross-cutting criteria for prioritisation above. The team should consider how impact driver metrics can be used as inputs to models to estimate changes to the state of nature and ecosystem service provision, and to interpret or anticipate trends in state indicators at a corporate, national or regional level.[45]

Organisations may wish to refer to tools like the SBTN materiality tool to assess which impact drivers are most likely to be material.

Quantification of an impact driver alone will not be sufficient for report users to understand the organisation's impact. Impact driver metrics should be put in the context of the dependency or impact pathway, alongside other contextual information such as whether the ecosystem on which the impact driver is having an effect is approaching a tipping point, or if the organisation is one of many organisations having similar impacts.

Where linking an impact driver metric to a location and providing full context is not yet possible due to capacity or data issues, impact drivers could be measured in aggregate for your organisation and not contextualised to a specific location and still provide useful insights.

Contextualisation can be quantitative or qualitative. Useful information to contextualise impact driver metrics where possible includes:[46]

- **Thresholds:** Building on any evidence on thresholds gathered in E2, organisations should seek to compare their impact drivers and external drivers of change with quantitative thresholds where available for the ecosystems affected (see Box 9);
- **Direct or indirect:** Whether impact drivers affect nature directly, through activities that have a direct causal link, such as through land-use change, and/or indirectly, through an indirect causal link, such as habitat degradation caused by climate change to which GHG emissions contributed.[47] The former will be easier to attribute directly to the organisation and may require a different set of metrics;
- **Timing:** The timing of when impact drivers are likely to result in changes to the state of nature, including any time lags, cumulative impacts, thresholds and tipping points. This is of fundamental importance in decision-making to manage the impact;
- **Regulation:** Regulatory requirements to manage and disclose impact drivers, such as legal thresholds for water pollution; and
- **Stage of value chain:** The stage of the value chain to which the impact driver relates. For some organisations, such as those with agricultural supply chains, a focus on direct operations may not capture the greatest impacts and dependencies.

45 UNEP-WCMC et al. (2022) Recommendations for a standard on corporate biodiversity measurement and valuation. Aligning accounting approaches for nature.

46 Climate Disclosure Standards Board (2021) Application guidance for biodiversity-related disclosures.

47 Climate Disclosure Standards Board (2021) Application guidance for biodiversity-related disclosures.

The TNFD recommends organisations use the following sources of guidance when measuring impact drivers:

- Natural capital accounting frameworks, such as the Natural Capital Protocol[48], the related Transparent methodology[49] and UN SEEA,[50] which has also been applied at a corporate entity level;[51]
- Existing corporate disclosure requirements such as GRI,[52] CDSB guidance on water and biodiversity[53] (CDSB is now incorporated into the ISSB), and the Corporate Sustainability Reporting Directive (CSRD)[54] provide useful guidance on the measurement of impact drivers, particularly around resource exploitation, climate change and pollution;
- Target and measurement setting initiatives including the collaborative Align project recommendations;[55]
- Lifecycle analysis approaches, such as the EU Corporate Environmental Footprint (CEF) and Product Environmental Footprint (PEF);[56] and
- Environmental extended input–output models such as EXIOBASE, which may be useful for value chain analysis.

Annex 1 contains the TNFD's suggested set of assessment metrics for impact drivers.

Box 16: Assessing water stress related risk – Kirin Holdings Company

Kirin Holdings Company is an integrated Japanese food and beverage, biotechnology and pharmaceutical company founded in 1907. Kirin Holdings recognises that its business model and value chains are based primarily on agricultural products, and it relies heavily on a range of ecosystem services, including water provision, for its business activities.

Kirin Holdings scoped its LEAP assessment to focus on three priority areas related to its beverage business in July 2022: Sri Lankan tea farms, Japanese vineyards and water stressed areas in Australia. The results from this analysis, and an integrated climate/nature scenario assessment, informed the company's overall risk assessment.

ENCORE was used at an early stage to assess the impact of upstream activities across all Kirin Holdings' value chains, indicating the moderate impact of agricultural activities. This was complemented by secondary research into individual commodities, which provided important additional insight to contextualise the industry average data available through ENCORE.

48 Capitals Coalition (2016) Natural Capital Protocol.

49 Value Balancing Alliance, Capitals Coalition, World Business Council for Sustainable Development (2023) Standardized Natural Capital Management Accounting: A methodology promoting the integration of nature in business decision making.

50 United Nations et al. (2021) System of environmental-economic accounting – Ecosystem accounting.

51 Lammerant, J. (2021) Business and Natural Capital Accounting Case Study: Ambuja Cement, India; Lammerant, J. (2021) Business and Natural Capital Accounting Case Study: Quarry restoration by Holcim, Spain.

52 GRI (2021) GRI Standards Glossary.

53 CDSB (2021) Application guidance for biodiversity-related disclosures.

54 European Commission (2023) Delegated Regulation supplementing Directive 2013/34/EU.

55 UNEP-WCMC et al. (2022) Recommendations for a standard on biodiversity measurement and valuation. Aligning Accounting Approaches for Nature.

56 European Commission (2021) Environmental footprint methods.

For example, barley is a rainfed agricultural product and is considered in ENCORE to have a moderate impact on nature. However, in Kirin's Colorado operations, site visits and discussions with stakeholders revealed that barley farmers are located in areas of high water stress that farmers are handling using diverse methods, some using irrigation and others reducing water use through low impact agriculture.

Kirin then used the Science Based Targets Network's (SBTN) draft methods to assess the relationship between water stress, water withdrawal and ecosystem impacts and ranked their sites based on their scores across the three criteria (figure below). Kirin used this analysis to determine how water stress would impact the revenue of the group, based on consumption rates.

Trial Prioritisation				
Country	**Manufacturing site**	**Water stress**	**Water Use**	**Biodiversity risk**
US	Biokyowa	★★★★☆	★★★★★	★★☆
Thailand	Thai Kyowa Biotechnologies	★★★★☆	★★★☆☆	★☆☆
Japan	KYOWA PHARMA CHEMICAL	★★★☆☆	★★★★☆	★★☆
Japan	Kirin Brewery Toride Plant	★★★☆☆	★★★☆☆	★☆☆
Japan	Kirin Brewery Yokohama Plant	★★★☆☆	★★★☆☆	★☆☆
Japan	Kirin Gotemba Distillery	★★★☆☆	★★★☆☆	★☆☆
Japan	Kyowa Kirin Fuji Plant	★★★☆☆	★★★☆☆	★☆☆
Australia	Lion Tooheys Brewery	★★★★☆	★★☆☆☆	★★☆
Japan	Kirin Brewery Nagoya Plant	★★★☆☆	★★★☆☆	★★☆
China	Shanghai Kyowa Amino Acid	★★★★☆	★★☆☆☆	★☆☆
Japan	Kirin Beverage Shanan Plant	★★★☆☆	★★☆☆☆	★★☆
Australia	Lion Castlemaine Perkins Brewery	★★★★☆	★★☆☆☆	★★☆
China	Kirin Brewery (Zhuhai)	★★★☆☆	★★☆☆☆	★★☆
US	New Belgium Brewing Fort Collins Brewery	★★★★★	★☆☆☆☆	★☆☆

*Water stress is evaluated using three indicators (Aqueduct's Baseline Water Stress, Water Risk Filter's Baseline Water Depletion and Blue Water Scarcity) that assess the amount of available water resources.

*Water use as a percentage of total use at 14 sites with high water stress.

*Biodiversity is assessed by the scores in Species Threat Abatement and Restoration (STAR). namely START for threat abatement and STARR for restoration. These are calculated based on the IUCN Red List for the watershed of the manufacturing site. We also consider whether biodiversity elements triggering Key Biodiversity Area (KBA) criteria such as fish, amphibians. turtles, crustaceans, dragonflies, etc. are present within a 50km radius of the site's watershed.

Source: Kirin (2022) Environmental Report, page 19.

5.6.2. Measuring changes in the state of nature

There is no globally standardised approach to the measurement of the state of nature. However, there are many authoritative assessments on changes in the state of nature produced by governments and scientific organisations around the world that can provide a first source of material for a LEAP assessment team.

Where such independent authoritative assessments do not exist, organisations may need or wish to conduct their own measurement activities (or partner with others to do so), subject to capacity and financial resources.

To assist with the analysis, and in the absence of a standardised approach and a globally accessible database on state of nature data to support such assessments by business and financial institutions, the TNFD has provided additional guidance on the measurement of the state of nature (Annex 2), including descriptions of illustrative metrics that could be used and best practice principles for selecting metrics. This builds on the Align project, which provides a framework for incorporating biodiversity state and values into decision-making processes for businesses, focused on business dependence on the diversity of nature, its condition and extent, and its ability to provide ecosystem services now and into the future.[57]

Aligned with the conceptual foundations for assessment outlined in Section 2, this dashboard of state of nature metrics should seek to provide insights about:

- **The change in the status of ecosystems:**
  - **Ecosystem extent:** The area coverage of a particular ecosystem, usually measured in terms of spatial area (hectares or km^2); and
  - **Ecosystem condition:** The quality of an ecosystem measured by its living and non-living (biotic and abiotic) characteristics, against a reference state. Condition is typically assessed by an ecosystem's composition, structure and function which, in turn, underpins the ecological integrity of the ecosystem and supports its capacity to supply ecosystem services on an ongoing basis. Biodiversity is integral to measuring ecosystem condition, contributing to the composition, structure and function of ecosystems;
- **The change in the status of species:**
  - **Population size:** Changes in the number of individuals of a species within an area; and
  - **Extinction risk:** Threat status of a species and how activities/pressures may affect the threat status. The indicator may also measure change in the available habitat for a species as a proxy for impact on local or global extinction risk;[58] and
- **The change in genetic diversity**, where feasible and relevant.

Where possible and data is available at reasonable effort and cost, organisations should measure changes against a clear and transparent baseline and reference condition (Box 16),[59] and take into account the time period and geographic scale over which the impact or dependency could occur when choosing metrics. Metrics should also be put into context, for example, where the organisation is not the only actor contributing to the observed change.

57 UNEP-WCMC et al. (2022) Recommendations for a standard on biodiversity measurement and valuation. Aligning accounting approaches for nature.

58 UNEP-WCMC et al. (2022) Recommendations for a standard on biodiversity measurement and valuation. Aligning accounting approaches for nature.

59 UNEP-WCMC et al. (2022) Recommendations for a standard on biodiversity measurement and valuation. Aligning accounting approaches for nature; Climate Disclosure Standards Board (2021) Application guidance for biodiversity-related disclosures; Capitals Coalition (2016) Natural Capital Protocol; European Commission (2023) Delegated Regulation supplementing Directive 2013/34/EU.

Box 16: Reference condition and baselines

A reference condition is the condition against which past, present and future ecosystem condition (or other aspect of the state of nature) is compared in order to measure relative change over time. One reference condition could be a previous or desired state of nature that can be used for comparison. For species metrics, setting a reference condition could involve determining the target population size of species and/or establishing the target habitat size as a proxy. The choice of reference condition will depend on the business and environmental context. In some cases, it will be a pristine/undisturbed condition, while in others it will be a functional/resilient managed ecosystem. Refer to Annex 2 for further details on setting a reference condition.

A baseline is the starting point or benchmark against which changes in the state of nature attributed to the business activity can be compared. The choice of baseline will influence the assessment of dependencies and impacts.

Source: Climate Disclosure Standards Board (2021) Application guidance for biodiversity-related disclosures

To assist with data gathering and state of nature analysis, organisations should refer to:

- The TNFD additional guidance on the state of nature for further detail on metrics for the living (biotic) aspects of ecosystem condition and species (see Annex 2);
- The TNFD Tools Catalogue for a list of tools and data sources that may be of value to LEAP assessment teams; and
- The Natural Capital Protocol for further conceptual guidance on measurement of change in the state of nature.

5.6.3. Measuring changes in ecosystem services

When choosing which ecosystem services to seek to measure, organisations should also consider:

- The level of financial risks and opportunities related to a change in the quantity and/or quality of ecosystem services, such as potential financial losses resulting from loss of production processes; and
- The implications of reduced ecosystem service provision to society and associated impacts on communities that depend on those services.

Table 8: Criteria for identifying potentially significant ecosystem services

Factor	Low	Medium	High
How significant is the loss of inputs to the company if the ecosystem service is disrupted? **Relevant to dependency pathway**	**Limited loss of inputs:** The company or operation can continue as is or with minor modifications	**Moderate loss of inputs:** The company or operation can continue only with important modifications e.g. slower production or use of substitutes	**Severe loss of inputs:** Disruption in company or operation sites prevents operation
How significant is the financial loss of impaired production/ services? **Relevant to dependency pathway**	**Limited financial loss:** Disruption to the company/operation does not have the potential to materially affect the company's profits	**Moderate financial loss:** Disruption to company or operations has the potential to materially affect the company's profits	**Severe financial loss:** There is a reasonable possibility that the disruption to the company or operations could affect the financial viability of the company
How significant is the impact of the loss of ecosystem services on society? **Relevant to impact pathway**	**Limited impact:** Impacts are temporary and minor	**Moderate impact:** Potential impacts may significantly constrain access to ecosystem services by other stakeholders	**Severe impact:** Reasonable possibility that societal access/ use of ecosystem services is prevented

Source: Adapted from United Nations Environment Programme World Conservation Monitoring Centre, Capitals Coalition, Arcadis, ICF, World Conservation Monitoring Centre Europe (2022) Recommendations for a standard on corporate biodiversity measurement and valuation, Aligning accounting approaches for nature; and ENCORE Partners (Global Canopy, UNEP FI, and UNEP-WCMC) (2023) ENCORE: Exploring Natural Capital Opportunities, Risks and Exposure.

Metrics for changes in ecosystem services

Examples of ecosystem service metrics for select categories of ecosystem services considered to be broadly applicable across all sectors are provided in the TNFD's assessment metrics in Annex 1.

These seek to achieve a number of outcomes for a LEAP assessment team:

- Provide insight into the extent of your organisation's dependency on an ecosystem service, such as the proportion of raw materials potentially exposed to risk as a result of dependence on an ecosystem service or level of productivity directly dependent on an ecosystem service; and

- Consider the value – now and over multiple future timescales – of these services to both the organisation and society (see Annex 3).

Undertaking measurement at the appropriate scale will be important. Ecosystem service metrics should be measured linked to location. However, like impact drivers, where linking ecosystem services to location is not yet possible due to capacity or data issues, they could be measured in aggregate for your organisation and not contextualised to a specific location and still provide some useful insights.

Frameworks such as UN-SEEA,[60] the Measure and Value stage of the Natural Capital Protocol[61] and associated biodiversity guidance[62] and the complementary BSI standard on natural capital accounting[63] provide further guidance on the measurement of ecosystem services. This includes how to link final ecosystem services to the beneficiaries that depend on those services, which can be used to inform the priority list of services. These frameworks also provide guidance on measuring ecosystem assets that support the provision of different ecosystem services.

5.6.4. Choosing data sources

Having chosen its indicators and metrics, the organisation needs to choose which data sources to use to evaluate those metrics. Once it has reviewed the data landscape, it may need to revisit its initial choice of metrics if some initial proposals prove infeasible. The TNFD's guidance for assessment metrics highlights which major reporting standards refer to the same metric in their standards guidance. This is designed to help a LEAP assessment team select a set of metrics that aligns with as many internal assessment and reporting requirements as possible to be time and cost efficient.

Organisations may also need to consider a mix of primary data and secondary or modelled and proxy data (Table 9).

Primary data should be the preferred option. This will be most straightforward for impact drivers, such as the volume of water consumed or quantity of solid waste produced. In other cases, modelled data, including intermediate or proxy indicators, may be required. For example, air pollution from the generation of electricity used might be estimated by combining electricity consumption air emissions factors for the electricity grid. Box 17 provides further guidance on secondary, modelled or proxy data.

The data collection (or estimation) process will depend on the scope and purpose of the assessment. The data required could be related to an operation owned and operated by the organisation, or operational sites upstream or downstream in the value chain. In this case, the analysis may need to be conducted with relevant supply chain partners or by using other approaches, such as input-output analyses.

60 United Nations et al. (2021) System of environmental-economic accounting – Ecosystem accounting; Capitals Coalition (2016) Natural Capital Protocol; British Standards Institution (2021) Natural Capital Accounting for Organizations.

61 Capitals Coalition (2016) Natural Capital Protocol.

62 Capitals Coalition and Cambridge Conservation Initiative (2020) Integrating biodiversity into natural capital assessments.

63 British Standards Institution (2021) Natural Capital Accounting for Organizations.

Table 9: Types of sources for nature-related data

Data type	Example
Primary data Data collected for the assessment being undertaken and collected to measure a specific impact driver, ecosystem service or change in the state of nature.	Internal business data, such as measured raw material consumption, revenue/site level data collected through surveys or sampling. Data collected from suppliers or customers. Land cover change derived from satellite imagery.
Secondary data Data generated by an entity other than the data users that may include modelled or third-party data. **Proxy data (a type of secondary data)** Data collected for an alternative purpose to its specific use case.	Published, peer-reviewed and grey literature (for example, lifecycle impact assessment (LCIA) databases, industry, government or internal reports). An entity could use the volume of manufactured product output and the estimated machinery water efficiency to estimate proxy water consumption.

Box 17: Using secondary data

In some cases, organisations may judge that secondary data might be an appropriate way to gain initial information on the likely nature-related issues, particularly where there is insufficient traceability along the value chain to be able to undertake direct measurement. Such data are increasingly available from third party data providers in a convenient to use format.

This approach comes with a number of advantages. It makes the analysis more tractable, with the organisation able to get a sense of the likely nature-related issues without investing in measurement or improved traceability. This may provide the organisation with enough information to be able to start to disclose and address its nature-related dependencies, impacts, risks and opportunities.

For example, an organisation may be sourcing soya from Brazil, but buys through a wholesaler, so the beans the organisation uses may come from an ever changing set of farms. It may therefore choose to use data on the average environmental impacts of soya cultivation in Brazil – or ideally the region, ecosystem or landscape – it sources from in order to assess the likely nature-related impacts of its supply chain.

However, organisations should only view the use of such data as a transitional measure until higher traceability across the value chain and direct measurement can be achieved. They should exercise caution and adopt conservative interpretations, while constantly striving to improve accuracy and being transparent on the approach and assumptions made.

Third party data should not be assumed to be accurate for individual organisations or representative of individual assets, as they may not apply specifically to the locations in the organisation's value chain but instead provide average dependencies and impacts at a lower level of geographic granularity.

This can lead an organisation to incorrectly flag high/low dependencies and/or impacts that do not reflect the reality of activity's impact, consequences for dependencies and impacts and related risks. This could, in turn, drive action that is undesirable or inappropriate.

Use of secondary or modelled data can also make it difficult for organisations to demonstrate progress. If they are only a relatively small part of the total market for a product in the country, their efforts to reduce risks resulting from impacts on nature are unlikely to show up in the market average data.

At the market level, it also means that strong and weak performers cannot be easily distinguished. Financial institutions looking to aggregate data across clients, or compare risk profiles for different companies, cannot do so reliably if some companies are using data directly from suppliers and others are using proxy data.

Organisations should only consider secondary or modelled data where:

- In the organisation's view, such data gives it sufficient information to assess and address nature-related risks and opportunities to the business;
- The data give investors and other users of the report sufficient information to be able to assess the organisation's risk and opportunity management; and/or
- It is impossible or disproportionately expensive to collect primary data.

Where organisations do use secondary or modelled data, they should assess data on the basis of five criteria:

- **Specific:** The data should be specific to the issue and location. For example, it should be specific to the type of pollution being investigated, and to the greatest extent possible, match the geography of the area of concern;
- **Measurable:** The organisation should look for proxy variables that can be measured through the collection of relevant data and information and have a well-established relationship with the targeted attributes, have been scientifically validated and have been used in similar contexts previously, with consideration of the biome, ecosystem or location where the proxy is being applied;
- **Ambitious:** The organisation should aim for a data source that is as ambitious as possible in its specificity to the issue and should be from a trustworthy source that has been peer-reviewed;
- **Realistic:** Organisations should make sure they have an understanding of the limitations of the proxy data and its use compared to direct measurements so they can be realistic in the understanding of the validity of their assessments, based on the evidence, knowledge and understanding, recognising practical constraints and limitations in data availability, analytical methods, and the complexity of the systems being assessed; and
- **Time-bound:** The data should be relevant to the time period in question and be regularly updated to allow the organisation to maintain an accurate understanding of the issue.

Where possible, organisations should:

- Combine multiple proxies to gain a more comprehensive understanding;
- Validate and ground-truth proxies against location-specific nature-related data; and
- Engage experts, including ecologists, in the process of selecting and interpreting proxy data.

Organisations should also:

- Clearly document the proxy selection process, the data sources used, and any assumptions made during the assessment;
- Regularly review and update the proxy usage to ensure relevance and accuracy to account for future technological developments and greater access to data; and
- Put in place a strategy to improve the data quality over time.

Organisations should disclose their use of secondary or modelled data, an assessment of the data quality and degree of location-specificity, and the strategy to move to higher traceability as part of their reporting under TNFD recommended disclosure Risk and impact management A(ii).

Data availability and quality – state of nature data

The TNFD recommends that organisations draw on authoritative assessments of changes in the state of nature produced by government or scientific organisations in the first instance, extracting and collating published data of relevance to their assessment needs. Where gaps exist and subject to financial and capacity consideration, they may consider collecting primary data. Nevertheless, the TNFD recognises that this may not always be practical or available. In such cases, organisations may wish to use secondary, modelled or proxy data as a starting point.

For example, if species abundance information is not available, the organisation can monitor the area of appropriate habitat or indicator species as a proxy.[64] The organisation may refer to published research on the health of the species population, or work with local biodiversity or ecosystem experts to understand the general trends in species health and/or habitat.

Modelled data may be:

i. Low-detail/high-level methods (e.g. basic population dynamics model, flood risk assessment based on historical events, Life Cycle Impact Assessment); or
ii. Detailed estimation or modelling methods (e.g. remote sensing, detailed fate models, detailed hydrological models).

Caution is required with these methods where the organisation is not the only actor contributing to the observed change. Reasonable estimates of the influence of others on the observed change will be important.

The availability and quality of state of nature data will depend on geography, realm, ecosystem type and the selected metrics. While analysis of satellite imagery and geospatial datasets can help assess the state of terrestrial ecosystems, they are insufficient to assess the state of ocean ecosystems, nor able to describe the state of a species at risk. Companies may therefore have to adopt, in these cases, a best-available-data approach to evaluating the state of nature.

In areas where data is out of date or at an inappropriate spatial scale, or where ecosystem interactions are complex and/or uncertain, the building of environmental accounts may be required to assess potential areas of nature risk.

Finally, if data cannot be sourced with reasonable effort or within reasonable cost parameters and the organisation believes the data is not of sufficient quality

64 UNEP-WCMC et al. (2022) Recommendations for a standard on corporate biodiversity measurement and valuation. Aligning accounting approaches for nature.

to support TNFD-aligned disclosure statements, it can state the identified dependencies and impacts in its disclosure statement, as outlined in the General Requirements in the Recommendations of the TNFD, and indicate that the data was not of sufficient reliability to undertake more detailed analysis to further qualify their materiality.

Data availability and quality for impact drivers

Organisations can source impact driver data through primary and secondary sources using proxies where data is unavailable. The type of data used and its limitations need to be considered, including the implications for how to interpret the conclusions appropriately.

5.7. E4: Impact materiality assessment

	Corporates	Financial institutions
E4: Impact materiality assessment	Which of our impacts are material?	Which of the identified impacts are material?

Organisations that need or want to disclose their impacts on nature and society aligned with an impact materiality lens – for example, through the use of GRI Standards or European Sustainability Reporting Standards (ESRS) – will need to undertake component E4 to arrive at a list of impacts that the organisation should consider disclosing.

- **For financial institutions:** This may relate to investment strategies, product offering or investee/client engagement.

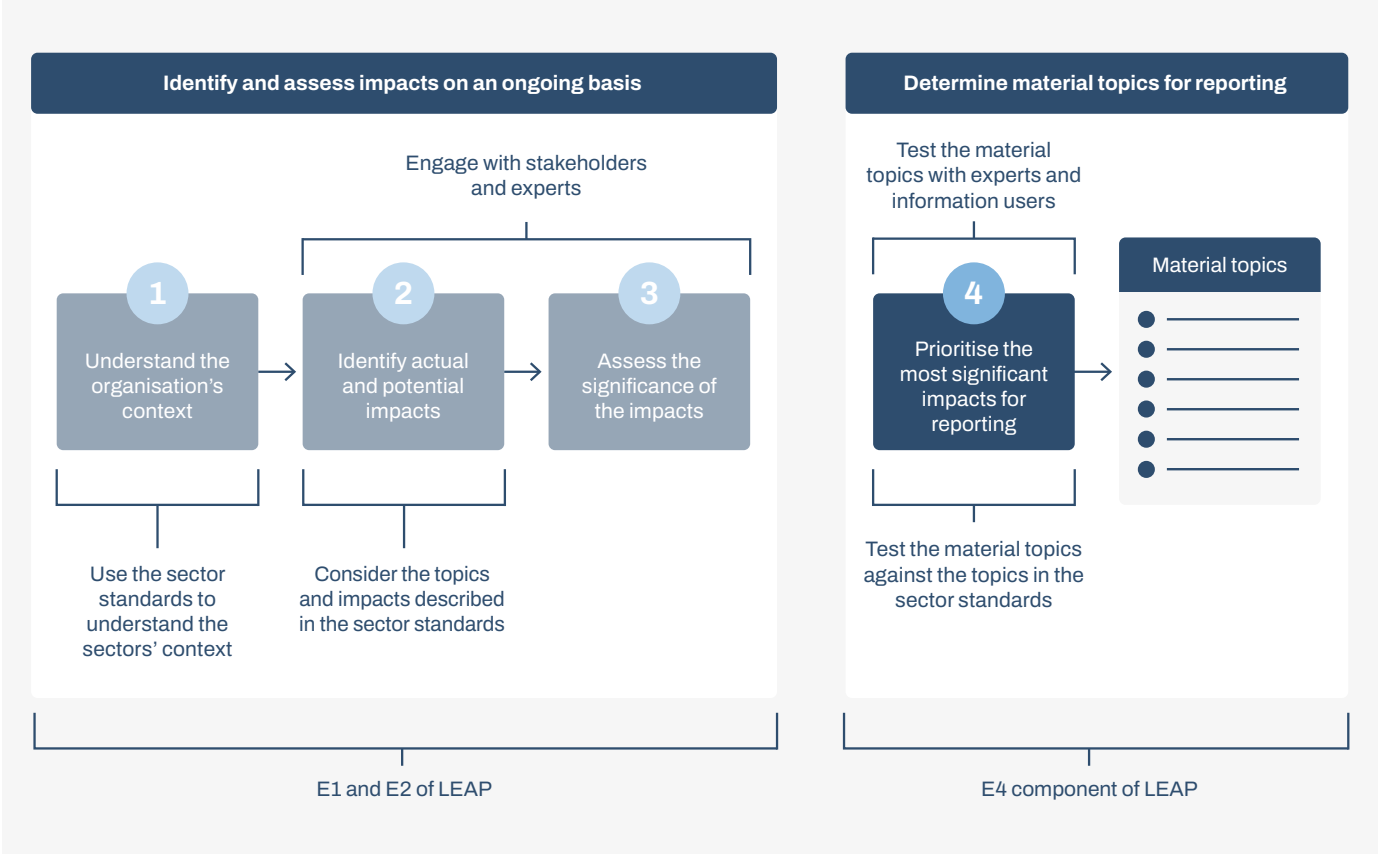
Organisations that do not intend to use an impact materiality approach can take their analysis from E3 and move straight to the Assess phase to consider how their identified dependencies and impacts inform their assessment of material risks and opportunities to the organisation.

Both GRI and the ESRS indicate the need to estimate the severity of the impact. This should include an estimation of the likelihood of potential impacts as well as actual negative impacts. GRI and ESRS also state that the organisation's due diligence process should inform the impact materiality assessment. In this context, the organisation may use its ongoing due diligence process or other risk management processes to inform its threshold setting and determine whether impacts are material for reporting purposes.[65]

Figure 21 summarises the steps illustrated by GRI to determine impact materiality. The first three steps relate to the organisation's ongoing identification and assessment of impacts (and are aligned with components E1, E2 and E3 of this guidance). In Step 4, the organisation prioritises its most significant impacts for reporting based on severity (and likelihood, in case of potential impacts) and in this way, determines its material topics.

65 See GRI (2023) Material Topics 2021. Both GRI and the ESRS also refer to Organisation for Economic Co-operation and Development (2018) Due Diligence Guidance for Responsible Business Conduct.

Figure 21: GRI approach to determine impact materiality



Source: GRI (2023) Material Topics 2021

The Align project recommends using a priority filter to identify the most significant impact drivers based on characteristics of the impact driver (spatial extent, frequency and duration, and magnitude) and characteristics of biodiversity (exposure and sensitivity to impact drivers).[66]

As outlined in the TNFD recommendations, the Taskforce recognises that different definitions of impact materiality exist. To highlight how a LEAP assessment team can undertake an impact materiality analysis, this guidance references the definitions of impact materiality from GRI (GRI 2021 Material Topics) and EU's ESRS 1 (General Requirements).

GRI states that "material topics are topics that represent an organisation's most significant impacts on the economy, environment, and people, including impacts on their human rights".[67]

66 UNEP-WCMC et al. (2022) Recommendations for a standard on corporate biodiversity measurement and valuation. Aligning accounting approaches for nature.

67 GRI (2021) GRI 1: Foundation 2021, Section 2.2.

ESRS states that "a sustainability matter is material from an impact perspective when it pertains to the organisation's material actual or potential, positive or negative impacts on people or the environment over the short-, medium- or long-term".[68]

ESRS 1 also requires organisations to clarify the use of criteria to determine which of the impacts will be covered in its sustainability statement and are therefore defined as material. While the organisation is also asked to disclose whether thresholds have been used, the standard is not prescriptive on the choice or estimation of such thresholds.

Desired outputs from the Evaluate Phase

The goal of the Evaluate phase is for your organisation to identify its material dependencies and impacts on nature in its direct operations, upstream and downstream. For a financial institution, this primarily refers to dependencies and impacts among its portfolio companies. This is necessary to take forward for further detailed due diligence of material risks and opportunities in the Assess phase of LEAP. It is also necessary for organisations needing or wishing to report against an impact materiality threshold (as outlined in component E4).

Corporates, after working through the four components of the Evaluate phase, should have the following outputs:

- A list of relevant environmental assets, ecosystem services and impact drivers mapped to business activities and/or assessment locations (from E1). The output of this can support reporting on the TNFD's recommended disclosures (Strategy D, and Risk and impact management A);
- A list of the organisation's dependencies and impacts on nature by assessment location, with a description of the dependency and impact pathway, including impact drivers, external factors, relevant ecosystem services and actual or potential changes in the state of nature (from E2). The output of this can support reporting on the TNFD's recommended disclosures (Strategy A);
- Evaluation of material dependencies and impacts on nature, consistent with the impact materiality approach and reporting requirements of GRI and ESRS in the European Union; and
- A set of indicators and associated metrics produced by the organisation as part of this assessment (from E3 and E4). The output of this can support reporting on the TNFD's recommended disclosures (Metrics and targets B, and Risk and impact management B).

For a **financial institution**, the outputs of the Evaluate phase will be:

- A list of environmental assets, ecosystem services and impact drivers by portfolio sector identified in the heatmapping exercise in the Locate phase;
- A list of the portfolio companies/activities in these sectors mapped to their dependencies and impacts on nature; and
- An enhanced list of these companies/activities mapped against data on the scale of their dependencies and impacts, taking account of their management and mitigation efforts.

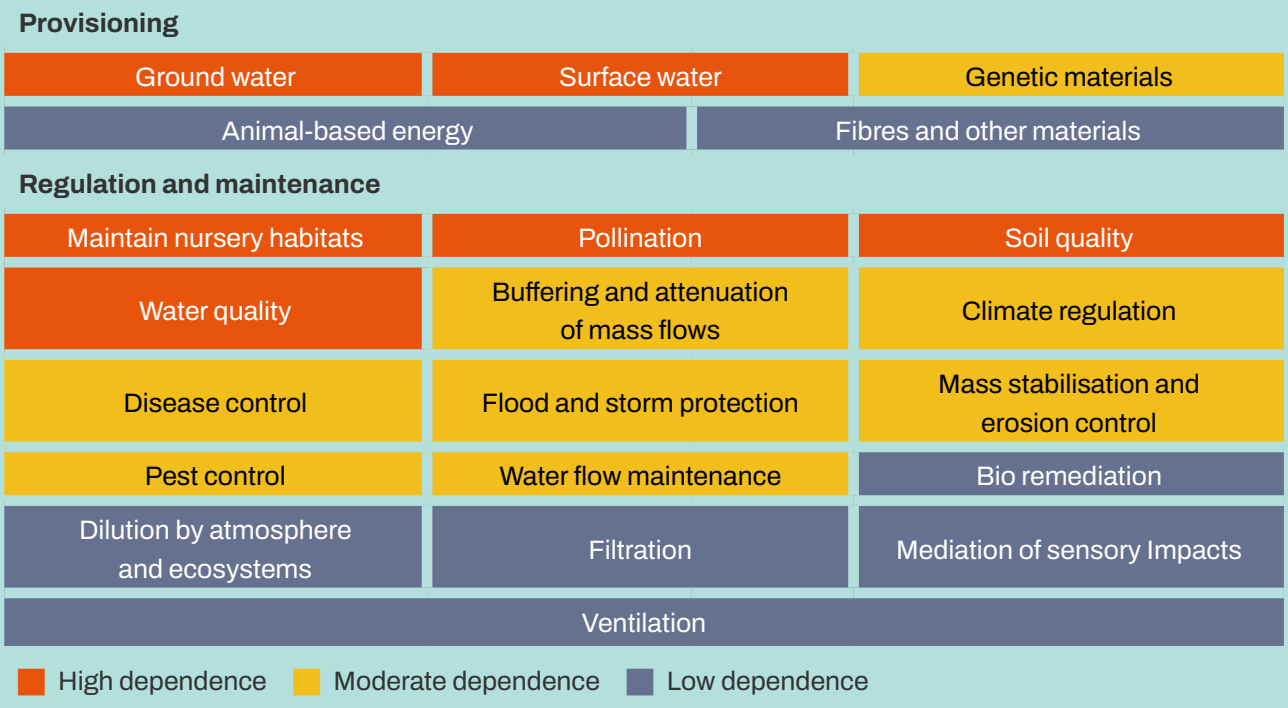
68 European Commission (2023) Delegated Regulation supplementing Directive 2013/34/EU, Annex 1, p. 7, as adopted by the Commission by means of delegated act on 31 July 2023. The ESRS word 'undertaking' has been substituted with the word 'organisation' for consistency of terminology in this document.

Box 18: Identifying dependencies on ecosystem services to an asset-centric materiality analysis – AXA Climate

AXA Climate is part of the AXA Group, and one of the entities piloting the TNFD framework. For this initial pilot, the group analysed a potential portfolio from the viticulture sector, and focus on a specific potential company, given its dependency on ecosystem services, including provisioning (e.g. clean water, energy), regulating (e.g. climate, soil health, biodiversity), and cultural services (e.g. supporting identities, promoting goodwill). However, vine growing, like any monoculture system, is highly vulnerable to vine diseases, pests, biodiversity loss, wildlife habitat degradation, and soil degradation. By assessing vine cultivation as well as its supply chain, valuable insights can be gained into the company's dependencies, impacts and potential action plans to effectively manage and mitigate risks.

The potential case of vineyards across Europe, using the ENCORE methodology and propriety analyses allows for mapping dependencies and impacts at each location based on business activity information. This analysis considers factors such as the availability, quality and accessibility of ecosystem services, as well as the potential risks or vulnerabilities associated with their availability.

Synthesis of the dependencies on ecosystem services based on the sector of the assets

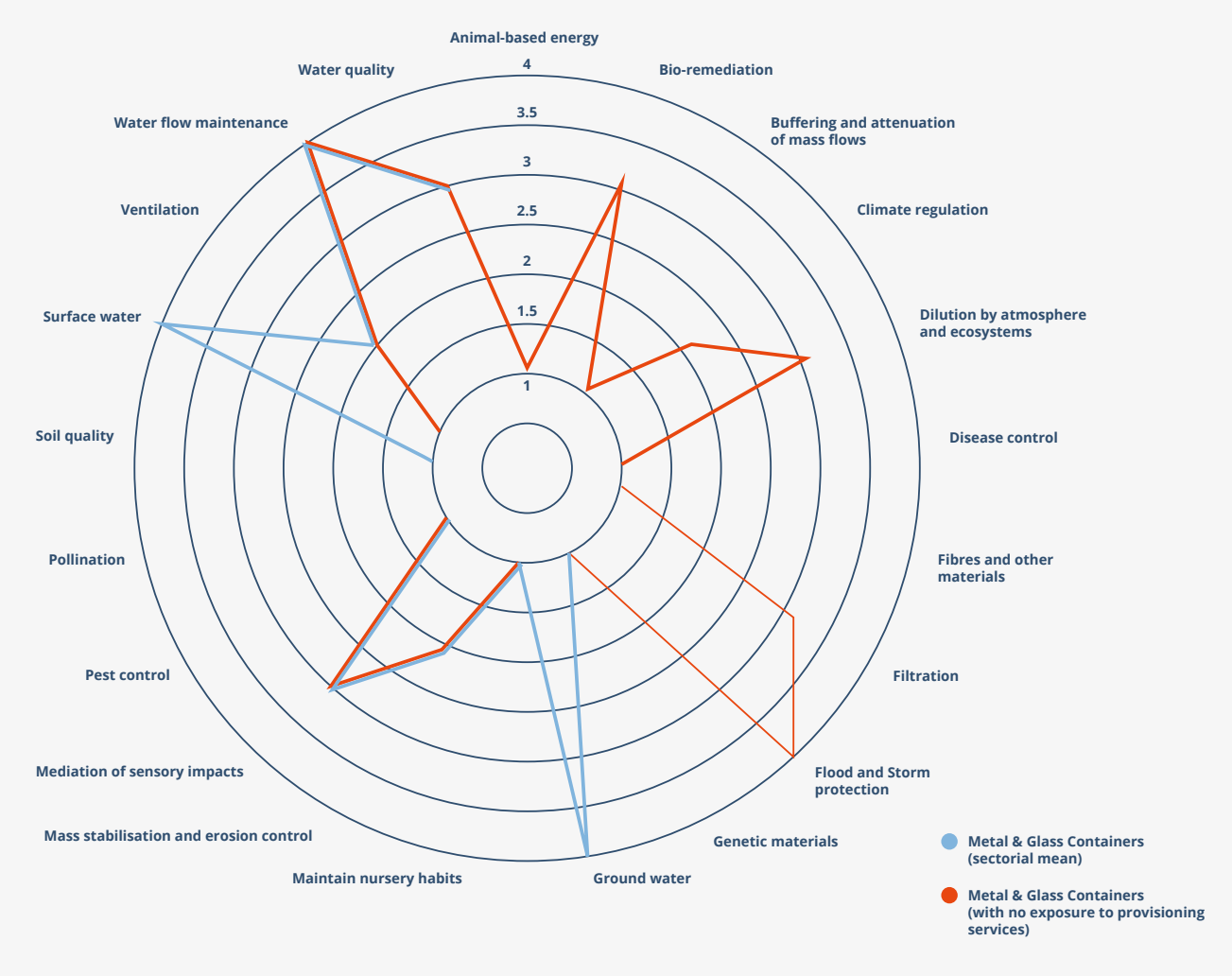


These assessments can be ranked according to the magnitude of potential impacts of these dependencies on business. The objective of this more detailed analysis is to move from a sectoral materiality analysis to a more granular, asset-centric, materiality analysis.

Table presenting the methodology to improve the granularity of the sectoral materiality analysis using a "what if…" scenario approach.

Materiality			
	What if …	**Impact on the priority location**	**Relative level of magnitude**
Climate Regulation	Climate regulation changes radically to the point where it is no longer possible to grow grape varieties nor to produce the sweet wines.	Questioning the agricultural model. Redefining product and brand positioning.	VERY HIGH The activity is jeopardised by the degradation of the ecosystem service and should at least be adapted or even radically transformed.
Disease control	Disease control provided by the ecosystem is no longer efficient and undesired disease incidences increase over time, affecting the crop yield and quality. Botrytis cinerea is not developing as steadily as in the past, which affects the crop yield and quality.	Direct impact on yield and quality. Could price adjustment maintain the economic model?	MEDIUM The activity is affected by the loss of the ecosystem service and should either be adapted or pass on the impact on the market.
Pest control	Pest control provided by the ecosystem is no longer efficient and undesired pest incidences increase over time, affecting the crop yield and quality.	Direct impact on yield and quality. Could price adjustment maintain the economic model?	MEDIUM The activity is affected by the loss of the ecosystem service and should either be adapted or pass on the impact on the market.

Spider chart highlighting the difference between sectoral dependencies and specific adjustment considering the specificities of the assets.



Axa Climate (2023) *TNFD 101: An illustrated guide to the future of nature reporting*

5.8. Resources to support the Evaluate phase

As noted above, a range of data, tools and methods can be used to support the Evaluate phase, with many of the tools and methods building on each other as approaches have developed. The evaluation community has worked together to ensure consistency and therefore this list shows the maturity of the approach as it has developed, with each method building from the previous ones. Organisations are encouraged to learn from:

- The Economics of Ecosystems and Biodiversity (2012) TEEB in business and enterprise;
- Capitals Coalition (2016) The Natural Capital Protocol, with associated sector guidance and supplements;
- Transparent Project;[69]
- Align Project;[70]
- Life Cycle Analysis will also be helpful and is summarised through the European Platform on LCA;
- ENCORE;[71]
- UNEP and S&P (2023) Nature risk profile methodology;
- Further projects including transparency criteria for the use of value factors, which are coordinated through the Capitals Coalition; and
- Further tools available in the TNFD Tools Catalogue.

69 Value Balancing Alliance, Capitals Coalition, World Business Council for Sustainable Development (2023) Standardized Natural Capital Management Accounting: A methodology promoting the integration of nature in business decision making.

70 UNEP-WCMC et al. (2022) Recommendations for a standard on corporate biodiversity measurement and valuation; Capitals Coalition. Aligning accounting processes for nature.

71 ENCORE Partners (Global Canopy, UNEP FI, and UNEP-WCMC) (2023) ENCORE: Exploring Natural Capital Opportunities, Risks and Exposure. Cambridge, UK: the ENCORE Partners.

6. Assessing nature-related risks and opportunities

6.1. Why

A LEAP assessment team needs to identify and prioritise the nature-related risks and opportunities to the organisation stemming from their identified dependencies and impacts on nature.

The identification of these risks and opportunities requires the adaptation of existing risk management processes to ensure these new risks are fully integrated. To do so, risk management processes will need to be adjusted in the way they measure risks, possibly using and developing new methods to prioritise nature-related risks and opportunities, and estimate the financial effects of these for the organisation to understand which could be disclosed as part of the materiality assessment.

6.2. What

Through the Assess phase, the LEAP assessment team can develop an understanding of how to integrate nature-related risks and opportunities into the organisation's existing enterprise or portfolio risk management processes.

To help create a list of material nature-related risks and opportunities for disclosures, the Assess phase provides guidance on how to prioritise risks by assessing the *magnitude* and *likelihood* of these risks, along with additional criteria that are specific to nature-related risks and opportunities. The assessment of material risks and opportunities is based on estimation of the financial effects of these risks and opportunities on the business.

Objective

To understand which nature-related risks and opportunities are material and should be disclosed by the organisation. This is done through the identification, measurement and prioritisation of nature-related risks and opportunities originating from the dependencies and impacts on nature identified in the Locate and Evaluate phases.

Desired outputs

- A 'longlist' of relevant nature-related risks and opportunities, which can be plotted into any existing risk matrix in use by the organisation;
- A 'shortlist' of material nature-related risks and opportunities, and a list of priority locations; and
- An outline of the process followed to adapt existing risk processes and associated elements to integrate nature-related risks and opportunities.

Practical tips from pilot testers

- Organisations should consider a range of methods and tools to support their assessment. It is important they are familiar with the benefits and limitations of such methods and tools in order to be able to critically examine their results; and
- Organisations can make use of standard international risk management frameworks, guidelines and tools such as the Committee of Sponsoring Organizations (COSO)'s Enterprise Risk Management Framework and the International Organization for Standardization (ISO) 31000 Risk Management Guidelines when assessing their nature-related risks and opportunities.

The TNFD recommends that organisations use the four components of the Assess phase of LEAP to assess nature-related risks and opportunities to their organisation, determine those that are material and integrate nature-related risks into existing enterprise and portfolio risk management processes. The LEAP components adapt and build on the TCFD steps for integrating climate-related risks into risk management[72] and are consistent with the application guidance and approach to meet the material information needs of capital providers consistent with the ISSB Standards, with a focus on risk management and how dependencies and impacts on nature create risks and opportunities for an organisation's financial position and prospects.[73] In line with the TCFD, the TNFD uses the COSO's enterprise risk management (ERM) framework as the foundation for risk management topics in this guidance.[74]

6.3. Guiding questions

The following high-level questions should guide analysis in the Assess phase:

A1: Risk and opportunity identification – What are the corresponding risks and opportunities for our organisation?

A2: Adjustment of existing risk mitigation and risk and opportunity management – What existing risk mitigation and risk and opportunity management processes and elements are we already applying? How can risk and opportunity management processes and associated elements (e.g. risk taxonomy, risk inventory, risk tolerance criteria) be adapted?

A3: Risk and opportunity measurement and prioritisation – Which risks and opportunities should be prioritised?

A4: Risk and opportunity materiality assessment – Which risks and opportunities are material and therefore should be disclosed in line with the TNFD recommended disclosures?

These guiding questions draw on guidance developed by ISO,[75] COSO and the World Business Council for Sustainable Development (WBCSD) on integrating environmental, social and governance-related risks into risk management processes[76] as well as other COSO documents. They provide a starting point for organisations to think through the integration of nature-related risks into existing risk management processes.

6.4. A1: Risk and opportunity identification

A1: Risk and opportunity identification	What are the corresponding risks and opportunities for our organisation?

Based on the evaluation of dependencies and impacts on nature prepared by the LEAP assessment team in the Evaluate phase, organisations should be able to identify their nature-related risks and opportunities.

72 Task Force on Climate-related Financial Disclosures (2020) Guidance on Risk Management Integration and Disclosure.

73 International Sustainability Standards Board (2023) IFRS S1 General Requirements for Disclosure of Sustainability-related Financial Information together with its accompanying documents.

74 Committee of Sponsoring Organizations (2020) Creating and Protecting Value: Understanding and Implementing Enterprise Risk Management.

75 International Organization for Standardization (2018) ISO 31000, Risk Management – Guidelines.

76 Committee of Sponsoring Organizations and World Business Council for Sustainable Development (2018) Enterprise Risk Management–Applying Enterprise Risk Management to Environmental, Social and Governance-Related Risks.

This section provides further detail based on the overview of nature-related risks and opportunities provided in Section 2.

For **financial institutions**, this will involve assessing whether the nature-related risks and opportunities should be identified as new risk and opportunity categories or aggravating/mitigating factors for the prudential risk categories already covered by the risk management system, including credit risks, operational risks and market risks.[77]

Financial institutions will identify the risk their own organisation faces through its portfolio companies. The risk may materialise, for example, through:

- Increased credit risk and potential related losses;
- Changes in investment risk profiles;
- Market risk (for example, stemming from stranded assets);
- Potential systemic risk (for example, increased inflation due to droughts);
- Underwriting risks (as insurance may become more costly to provide);
- Possible reputational risk (for example, lending to a client depleting the watershed in a controversial context); and
- Potential regulatory risk (for example, financing companies with value chains associated with deforestation under EU regulations).

A financial institution will also reflect on the opportunities, such as new service offerings (new nature related indices, new nature bond offerings, biodiversity credits, nature positive funds, and more).

6.4.1. Nature-related risks

As outlined in Section 2, the TNFD defines **nature-related risks** as potential threats posed to an organisation that arise from its and wider society's dependencies and impacts on nature. Nature-related risks can be physical risks, transition risks or systemic risks.[78] In addition to shorter-term financial risks deemed material today or in the near term, this includes longer-term risks presented by its dependencies and impacts on nature.

Nature-related physical risks are risks to an organisation that stem from the degradation of nature, such as changes in ecosystem equilibria like soil quality and species composition, and the consequential loss of ecosystem services that economic activities depend upon. These risks can be chronic, such as a gradual decline of species diversity of pollinators resulting in reduced crop yields or water scarcity, or acute, such as natural disasters or forest spills. Nature-related physical risks arise as a result of changes in the biotic (living) and abiotic (non-living) conditions that support healthy, functioning ecosystems. These risks are usually location-specific. See Table 2 in Section 2 for further details.[79]

77 In line with what is recommended for climate-related risks. See Basel Committee on Banking Supervision (2022) Principles for the effective management and supervision of climate-related financial risks.

78 Climate Disclosure Standards Board (2021) Application guidance for biodiversity-related disclosures; Task Force on Climate-related Financial Disclosures (2017) Recommendations of the Task Force on Climate-related Financial Disclosures; Financial Stability Board (2022) FSB Supervisory and Regulatory Approaches to Climate-related Risks Final report; International Association of Insurance Supervisors (2021) Application Paper on the Supervision of Climate-related Risks in the Insurance Sector; Network for Greening the Financial System (2023) Nature-related Financial Risks: A conceptual framework to guide action by Central Banks and Supervisors; Organisation for Economic Co-operation and Development (2023, forthcoming) A prudential framework for assessing nature-related financial risks: identifying and navigating biodiversity risks.

79 Network for Greening the Financial System (2023) Nature-related Financial Risks: A conceptual framework to guide action by Central Banks and Supervisors.

Nature-related transition risks are risks to an organisation that stem from a misalignment of economic actors with actions aimed at protecting, restoring and/or reducing negative impacts on nature. These risks can be prompted, for example, by changes in regulation and policy, legal precedent, technology or investor sentiment and consumer preferences. They can also arise from activities aimed at restoring nature that no longer align with, for example, revised policies.[80]

Consistent with the TCFD, **liability risk** is included as a sub-category of transition risk. That is, potential financial losses stemming directly or indirectly from legal claims. A recent body of work has suggested that the specific characteristics of liability risk – as both a consequence of transition-related actions and a driver of transition – may mean it warrants separate consideration for organisations. Other work has suggested liability risk is associated with both transition and physical risks and could be a sub-set of both physical and transition risk categories. See Table 3 in Section 2 for further details.

Nature-related systemic risks are risks to an organisation that arise from the breakdown of the entire system, rather than the failure of individual parts. These risks are characterised by modest tipping points combining indirectly to produce large failures, where one loss triggers a chain of others, and prevents the system from reverting to its prior equilibrium.[81]

There are two categories of nature-related systemic risk:

- **Ecosystem stability risk:** Risk of an event that leads to a destabilisation of a critical natural system so it can no longer provide ecosystem services in the same manner as before. For example, tipping points are reached or regime shifts and/or ecosystem collapses occur that generate forms of physical and/or transition risk; and
- **Financial stability risk:** Risk that a materialisation and compounding of physical and/or transition risk leads to the destabilisation of an entire financial system.

There are close relationships between the different forms of nature-related risk. Physical and transition risks can stem from systemic forms of nature-related risk (i.e. ecosystem stability risk) or non-systemic sources. Both physical and transition risks can interact and affect economic agents through various channels. For example, organisations can generate acute physical risk by removing coastal marshes, leading to potential damage costs linked to loss of coastal infrastructure from storms. This can also generate a transition risk, specifically policy and legal risk (if that action was illegal) and reputation risk (if it is negatively perceived by consumers). If a sufficient number of organisations in that region remove coastal marshes, then whole regions of industry may suffer from a lack of protection from coastal storms. These events would then create traditional sources of financial risk (e.g. credit or market risk), and potentially, through compounding, cascading and contagion effects,[82] would lead to one form of nature-related systemic risk (i.e. financial stability risk). See Figure 14 in Section 2 for further details.

80 Network for Greening the Financial System (2019) A call for action: climate change as a source of financial risk; Network for Greening the Financial System (2021) Climate-related litigation: raising awareness about a growing source of risk; Financial Stability Board (2022) FSB Supervisory and Regulatory Approaches to Climate-related Risks Final report; Organisation for Economic Co-operation and Development (2023, forthcoming) A prudential framework for assessing nature-related financial risks: identifying and navigating biodiversity risks.

81 Goldin, I. and Mariathasan, M. (2014) The Butterfly Defect: how globalisation creates systemic risks and what to do about it; International Risk Governance Council (2018) IRGC Guidelines for the Governance of Systemic Risks; Kaufmann, G. and Scott, K. (2003) What Is Systemic Risk, and Do Bank Regulators Retard or Contribute to It? The Independent Review VII(3), 371–391; Network for Greening the Financial System (2023) Nature-related Financial Risks: A conceptual framework to guide action by Central Banks and Supervisors; OECD (2023, forthcoming), A prudential framework for assessing nature-related financial risks: identifying and navigating biodiversity risks.

82 Network for Greening the Financial System (2023) Nature-related Financial Risks: A conceptual framework to guide action by Central Banks and Supervisors; OECD (2023) A supervisory framework for assessing nature-related financial risks: identifying and navigating biodiversity risks.

6.4.2. Links between climate and nature-related risks

Nature-related risks are closely linked to climate-related risks. Climate change is one of the five main drivers of nature change.[83]

For example, ecosystems play a key role in emitting and sequestering greenhouse gas emissions, and in supporting adaptation to a changing climate. The world's forests are a net carbon sink that absorb 7.6 billion tonnes of CO_2 per year,[84] which is around 15% of the estimated 50 billion tonnes of greenhouse gases emitted annually.[85] Nature's absorption of greenhouse gas emissions slows atmospheric CO_2 concentrations, but with nature's capacity to sequester greenhouse gases currently far below global annual emissions, we have an imbalance that leads to global warming. This, in turn, drives impacts on nature.

Moreover, other drivers of the loss of nature, such as deforestation, are significant sources of greenhouse gas emissions. Nature-related risks are therefore closely linked to climate-related risks in several ways, and the risks must be considered together. When assessing the potentially material financial risks to an organisation associated with climate change, the role of the loss of nature in climate feedback loops and tipping points should also be considered.

83 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (2019) Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.

84 Harris, N. L. et al. (2021) Global maps of twenty-first century forest carbon fluxes. Nature Climate Change 11, 234–240.

85 Ritchie, H. and Roser, M. (2020) CO_2 and GHG Emissions – Emissions by Sector.

Table 10: Description of the climate-nature nexus

Connection	Description
Climate change as a driver of nature-related risk	Climate change, and the resulting rising global temperatures, is one of the direct drivers of nature degradation. For example, climate-induced flooding, wildfires, ocean acidification and cyclones can disrupt the water cycle, alter soil temperatures and accelerate habitat and wildlife loss. Consequently, combating climate change can slow the climate-driven deterioration of ecosystems.
Nature degradation as a driver of climate-related risk	Loss of key ecosystems increases the pace of climate change through adverse changes in the carbon, nitrogen and water cycles. Additionally, the destruction of forests, peatlands and other carbon-sequestering ecosystems may accelerate climate change through the release of long-stored carbon into the atmosphere, alongside a reduced ability to sequester future carbon. The destruction of ecosystems such as wetlands or mangroves may also alter ecosystem assets that are important for climate resilience.
Climate change mitigation and adaptation as a potential driver of nature-related risk	Certain strategies for climate change mitigation/adaptation and achieving net zero goals have the potential to cause inadvertent negative effects on ecosystems. For example, nature can be adversely impacted by poorly planned tree planting to capture carbon dioxide emissions (e.g. of non-native species and monocultures), mining of materials for battery storage technology, destruction of natural areas to install solar installations, or land use changes to fulfil bioenergy needs (e.g. deforestation for wood or planting biofuel crops).
Nature as a solution to decrease climate-related risk (i.e. nature-based solutions)	Conservation of ecosystems contributes substantively to mitigating climate change. As suggested above, combatting deforestation and peatland destruction can prevent the release of stored carbon and facilitate future carbon sequestration. Conservation or extension of natural systems can also help to adapt to the effects of climate change. For example, ecosystems such as wetlands, forests, mangroves and dune habitat increase resilience to physical shocks (e.g. storms, wildfires, landslides or floods) by providing protective barriers or buffers.

Adapted from Network for Greening the Financial System (2023) Nature-related Financial Risks: A conceptual framework to guide action by Central Banks and Supervisors.

6.4.3. Nature-related opportunities

According to ISO 31000's definitions, opportunities arise from positive effects of uncertainty on objectives.[86] In line with this, the TNFD defines **nature-related opportunities** as activities that create positive outcomes for organisations and nature by creating positive impacts on nature or mitigating negative impacts on nature. Nature-related opportunities are

86 International Organization for Standardization (2018) ISO 31000, Risk Management – Guidelines.

generated through dependencies and impacts on nature, and can occur:

- When organisations avoid, reduce, mitigate or manage nature-related risks, for example, connected to the loss of nature and ecosystem services that the organisation and society depend on; and/or
- Through the strategic transformation of business models, products, services, markets and investments that actively work to reverse the loss of nature, including by restoration, regeneration of nature and implementation of nature-based solutions.

Reflecting the opportunity for organisations to avoid and reduce negative impacts and restore and regenerate ecosystems and to innovate and invest in new business models, products, services and markets to contribute to nature positive outcomes, the TNFD recommends a set of metrics that help to quantify and report both negative and positive impacts on nature.

While business opportunities can arise from restoring nature and mitigating existing damage through reconstructive or compensatory measures, business actions that avoid or minimise negative impacts on nature should be prioritised, following mitigation hierarchy principles and the SBTN AR3T framework (see Prepare phase).[87] Importantly, reducing negative impacts on nature does not equate to contributing to nature-positive outcomes. For nature-positive outcomes, actions should go beyond risk reduction and influence the threats and pressures that drive nature loss and degradation globally[88] and invest in nature through conservation and restoration. Strategic transformation is likely to be more impactful than the mitigation or management of nature-related risks in isolation. The TNFD's categories of negative and positive impacts stemming from drivers of change in the state of nature illustrate these differences (see Evaluate phase) and are reflected in the TNFD's recommended metrics for assessment and disclosure.

Efforts to create positive impacts on nature and/or to mitigate negative impacts can improve the resilience of organisations to nature-related trends and nature-related physical, transition and systemic risks.

Resilience is defined as having the capacity to live and develop with change and uncertainty. It provides capacities for turning risks into opportunities. This includes:

- Adaptive capacities to absorb shocks and turbulence and avoid unpleasant tipping points, thresholds and regime shifts;
- Capacities to prepare for, learn from and navigate uncertainty and surprise;
- Capacities for keeping options alive and creating space for innovation; and
- Capacities for systemic transformation in the face of crises and unsustainable development pathways and traps.[89]

Nature-related opportunities will vary according to the region, market and industry in which an organisation operates. Opportunities encompass a wide range of actions, such as the protection and management of ecosystems, the incorporation of green and blue infrastructure in urban areas, and the application of ecosystem-based principles to agricultural systems. The concept is grounded in the knowledge that healthy natural and managed ecosystems produce a diverse range of services on which human wellbeing depends, from storing carbon, controlling floods and stabilising shorelines and slopes, to providing clean air and water, food, fuel, medicines and genetic resources.See Figure 15 in Section 2 for further details.

87 Adapted from: WWF (2022) A Biodiversity Guide for Business.

88 Science Based Targets Network (2020) Initial Guidance for Business.

89 Folke, C. et al. (2016) Social-Ecological Resilience and Biosphere-Based Sustainability Science. Ecology and Society, 21(3), 41; Rockström, J. et al. (2023) Shaping a Resilient Future in Response to COVID-19. Nature Sustainability 6, 897–907.

Box 19: Positive impacts and nature-related opportunities related to an Indigenous community-led enterprise in Mexico – Puethe Products and Services

Indigenous People: Hñähñu

Where: Community of Puerto Juárez, in the municipality of Zimapán, Hidalgo, México

Between June and July 2023, CIELO ran TNFD pilot workshops with six Indigenous enterprises in Mexicc The aim was to socialise, analyse and reflect on the TNFD framework, and carry out internal assessment of nature-related risks and opportunities within the enterprises.

One of the Indigenous enterprises was Puethe Products and Services (Puethe), a venture establish to tackle the issue of indiscriminate looting of cacti within the Indigenous territory. The enterprise operat in Puerto Juarez, in the region of Puerto Hidalgo, Mexico, an area with a unique ecosystem hosting many endemic species.

The Indigenous community recognised the valuable ecosystem services provided by cacti in the area, such as:

- Supporting rainwater retention, slowing down soil erosion and providing nectar for pollinating insects
- Promoting soil fertility;
- Generating economic opportunities through community nurseries, training, and ecotourism; ar
- Being spiritually and culturally significant to the community, for example, through use in cooking, traditional medicine, and religious rituals.

The venture, established in 2010, aims to plant, conserve, and sell cacti in a controlled and sustainab way. Natural inputs include seeds, plants, soil, substrates and the use of water for irrigation, with the venture highly dependent on weather, water resource soil health and land. Some positive social impacts of the venture include:

- Generation of economic opportunities and strengthening of territorial management;
- Valuation, promotion and protection of Indigenous culture / traditional knowledge; and
- Development of environmental awareness and capacities in the members of the community.

The venture also noted potential negative impacts associated with unsustainable use of water resources and possible soil contamination. To avoid negative impacts on water resources, the venture installed a rainwater cistern and decided not to use agrochemicals to ensure the water filters back into the subsoil. Further opportunities identified recognised the possibility to strengthen the local culture and value traditional/ceremonial knowledge, and develop a business model, replicable in other semi-desert biome communities, for the sustainable use of biodiversity.

Between the years of 2000 and 2021, Landsat imagery showed that vegetation health improved in the areas surrounding Puerto Juarez and the location of the venture. Puethe is committed to increasing actions in favour of a more balanced environment, through positive results for nature. The enterprise continues to work closely with the community to highlight the importance of cacti, to promote sustainable practices in the local community and beyond. The enterprise is proof that community action is an essential part of the sustainable management of nature. Economic activity must take into account the impacts generated on biodiversity and the knowledge of Indigenous Peoples.

Following the TNFD workshops, Puethe plans to design and implement a strategic roadmap for the enterprise, including a system of metrics and objectives focused on nature. Puethe also plans to start the operation of an environmental management unit and develop yearly sustainability reports.

Source: CIELO (2023)

6.4.4. Drivers of exposure to nature-related risks and opportunities

The exposure of the organisation to a nature-related risk or opportunity is driven by two key elements:

1. The presence of a corporate's operations or value chain – or a financial institution's deployed capital – in sensitive locations – see the Locate phase); and
2. An organisation's dependencies and impacts on nature (see the Evaluate phase).

The identification of nature-related risks and opportunities can also be informed by an understanding of the wider context and driving forces affecting physical and transition risks and nature-related opportunities, including but not limited to:

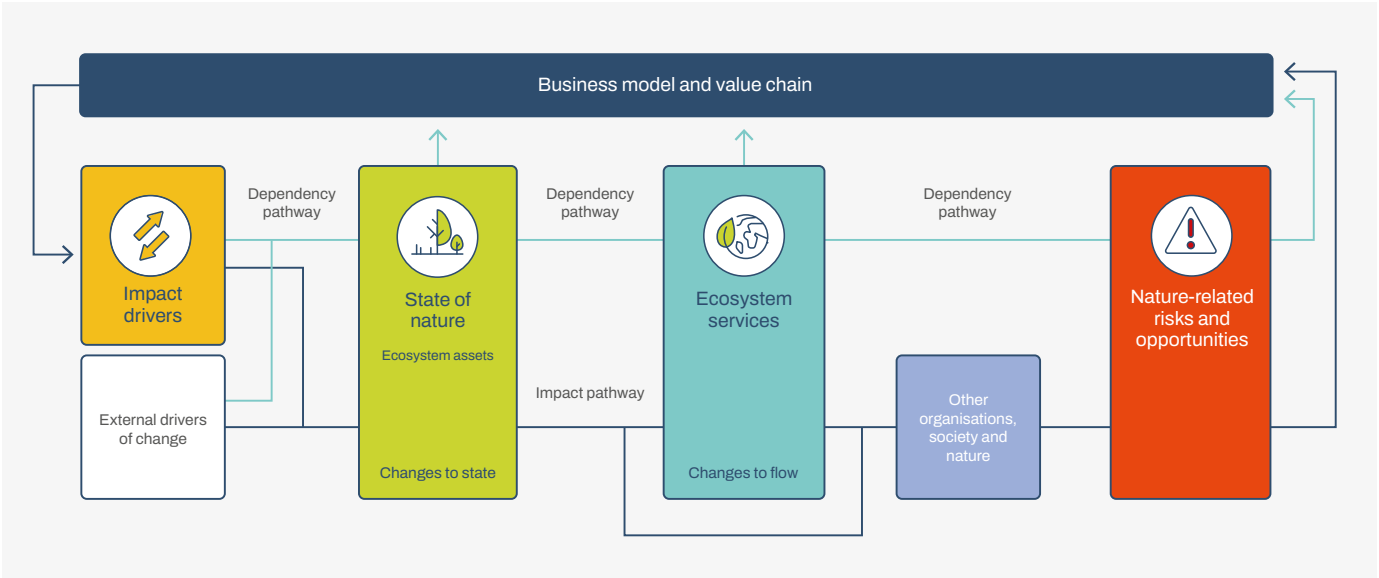
- Local and international policy and regulatory contexts;
- Technological innovation;
- Changes in market dynamics; and
- Changes in consumer preferences and demand.

Scenario analysis can support thinking on how these driving forces may evolve under plausible futures. LEAP assessment teams are encouraged to incorporate scenario analysis into their assessment. For more on the use of scenario analysis and scenario workshops to inform the assessment of nature-related issues, see the TNFD guidance on scenario analysis.

6.4.5. The link with dependencies and impacts on nature

Nature-related risks and opportunities arise from an organisation's dependencies and impacts on nature, as illustrated in the figure below.

Figure 22: Connections between nature-related dependencies, impacts, risks and opportunities



Nature-related risks can result from both dependencies and impacts on nature. Dependencies and impacts can lead to nature-related risks through:

- **Changes to the state of nature** itself, caused by business impact drivers or external factors and trends;
- **Changes to the flow of ecosystem services** associated with the changes to the state of nature; and
- **Impacts to society** resulting from business impacts on nature that may affect the organisation, for example, through lack of access to land due to damaged stakeholder relations, or damage to reputation following the release of pollutants that affect the health of local communities.

Nature-related opportunities can occur:

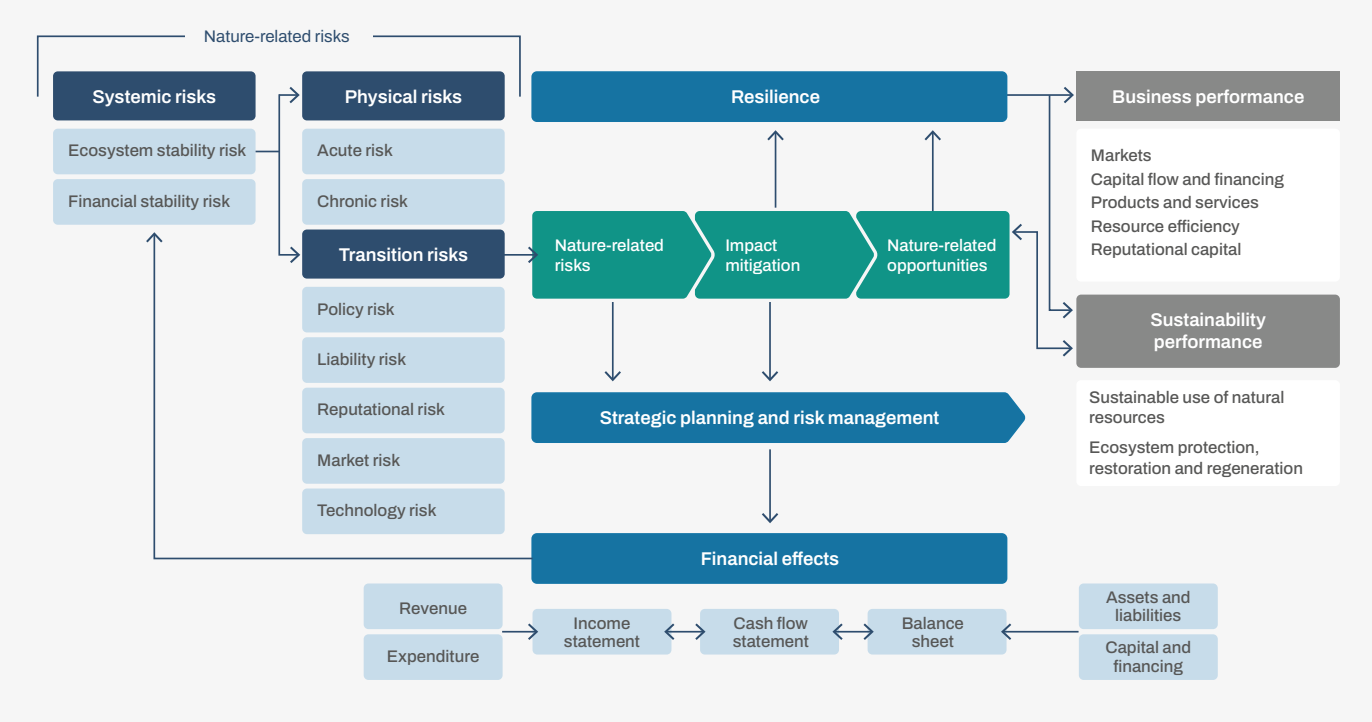
- When organisations **avoid, reduce, mitigate or manage** nature-related risks, for example, connected to the loss of nature and its associated ecosystem services that the organisation and society depend on, including the organisation's dependencies and impacts on nature that are a source of these risks; and/or
- Through the **strategic transformation of business models, products, services, markets and investments** that actively work to halt or reverse the loss of nature, including by implementation of conservation, restoration and nature-based solutions (or support for them through financing or insurance).[90]

6.4.6. Financial implications for an organisation of nature-related risks and opportunities

Nature-related risks and opportunities have financial implications for your organisation through changes to its revenue streams, cost base and potentially cost of capital through, for example, re-ratings of its credit risk or insurance premiums. In addition, they can change the valuation of assets and influence financing conditions. These transmission channels can have a positive or negative effect on credit, operational, market, liquidity, liability, reputational and strategic risk and opportunity. Figure 23 illustrates these links.

90 Task Force on Climate-related Financial Disclosures (2020) Guidance on Risk Management Integration and Disclosure.

Figure 23: Links between nature-related risks and opportunities, business performance and financial implications for the organisation



Examples of how prudential risk categories can be affected by potential nature-related factors are provided by NGFS in its conceptual framework and reported in Table 11.[91] As with climate, **financial institutions** should monitor how nature-related risks evolve to identify any additional channels for transmitting these risks to traditional prudential risk categories.[92]

91 Network for Greening the Financial System (2023) Nature-related Financial Risks: A conceptual framework to guide action by Central Banks and Supervisors.

92 Basel Committee on Banking Supervision (2022) Principles for the effective management and supervision of climate-related financial risks.

Table 11: Potential financial implications of nature-related risks

Financial risk category	Potential financial implication of nature-related risks
Credit risk	Credit risks increase if nature-related risks reduce a borrower's ability to repay and service debt (income effect) or a financial institution's ability to recover fully the value of a loan in the event of default (wealth effect). For example, soil degradation affects agricultural productivity, influencing the collateral value of agricultural land or the ability of farmers to repay debt.
Market risk	Changing dynamics in overall markets, including changes in consumer preferences, which arise from other risk categories because of changing physical, regulatory, technological and reputational conditions and stakeholder dynamics. For example, the market value of a company is affected by assets that have decreased in value because there is insufficient freshwater for the production process, or the value of the business' production process is reduced by the emergence of new technologies that require less water to operate.
Liquidity risk	The access of financial institutions to stable sources of funding could be reduced as market conditions change. Nature-related risks may cause counterparties to draw down deposits and credit lines. For example, there may be pressure to liquidate assets due to rapid nature degradation caused by a tipping point being crossed, or by regulations affecting particular assets that influence cash flows and collateral values.
Operational risk	Increasing legal and regulatory compliance costs associated with investments and businesses. This includes reputational risks based on changing market or consumer sentiment. For example, a financial institution may face regulatory, reputational or liability risks if it finances a company engaged in activities that contribute to deforestation. Facilities/ suppliers of the financial institution may be affected by flooding or landslides.
Liability risk	Arising directly or indirectly from legal claims. For example, as laws, regulations and case law related to an organisation's preparedness for nature action evolve, the incident or probability of contingent liabilities arising from an organisation may increase.

Sources: Task Force on Climate-related Financial Disclosures (2017) Recommendations of the Task Force on Climate-related Financial Disclosures; Financial Stability Board (2022) FSB Supervisory and Regulatory Approaches to Climate-related Risks Final report; Network for Greening the Financial System (2023) Nature-related Financial Risks: A conceptual framework to guide action by Central Banks and Supervisors and Organisation for Economic Co-operation and Development (2023) A supervisory framework for assessing nature-related financial risks: identifying and navigating biodiversity risks.

Box 20: Risk and opportunity identification – Ecopetrol

Ecopetrol S.A. is a national public limited company linked to the Ministry of Mines and Energy in Colombia. Ecopetrol is Colombia's biggest company and its largest producer of oil. It participates in all links of the hydrocarbon chain: exploration, production, transportation, refining and commercialisation and is now leading a diversified energy group in Latin America.

Ecopetrol has access to a significant amount of nature data that has been instrumental in identifying its operations and assets in the study area, identifying its interface with nature, and defining high-risk ecosystems by analysing biotic and abiotic factors as well as impacts, like water use.

A pilot of the LEAP approach utilised tools including ENCORE, IBAT, Global Forest Watch and WWF's risk filter, as well as data from environmental studies, to evaluate impacts and dependencies and produce an overview of the significance of ecosystem services, prioritise the main dependencies and impacts, and guide the development of scenarios for associated risks and opportunities. Exposure and magnitude indicators for each risk and opportunity were established to determine their financial implications.

As a result of the analysis of impacts and dependencies in the Yariguí-Cantagallo oil field, two potentially material risks and one opportunity were considered for detailed evaluation.

Risks:

- Flooding (acute physical risk): This risk entails disruption in Ecopetrol's operations due to flooding resulting from changes in ecosystem conditions (vegetation cover and regulating water bodies), resulting in physical damage to assets. This risk is linked to the dependency on the ecosystem service of flood regulation; and
- Conflict over water use (transition risk): increased conflicts due to competition for resources by third parties and/or the quality of water sources, resulting in reputational damage for Ecopetrol. The above is associated with the impact of the company's water use.

Opportunities:

Restoration and conservation in La Doncella Ecoreserve: Ecoreserves are areas owned by Ecopetrol, designated for the protection of strategic ecosystems, without limiting their productive uses. The assessment identified the potential for further positive impact on the maintenance of vegetation cover, erosion control and runoff management with the resulting benefit of enhancing the company's resilience to natural disasters and improving reputation value among stakeholders through restoration efforts aligned with Colombia's proposed green taxonomy.

The table below highlights the exposure and magnitude indicators identified through the LEAP assessment:

Risk	Risk categories	Exposure indicators	Magnitude indicators
Conflict over water use	Reputation (transition) risk	• Amount of concentration of pollutants • Change in the median of species in water bodies • Increased socio-environmental conflicts	• Cost associated with relocation of assets • Reduced revenue due to disruption of operations • Reduction in market valuation due to reputational impacts
Opportunity	**Risk categories**	**Exposure indicators**	**Magnitude indicators**
Restoration and conservation in La Doncella Ecoreserva	Resilience	• Degraded area for restoration • Improvement of ecosystem conditions • Decrease in socio-environmental conflicts	• Enhanced resilience to natural disasters • Market valuation boost • Better stakeholder engagement • Climate adaptation

Source: Ecopetrol (upcoming)

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

A2: Adjustment of existing risk mitigation and risk and opportunity management	What existing risk mitigation and risk and opportunity management processes and elements are we already applying? How can risk and opportunity management processes and associated elements (e.g. risk taxonomy, risk inventory, risk tolerance criteria) be adapted?

In A2, the LEAP assessment team should identify the specific risk mitigation and risk and opportunity management processes and elements that exist today and what adjustments the organisation should make, based on knowledge gained through the previous components of LEAP and on the unique characteristics of nature-related risks and opportunities. Implementing these adjustments will take time and involve teams and departments within the organisation beyond the LEAP assessment team. The objective of this component of the LEAP approach is to identify adjustments and improvements that should be recommended to the organisation's senior management as part of the LEAP assessment.

Financial institutions as part of A2 should:

- In line with Basel Committee on Banking Supervision (BCBS) for climate-related risks, seek to ensure that their internal reporting systems are capable of monitoring nature-related risks and producing timely information to ensure effective board and senior management decision making;
- Ensure that their credit, market, liquidity, operational and other risk management systems and processes consider nature-related risks. As an example, they should establish effective processes to control or mitigate the potential risk of losses on and increased volatility of their portfolio, or the calibration of liquidity buffers;[93] and
- Assess their current stewardship policies, engagement or client due diligence processes applied to portfolio companies/activities in relation to nature-related dependencies, impacts, risks and opportunities.

An important aspect of integrating nature-related risks and opportunities into existing processes is to understand how risk and opportunity management and strategic planning tie together, and the relevant key stakeholders. In this regard, it may be helpful to review key governance, strategy setting and risk management elements and then identify the various functions involved in risk management activities that support strategic planning. Organisations could refer to the TCFD for further support.[94]

The TCFD Guidance on Risk Management Integration and Disclosure refers to a general set of overarching activities or processes and associated key elements that are common to risk management in most organisations, and the various ways they manage their risks in terms of organisational structure, roles and responsibility, specific approaches and tools used. Some of the key elements of risk management that may be adjusted to integrate nature-related risks and opportunities include:

- Risk inventory;
- Risk taxonomy;
- Risk metrics and data;
- Risk management tools;
- Risk assessments;
- Risk responses;
- Risk tolerance criteria; and
- Risk reporting.[95]

93 Basel Committee on Banking Supervision (2022) Principles for the effective management and supervision of climate-related financial risks.

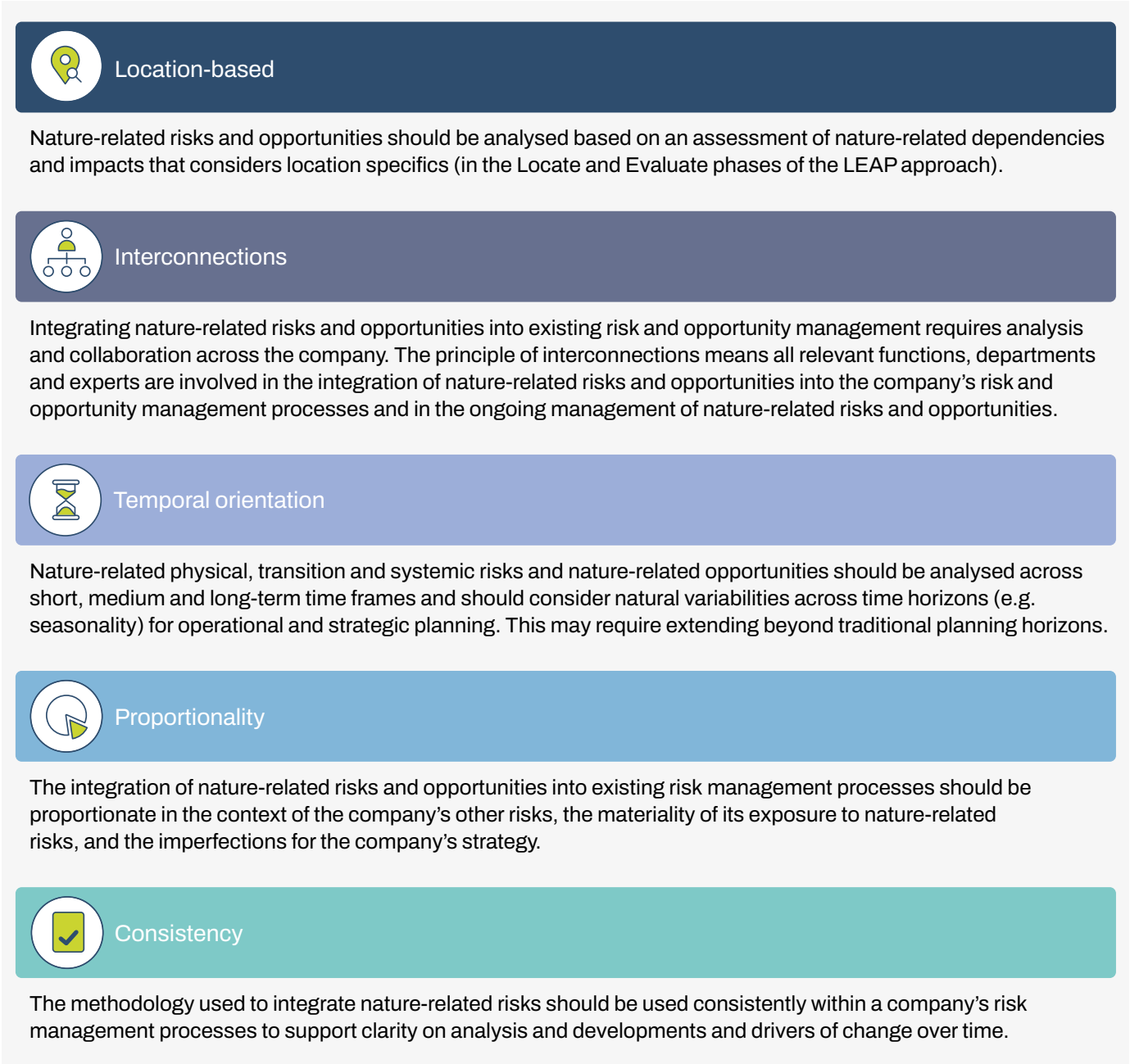
94 Specifically, identify the specific risk management processes and elements that may need to be adjusted for the integration of climate-related risk as well as the functions and departments responsible for those processes and elements.

95 In line with the TCFD, the TNFD's considerations related to integration of nature-related risks into risk management framework build on Committee of Sponsoring Organizations and World Business Council for Sustainable Development (2018) Enterprise Risk Management–Applying Enterprise Risk Management to Environmental, Social and Governance-Related Risks.

6.5.1. Key principles for integrating nature-related risks and opportunities into existing risk and opportunity management frameworks

The TNFD has adopted five principles for integrating nature-related risks and opportunities into existing risk and opportunity management frameworks. The TNFD aligns with the TCFD's four principles to guide integration of climate-related risks (interconnections, temporal orientation, proportionality and consistency) and includes an additional nature-specific principle of 'location-based' to emphasise that dependencies and impacts on nature are specific to particular geographic locations.

Figure 24: The TNFD's principles for integrating nature-related risks and opportunities into risk and opportunity management frameworks



The TNFD recommends that nature-related risks and opportunities are integrated into existing enterprise or portfolio risk management processes using the categories or sub-categories already in use by the organisation to manage other types of risks.

Commonly used (traditional) risk categories include financial, operational and strategic risk. However, most organisations also have additional risk categories. Table 12 shows examples of nature-related risks for each of these common categories.

Table 12: Sample of risk categories, risk types and nature-related risks

Traditional risk category	Traditional risk sub-category	Nature-related risk category	Nature-related risk manifestation (example)
Financial	Credit risk Liquidity risk Tax strategy	Physical risk *(chronic)* Transition risk *(policy)*	Creditworthiness is eroded as an agricultural company's crop yield projection is highly affected by the decline of pollinators. Mining company's costs increase from taxes and fees on groundwater use.
Operational	Supply chain Raw material availability Business continuity	Physical risk *(acute)* Transition risk *(policy)*	Supply chain disruptions occur because of droughts/ extreme weather in supply regions exacerbated by ecosystem degradation, which has impact on production. Costs increase on raw materials due to sustainable forestry practice requirements.
Strategic	Competitive landscape Changing consumer sentiment	Transition risk *(market)*	Shift in consumer preferences toward products that are produced from recycled, regenerative, renewable, biodegradable, ethically, responsibly sourced organic materials.

Aligned with the TCFD, integrating nature-related risks and opportunities into existing processes involves determining whether such risks will be treated as:

- Stand-alone risks and opportunities;
- Cross-cutting drivers of existing risks and opportunities; or
- A combination of both.

Adapting enterprise and portfolio risk management processes is a complex undertaking that takes significant time and resources. A LEAP assessment team can usefully contribute to that task by reflecting on the guidance and examples above to identify and recommend where the organisation can more appropriately incorporate the nature-related risks and opportunities into its risk and opportunity taxonomy and its core processes.

6.5.2. The TNFD nature-related risk and opportunity registers

A LEAP assessment team should consider enhancements to the organisation's risk register to ensure it is comprehensive and incorporates nature-related risks and the interconnections across environmental and social risks, not just climate, as well as their contribution to systemic risks. Organisations can create a register of nature-related risks and opportunities most relevant to their business or portfolio, referring to the TNFD templates for nature-related risk and opportunity registers, available on the TNFD website.

For organisations that undertake scenario analysis to support their nature-related strategy and risk management decision making, a risk and opportunity register can usefully inform internal scenario thinking and be informed by this as relevant trends and critical uncertainties shift over time. For more on scenario analysis, see the TNFD guidance on scenario analysis.

6.5.3. Considering contributions and exposure to nature-related systemic risks

Addressing nature-related risks and harnessing nature-related opportunities, particularly through strategic transformation and circular economy models, can influence the drivers of nature loss globally and contribute to a reduction in nature-related systemic risks. Where possible, the LEAP assessment team should consider connections between physical and transition risks, and systemic risks. For ecological stability risk, this would include considering how a potential materialisation would generate different forms of physical and transition risk. For financial stability risk, this would include considering how a compounding of physical and/or transition risks could result in destabilisation to the financial system the organisation operates in and/or is reliant on.

The LEAP assessment team should also consider both the organisation's exposure to different forms of systemic risk and how their activities can contribute to the reduction and management of different forms of systemic risk. When performing the prioritisation and assessment of nature-related risks and opportunities, organisations should consider whether, and to what extent, the risk or opportunity affects progress on societal environmental priorities or goals, including, at the global scale, towards the targets of the UN Convention on Biological Diversity's Kunming-Montreal Global Biodiversity Framework (GBF), the safe operating spaces of planetary boundaries and safe and just earth system boundaries, and the Sustainable Development Goals (SDGs).[96]

Once the LEAP assessment team has determined how nature-related risks and opportunities fit into the risk and opportunity taxonomy and risk and opportunity categories, it can recommend how the organisation can update its risk and opportunity inventory, which may include possible risk responses, and assign a risk owner.

96 Convention on Biological Diversity (2022) Kunming-Montreal Global Biodiversity Framework; United Nations (2015) Transforming our world: the 2030 Agenda for Sustainable Development; Rockström, J. et al. (2023) Safe and just Earth system boundaries. Nature 619, 102–111.

6.6. A3: Risk and opportunity measurement and prioritisation

A3: Risk and opportunity measurement and prioritisation	Which risks and opportunities should be prioritised?

In this component, organisations should prioritise the risks and opportunities identified in the previous components by assessing and measuring their *severity*, as determined by the intersection of their *magnitude*, *likelihood* and additional criteria. Measurement and prioritisation are fundamental to the management of risks and opportunities. The concepts of magnitude, severity and likelihood are consistent with standard risk management practices and aligned with the application guidance provided in the IFRS S1 General Requirement standard, the European ESRS General requirements and General Disclosures standards (ESRS 1 and ESRS 2) and other market guidance on materiality assessment.[97]

For **financial institutions**:

- The first output of A3 is a view of their portfolios where each of the risks and opportunities identified in A2 gets scaled and quantified to the extent possible. Financial institutions can approach this in a granular manner, by looking at each of their holdings and quantifying the risk delta stemming from their interface with nature;
- In A3, financial institutions can use risk assessment methods at varying levels of granularity (see Annex 4). It may prove useful for financial institutions to assess the severity, magnitude and likelihood of risks in A3 at the level of a sub-portfolio. For example, a scenario can be developed for the extractive sector on the effects of water depletion, or a scenario can be developed on increased inflation linked to droughts; and[98]
- A second output of A3 for financial institutions is a view, quantified as far as possible, of opportunities, such as expected revenues from a new nature bond offering.

6.6.1. Prioritising nature-related risks and opportunities

Many organisations use a traditional likelihood-and-impact approach to gauge the severity or materiality of their risks and then assess the severity of risks relative to their risk appetite and risk tolerance criteria (refer to the TCFD for further details on risk appetite and risk tolerance). The TCFD expands these prioritisation criteria to also include vulnerability and speed of onset.

97 Such as Organisation for Economic Co-operation and Development (2018) Due Diligence Guidance for Responsible Business Conduct.

98 As defined in the TNFD scenario guidance, The TNFD is working with partners to explore the possibilities for more advanced scenarios for financial institutions (that could also be used by large or multinational corporates), which build on the TNFD's 2x2 critical uncertainties matrix and are consistent with the approaches outlined in Annex 4.

Figure 25: Criteria for prioritising nature-related risks and opportunities

Aligned with application guidance provided by the ISSB and other standards bodies, the TNFD recommends using the same prioritisation criteria,[99] with two additional criteria that relate to:

1. The severity (or scale and scope, for positive impacts) of impacts on nature; and
2. The severity (or scale and scope, for positive impacts) of implications for society from those nature impacts.[100]

As with the efforts to identify risks, the efforts to prioritise risks should take into account the geographic location of dependencies and impacts.[101]

Table 13 provides an overview of the TNFD's criteria for prioritising nature-related risks and opportunities.

99 The TNFD refers to the TCFD impact criteria as magnitude to avoid confusion with the directionality of the term for impacts on nature.

100 In line with ESRS, severity is composed of the following factors: the scale; the scope and irremediable character of the impact.

101 Network for Greening the Financial System (2023) Nature-related Financial Risks: A conceptual framework to guide action by Central Banks and Supervisors; Organisation for Economic Co-operation and Development (2023, forthcoming) A prudential framework for assessing nature-related financial risks: identifying and navigating biodiversity risks.

Table 13: TNFD prioritisation criteria for nature-related risks and opportunities

Prioritisation criteria	Description
Magnitude	The significance of the risk or opportunity to the organisation, based on the risk implications for the organisation, measured through risk assessment methods such as scenario analysis.
Likelihood	The severity of information about a possible risk is higher if the event is likely to occur.
Additional TCFD prioritisation criteria	**Description**
Vulnerability	Vulnerability refers to propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements, including sensitivity or susceptibility to harm and lack of capacity to cope and adapt. It includes the organisation's ability or inability to adapt, mitigate or control the risk, or ability to harness the opportunity. It is dependent on risk and opportunity awareness, management along the value chain, operational and managerial resilience, value chain and/or product diversification, or market or sector influence.
Speed of onset[102]	The speed of onset that the risk/opportunity is expected to arise, i.e. in the long term, medium term or short term.[103]
Additional TNFD prioritisation criteria[104]	**Description**
Severity (or scale and scope) of impact on nature	The scale (temporal and spatial), scope and irremediable character of the negative impact, or the scale (temporal and spatial) and scope of the positive impact on nature.
Impact to society	The value of the impact on nature to society. See Annex 3 on valuation of nature-related dependencies and impacts, drawing from the Natural Capital Protocol, for more details.

When prioritising (and measuring) nature-related risks and opportunities, organisations may find it helpful to use valuation techniques, which can be qualitative or quantitative, and provide indications of the importance of a nature-related impact and dependency from either a business or societal perspective.

102 Speed of onset refers to the time that elapses between the occurrence of an event and the point at which the organisation first feels its effects.

103 Task Force on Climate-related Financial Disclosures (2020) Guidance on Risk Management Integration and Disclosure.

104 The TNFD has identified additional criteria that could reasonably be expected to affect (in positive or negative) the undertaking's financial position, financial performance, cash flows, its access to finance or cost of capital over the short, medium or long term and therefore are relevant for assessing financial materiality.

6.6.2. Methods for measuring the magnitude of nature-related risks

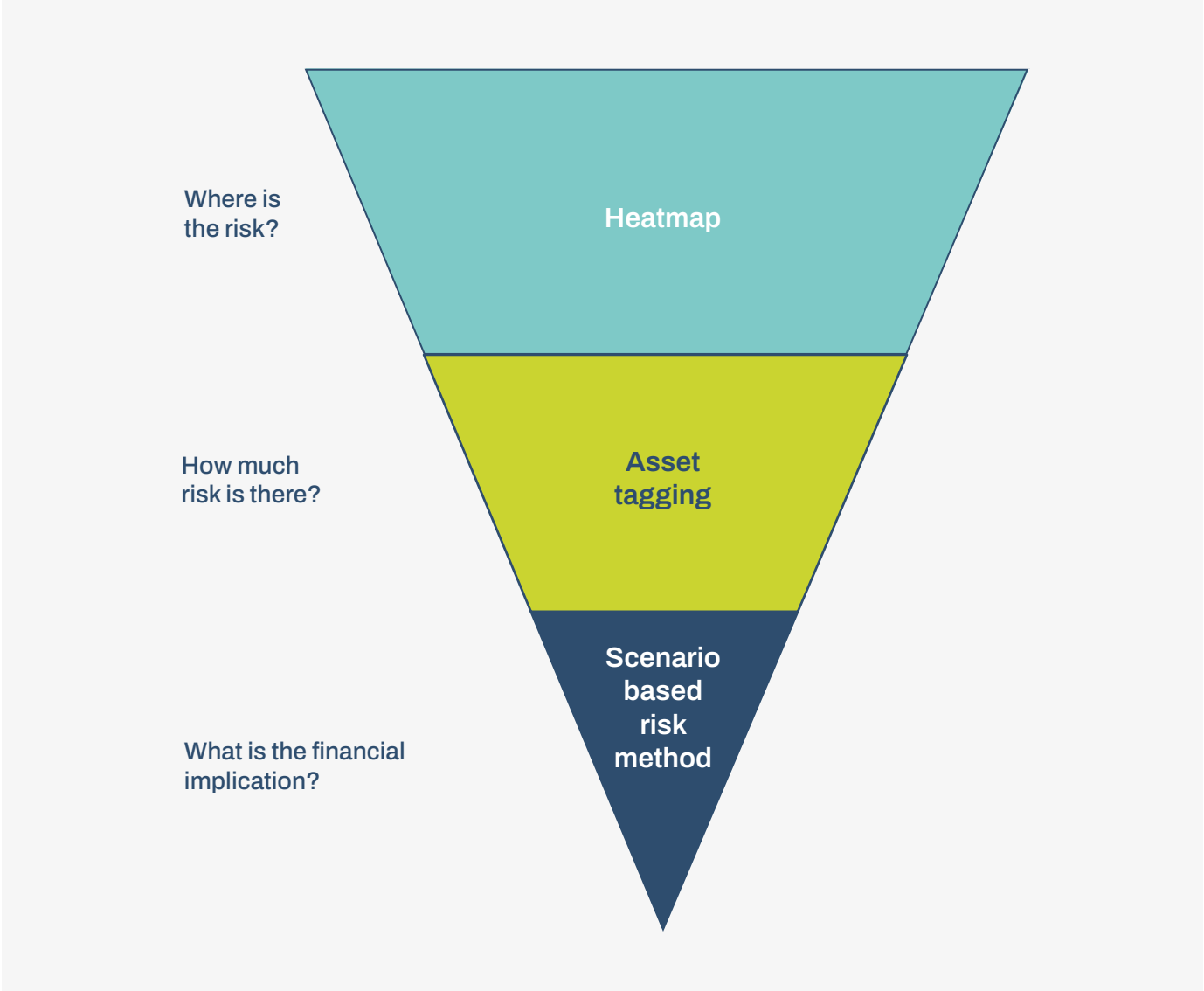
Context and objectives

Throughout LEAP, the LEAP assessment team can consider using a number of risk assessment methods to help the organisation link assets to sectors and locations in order to assess the magnitude of nature-related risks:

- Heatmapping;
- Asset tagging; and
- Scenario-based risk assessment.

These methods build on each other and can be deployed in sequence when applying the LEAP approach iteratively.

Figure 26: Methods for locating and assessing nature-related risks to the organisation



Financial institutions tend to use risk assessment methods to measure nature-related risk in a specific sector or company to which they have a financial exposure. Corporates typically use them to understand their exposure to nature-related dependencies, impacts and risks stemming from sectors of operation, products and services, and geographic locations. See Annex 4 for additional information on how these methods can support organisations in the assessment of nature-related risks.

Box 21: Assessing nature-related risks and opportunities – Reckitt

Reckitt is a British multinational consumer goods company that produces health, hygiene and nutrition products. Reckitt scoped a LEAP assessment to understand nature-related risks and opportunities in their natural latex supply chain in Surat Thani, Thailand, which supplies a large proportion of material for the Durex brand. Nature-based Insights (NbI) developed a desk-based analytical framework for evaluating and assessing the nature-related dependencies, impacts, risks, and opportunities in the landscape to support the pilot.

The Surat Thani landscape in Thailand was chosen as a deep-dive location for analysis due to its importance for supplying latex for Reckitt's Durex brand and an existing partnership programme with Earthworm Foundation to support farmers in the region. Reckitt's impacts on biodiversity were estimated using NbI Analytics model, a spatially explicit approach to quantifying the state of nature, which combines established datasets and methods, including the PREDICTS and IUCN databases and tools such as the GLOBIO, InVEST models and IPCC carbon accounting methodologies. The outputs are represented as a Biodiversity Impact Metric[105] (BIM; units: weighed impact hectares; CISL, 2018). Following an overview of the potential impacts in the landscape, Reckitt and NbI carried out a deep-dive into deforestation and water-related impacts and their associated risks. This took a forward-looking approach with the aim of predicting areas at high risk of deforestation and water stress into the future.

Deforestation risk

To map deforestation risk, Reckitt and NbI first filtered for forest pixels suitable for expansion of rubber plantations (based on rainfall, elevation, slope and temperature). Spatial information was then added on distance to roads and farms, protected status, and recent forest loss in the adjacent area.[106] For each variable, each area was ranked and scored from 1-10 and those values summed, providing a high-level indication of deforestation risk. The analysis highlighted some priority areas of high deforestation risk.

105 The BIM is the inverse of Mean Species Abundance (MSA), a common species-focused measure of ecosystem integrity, and calculated from the PREDICTS database (Hudson et al., 2017) and several other published scientific meta-analyses (Benitez-Lopez et al. 2010; 2017; 2019; Meijer et al., 2018; Midolo et al., 2019; Nunez et al., 2019). It also uses rarity weighted species richness as a measure of biodiversity importance, weighting the impact score according to local species richness and endemism.

106 Burivalova, Z. et al. (2021) "Early warning sign of forest loss in protected areas." Current Biology 31.20 (2021): 4620-4626; Rosa, I. M. et al. (2013) Predictive modelling of contagious deforestation in the Brazilian Amazon. PLoS One, 8: e77231.

Water risk

The baseline water risk was mapped according to the Aqueduct Water Risk Atlas produced by WRI. This tool combines multiple sources of geospatial data and hydrological models to estimate risks across 13 indicators (relating to quantity, quality and regulatory risks). These are aggregated into an overall 'water risk' indicator. Overall water risk is low throughout most of the landscape (Figure 3a); disaggregating this using the Water Risk Atlas online viewer highlights that the region is not at risk of water stress or depletion, has low interannual and seasonal variability at the baseline, and overall low regulatory risk. Coastal regions have a high coastal flood risk, but the inland basin that occupies the majority of the landscape is rated as low. Water quality risks (untreated wastewater and coastal eutrophication potential) are medium to high. From the perspective of disaster risk reduction, both riverine flood risk and drought risk are high or extremely high in the region. Further, as seasonal variability is expected to increase by 2030, this risk will likely be exacerbated. This analysis showed the importance of disaggregating the overall water risk metric to get an understanding of the particular hydrological pressures faced in the region. It highlights opportunities for implementing solutions to address flood risk, drought risk and nutrient run off.

Market risk

Consultation with the project implementation partner (the Earthworm Foundation) by Reckitt and NbI revealed that high market prices for durian is further incentivising smallholders in the landscape to switch their primary cash crop. Durian is generally produced with higher levels of fertilisers and pesticides, requires irrigation (as opposed to rain-fed rubber), and has a 10-year plantation cycle (as opposed to 25-30 years for rubber) after which the wood is not used for timber production. Transitioning productive landscapes from rubber to durian not only risks increasing the intensity of inputs and water abstractions, but also reduces long-term biodiversity and carbon gains in mature rubber plantations.

Reckitt has taken measures to support smallholder livelihoods by investing in the Smallholder Rubber Association and Earthworm's Rurality programme. However, current political instability and an uncertain regulatory landscape could threaten these programmes, and the risk of rubber conversion needs to be monitored.

Assessing nature-related opportunities

In assessing nature-related opportunities, the mitigation hierarchy was used to first mitigate the negative impacts of latex farming on biodiversity in the landscape, before identifying opportunities for restoration and NbS implementation. The outcomes of the analysis were discussed in a three-day stakeholder workshop held in the Surat Thani province of Thailand. Teams from Reckitt, NbI and Earthworm Foundation worked with local stakeholders to explore a portfolio of NbS activities. These included opportunities for improving farm management practices, protecting ecosystems from conversion or degradation, and restoring ecosystems connected to these farms (e.g. forests, riparian buffer zones, wetlands).

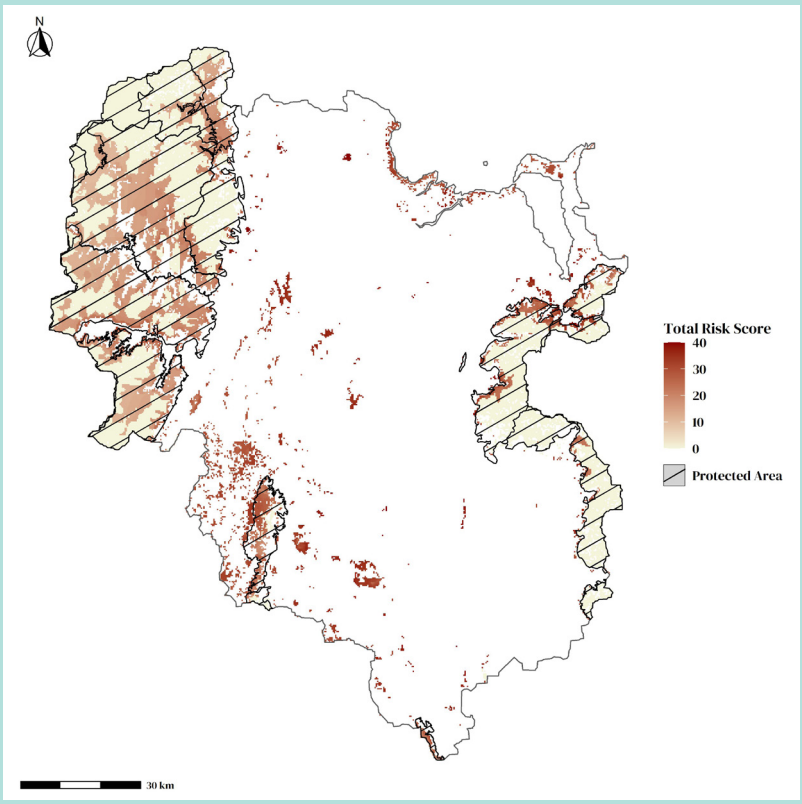
Outputs of analysis

The results of the analysis indicated that the region has a high-risk rating for drought, coastal floods and riverine floods (physical acute risk) and the large forest complexes are both upstream of the river basin highlighting their importance in regulating water flow into the basin (physical chronic risk).

Several areas of unprotected forest are at risk from future deforestation based on their spatial characteristics and suitability for planting rubber (reputational risk).

High durian prices on the market are incentivising rubber farmers to switch to comparatively intensive plantation systems (market risks), combined with fluctuating natural rubber prices impacting income stability and the growing popularity of synthetic rubber (technology risk).

Exhibit 1: Outputs of nature-related risk and opportunity assessment



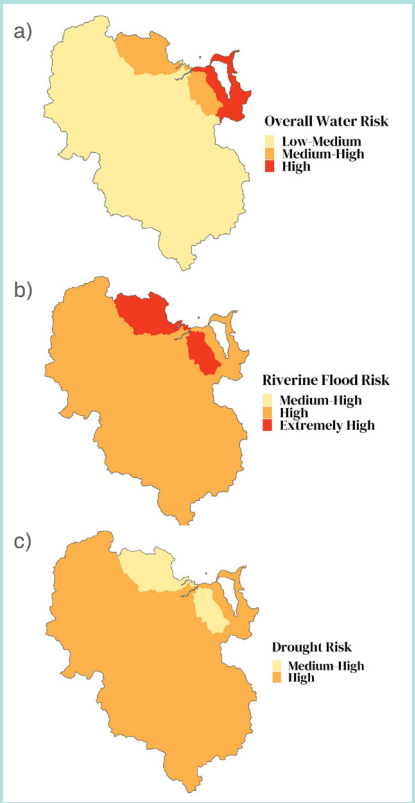


Figure 1: Deforestation risks are estimated based on multiple factors, including topographical and climatological suitability for optimal rubber production, level of protection, distance to roads, amount of recent deforestation in 1km radius, distance to supply chain farms. Each variable is scored from 1-10 and these scores are summed across all variables (suitability for production is used as a filter to remove unsuitable pixels so is not included in the scoring).

Figure 2: Water risk as mapped by the Aqueduct Water Risk Atlas (World Resources Institute).

a) Overall water risk representing 13 sub-indicators; b) Riverine flood risk; c) Drought risk.

Source: Reckitt (2023)

When measuring and prioritising risks, **financial institutions** should consider that physical and transition risks can have not only microeconomic but also macroeconomic effects. Box 22 provides an overview of possible key macro effects of physical and transition risks.

Box 22: Key macroeconomic effects of nature-related risks[107]

As outlined by NGFS, on a macro level, physical and transition risks may have implications for prices, productivity, investment, socio-economic changes, fiscal balances and trade and capital flow, in particular affecting information and gross domestic product (GDP).

Potential macro effects could be the following:

- **Prices**: Changes in prices of commodities, energy or water could create inflationary pressure;
- **Productivity**: Effects on GDP from a diversion of investment or lower risk appetites for innovation, reduced labour productivity (e.g. as a result of heat or pollution), the loss of provisioning or regulating service productivity (e.g. affecting agriculture) or damage and disruptions to assets;
- **Capital**: Higher investment needs for mitigation or adaptation to prevent nature degradation and potentially accelerated depreciation of the current capital base;
- **Socio-economic changes**: Effects from changing societal preferences, arising inequalities, migration or conflict;
- **Trade and capital flows**: Changes to trade and capital flows may result from shocks in ecosystem service provision, potentially amplified via value chains, which affects exchange rates and sovereign credit ratings; and
- **Fiscal balances**: The lack of access to ecosystem services may necessitate an increase in social protection spending on, for instance, water or food. Losses in production and employment may also reduce fiscal revenue.

Valuation

Valuation is the process of determining the importance, worth or usefulness of something in a particular context. A number of different types of valuation are possible that include:

- **Qualitative valuation** is used to identify the potential scale of costs and/or benefits, expressed through qualitative, non-numerical terms (e.g. high increase in health impacts from emitted pollutants or low decrease in recreation visits);
- **Quantitative valuation** is used to provide numerical data as indicators for costs and/or benefits (e.g. 20% increase of health impacts from emitted pollutants or 0.5% decrease in number of people benefitting from recreation visits); and
- **Monetary valuation** translates quantitative estimates of costs and/or benefits into a single common currency.

Understanding the social, environmental and/or economic context is essential to allow organisations

107 Network for Greening the Financial System (2023) Nature-related Financial Risks: A conceptual framework to guide action by Central Banks and Supervisors.

to estimate value meaningfully and correctly interpret results.

A valuation exercise can help a LEAP assessment team define the consequences of dependencies and impacts on nature for both business and society, determine the relative significance of associated costs and benefits, and determine the value of these costs and benefits in the given context. Valuation can help assess the relative importance of risks and opportunities to determine which are material for the business (in A4).

If the LEAP assessment team undertakes a valuation exercise, they are encouraged to follow four steps, aligned with the Natural Capital Protocol:

Step 1: Define the consequences of impacts and/or dependencies on nature (for business and/or society);

Step 2: Determine the relative significance of associated costs and/or benefits;

Step 3: Select appropriate valuation technique(s); and

Step 4: Undertake or commission valuation.

Organisations should refer to Annex 3 for further details. This draws from relevant material in the Natural Capital Protocol (mainly Step 7) and has been co-developed with the Capital Coalition. Further guidance can also be found on the Capitals Coalition website.

6.7. A4: Risk and opportunity materiality assessment

A4: Risk and opportunity materiality assessment	Which risks and opportunities are material and therefore should be disclosed in line with the TNFD recommended disclosures?

This component of LEAP will help assess which nature-related risks and opportunities are material and should be disclosed based on an understanding of the current and anticipated effects of nature-related risks and opportunities on the organisation's financial position, financial performance and cash flows.

For **financial institutions**, this component will help focus on the risks and opportunities they will disclose, and in particular bring to light the elements of their portfolios (assets, liabilities, revenue and expenses) that are assessed as vulnerable to nature-related transition and physical risks.

6.7.1. Financial effects of nature-related risks and opportunities

The measurement and prioritisation of nature-related risks and opportunities (in A2 and A3) helps the organisation understand the implications such risks and opportunities may have on its financial position, financial performance and cash flows (financial effects). This can be in the form of quantitative or qualitative information.

Determining the financial implications of nature-related risks and opportunities generally involves an organisation assessing its:

- Potential for damages or benefits from identified risks and opportunities;
- Planned responses; and
- Response effectiveness.

Forward-looking analysis is also important and can be informed by scenario analysis (see the TNFD scenarios analysis guidance for the TNFD's proposed approach to scenarios).

Those risks and opportunities identified that satisfy the materiality definition and guidance provided by the ISSB's IFRS S1 materiality guidance or equivalent national regulatory requirements for corporate disclosure should be disclosed.[108]

Table 14 and Table 15 provide examples of financial effects generated by nature-related risks and nature-related opportunities respectively.

108 International Sustainability Standards Board (2023) IFRS S1 General Requirements for Disclosure of Sustainability-related Financial Information.

Table 14: Examples of nature-related risks and their potential financial impact

Risk type	Category	Financial effects
Physical risk	**Acute** • Degradation of nature and loss of natural protection (e.g. caused by vegetation clearance for initial clearing for mining sites) can exacerbate severity of damages from extreme weather events such as cyclones, droughts, flooding and storms; • Species loss and ecosystem degradation (e.g. loss of connectivity associated with species ranges, impacting flyways or marine migratory corridors) due to leaks or accidental discharges (e.g. oil) contaminating air, soil and water bodies by the organisation itself or by other stakeholders located in the same area; and • Disease or pests affecting the species or variety of crop the organisation relies on, especially in the case of no or low genetic diversity.	• Increased natural hazard costs, for example, impaired assets due to damages resulting from floods or cyclones, not limited to the organisation's property (e.g. the infrastructure it relies on); • Reduced revenue and/or increased costs due to interruption of operations or interruption/deterioration of supply chains because of uncertainty over natural inputs/raw material supply (e.g. loss of pollinators, pests, loss of fish stocks, water), or damage caused by natural hazards; • Increased insurance premiums and potential for reduced availability of insurance on assets; • Increased capital expenditure due to adaptation (e.g. mechanical pollination, protection against floods); • Reduced productivity and consequent rethinking of production processes or timing (e.g. agricultural production); and • Write-offs, early retirement of existing assets and relocation of operations and suppliers, affecting the costs of raw materials (e.g. transport).

Risk type	Category	Financial effects
	Chronic • Increasing scarcity of key natural inputs • Ecosystem degradation due to operations leading to, for example, deforestation • Ocean acidification • Overfishing • Land loss to desertification and soil degradation and consequent loss of soil fertility • Species loss and degradation due to soil, water and ocean contamination caused by organisation itself or stakeholders in specific areas	
Transition risk	**Policy** • Changes to existing policies/new policies aimed at achieving nature-positive outcomes and targets • Tighter (emerging) legislation (e.g. trade restrictions or taxes) on activities, products and/or services that impact nature, and rights, permits and allocations on natural resources designated to alleviate pressure on nature or impacts on local communities • Enhanced reporting obligations	• Increased costs of operations and inputs • Increased costs of personnel and monitoring of activities required for reporting • Increased capital costs or production losses due to permit denials or delays
	Market • Shifting customer values or preferences to products (e.g. foods, textiles) with lower impacts on nature • Volatility or increased costs of materials	• Reduced demand for products and services – supply disruption • Increased production costs • Loss of market access • Increased raw material costs

Risk type	Category	Financial effects
	Reputation • Shifts in consumer sentiment towards the organisation/brand as a result of poor nature management and/or lack of stewardship activities	• Reduced demand for products • Decreased employee retention and worker strikes • Reduced loyalty of suppliers or key stakeholders
	Technology • Transition to more efficient and cleaner technologies (i.e. with lower impacts on nature) • Lack of access to data, or access to poor quality data, that hamper nature-related assessments • New monitoring technologies used by regulators	• Increased expenditure for research and development of new and alternative technologies • Increased costs of operations and raw materials required to achieve nature-related goals • New monitoring technologies used by regulators • Lack of access to technology developed by competitors resulting in higher operational costs
	Liability • Arising directly or indirectly from legal claims	• Increased forms of litigation and other legal claims, fines and penalties

Compiled from: Climate Disclosure Standards Board (2021) Application guidance for biodiversity-related disclosures; Task Force on Climate-related Financial Disclosures (2017) Recommendations of the Task Force on Climate-related Financial Disclosures and Taskforce for Nature-related Financial Disclosures (2021) Nature in scope.

Table 15: Nature-related opportunities and their potential financial impact

Category	Financial effects
Resource efficiency • Transition to more efficient services and processes that require fewer natural resources, energy or impacts on nature • Increased reuse and recycling of natural resources • Reduced waste production • Diversification of nature-related resources (e.g. use of different plant species)	• Reduced operation and compliance costs • Reduced exposure to raw material and natural resource price volatility • Reduced reliance on natural resources and increased resilience to potential shortages
Products/services • Development of less natural resource-intensive products and services (e.g. regenerative agriculture that preserves and restores soil fertility and leads to a reduced use of fertilisers) • Development of green solutions (e.g. nature-related insurance risk products) • Diversification of business activities (e.g. new business units on green infrastructures)	• Increased resilience due to business diversification • New revenue streams • Reduced costs of raw materials and production inputs • Better competitive position to reflect shifting consumer preferences
Markets • Access to new markets • Use of public sector incentives • Access to new assets and locations needing insurance coverage	• Increased revenues through access to new and emerging markets • Access to public sector incentives • Increased diversification of financial assets
Financial incentives • Access to nature-related and/or green funds, bonds or loans • Incentives for suppliers to improve their nature and ecosystem management	• Increased access to funds and loans • Access to capital for high-risk projects

Category	Financial effects
Reputation • Collaborative engagement with stakeholders to tackle nature-related challenges • Improved condition of nature the organisation relies on	• Improved reputation among stakeholders located in different areas • Improved stability of operations and working conditions, and ability to attract and retain employees • Increased brand value • Improved supply chain engagement • Increased influence of government policy

Compiled from: Climate Disclosure Standards Board (2021) Application guidance for biodiversity-related disclosures; and Task Force on Climate-related Financial Disclosures (2017) Recommendations of the Task Force on Climate-related Financial Disclosures.

6.7.2. Metrics for nature-related risks and opportunities

The LEAP assessment team should use the TNFD's recommended metrics for risks and opportunities to assess the current and anticipated financial impacts on the organisation (see the TNFD's core and additional disclosure metrics in the TNFD recommendations and assessment metrics in Annex 1.2 of this document). Metrics for individual risks and opportunities during the assessment may be at the site, project, product/service or location level.

The TNFD recommends nature-related risks and opportunities are assessed through the use of:

- **Exposure metrics** based on nature-related dependencies and impacts (refer to the Evaluate phase of LEAP); and
- **Magnitude metrics** used to assess the financial implications to the organisation of nature-related risks and opportunities. As far as possible, magnitude metrics should quantify the financial value of nature-related risks and opportunities for the organisation.

Table 16 contains illustrative examples, drawing from the TNFD's suggested assessment metrics, for the exposure to risks and opportunities, based on dependencies and impacts, and the financial implication of risks and opportunities to the organisation.

Table 16: Illustrative examples of the quantification of risks

Type	Risk	Example	Exposure indicators	Magnitude indicators
Physical risk				
Acute risk	Changes in the state of ecosystems (condition and/or extent) and species (population size, extinction risk) the organisation is dependent on or impacted by, resulting in changes to the flow of ecosystem services.	Degradation of freshwater habitat due to pollutants released by the organisation and other stakeholders.	Quantity and concentration of pollutants emitted (impact driver). Change in mean species abundance in freshwater ecosystems (ecosystem condition). Concentration of pollutants in water (ecosystem condition).	Costs associated with the relocation of operations and suppliers. Reduction in revenue/ costs associated with an interruption of operations/ supply chain. Restoration costs. Value of assets/revenue dependent on area. Number of locations/ business lines/facilities exposed.

Type	Risk	Example	Exposure indicators	Magnitude indicators
Chronic risk	Changes in the state of ecosystems (condition and/or extent) and species (population size, extinction risk) the organisation is dependent on or impacted by, resulting in changes to the flow of ecosystem services.	Reduction in crop yield due to change in abundance of pollinators.	Change in abundance of pollinators (species). Changes to crop yield (ecosystem service).	Increased costs of natural inputs/reduced supply. Increased capital expenditure on adaptation e.g. mechanical pollinators. Reduction in revenue/costs associated with interruption of operations/supply chain. Costs associated with the relocation of operations and suppliers. Costs related to substituting existing products/services Value of assets/revenue dependent on area. Restoration costs. Number of locations/ business lines/facilities exposed.

Type	Risk	Example	Exposure indicators	Magnitude indicators
		Inability of ecosystem to provide protection against storms/ flooding due to increased natural disasters.	Occurrence/ increase of storms/ floods in area (external factor).	Capital expenditure on infrastructure repair/ adaptation. Reduction in revenue/costs associated with interruption of operations/supply chain. Write-offs and early retirement of existing assets. Restoration costs. Costs associated with the relocation of operations and suppliers. Value of assets/revenue dependent on area. Insurance costs.
Transition risk				
Liability	Fines/penalties due to nature-negative outcomes	Degradation of freshwater habitat due to pollutants released by the organisation that exceeds legislative limits.	Quantity and concentration of pollutants (impact driver).	Increased costs of personnel and monitoring of activities required. Losses due to delays in operations/permit denials. Revenue reduction due to loss of license to operate. Costs related to the loss of operating areas. Clean-up costs.

Type	Risk	Example	Exposure indicators	Magnitude indicators
Policy	Changes to legislation/ regulations aimed at achieving nature-positive outcomes/ reducing nature-negative outcomes.	New protected area in close proximity to area of operations.	Change to state of ecosystem (ecosystem condition).	Increased compliance costs. Increased costs of personnel and monitoring of activities required. Costs related to relocation of operations.
Technology	Requirements to transition to more efficient, resilient and less environmentally damaging technologies.	Failure of nature-friendly technological innovation.	Reduction in negative impact drivers expected as a result of innovation (impact driver).	Increased research and development expenditure of new and alternative technologies. Increased costs of operations required to achieve nature-related goals. Write-offs and early retirement of existing assets.
Market	Shifting customer/ investor values or preferences to products and/or services that are nature-positive/ have lower impacts on nature.	Increased cost of plant-based inputs the organisation uses in the production process.	Amount of input used in the production process (ecosystem service).	Increased production/raw material costs. Costs related to substituting existing products/services.

Type	Risk	Example	Exposure indicators	Magnitude indicators
Reputation	Changes in sentiment towards the organisation/ brand due to impacts on nature.	Company is responsible for an oil spill.	Total number of recorded oil spills (impact driver). Volume of spill (impact driver). Change in biodiversity intactness (ecosystem condition). Change in catch numbers of fish in local fisheries (ecosystem service). Decline in recreational value of area (ecosystem service).	Reduction in revenue due to lower demand for products and services. Increased costs due to increased employee turnover/strikes. Increased operational costs due to reduction in loyalty of suppliers or stakeholders. Costs related to substituting existing products/services.

Table 17: Illustrative examples of the quantification of opportunities

Sustainability performance opportunity	Business performance opportunity	Example	Exposure indicators	Magnitude indicators
Sustainable use of natural resources: Transition to processes/circularity mechanisms that reduce risks related to business dependencies on nature, including within the value chain: reduced pollution and waste	**Transmission mechanisms:** Resource efficiency Markets	An organisation adopts internal processes that reduce the levels of pollutants emitted to freshwater	Reduction in total freshwater discharge in areas with water scarcity (impact driver) Water quality in area (ecosystem condition)	Reduced operational and compliance costs Increased market valuation through resilience planning Access to new sources of finance
Ecosystem protection, restoration and regeneration: Direct restoration, conservation or protection of ecosystems or habitats	**Transmission mechanisms:** Reputational capital Markets	An organisation invests in the restoration of an area of degraded mangrove with the purpose to increase resilience of infrastructure	Area of degraded land restored (impact driver) Improvement in ecosystem condition (ecosystem condition) Incidence of flooding events (ecosystem service)	Increase in revenue due to improved reputation Increased market valuation through resilience planning

Organisations should refer to the TNFD's suggested set of assessment metrics (Annex 1). Where the location is not known, potential exposure can be surmised through the use of estimates, models or generic sector impacts.

Financial institutions should also refer to the TNFD Additional Guidance for Financial Institutions for metrics currently in use among financial institutions for nature-related dependencies, impacts, risks and opportunities.

6.7.3. Summary metrics

Summary metrics provide an understanding of the overall exposure and/or potential financial implications for the organisation of nature-related risks and opportunities. They may be useful to define at a:

- Corporate level; and/or
- Portfolio level.

Summary metrics can help inform corporate and financial institution decision making and feed into external disclosures.

Illustrative risk and opportunity summary metrics

The following summary metrics can be used to assess nature-related risks and opportunities:

- Value of assets, liabilities, revenue and expenses assessed as vulnerable to nature-related physical/ transition risks (total and proportion of total);
- Value of assets, liabilities, revenue and expenses exposed to nature-related physical/transition risks (total and proportion of total);
- Value of significant fines/penalties received/litigation action in the year due to negative nature-related impacts;
- Value of write-offs and early retirements of assets due to nature-related risks;
- Value of capital expenditure, financing or investment deployed towards nature-related risks/opportunities; and
- Value of revenue from products and services producing demonstrable positive impacts on nature.[109]

Where possible, it may be useful to split values into:

- Values currently already being realised; and those that could be realised;
- Different risk/opportunity categories; and
- Prioritisation rating categories (e.g. very high, high, medium, low).

6.8. Desired outputs from the Assess phase

As a result of working through the four components of the Assess phase, the LEAP assessment team should be equipped with:

- A longlist of relevant nature-related risks and opportunities for the organisation. The output of this can support reporting on TNFD recommended disclosures (Metrics and targets A);
- A matrix of risks consistent with the enterprise risk management framework of the organisation (e.g. significance by sector, business line, location and value chain);
- A shortlist of material nature-related risks and opportunities. The output of this can support reporting on TNFD Recommended Disclosures (Strategy A);
- A list of priority locations. The output of this can support reporting on TNFD Recommended Disclosures (Strategy D); and
- An outline of the process followed to identify existing risk mitigation and risk and opportunity management processes and elements and a set of recommendations for senior management to consider regarding the adaptation and improvement of these processes and elements to integrate nature-related risks and opportunities. The output of this can support reporting on TNFD recommended disclosures (Strategy B, and Risk and impact management A, B, and C).

6.9. Resources to support the Assess phase

- Suggested metrics for nature-related risks and opportunities (Annex 1.2: Assess – Risk and opportunity metrics);
- Guidance on valuation of dependencies and impacts on nature, prepared with the Capitals Coalition and based on the Natural Capital Protocol (Annex 3);
- Guidance on risk assessment methods for measuring nature-related risks and opportunities (Annex 4: Risk assessment methods);
- TNFD guidance on scenario analysis; and
- Nature-related risk and opportunity registers.

109 Positive impacts on nature refer to positive changes to the state of nature. They can be generated by both positive impact drivers and reducing negative impacts.

7. Preparing to respond and report

This Prepare phase guidance is consistent with the joint guidance for corporates setting science-based targets for nature developed by the TNFD with the Science Based Targets Network (SBTN). Organisations are recommended to refer to SBTN's full guidance for further details.[110]

7.1. Why

Having completed the Locate, Evaluate and Assess phases of the LEAP approach, a project team will be equipped with an assessment of material nature-related issues – dependencies, impacts, risks and opportunities – for the organisation.

The project team will need to use this assessment to inform a discussion with internal stakeholders on how the organisation should respond to the issues identified, and what the organisation will disclose in line with the TNFD recommended disclosures.

7.2. What

Your organisation should consider how to respond to the assessment of nature-related dependencies, impacts, risks and opportunities identified using the LEAP approach. This should include discussions among senior management teams across the organisation on implications for the organisation's strategy, resource deployment and capital allocation at a business unit and enterprise level. The response decisions by your organisation should be framed within the broader corporate strategy and take into account short, medium and long-term considerations.

Your organisation's response to the identified material nature-related dependencies, impacts, risks and opportunities will be specific to the sector, biome and geographic location in which the organisation is interfacing with nature. This guidance focuses on the process of forming organisational responses and targets, rather than what the specific responses and targets should be.

Objective

To decide how the organisation should respond to the material nature-related issues identified in the LEAP approach, including what to disclose and how to disclose the material issues identified.

Desired outputs

- Agreement on how the organisation will respond to the nature-related issues identified in the LEAP approach, including through setting effective goals and targets;
- A discussion within the organisation of its governance and risk management processes in light of its nature-related assessment;
- The setting of nature-related targets and goals by the organisation in light of its nature-related assessment; and
- The production and publication of a set of TNFD-aligned disclosures.

Practical tips from pilot testers

- Review and revisit previous phases of the LEAP approach if you need to, to ensure you have a fully informed response; and
- Reflect on the learning from the LEAP assessment about how to define and describe the scope of the disclosures the organisation might make.

110 SBTN (2023) Resources

When corporates apply the TNFD Recommendations to set targets, the TNFD recommends they use methods developed by the SBTN to set science-based targets for nature. The TNFD recommends that corporates use SBTN guidance to take action towards, and measure progress and performance against these targets, as available.[111]

Where relevant, further details on specific business responses to identified issues is provided in the TNFD sector and biome additional guidance.

Your organisation will then need to decide what to disclose on nature-related issues in line with the TNFD recommended disclosures and the form and presentation of those disclosures in line with relevant voluntary disclosure standards, such as those provided by the ISSB and GRI, and in line with regulatory requirements.

7.3. Guiding questions

The following high-level questions should guide analysis in the Prepare phase:

P1: Strategy and resource allocation plans – What risk management, strategy and resource allocation decisions should be made as a result of this analysis?

P2: Target setting and performance management – How will we set targets and define and measure progress?

P3: Reporting – What will we disclose in line with the TNFD recommended disclosures?

P4: Presentation – Where and how do we present our nature-related disclosures?

7.4. P1: Strategy and resource allocation plans

P1: Strategy and resource allocation plans	What risk management, strategy and resource allocation decisions should be made as a result of this analysis?

7.4.1. Key considerations

Based on the assessment of nature-related dependencies, impacts, risks and opportunities in the Locate, Evaluate and Assess phases of the LEAP approach, the LEAP assessment team, backed by their senior sponsor, should present their assessment to senior management teams from across the organisation and discuss the implications for risk management, strategy and resource allocation decisions at a business unit and enterprise level.

These discussions and subsequent decisions should be framed within the context of broader risk management, strategy, governance processes and resource allocation, taking into account short, medium and long-term considerations. They should include:

- **Implications for the organisation's strategy**: What are the implications of our assessment of nature-related dependencies, impacts, risks and opportunities for the organisation's corporate or business unit strategy? What should be the organisation's strategy in relation to nature-related issues? How is this shaped by different plausible future scenarios facing the organisation? Is the strategy resilient in the face of the trends and uncertainties, and risks and opportunities identified?

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- **Implications for the organisation's governance processes:** What are the implications of nature-related dependencies, impacts, risks and opportunities for the organisation's governance process? Do board and management oversight of nature-related dependencies, impacts, risks and opportunities need to be improved in light of the assessment?
- **Implications for the organisation's risk management processes:** What are the implications of nature-related dependencies, impacts, risks and opportunities for the organisation's overall risk management processes? Based on the assessment, do nature-related issues need to be better integrated into overall risk management processes? If so, how?
- **Implications for the organisation's resource allocation and financial position:** What are the implications of nature-related dependencies, impacts, risks and opportunities for the organisation's resource allocation? How would the organisation's financial position change over the short, medium and long term, given its proposed strategy to manage nature-related risks and opportunities? What investment and disposal plans (for example, plans for capital expenditure, major acquisitions and divestments, joint ventures, business transformation, innovation, new business areas and asset retirements) and planned sources of funding should be considered to implement the strategy?

To inform these discussion and decisions, an organisation should consider:

- **Investor preferences**: What are the attitudes and investment criteria of key capital providers to our organisation? What nature-related issues are they assessing? How can we address their concerns and/or capitalise on their interest in financing nature-positive outcomes in the locations, and across the sectors and value chains, in which we are active? What risks, if any, do we face with respect to a possible loss of investor confidence as a result of our nature-related dependencies, impacts and risks? What impact could that have on our access to, or cost of, capital?
- **Government and financial regulatory policies:** What implications do current and potential changes in government policy in relevant jurisdictions have for our responses to nature-related issues? Are policy and regulatory signals within and across key markets and areas of nature-related issues aligned or misaligned? What are the implications for managing potential transition risks? For **financial institutions**, what implications do current and potential changes in financial regulation have for our responses to nature-related issues?
- **Rights-holders and stakeholders**: What are we learning from our engagement with Indigenous Peoples, Local Communities and affected stakeholders at the locations where our organisation interfaces with nature and has moderate/high impacts, dependencies, risks and opportunities? What potential responses and solutions have we identified through this engagement?

Financial institutions should look into resource allocation and governance of several key functions, including risk functions (in the case of all institutions), underwriting units (in the case of insurers), lending teams (in the case of banks) and investment teams (in the case of asset managers and owners) to monitor nature-related dependencies. These teams and the processes they are responsible for should be readied to integrate the nature-related issues identified. It can entail the integration of nature into risk management, commercial strategy investment management or insurance hazard models. A more specific focus may be needed for certain geographies or sectors. Additional engagement or due diligence processes may need to be put in place. New teams may need to be built to develop nature-related advisory and product and service offerings. External data providers may be able to support these teams and processes.

7.4.2. General principles for response – the mitigation hierarchy

Organisations should adopt mitigation hierarchy principles when determining responses to identified nature-related issues. Use of the mitigation hierarchy to guide responses can help to reduce negative impacts on nature and related risks to the organisation and identify new opportunities for growth and contributions to nature-positive outcomes.

The TNFD recommends that organisations follow SBTN's Action Framework for the mitigation hierarchy, AR3T. The AR3T Framework includes four types of actions that should be followed sequentially:

- **Avoid:** Prevent negative impacts from happening in the first place; eliminate negative impact entirely;
- **Reduce:** Minimise negative impacts that cannot be fully eliminated;
- **Regenerate:** Take actions designed within existing land/ocean/freshwater uses to increase the biophysical function and/or ecological productivity of an ecosystem or its components, often with a focus on a few specific ecosystem services; and
- **Restore:** Initiate or accelerate the recovery of an ecosystem with respect to its health, integrity and sustainability, with a focus on permanent changes in state.

It further includes **transformative action**, which covers the ways organisations can contribute to needed systemic change inside and outside their value chains.

Figure 27: SBTN AR3T framework

Examples of **corporate responses** to nature-related issues, and their connection to mitigation hierarchy principles are outlined in Table 18.

Financial institutions determining their responses to identified nature-related issues should keep in mind the mitigation hierarchy to prioritise their actions and internal resource allocation. Investment in companies avoiding and reducing their impacts aligns with the 'Avoid' and 'Reduce' first priorities.

Table 18: Examples of business responses to nature-related issues, categorised by mitigation hierarchy component

Mitigation hierarchy component	Illustrative responses
Avoid	Use of recycled water so that a facility does not need to withdraw water and has no net water consumption.
	Avoid illegal logging through monitoring/patrolling and regulating forest use of all timber and non-timber products.
Reduce	Reduce water use (existing or future) through efficient use of water because of behaviour and technology changes.
	Use land, fertilisers and pesticides more efficiently in agriculture (e.g. minimise use of chemical-based pesticides and fertilisers).
Regenerate and restore	Remove alien vegetation and aggressive indigenous plant species.
	Switch emphasis of food production towards enhancing working lands (e.g. organic agriculture, sustainable production, sustainable rate of harvest, regenerative agriculture).
Transform	Influence consumer behaviour e.g. reduce water use or reduce nonpoint source pollution when consuming your products.
	Develop and apply methods that measure farm output in ways that are more than just yield per area, but include nutritional value and wider values in terms of society and benefits of a healthy landscape.

Source: Science Based Targets Network (2023) Response options.

7.4.3. Frequency of review

As part of its response to nature-related issues – covering its proposed changes to strategy, governance, risk management and resource allocation decisions – your organisation should ensure it identifies an appropriate frequency to review its response. The LEAP assessment team should propose a review period and process in its recommendations. This would include:

- The frequency of the process for which the response is designed (for example, reducing water consumption in a daily manufacturing process should be reviewed more frequently than that for an annual agricultural harvest, which may take multiple cycles to see results); and
- The timeline set to implement the response (for example, addressing a short-term risk/opportunity will require more frequent reviews than long-term risks/opportunities to track progress and to adapt the response where needed).

7.5. P2: Target setting and performance management

P2: Target setting and performance management	How will we set targets and define and measure progress?

Having defined its plan to respond to nature-related dependencies, impacts, risks and opportunities, your organisation will want to determine metrics to measure progress and to set targets. Organisations should consider setting targets, including in the context of a transition plan aligned to the global goals and targets of the Kunming-Montreal Global Biodiversity Framework, much as organisations are now doing with net zero transition plans aligned to the Paris Agreement. The TNFD recommended disclosure Metrics and targets C encourages organisations to describe their commitment to target setting and transition planning.

7.5.1. Metrics for monitoring response effectiveness and outcomes

The TNFD provides a set of assessment and disclosure metrics to help organisations measure progress against their actions, policies and plans to respond to nature-related issues. These metrics are described as response metrics.

Response metrics can:

- Be forward looking (evaluating the potential effectiveness of possible responses) or backwards looking (evaluating the effectiveness and performance of actions taken);
- Cover governance, strategy and nature-related issue assessment and management directly (see Annex 1 for examples of indicators for each category); and
- Apply at different organisational levels (product, service or location) or at the corporate level.

The TNFD recommends that organisations choose a set of response metrics that draw from the metrics used in the dependency and impact assessment (the Evaluate phase of LEAP) and the risk and opportunity assessment (the Assess phase of LEAP). This could mean the ongoing measurement of the impact drivers, changes in the state of nature and ecosystem services, risks and opportunities.

Table 19 illustrates the connections between response metrics and other categories of metrics used in the LEAP approach. Many responses will be specific to the sector and biome with which the organisation is interacting. Indicators and metrics are provided in Annex 1.

Table 19: Connections between response metrics and other categories of metrics in the LEAP approach

Nature risk	Locate	Evaluate	Assess	Prepare
Dependency on water	Organisation identifies that it is consuming water from an area experiencing water stress.	Organisation identifies that its production depends on an ongoing supply of water, and that its use of water has an impact on that supply.	Organisation assesses the risk and opportunities arising from its water use. This could be up to the full financial value of the product lines that depend on the water supply, and determines the risk level.	Organisation assesses different response options and decides to increase water-efficiency, increase the amount of recycled and reused water and have all sites certified by ISO 14001.

Nature risk	Locate	Evaluate	Assess	Prepare
Related indicators and metrics	**Location prioritisation**	**Exposure**	**Magnitude**	**Response**
	Area of direct and indirect influence that overlaps with potential or likely water-stressed areas (absolute and % change). Area of direct assets/ sites located in a water-stressed area (absolute and % change).	Volume of water consumption by source, from water-stressed areas (absolute and % change). Volume of water recycled or reused (absolute and % change). Volume of water loss (absolute and % change). Measurement of the ecosystem condition, e.g. MSA (absolute and % change). Water depth in reservoirs (absolute and % change). Amount of secure water supply (absolute and % change).	Increased costs of water supply (absolute and % change). Reduction in revenue due to interruption of operations (absolute and % change). Costs of relocating operations. Number of business lines exposed. Value of assets/ revenues dependent on the area. Increased operational costs due to reduction in loyalty from stakeholders.	Performance against commitment to increase water efficiency by 40%, reduce water consumption by 30% and increase reused and recycled water by 80% (baseline year -1). Proportion of sites certified by ISO 14001 (%). Number of meaningful engagements with affected stakeholders, including understanding the impacts of loss of ecosystem services on local communities. Proportion of local population meaningfully engaged on water-related issues (%).

7.5.2. Setting effective targets

Having defined its plan to respond to nature-related dependencies, impacts, risks and opportunities, and chosen metrics to measure progress and outcomes, organisations may want to set targets and goals to support actions, display commitments and help communicate their strategy. Target setting is an important aspect of nature-related disclosures for report users, including financial institutions and other stakeholders (see TNFD Recommendations, Metrics and targets C). The TNFD strongly recommends that organisations set targets that align with the goals and targets of the Kunming-Montreal Global Biodiversity Framework, just as organisations are aligning their net zero transition plans with the Paris Agreement.

Consistent with the SBTN, the TNFD defines a target as a specific, quantitative, time-bound objective. Targets might sit alongside goals and non-quantifiable actions as part of a holistic strategy (Box 23).

Box 23: TNFD's definitions of goals, targets and science-based targets

- **Goal** – A high-level statement of direction/ambition, including a timeframe.
- **Target** – A specific, quantitative and time-bound objective, preferably with a defined means of measurement.
- **Science-based target (SBT)** – A measurable, actionable and time-bound objective based on the best available science, that allow actors to align to Earth's limits and societal sustainability goals.

Source: Science Based Targets Network (2020) Initial Guidance for Business*; see also Andersen et al. (2020)* Defining 'science-based targets'*. National Science Review 8(7), nwaa186.*

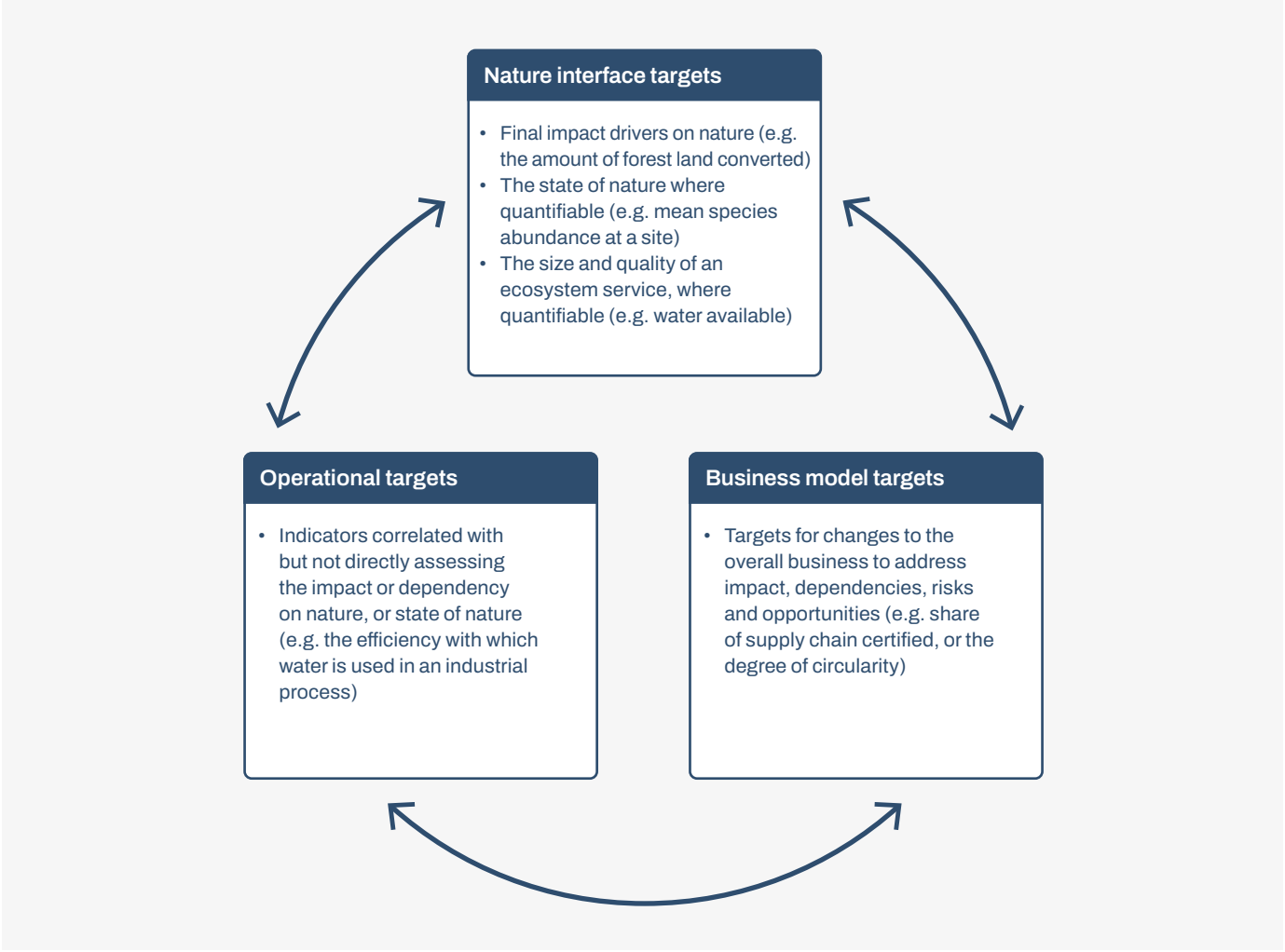
Effective targets within this definition usually meet a number of design principles. These principles fall under four key categories aligned with the target creation process:

1. What to target?
2. How to measure it?
3. The target value and trajectory; and
4. The monitoring, reporting and reviewing process.

1. What to target

Your organisation first needs to identify what it wants to target. In doing so, it may aim to set targets to address nature-related issues directly, or indirectly through correlated indicators at different levels and geographies within the business (Figure 28), in line with the plans, policies, actions and response metrics in place at different levels of the organisation.

Figure 28: Categories of targets with illustrative examples



In setting targets, your organisation should also consider:

- **The dependency or impact pathway** – As with determining actions to manage nature-related issues, targets need to be grounded in an understanding of the pathway that gives risk to specific dependencies and impacts, and the consequent risks and opportunities the organisation is facing. The organisation will need to consider which elements of the dependency or impact pathway have or can be adequately quantified to allow a target to be set, or where correlated indicators can be used instead. If targets are not grounded in this understanding, they may not successfully help the organisation to manage the dependency, impact, risk or opportunity in question;
- **Alignment with strategy and risk and opportunity management goals** – Targets should be clearly aligned with the organisation's priorities, objectives or strategy for managing nature-related dependencies, impacts, risks and opportunities (P1), informed by scenario analysis and based on the best available science. If targets are not aligned with the wider strategy, they may divert activity and investment away from overall risk and opportunity management objectives or undermine confidence in the organisation's commitment to the strategy.

- **Control and incentives –** Your organisation should choose targets for activities, impacts and outcomes over which it has control or significant influence and design the target in a way that incentivises actions to achieve the desired outcomes. The target should be set at the level within the organisation (e.g. site, product, whole organisation) and geography (e.g. land held or managed by the organisation, surrounding ecosystems, wider sphere of influence) that is best aligned with the aim of the target and with control of the relevant levers. Failure to do this could either result in the target not being achievable or efforts to achieve the target could produce adverse outcomes for nature or the organisation; and
- **Interactions and trade-offs with climate goals** – In setting nature-related targets, the organisation should consider the interactions with any climate-related targets it has adopted or is planning to adopt. The organisation should ensure that any alignment, contributions and possible trade-offs between targets for climate and nature are clearly identified.

The TNFD recommends that, when corporates set targets for nature and measure performance against these targets, they set science-based targets for nature drawing on the SBTN framework. The TNFD and SBTN have published joint guidance for corporates setting science-based targets for nature. The TNFD recognises that some organisations may choose another process for setting targets for nature, where there are gaps in SBTN's current guidance. If your organisation chooses to follow another approach to target setting, the TNFD recommends that target setting follows the basic principles of science-based targets set out in this guidance and consistent with the SBTN approach.

The TNFD also strongly encourages organisations to set nature-related targets that are complementary to, supportive of and integrated with global targets and goals under conventions such as the Kunming-Montreal Global Biodiversity Framework (GBF), the Paris Agreement, the High Seas Treaty and the Glasgow Leaders' Declaration on Forests and Land Use, as well as other goals such as those related to planetary boundaries and safe and just earth system boundaries, and the UN Sustainable Development Goals (SDGs).[112] Many of the targets and metrics in the GBF can be translated directly to business activities. Others that apply more directly to national-level reporting can still provide thematic guidance for businesses on which areas to set targets. Annex 5 illustrates some of the ways that the GBF targets might be translated for an individual organisation.

When developing targets, your organisation should also refer to the TNFD guidance on engagement with Indigenous Peoples, Local Communities and affected stakeholders. Engagement with these groups and other stakeholders in target design, monitoring and evaluation can help ensure that targets, the associated reporting and consequential outcomes are credible and legitimate. As with other forms of collaborative engagement, stakeholders will need to have the technical capacity to engage in joint monitoring and evaluation or be supported in building or accessing that capacity.

112 Convention on Biological Diversity (2022) Monitoring framework for the Kunming–Montreal Global Biodiversity Framework; United Nations (2015) Paris Agreement; United Nations (2023) Agreement under the United Nations Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction; UN Climate Change Conference UK 2021 (2021) Glasgow leaders' declaration on forests and land use; United Nations (2015) Transforming our world: the 2030 Agenda for Sustainable Development.

Box 24: Dependency and impact pathways and target setting

Targets to address dependencies, impacts, risks and opportunities need to be based on an understanding of the relevant dependency and impact pathways, as outlined in component E2.

When setting targets, an organisation should consider how dependencies and impacts can feed into each other. This can occur, for example, where an organisation's impacts lead to the degradation of an ecosystem on which the organisation also has a dependency. For example, a beverage business extracting too much water from watersheds undermines the long-term ability of that watershed to provide the water the business needs, or an organisation farming an intensive monoculture with high annual yields may undermine soil health over time, putting future harvests at risk.

There are three key elements of dependency and impact pathways that should be considered to set effective targets:

- **Impact drivers** are natural resource inputs and non-product outputs of an organisation's activity, such as total water withdrawn. These may be relatively straightforward to quantify and control;
- **Ecosystem services**, some of which can be easily quantified, including most provisioning services and those directly linked to an impact driver, which can be controlled. Other ecosystem services can be harder to quantify. In such cases, an organisation may want to set indirect targets, such as for the state of nature, to ensure that an ecosystem is managed so that the services it provides are sustained;
- **Changes to the state of nature**, such as the change in the extent and condition of an ecosystem asset or changes to species population size. These may be observable, quantified and targeted but an organisation's control over the state of nature may in some cases be indirect. Changes in the state of nature may be the result of a variety of factors that cannot all be controlled directly, such as other entities' actions. An organisation needs to consider whether it has sufficient influence over the outcome, or if it could gain sufficient influence collectively through work with partners also interfacing with the ecosystem.

More detail on quantification of impact drivers, ecosystem services and changes to the state of nature are set out in E3 and E4.

2. How to measure and track progress against targets

Quantified targets must be linked to metrics that can be used to measure and track progress. In many cases these will align with the response metrics. Your organisation should select metrics for its targets that are:

- **Relevant** – Metrics used should be clearly linked to the overall aim of the target. For example, an organisation setting a target to eliminate deforestation in its supply chain by 2025 could choose as a metric the volume of deforestation-linked commodities bought each year that cannot be traced to non-deforested land, or the share of deforestation-linked commodities bought each year that are certified as deforestation-free. Where a target is site specific, the metric should also relate to that specific site. For example, a target for a water body to have good chemical status[113] by 2025 could include the concentration of mercury and brominated flame retardants in the water body;[114]
- **Transparent and practical** – Your organisation should ideally use open source and freely available data and tools. This builds confidence that there will be accountability for the outcomes, increases chances of replicability and creates fewer burdens to validation and verification. If proprietary data and tools are used, your organisation should make the methods transparent to enable such validation and verification; and
- **Responsive** – Some metrics for nature may evolve slowly in response to your organisation's efforts. This can make it hard to assess if progress is being made. Where possible, your organisation should choose a metric that will respond to changes in the organisation's activity in a timely way.

In choosing a target metric, your organisation should consider aligning to the metrics recommended for assessment and disclosure by the TNFD. Table 20 sets out examples of the types of metrics that can be used to quantify targets for impact drivers, the state of nature and ecosystem services.

113 For example, as defined by the European Commission (2000) Water Framework Directive 2000/60/EC.

114 WISE Freshwater: Surface water chemical status.

Table 20: Links between TNFD's LEAP approach, metrics categories and targets

LEAP phase and metrics category	Metrics sub-category	Example of metrics	Example of targets
Evaluate: Exposure metrics (dependency and impact)	Impact drivers	Natural resource inputs and non-product outputs of a business activity.	Reduce to zero by 31 December 2025 the quantity of primary commodities sourced from land deforested since 2020[115]. Reduce by 50% pesticide use per area of cropland in areas interacted with by 2030, relative to 2020 levels. Reduce food waste by 50% and food losses by at least 25% by 2030,[116] relative to 2020 levels.
	State of nature	Condition/extent of an ecosystem asset.	All bodies of water interacted with have environmentally healthy ambient water quality and ecologically sound flow conditions by 2030, relative to 2020 levels. Cropland with at least 20% natural vegetation per 1x1km (%).
		Contributions towards global species extinction risk reduction.	100% of land areas interacted with in the direct operations and value chain assessed for the presence of threatened species by 2025, and 100% of those areas that are known to host threatened species are under effective management by 2030 to reduce threats, improve species health and increase species population.
	Dependencies	Desired flow of ecosystem services.	Reduce water withdrawal in high impact parts of the value chain by 20% by 2030, relative to 2020 levels.

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

116 Convention on Biological Diversity (2022) Target 16; SDG 12 Hub: Target 12.3.

3. The target value and trajectory

Your organisation needs to assess the level at which the target should be set, the deadline by which it will be achieved, and the trajectory over that period. It should consider making the key dates tracked consistent with international frameworks, such as the Kunming-Montreal Global Biodiversity Framework (GBF), the Paris Agreement on climate change[117] and other relevant international conventions and governance bodies.

In general, targets should be:

- Clearly specified over time and trajectory, including:
  - **A baseline time** period against which progress will be tracked should be clearly defined. This will ideally be consistent across all targets;
  - **A time horizon** by which targets are intended to be achieved must be defined. Short-, medium- and long-term time horizons should be consistent across an organisation's targets; and
  - **Interim targets**, i.e. checkpoints between now and the target end date, at which point an organisation assesses its progress and makes any adjustments to its plans and target. Any long-term targets should have interim targets set at appropriate intervals, such as every five years, to start to drive action, covering the full time-horizon.
- Based on the best available science:
  - Determined at the level and timing of interim and final targets based on the best available science on nature and societal needs. This should take account of potential tipping points in local ecosystems that would lead to changes that mean ecosystem services are no longer available to the organisation. This should be informed by credible science and scenario analysis (see the TNFD's guidance on scenario analysis for more detail).

4. The monitoring, reporting and reviewing process

Your organisation's performance and progress against targets should be internally monitored, reported on and periodically reviewed. The indicators used to monitor performance will likely relate to both exposure (dependencies and impacts, from the Evaluate phase of LEAP) and magnitude (risks and opportunities, from the Assess phase of LEAP), compared to a baseline and/or reference state. Effective monitoring includes targets being:

- **Understandable and contextualised –** Nature-related targets should be presented in a manner that is easy to understand, with clear language and labelling, and include descriptions of any limitations and caveats. Disclosures of targets should be supported by contextual, narrative information on items such as organisational boundaries, methodologies and underlying data and assumptions;
- **Reported regularly –** An organisation should report on progress against nature-related targets on at least an annual basis and provide updates to the targets and any new targets adopted. This can be done via a TNFD-aligned disclosure report; and
- **Periodically reviewed and updated** – An organisation should have a clear process for reviewing nature-related targets at least every five years, and for updating them if necessary. Because targets can become outdated, for example, as the science improves, it is necessary to periodically refresh and update them to ensure their continued relevance and efficacy for an organisation's overall strategy planning process. Organisations may adjust targets if their strategy or goals change or if they outpace or underperform previously set targets.

117 United Nations (2015) Paris Agreement.

7.6. P3: Reporting

P3: Reporting	What will we disclose in line with the TNFD recommended disclosures?

The development of a set of recommended disclosures for nature-related issues is built on the premise that transparency of information through disclosures facilitates better risk and capital allocation decisions by corporates, investors and lenders.

As this occurs, understanding of the financial implications of the dependencies and impacts on nature that materially shape risks and opportunities will grow. This will enable financial markets to channel capital away from nature-negative outcomes and towards nature-positive outcomes, ultimately supporting more efficient allocation of both risk and capital, and the functioning of stable markets.

The TNFD recommended disclosures are designed principally to provide decision-useful information to the primary users of general purpose financial reports. Pilot testing of the TNFD LEAP approach has also demonstrated that they can support:

- Support strategy and risk management decision making at the board and management level, and ultimately improve capital allocation and asset valuation decisions by corporates;
- Promote more informed investment, credit and insurance underwriting decisions by financial institutions; and
- Enable a stronger understanding of the concentrations of nature-related risk and opportunities, based on insights into nature dependencies and impacts.

The TNFD's recommended disclosures are detailed in the TNFD Recommendations and summarised in Figure 29 below.

Figure 29: TNFD recommended disclosures

TNFD recommended disclosures

Governance

Disclose the organisation's governance of nature-related dependencies, impacts, risks and opportunities.

Recommended disclosures

A. Describe the board's oversight of nature-related dependencies, impacts, risks and opportunities.

B. Describe management's role in assessing and managing nature-related dependencies, impacts, risks and opportunities.

C. Describe the organisation's human rights policies and engagement activities, and oversight by the board and management, with respect to Indigenous Peoples, Local Communities, affected and other stakeholders, in the organisation's assessment of, and response to, nature-related dependencies, impacts, risks and opportunities.

Strategy

Disclose the effects of nature-related dependencies, impacts, risks and opportunities on the organisation's business model, strategy and financial planning where such information is material.

Recommended disclosures

A. Describe the nature-related dependencies, impacts, risks and opportunities the organisation has identified over the short, medium and long term.

B. Describe the effect nature-related dependencies, impacts, risks and opportunities have had on the organisation's business model, value chain, strategy and financial planning, as well as any transition plans or analysis in place.

C. Describe the resilience of the organisation's strategy to nature-related risks and opportunities, taking into consideration different scenarios.

D. Disclose the locations of assets and/or activities in the organisation's direct operations and, where possible, upstream and downstream value chain(s) that meet the criteria for priority locations.

Risk & impact management

Describe the processes used by the organisation to identify, assess, prioritise and monitor nature-related dependencies, impacts, risks and opportunities.

Recommended disclosures

A(i) Describe the organisation's processes for identifying, assessing and prioritising nature-related dependencies, impacts, risks and opportunities in its direct operations.

A(ii) Describe the organisation's processes for identifying, assessing and prioritising nature-related dependencies, impacts, risks and opportunities in its upstream and downstream value chain(s).

B. Describe the organisation's processes for managing nature-related dependencies, impacts, risks and opportunities.

C. Describe how processes for identifying, assessing, prioritising and monitoring nature-related risks are integrated into and inform the organisation's overall risk management processes.

Metrics & targets

Disclose the metrics and targets used to assess and manage material nature-related dependencies, impacts, risks and opportunities.

Recommended disclosures

A. Disclose the metrics used by the organisation to assess and manage material nature-related risks and opportunities in line with its strategy and risk management process.

B. Disclose the metrics used by the organisation to assess and manage dependencies and impacts on nature.

C. Describe the targets and goals used by the organisation to manage nature-related dependencies, impacts, risks and opportunities and its performance against these.

7.6.1. Contents of a disclosure

The TNFD has provided a set of recommendations for disclosures, not a specific disclosure standard. For detailed disclosure requirements, the TNFD refers report preparers to the IFRS International Sustainability Standard Board (ISSB), which is providing a global reporting baseline for corporate sustainability reporting, and the GRI, which provides impact-focused disclosure standards for those organisations that need or want to disclose their impacts on the environment and society.

Consistent with the ISSB's IFRS S1 General Requirements disclosure standard,[118] the TNFD suggests that an organisation should disclose information that enables users of general purpose financial reports to understand the effects of nature-related issues on its strategy and decision-making. Specifically, the organisation should disclose information about:

- How the organisation has responded to, and plans to respond to, nature-related issues in its strategy and decision making;
- Its progress against plans the organisation has disclosed in previous reporting periods, including quantitative and qualitative information; and
- Any trade-offs between nature-related issues that the organisation considered (for example, in deciding on the location of new operations, an organisation might have considered the nature impacts of those operations and the employment opportunities they would create in a community).

In addition, the TNFD recommends that report preparers adhere to the conceptual foundations in the ISSB's IFRS-S1 (General Requirements) standard, in relation to:

- Fair presentation;
- Reporting entity; and
- Connected information.

In addition to the General Requirements and other provisions of the ISSB S1 Standard, the use of the TNFD recommendations includes six additional general requirements. These are intended to help ensure a common approach to nature-related disclosures.

Report preparers publicly stating their use of, and alignment with, the TNFD's recommendations are expected to apply the general requirements to enable consistency in the information disclosed. The general requirements apply across the four pillars of the recommended disclosures: Governance, Strategy, Risk and Impact Management, and Metrics and Targets. They describe:

1. The application of materiality;
2. The scope of disclosures;
3. The location of nature-related issues;
4. Integration with other sustainability-related disclosures;
5. The time horizons considered; and
6. The engagement of Indigenous Peoples, Local Communities and affected stakeholders in the identification and assessment of the organisation's nature-related issues.

For more information on what is required, organisations should refer to the TNFD Recommendations.

118 International Sustainability Standards Board (2023) IFRS S1 General Requirements for Disclosure of Sustainability-related Financial Information.

7.7. P4: Presentation

P4: Presentation	Where and how do we present our nature-related risk disclosures?

The content of nature-related disclosures should be as outlined in the TNFD Recommendations and the presentation of disclosure statements should be consistent with the ISSB's IFRS S1 (General Requirements).[119]

7.8. Desired outputs from the Prepare phase

For your organisation, completing the Prepare phase should result in:

- Agreement of the board's oversight and management role in assessing and managing nature-related issues. This could include, for example, a description by the executive committee and board outlining the organisation's proposed nature-related risk management strategy, advice on ways to manage and mitigate nature-related risks, and to identify and realise nature-related opportunities for the organisation. The output of this can support reporting on TNFD recommended disclosures Governance A and B;
- The ability to describe the organisation's processes for engaging Indigenous Peoples, Local Communities and affected stakeholders with respect to the assessment of, and response to, nature-related issues and any agreed actions to improve these processes of engagement. The output of this can support reporting on TNFD recommended disclosures Governance C;
- Agreement of the overall risk and impact management processes relevant to nature-related issues. This could include, for example, a description of the organisation's nature-specific risk and impact management processes. The output of this can be used to support reporting on TNFD recommended disclosures Risk and impact management A, B and C;
- Agreement on the strategic implications of the organisation's nature-related assessment, taking into consideration different scenarios. This could include, for example, a description of how the assessment has influenced decisions related to the organisation's businesses, strategy and financial planning. The output of this can support reporting on TNFD recommended disclosures Strategy B and C; and
- The setting of goals and targets in response to the nature-related assessment. This could include, for example, a selected number of science-based, ambitious and verifiable targets and goals for the organisation. The output of this can support reporting on TNFD recommended disclosures Metrics and targets C.

By completing the Prepare phase, your organisation will have completed the entire LEAP approach. By compiling and reviewing the outputs across all phases and relevant components, the organisation, based on the assessment conducted by the LEAP assessment team and subject to time, cost and data constraints, should be able to disclose their material nature-related issues in line with the full set of TNFD recommended disclosures.

7.9. Resources to support the Prepare phase

Key guidance to support your organisation in the Prepare phase includes:

- TNFD Recommendations;
- SBTN guidance on setting science-based targets for nature;
- Guidance on disclosure presentation by relevant standards bodies; and
- ISSB's IFRS-S1 General Requirements for Disclosure of Sustainability-related Financial Information.

119 International Sustainability Standards Board (2023) IFRS S1 General Requirements for Disclosure of Sustainability-related Financial Information.

Annex 1: TNFD suggested assessment metrics

The following tables list TNFD suggested metrics that may be useful for an organisation's assessments of nature-related issues, mapped to each phase of LEAP. Where metrics also appear in the sets of core or additional disclosure metrics (Annexes 1 and 2 of the TNFD Recommendations), this has been noted. Note that all sets of metrics below are non-exhaustive and organisations should use the assessment metrics that are most relevant to their specific business operations, including sectors and biomes with which they interact.

Annex 1.1: Evaluate – Dependency and impact metrics

Table 21: Impact driver metrics categories

Driver of nature change	Impact driver
Land/freshwater/ocean-use change	Land-use change
	Freshwater-use change
	Ocean-use change
Climate change	Greenhouse gas emissions
Resource use/replenishment	Water use
	Other resource use
Pollution/pollution removal	Non-GHG air pollution
	Water pollution
	Soil pollution
	Waste
	Disturbances
Invasive species and other	Biological alterations

Table 22: Impact driver assessment metrics

Driver of nature change	Impact driver	Indicator	Metric	Disclosure inclusion
Climate change	Greenhouse gas emissions	GHG emissions	Refer to ISSB S2 Climate-related Disclosure Standard.	Core
Land/ freshwater/ ocean-use change	Multiple	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).	Core
	Multiple	Extent of land/ freshwater/ ocean-use change	Extent of land/freshwater/ocean ecosystem use change (km^2) by: • Type of ecosystem;[120] and • Type of business activity. Extent of land/freshwater/ocean ecosystem conserved or restored (km^2), split into: • Voluntary; and • Required by statutes or regulations. Extent of land/freshwater/ocean ecosystem that is sustainably managed (km^2) by: • Type of ecosystem;[121] and • Type of business activity.	Core
	Land-use change	Land-use intensity	Land-use intensity (tonnes or litres of output/ km^2). This will vary by sector context; for example, crop yield (tonnes/km^2) for the agriculture sector.	Additional

120 When disclosing on ecosystem types, refer to the IUCN Global Ecosystem Typology.

121 When disclosing on ecosystem types, refer to the IUCN Global Ecosystem Typology.

Driver of nature change	Impact driver	Indicator	Metric	Disclosure inclusion
Pollution/ pollution removal	Soil pollution	Pollutants released to soil split by type	Pollutants released to soil (tonnes) by type, referring to sector-specific guidance on types of pollutants.	Core
	Soil pollution	Soil-related detrimental impact incidents	Number of soil-related detrimental impact incidents experienced by organisation by location.	N/A
	Water pollution	Wastewater discharged	Volume of water discharged (m^3), split into: • Total; • Freshwater; and • Other.[122] 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.	Core
	Water pollution	Wastewater treated, reused/ recycled or avoided	Volume of wastewater treated, reused or recycled (m^3). Reduction in volume of wastewater relative to baseline as a result of technological or process changes (m^3).	Additional
	Water pollution	Waste minimised, reused or recycled	Reduction in waste generated relative to baseline as a result of technological or process changes (tonnes).	Additional

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

Driver of nature change	Impact driver	Indicator	Metric	Disclosure inclusion
Pollution/ pollution removal	Water pollution	Water-related detrimental impact incidents	Number of water-related detrimental impact incidents experienced by organisation by location.	N/A
	Water pollution	Wastewater discharged to locations	Volume of water discharged (total, freshwater, other) to destinations (e.g. fresh surface water, brackish surface water, groundwater, seawater, third party destinations).	N/A
	Waste	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.	Core

Driver of nature change	Impact driver	Indicator	Metric	Disclosure inclusion
Pollution/ pollution removal	Waste	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.[123] For plastic packaging, percentage of plastics that is: • Re-usable; • Compostable; • Technically recyclable; and • Recyclable in practice and at scale.	Core
	Waste	Waste minimised, reused or recycled	Reduction in waste generated relative to baseline as a result of technological or process changes (tonnes).	Additional
	Non-GHG air pollution	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).	Core

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

Driver of nature change	Impact driver	Indicator	Metric	Disclosure inclusion
Pollution/ pollution removal	Disturbances	Light and noise pollution	For example: • Percentage of light fixtures that fully cut-off or fully shielded or below 60W; • Outdoor lighting (lumen/ha); and • Average noise level on-site during noisiest part of the day, an hour either side of sunrise and an hour either side of sunset (dB); distance from nearest habitat (m).	Additional
	Multiple	Pollutants removed	Volume of pollutants removed from land, atmosphere, ocean and freshwater (tonnes).	Additional
Resource use and replenishment	Water use	Water withdrawal and consumption from areas of water scarcity	Water withdrawal and consumption[124] (m^3) from areas of water scarcity, including identification of water source.[125]	Core
	Water use	Total water consumption and withdrawal	Total volume of water withdrawal and consumption (m^3).[126]	Additional
	Water use	Water replenished	Volume of water (m^3) replenished to the environment through replenishment programmes (split into total and to areas of water scarcity).	Additional

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

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

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

Driver of nature change	Impact driver	Indicator	Metric	Disclosure inclusion
Resource use and replenishment	Water use	Water reduced, reused or recycled	Total volume (m^3) or percentage of water (total, freshwater, other) reduced, reused or recycled.	Additional
	Water use	Water loss mitigated	Volume (m^3) of water loss mitigated.	Additional
	Water use	Water consumption and withdrawal by source	Volume of water consumption and withdrawal (total, freshwater, other) by source (e.g. surface water, groundwater, seawater, produced water, third-party water).	N/A
	Other resource use	Quantity of high-risk natural commodities sourced from land/ocean/ freshwater	Quantity of high-risk natural commodities[127] (tonnes) sourced from land/ocean/freshwater, split into types, including proportion of total natural commodities. Quantity of high-risk natural commodities[128] (tonnes) sourced under a sustainable management plan or certification programme, including proportion of total high-risk natural commodities.	Core
	Other resource use	Area used for the production of natural commodities	Area (km^2) that the organisation controls and/ or manages that is used for the production of natural commodities from land/ocean/ freshwater ecosystems, by type of ecosystem.	Additional

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

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

Driver of nature change	Impact driver	Indicator	Metric	Disclosure inclusion
Resource use and replenishment	Other resource use	Use of wild species	Quantity of wild species (tonnes and/or number of individual specimens, by species) extracted from natural habitats for commercial purposes.	Additional
Invasive species and other	Biological alterations	Measures against unintentional introduction of invasive alien species (IAS)[129]	Proportion of high-risk activities operated under appropriate measures to prevent unintentional introduction of IAS, or low-risk designed activities.	Core placeholder
	Biological alterations	Number/ extent of non-purposefully introduced species, varieties or strains	Number/extent of unintentionally introduced species, varieties or strains in areas owned, operated, used or financed in priority areas (absolute, presence/absence and/or number removed).	Additional

129 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'.

Table 23: Ecosystem service metrics categories

Ecosystem service category	Ecosystem service
Provisioning services	Water supply
	Genetic material
	Biomass provisioning
	Other provisioning services
Cultural services	Recreation-related services
	Visual amenity services
	Education, scientific and research services
	Spiritual, artistic and symbiotic services
	Other cultural services

Ecosystem service category	Ecosystem service
Regulating and maintenance services	Pollination
	Soil and sediment retention
	Water flow regulation
	Solid waste remediation
	Water purification
	Flood mitigation
	Air filtration
	Soil quality regulation
	Nursery population and habitat maintenance
	Local (micro and meso) climate regulation
	Biological control
	Global climate regulation
	Rainfall pattern regulation
	Storm mitigation
	Noise attenuation
	Other regulating and maintenance services

Table 24: Ecosystem service assessment metrics

Metric category	Sub-category	Indicator	Metric	Disclosure inclusion
General	N/A	Ecosystem services the organisation has an impact on: measurement of the change in the availability and quality of the ecosystem services	For ecosystem services (provisioning, regulating & maintenance and cultural) impacted, measurement on the change in the availability and quality of the ecosystem services.	Additional
	N/A		For ecosystem services (provisioning, regulating & maintenance and cultural) depended on, measurement on the change in the availability and quality of the ecosystem services.	Additional
Regulating and maintenance services	Water flow regulation	Amount of water flow regulated	Capacity of reservoirs or alternative forms of storage (cubic metres) otherwise needed to provide same service.	N/A
			Volume of diverted water flow otherwise needed to provide same service	N/A
		Amount of secure water supply	Altered level of number of people/ businesses/acres with secure water supply.	N/A
		Altered flood risk level	Altered risk level of incident (e.g. flood frequency).	N/A

Metric category	Sub-category	Indicator	Metric	Disclosure inclusion
Regulating and maintenance services	Flood mitigation	Altered flood risk level	Change in flood damage costs.	N/A
			Altered level of land-loss from inundation and/or coastal erosion in km^2 (e.g. reduction of land-loss).	N/A
		Number of people affected due to habitat hazards	Altered level of number of people suffering from flood-related infections (e.g. reduced number of people).	N/A
	Global climate regulation	Tonnes of greenhouse gas (GHG) retained	Tonnes of carbon and other greenhouse gases retained (sequestered and stored) within company operations or supply chain.	N/A
			Amount of carbon absorbed by vegetation.	N/A
		Altered wildfire risk level	Altered level in the number of wildfires and/or in the area damaged by wildfires in km^2 (e.g. reduction in the number of wildfires).	N/A
		Number of people affected due to climate-related hazards	Number of people evacuated/injured/displaced/economically unproductive due to climate-related hazards (e.g. reduced number of people injured).	N/A
	Local (micro and meso) climate regulation	Number of people affected due to climate-related hazards	Number of households with air temperature reduced by more than 5°C on hot days.	N/A

Metric category	Sub-category	Indicator	Metric	Disclosure inclusion
Regulating and maintenance services	Air filtration	Weight or volume of pollutant filtered/ remediated	Tonnes of pollutants absorbed by type of pollutant (e.g. PM_{10}; $PM_{2.5}$).	N/A
	Soil and sediment retention	Soil retained	Tonnes of soil retained.	N/A
			Number of properties with reduced risk of landslide.	N/A
	Solid waste remediation	Weight or volume of waste remediated	Tonnes of solid waste remediated.	N/A
	Water purification	Weight or volume of pollutant filtered/ remediated	Tonnes of pollutants remediated by type of pollutant (nutrients and other pollutants).	N/A
		Area of habitat providing services	Hectares of habitat providing water filtration.	N/A
		Volume of water filtered	Cubic metres of water filtered by vegetation.	N/A
	Pollination	Area of habitat pollinated	Area of crops pollinated, by type of crop.	N/A
	Nursery population and habitat maintenance	Biomass stocks dependent upon nursery and habitat services	Size of biomass stocks dependent upon nursery and habitat services.	N/A

Metric category	Sub-category	Indicator	Metric	Disclosure inclusion
Provisioning services	Biomass provisioning	Weight or volume of provisioned assets	Gross tonnes of cultivated plants e.g. wheat (proxy measure).	N/A
		Weight or volume of provisioned assets	Gross tonnes of grazed biomass.	N/A
		Weight or volume of provisioned assets	Gross tonnes of wood (timber) biomass harvested.	N/A
		Weight or volume of provisioned assets	Gross tonnes of aquatic products harvested.	N/A
		Area of habitat providing services	Area and yield of area providing crops, by type of crop.	N/A
	Water supply	Weight or volume of water supply	Cubic metres of water, by type and quality.	N/A
Cultural services	Recreation-related services	Visits for cultural purposes	Number and length (hours) of visits.	N/A
	Visual amenity services	Number of properties with visual amenity services	Number of properties with views of natural landscapes/located near green/blue areas.	N/A
	Education, scientific, and research services	Number of visits for educational, scientific and research purposes	Number of visits for educational, scientific and research purposes.	N/A
	Spiritual, artistic and symbiotic services	Number of visits for spiritual, artistic and symbiotic purposes	Number of visits for spiritual, artistic and symbiotic purposes.	N/A

Annex 1.2: Assess – Risk and opportunity metrics

Table 25: Risk and opportunity metrics categories

Metric category	Sub-category
Physical risk	General
Transition risk	Policy
	Liability
	Technology
	Market
	Reputation
Opportunity	Resource efficiency
	Products and services
	Market
	Capital flow and financing
	Reputational capital
	Ecosystem protection restoration and regeneration
	Sustainable use of natural resources

Table 26: TNFD global risk and opportunity assessment metrics

Risk/opp	Category	Metric	Disclosure inclusion
Risk	Transition	Value of assets, liabilities, revenue and expenses that are assessed as vulnerable to nature-related transition risks (total and proportion of total).[130]	Core
	Physical	Value of assets, liabilities, revenue and expenses that are assessed as vulnerable to nature-related physical risks (total and proportion of total).[131]	Core
	Transition	Value of assets, liabilities, revenue and expenses that are exposed to nature-related transition risks (total and proportion of total).	Additional
	Physical	Value of assets, liabilities, revenue and expenses that are exposed to nature-related physical risks (total and proportion of total).	Additional
	Multiple	Value of write-offs and early retirements of assets due to nature-related risks.	Additional
		Value of capital expenditure, financing or investment deployed towards nature-related risks.	Additional
	Physical	Description and value of assets/total annual revenue dependent on area affected by physical risk.	Additional
		Number of locations/business lines/facilities exposed to physical risk.	Additional

130 Refer to the TNFD Glossary for the definition of 'vulnerable'. This metric is connected to the below metric asking for 'exposure' to nature-related risks. For organisations following the LEAP approach, 'exposure' is determined in the Evaluate phase and connected to exposure to nature-related dependencies and impacts, whilst 'vulnerability' is determined in the Assess phase, considering the likelihood of the risk arising and the organisation's ability to mitigate the risk.

131 Refer to the TNFD Glossary for the definition of 'vulnerable'. This metric is connected to the below metric asking for 'exposure' to nature-related risks. For organisations following the LEAP approach, 'exposure' is determined in the Evaluate phase and connected to exposure to nature-related dependencies and impacts, whilst 'vulnerability' is determined in the Assess phase, considering the likelihood of the risk arising and the organisation's ability to mitigate the risk.

Risk/opp	Category	Metric	Disclosure inclusion
Risk	Physical	Value of capital expenditure on infrastructure asset repair or replacement as a result of nature-related loss and damage.	Additional
		Percentage increase in insurance costs due to nature-related loss and damage in the previous year.	Additional
		Capital expenditure on adaption due to nature-related physical risks.	Additional
		Costs associated with the relocation of operations and suppliers due to physical nature-related risks.	Additional
		Reduction in revenue/increased costs due to interruption of operations/supply chain.	N/A
		Costs associated with restoration.	N/A
		Costs related to substituting existing products/services.	N/A
		Increased costs of natural inputs/ reduced supply.	N/A
	Transition – Policy	Increased compliance costs.	N/A
		Description and costs related to loss of operating areas.	Additional
		Losses due to delays in operations/permit denials/loss of licence to operate/reduction in operating capacity.	N/A
		Write-offs and early retirement of existing assets.	N/A
		Costs related to increased reporting obligations.	N/A

Risk/opp	Category	Metric	Disclosure inclusion
Risk	Transition – Liability	Description and value of significant fines/penalties received/ litigation action in the year due to negative nature-related impacts.	Core
		Description and value of clean-up costs due to nature-related impacts.	Additional
		Increased costs of personnel and monitoring of activities required.	N/A
	Transition – Market	Description of exposure to/costs related to loss of market access.	Additional
		Reduction in revenue due to lower demand for products and services.	N/A
		Reduction in asset value/value of stranded assets.	N/A
		Increased costs resulting from stakeholder conflicts.	N/A
		Loss of market share and investor goodwill.	N/A
		Description of exposure and costs related to raw material and natural resource price volatility.	Additional
	Transition – Reputation	Exposure to increased operational costs/loss of revenue due to reputational risks.	Additional
		Reduction in revenue due to lower demand for products and services.	N/A
		Increased costs due to increased employee turnover/strikes.	N/A
		Increased operational costs due to reduction in loyalty of suppliers or stakeholders.	N/A

Risk/opp	Category	Metric	Disclosure inclusion
Risk	Transition – Technology	Expenditure on R&D for new and alternative technologies related to mitigation and adaptation of nature-related risks.	Additional
		Write-offs and early retirement of existing assets.	N/A
		Costs related to purchasing new monitoring technologies, including write-offs and early retirement of existing assets.	N/A
Opportunity – business performance	N/A	Amount of capital expenditure, financing or investment deployed towards nature-related opportunities, by type of opportunity, with reference to a government or regulator green investment taxonomy or third-party industry or NGO taxonomy, where relevant.	Core
	Resource efficiency	Value of operational cost savings associated with nature-related management, such as improvements in efficiency of use of nature-related resources and adoption of circular economy practices.	Additional
		Reduced operational and compliance costs.	N/A
		Increased market valuation through resilience planning.	N/A
		Reduced exposure to raw material and natural resource price volatility.	N/A
		Increased resilience to reduction in availability of natural resources.	N/A
		Costs savings from technological innovations that increase resource efficiency and/or reduce risks related to nature dependencies.	N/A
		Reduced costs due to engagement of suppliers and stakeholders.	N/A

Risk/opp	Category	Metric	Disclosure inclusion
Opportunity – business performance	Resource efficiency	Increased resilience, e.g. to natural disasters.	N/A
		Reduced capital/infrastructure costs.	N/A
		Tax benefits for certifications (e.g. payments for ecosystem services).	N/A
	Products and services	Increase and proportion of revenue from products and services producing demonstrable positive impacts on nature with a description of impacts.	Core
		Increased resilience due to business diversification.	N/A
		Reduced costs of raw materials and production inputs.	N/A
	Products and services	Increase in revenue resulting from development of financial solutions for nature positive outcomes.	N/A
	Market	Year-on-year change in ESG rating scores for previous three years.	Additional
	Capital flow and financing	Value of green finance instruments used, such as green bonds and sustainability-linked bonds.	Additional
		Access to new sources of finance.	N/A
		Increase in cost savings resulting from financial incentives for suppliers to improve nature and ecosystem management.	N/A
		Tax benefits for certifications (e.g. payments for ecosystem services).	N/A
		Cost savings or revenue resulting from public-sector incentives (e.g. biodiversity credits, payments for ecosystem services).	N/A

Risk/opp	Category	Metric	Disclosure inclusion
Opportunity – business performance	Reputational capital	Change in revenue/brand value due to reputational impact of nature-related issues.	N/A
		Reduced costs due to decrease in employee turnover.	N/A

Annex 1.3: Prepare – Response metrics

Table 27: Response metrics categories

Metric category	Subcategory 1	Subcategory 2
Response	Governance	General
	Strategy	General
		Policies, commitments and targets
		Engagement
		Capital allocation/investment
	Dependency, impact, risk and opportunity (DIRO) management and assessment	General
		Value chain
		Changes to nature (dependency and impact): mitigation hierarchy steps
		Voluntary conservation, restoration and regeneration
		Dependency, impact, risk and opportunity assessment

Table 28: Response assessment metrics

Category	Sub-category	Metric	Disclosure inclusion
Governance	General	Highest level of responsibility and accountability for nature policies, commitments and targets.	N/A
		Frequency of communication of performance and progress in priority locations to management.	N/A
		Frequency that nature issues are discussed during board meetings.	N/A
		Number (absolute and proportion of total) of members of board with competence on nature-related issues.	N/A
		Incentives for employees to reward the effective delivery of nature strategies (value of incentives, levels applied to and performance indicators).	N/A
Strategy	General	Level of integration of nature-related issues, including circular economy plans, into overall risk management and strategy.	N/A
	Policies, commitments and targets	Proportion of targets that are time-bound and quantifiable.	Additional
		Proportion of targets that address short-term, medium-term and long-term risks and opportunities.	Additional
		Proportion of geographical sites/priority locations that are covered by targets.	Additional
		Incorporation of lessons learned into organisation's operational policies and procedures.	N/A
		Policies, commitments and targets in place for each significant impact driver identified (e.g. commitment for zero conversion across ecosystems).	N/A

Category	Sub-category	Metric	Disclosure inclusion
Strategy	Policies, commitments and targets	Embeddedness of mitigation hierarchy principles into management policies, commitments and targets.	N/A
		Where relevant, policies, commitments and targets in place for the following: Circular economy risks; Commodity-specific risks; Operations and sourcing; and Screening and engaging with suppliers.	N/A
		Proportion of production/consumption covered by nature commitments.	N/A
		Processes in place to ensure that business activities are consistent with nature policies, commitments and targets.	N/A
		Policies and commitments aligned to a pathway leading to nature's full recovery by 2050.	N/A
		Targets connected to SDGs, the CBD Global Biodiversity Framework, and/or planetary boundaries or other system-wide initiatives.	N/A
		Targets informed by science and/or intergovernmental instruments such as the CBD.	N/A
		Strategies, policies and commitments are in place for each biome identified to be a priority (e.g. commitment to conversion free supply).	N/A
		Policies/commitments on the social consequences of nature-related impacts and dependencies.	N/A

Category	Sub-category	Metric	Disclosure inclusion
Strategy	Engagement	Proportion of sites that have active engagement with local stakeholders on nature-related issues.	Additional
		Participation in sector-wide and/or multi-stakeholder agreements (number of agreements; number of stakeholders and stakeholder groups covered).	Additional
		Endorsement/engagement with key initiatives for priority nature issues identified.	N/A
		Collaboration/engagement with NGOs when: Forming and implementing nature-related policies and commitments; and Understanding nature trends.	N/A
		Engagement in activities that could directly or indirectly impact public policy on nature.	N/A
		Investment in staff training on nature-related issues.	N/A
		Extent to which customers/ suppliers are engaged on circular economy topics.	N/A
		Indirect supplier engagement approaches used: Supply mapping tools; Supplier questionnaires; On-site meetings; Audits; Training and capacity building.	N/A
		Engagement with local and indigenous communities when forming nature-related management practices.	N/A
	Capital allocation/ investment	Value of investment in projects that avoid or reduce negative nature impacts or conserve or restore ecosystems or species where impacts cannot be avoided.	Additional
		Investment in nature-related solutions as defined in relevant government or regulator green investment taxonomy.	Additional

Category	Sub-category	Metric	Disclosure inclusion
Strategy	Capital allocation/ investment	Development of nature-positive investment criteria.	N/A
		Investment in portfolio companies (by number and by portfolio exposure) that: Have committed to align with nature-positive initiatives; Have publicly available nature policies; Have set a time bound, science-based nature target.	N/A
		Investment in new locations/ real estate associated with nature-related activities.	N/A
		Investment in nature-related product/service lines.	N/A
		Investment in nature-related technology development.	N/A
DIRO management	Value chain	Proportion of suppliers screened on nature-related issues, by spend and/or volume.	Additional
		Proportion of suppliers engaged for priority nature issues identified and/or when assessing nature-related issues, by spend and/or volume.	Additional
		Credible and transparent third-party certification: percentage and/or value of production, consumption and sourcing of raw materials, per certification type.	Additional
		Proportion of production, consumption and sourcing of raw materials that is traceable to original location.	Additional
		Proportion of suppliers committed to and effectively implementing sustainable production.	Additional
		Proportion of suppliers engaged for priority nature issues identified/when assessing nature-related issue.	N/A

Category	Sub-category	Metric	Disclosure inclusion
DIRO management	Changes to nature (dependency and impact): mitigation hierarchy steps	Proportion of sites producing and effectively implementing nature action plans.	Additional
		Rate of reuse and recycling of i) waste or ii) product/material outflows (%).	Additional
		Mandatory credit market schemes: Value of total biodiversity offsets purchased and sold by type and scope (geographies, activities).	Additional
		Restoration of negatively affected species and ecosystems (investment and extent (km2)) split into ecosystem/biome type and split into: • Required by regulation; • Required by certifier; and • Voluntary.	Additional
		Extent (km^2), duration (years) and monitoring frequency (count/year) of ecosystem restoration and/or species restoration projects.	Additional
		Circular material use rate (%).	Additional
		Value of operational/capital expenditure, categorised into mitigation hierarchy actions (avoid, reduce, restore and regenerate, transform) by value and/or proportions (%).	Additional
		Actions/action plans in place that contribute to system wide change (e.g. through technological, economic, institutional and social factors and changes in underlying values and behaviours).	N/A
		Management strategies/plans in place for each significant impact driver.	N/A

Category	Sub-category	Metric	Disclosure inclusion
DIRO management	Changes to nature (dependency and impact): mitigation hierarchy steps	Workers trained in biodiversity conservation.	N/A
		Quality criteria and standards for biodiversity offsets.	N/A
		Processes and due diligence in place to prevent and manage impact drivers.	N/A
		Value of production, consumption and sourcing of raw materials from ecosystems that maintain or enhance conditions for nature.	N/A
		Number and efficacy of human wildlife coexistence measures.	N/A
	Voluntary conservation, restoration and regeneration	Value invested in voluntary ecosystem and/or species restoration.	Additional
		Extent (km^2), duration (years) and monitoring frequency (count/year) of voluntary ecosystem and/or species restoration projects.	Additional
		Value of investment in additional conservation actions split into type of action and type of ecosystem/biome applied to.	Additional
		Value of investment in nature-related community development programs intended to enhance positive impacts for Indigenous Peoples and affected, Local Communities stakeholders.	Additional
		Voluntary credit market schemes: Value of total biodiversity offsets purchased and sold by type and scope (geographies, activities).	Additional

Category	Sub-category	Metric	Disclosure inclusion
DIRO management	Dependency, impact, risk and opportunity assessment	The level(s) at which the assessment is taken (corporate, location-specific and/or project/service-line-specific).	Additional
		Percentage of direct operational locations assessed.	Additional
		Percentage of operational locations assessed upstream and downstream.	Additional
		Percentage of suppliers engaged on access to and availability of high-quality data.	Additional
		Timescale for assessing nature-related issues (e.g. consideration of past and future nature-related impacts, dependencies, risks and opportunities).	N/A
		Verification of data points.	N/A
		Frequency of assessment.	N/A

Annex 2: Guidance on how to measure changes in the state of nature

Introduction

This guidance annex has been prepared to:

1. Provide further guidance on how to measure changes to the state of nature in the Evaluate phase of the LEAP approach; and
2. Assist organisations with their disclosure of changes to the state of nature when reporting their material impacts and dependencies (Strategy A and Metrics and Targets B in the TNFD recommended disclosures).

This annex benefited from technical input by an expert group of scientists involved in ecosystem condition and species extinction risk assessment.

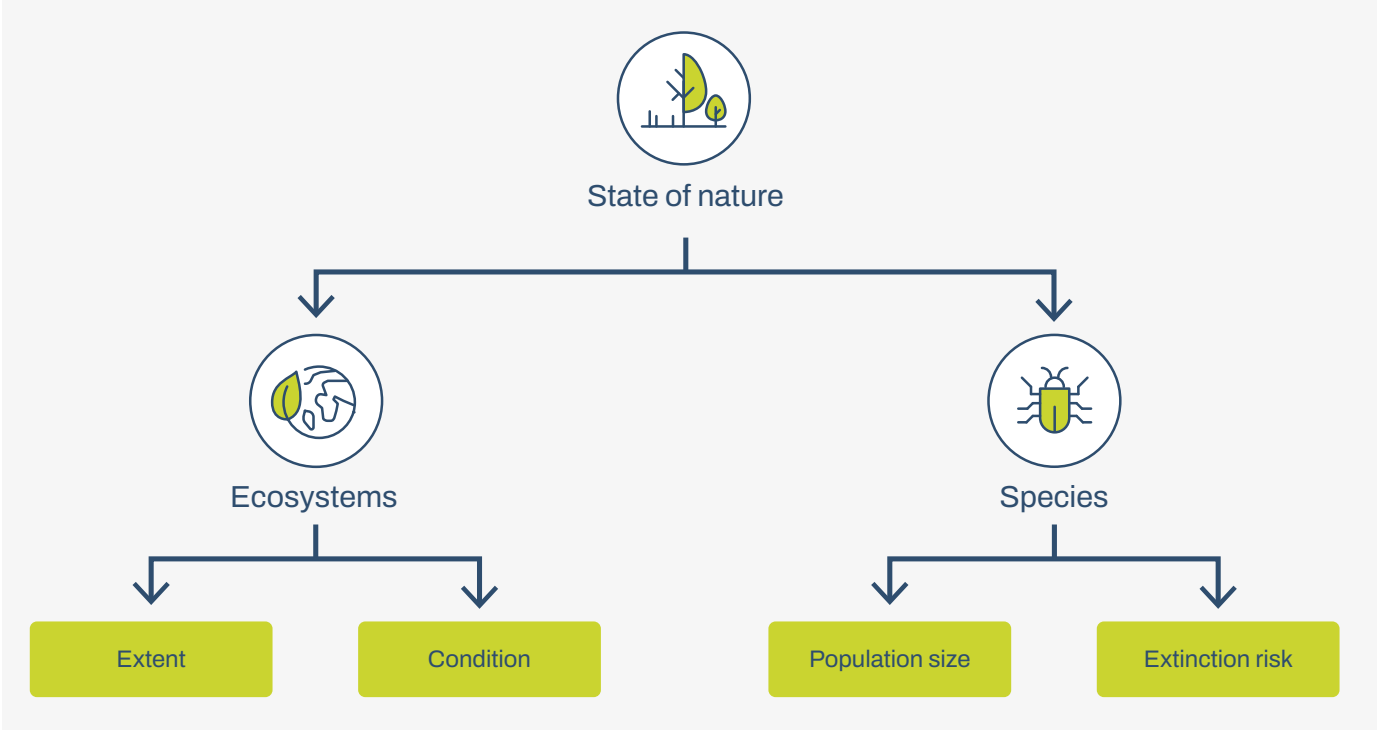
The state of nature is defined by the TNFD to include the condition and extent of ecosystems and species population size and extinction risk.[132] Changes to the state of nature can include both positive and negative changes. Following the impact and dependency pathway approach outlined in the Evaluate phase of LEAP, it is important for organisations to measure changes to the state of nature as part of any assessment of their impacts and dependencies.

As illustrated in Figure 30, measuring changes to the state of nature requires the assessment of:

1. Changes to ecosystem condition and the extent of ecosystem assets for which the organisation has an impact or dependency; and
2. Changes to species population size and extinction risk within ecosystem assets for which the organisation has an impact or dependency.

132 Adapted from United Nations et al. (2021) System of Environmental-Economic Accounting – Ecosystem Accounting; UNEP-WCMC, Capitals Coalition, Arcadis, ICF, WCMC Europe (2022) Recommendations for a standard on corporate biodiversity measurement and valuation, Aligning accounting approaches for nature.

Figure 30: Components of state of nature measurement



Guidance on how to measure ecosystem condition

Introduction

Ecosystem condition is the quality of an ecosystem measured by its abiotic and biotic characteristics. Ecosystem condition underpins the ecological integrity of an ecosystem and supports its capacity to supply ecosystem services on an ongoing basis.[133]

Negative impacts on ecosystem condition are a key source of nature-related risks, while positive impacts on ecosystem condition are important for both risk mitigation and the generation of nature-related opportunities.

Ecosystem condition metrics measure ecosystem quality compared to a reference state. They can be a useful way to simplify the complexity of the natural world and are therefore widely used in footprinting and impact assessment. However, ecosystem condition metrics vary considerably, particularly in which ecosystem characteristics they include and the type, geographic scope and precision of the underlying data. This means they also vary considerably in how they respond to positive and negative impacts.

This section:

- Introduces key concepts underpinning ecosystem condition, including a discussion of measurement within the LEAP approach;
- Provides guidance on how to measure ecosystem condition, including scales of metrics and metrics typology;
- Provides an overview of how to determine reference condition;
- Outlines key criteria for selecting metrics;

133 Align Project (2023) Measuring ecosystem condition – a primer for business.

- Sets out guiding principles for the use of ecosystem condition metrics;
- Provides a table of illustrative ecosystem condition metrics; and
- Describes future developments that could improve ecosystem condition metrics.

Key concepts

Defining ecosystems

Ecosystems comprise discrete assemblages of organisms and their interactions with their physical environment. Ecosystems can be differentiated from one another by their physical composition (i.e. the vegetation types and species present) and by ecological processes. Ecosystems are highly diverse, ranging in the land realm, for example, from tropical rainforests to grasslands and croplands. The biodiversity at any two locations will always be different, but ecosystems are a useful construct to help navigate the complexity of the natural world. **Ecosystem types** are differentiated from one another by a degree of uniqueness in composition, structure, and ecological processes and function.[134, 135]

The **IUCN Global Ecosystem Typology** provides descriptive profiles and groups for major ecosystems globally. Ecosystems can be grouped at the highest level into **realms**, which represent different components of the biosphere that differ fundamentally in ecosystem organisation and function.[136] The TNFD defines four realms: land, ocean, freshwater and atmosphere. Within each realm, **biomes** are groups of ecosystems that are united by broad features of structure and major ecological characteristics. Examples of biomes include deserts, tropical and subtropical forests, rivers and streams, lakes, and intensive land-use systems. Biomes are split into **functional groups** with characteristics related to major abiotic factors such as climate, geology or fire and specific ecosystems are then nested within these functional groups.[137]

What is ecosystem condition?

Ecosystem condition is the quality of an ecosystem measured by its abiotic and biotic characteristics.[138] It is a useful and important way of assessing the state of nature at a location, as condition underpins the ecological integrity of the ecosystem and supports its capacity to supply ecosystem services.

Following the UN-SEEA's definitions, the biotic characteristics of ecosystem condition are assessed with respect to an ecosystem's composition, structure and function. The abiotic characteristics are assessed with respect to its physical state, chemical state and landscape/seascape. These six characteristics underpin the integrity of the ecosystem and support its capacity to supply ecosystem services on an ongoing basis.[139]

Some typologies, such as that of the Align project, use a simpler classification with a focus on only the living components of the ecosystem:

- **Structure**, both at a location (e.g. canopy height) and relating to the broader landscape or seascape (e.g. patch size and connectivity);
- **Composition** (e.g. the species present and their abundance); and

134 Keith, D. A. et al. (2013) Scientific foundations for an IUCN Red List of Ecosystems.

135 Nicholson, E. et al. (2021) Scientific foundations for an ecosystem goal, milestones and indicators for the post-2020 global biodiversity framework.

136 Keith, D. A. et al. (eds.) (2020) IUCN Global Ecosystem Typology 2.0: descriptive profiles for biomes and ecosystem functional groups.

137 A detailed assessment of different ecosystem typologies can be found in Appendix 1 of Keith D.A. et al. (2022) A function-based typology of earth's ecosystems.

138 UN (2021) System of Environmental-Economic Accounting – Ecosystem Accounting.

139 UN (2021) System of Environmental-Economic Accounting – Ecosystem Accounting.

- **Function** and **physical, chemical and biological processes** (e.g. primary productivity or detritus formation).

This additional guidance follows the Align typology but includes physical and chemical state within structure. It focuses on ecosystems as a living component of nature, but organisations following the TNFD's LEAP approach should also measure non-living components, such as water quality, soil structure and air pollutant concentrations, where they are relevant to impacts and dependencies. The indicators in a component that should be measured will depend on the ecosystem in question.

Ecosystem integrity is the degree to which an ecosystem's composition, structure and function resemble those characteristics of its natural range of variation. Ecosystem integrity and ecosystem condition are often used interchangeably, but for a LEAP assessment, it is useful to distinguish between them based on scale:

- Ecosystem integrity refers to an ecosystem type (that could be at any level within a hierarchical ecosystem typology); [140]
- Ecosystem condition refers to a defined spatial unit within an ecosystem type (equivalent to the SEEA's 'ecosystem asset').

Within the TNFD LEAP approach:

- Ecosystem integrity (of broad ecosystem types) is most relevant in the Locate phase for determining the context of the nature interface (L3) and sensitive location identification (L3); and
- Ecosystem condition (of defined spatial units) is most relevant for the Evaluate, Assess and Prepare phases, focused on particular assessment locations.

Ecosystem condition is an important complementary measure to ecosystem extent. While impact measures based on changes in ecosystem extent, such as the area of a vegetation type converted or restored, are relatively simple to assess, measuring ecosystem extent alone can give an incomplete picture that does not account for changes in the quality of ecosystems at different stages of degradation or restoration.

140 Keith, D. A. et al. (eds.) (2020) IUCN Global Ecosystem Typology 2.0: descriptive profiles for biomes and ecosystem functional groups.

Figure 31: Ecosystem condition and its components in relation to state of nature

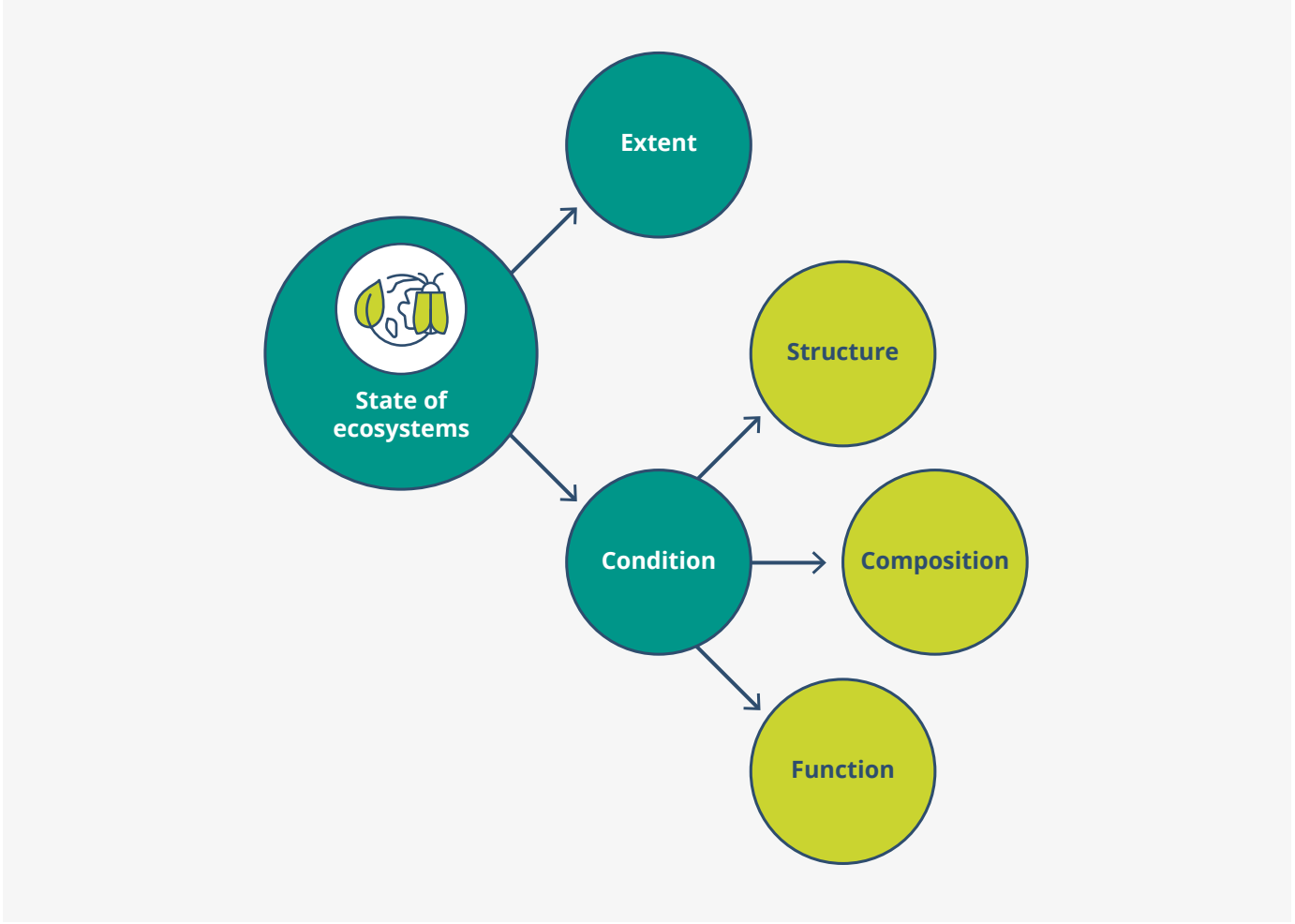
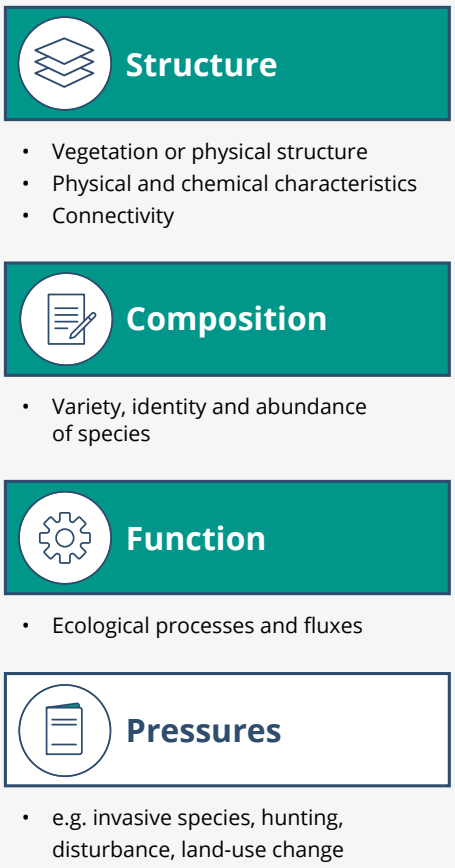


Figure 32: Measurable biotic components of ecosystem condition



Note – Pressures are included as they are often used as a proxy measure for one or more components of ecosystem condition.

Box 25: Components of ecosystem condition

The UN SEEA Ecosystem Accounting framework defines six classes of measurable characteristics of ecosystem assets:

- **Physical state** characteristics: physical descriptors of the abiotic components of the ecosystem (e.g. soil structure and water availability);
- **Chemical state** characteristics: the chemical composition of abiotic ecosystem elements (e.g. water quality, soil nutrient levels and air pollutant concentrations);
- **Compositional state** characteristics: the composition/diversity of ecological communities at a given time/location (e.g. species abundance and species richness);
- **Structural state** characteristics: the aggregate properties (e.g. mass, density) of the whole ecosystem or its main biotic components (e.g. total biomass, canopy coverage);
- **Functional state** characteristics: summarise the biological, chemical and physical interactions between ecosystem compartments (e.g. primary productivity and disturbance frequency); and
- **Landscape and seascape** characteristics: describe the spatial scales of ecosystems (e.g. landscape diversity, connectivity and fragmentation).

Ecosystem condition metrics

Ecosystem condition metrics measure ecosystem quality compared to a reference condition. They are usually rescaled to be between 0 (entirely destroyed) and 1 (the reference level).

Metrics of ecosystem condition can measure ecosystem characteristics **directly**, **indirectly** through proxies, or a combination of **both**.

Where pressure-condition relationships are well understood, pressures/impact drivers are often used as proxy measures of condition. Pressures/impact drivers are often relatively easy to measure, cost-effective and may provide a **leading indicator** that changes in advance of state indicators. Structure or composition indicators may sometimes also be used as easier-to-measure proxies for ecosystem function, e.g. structural connectivity as a proxy for dispersal, or the presence of certain species as a proxy for natural disturbance processes or recruitment.

The use of pressure metrics as proxies is usually best done in combination with one or more measures of state, and ideally would include ground-truthing to ensure that presumed relationships hold in a particular situation.

Relevance for business

Measuring ecosystem condition helps an organisation to understand its nature-related dependencies and impacts. Positive changes may create opportunities for the organisation or assist with risk mitigation, while negative changes can create both physical risks (e.g. in areas where there is a dependency on ecosystem services) and transition risks (e.g. where the organisation is creating a negative impact).

Understanding ecosystem condition is therefore an important part of the Evaluate phase of LEAP, and helps organisations to plan and implement appropriate responses, including target setting in the Prepare phase of LEAP.

The TNFD recommends that organisations use a dashboard of state of nature metrics to assess impacts and dependencies, and whenever possible, measurements of ecosystem condition should be informed by location-specific ecological expertise, alongside summary condition measures. Understanding the processes underlying ecosystem condition and whether certain species/environmental features are particularly relevant a business can be crucial to inform assessment and planning (see Box 26).

Box 26: Ecosystem-specific processes determining condition

Understanding the processes underlying ecosystem condition, alongside summary condition measures, can be crucial to inform assessment and planning. In light of this understanding, it may be appropriate to prioritise the measurement of certain biophysical features. This could include particular species groups. For example:

- **Coolibah-Black Box woodland ecosystems in Australia** depend critically upon the water table. Ecosystem condition metrics based on species composition might not detect real risks;
- **Intertidal ecosystems in the Pacific Northwest, USA** are regulated by a keystone predator, the starfish Pisaster ochraceus. Changes in abundance of this species have much greater implications for ecosystem collapse risk than other species;
- In **tropical rainforest ecosystems in Gabon,** elephants are a keystone species important for many ecosystem processes, such as seed dispersal. The status of elephants is thus particularly important for ecosystem integrity; and
- In **Dipterocarp forests in tropical Southeast Asia**, large emergent Dipterocarp trees contribute disproportionately to seedling recruitment and hence forest structure and composition. The status of these large individual trees may not be captured in summary condition metrics.

Table 29: Potential uses and desirable qualities of ecosystem condition metrics at each phase of the LEAP approach.

Phase			
Locate	**Evaluate**	**Assess**	**Prepare**
Desirable qualities of ecosystem condition metrics for this phase (see also Table 32)			
Flexible – can be used in different business contexts (e.g. for directly owned sites and in value chains) and comparable across a wide range of geographies. **Ecologically-connected** – clear relationship between values of the metric and ecosystem integrity. **Accessible** – packaged such that end users can use it without undue effort. **Timely** – data are up to date. **Ecosystem-explicit** – can be related to a specific ecosystem at a particular location.	**Relevant** – can attribute change in the metric to company activities. **Ecologically-connected** – clear relationship between values of the metric and ecosystem integrity. **Timely and responsive** – to change in pressures over time (both negative and positive), particularly those relevant to the company. **Flexible** – applicable at different scales from site to corporate level, and of impacts disaggregated by pressures.	**Relevant** – informs materiality assessment, future scenarios and potential management actions. **Forward-looking** – can be refined with more granular information. **Socially-connected** – reflects capacity for ecosystem service provision. **Aligned** – shows implications for global goals. **Ecologically-connected** – clear relationship between values of the metric and ecosystem integrity. **Flexible** – applicable at different scales from site to corporate level.	**Relevant** – helps explore strategy effectiveness (both risks and opportunities). **Aligned** with target setting frameworks. **Responsive and timely** – trackable over time to assess progress. **Understandable** – easily communicated to stakeholders. **Verifiable** – feasible to ground truth results. **Flexible** – applicable at different scales from site to corporate level.

Determining reference condition

For organisations evaluating ecosystem condition through direct measurement, the TNFD provides guidance drawn from the UN-SEEA Ecosystem Accounting (Table 30). For those entities using proxies/ modelled data, reference conditions are usually set within those models.

Table 30: Potential reference conditions for assessing change in nature

Ecosystem	Possible reference conditions
Natural ecosystems: Ecosystems predominantly influenced by natural ecological processes characterised by a stable ecological state maintaining ecosystem integrity; ecosystem condition ranges within its natural variability. Examples: primary and old growth forests (T1, T2), natural grasslands and savannahs (T4), natural lakes (F2) and wetlands (TF1).	**Undisturbed or minimally disturbed condition of an intact ecosystem:** The condition of an ecosystem with maximal ecosystem integrity with no or minimal disturbance.
	Historical condition: The condition of an ecosystem at some point or period in its history that is considered to represent the stable natural state (e.g., the pre-industrial period or pre-intensive agriculture).
	Least-disturbed condition: The currently best available condition of an ecosystem.
	Contemporary condition: The condition of an ecosystem at a certain point or period in its recent history for which comparable data are available.
Anthropogenic ecosystems: Ecosystems predominantly influenced by human activities, where a stable natural ecological state is unobtainable and future socioeconomic interventions are required to maintain a new stable state. Examples: urban green spaces and croplands (T4), artificial waterbodies (F3), anthropogenic marine systems (M4).	**Historical condition:** The condition of an ecosystem at some point or period in its history that is considered to represent the stable socioecological state (e.g. the pre-industrial period or pre-intensive agriculture).
	Least-disturbed condition: The currently best available condition of an ecosystem.
	Contemporary condition: The condition of an ecosystem at a certain point or period in its recent history for which comparable data are available.
	Best-attainable condition: The expected condition of an ecosystem under best possible management practices and attaining a stable socio-ecological state.

Reference conditions and levels can be estimated using one or a combination of the following methods:

- **Reference sites:** If pristine or minimally disturbed sites are available, they can be used to determine a reliable measure of the mean and statistical distribution of condition variables;
- **Modelled reference conditions:** These can be used to infer conditions in the absence of human disturbance, where representative reference sites are not available;
- **Statistical approaches based on ambient distributions:** Least-disturbed conditions or best attainable conditions can be estimated by observing the range of values from current ecosystem monitoring and by selecting a reference condition;
- **Historical observations and paleo-environmental data:** This method uses historical observations or paleontological data to describe a historical reference condition, typically before 1970 when routine environmental monitoring programmes started;
- **Contemporary data:** This method uses contemporary data to describe a contemporary reference condition, typically after 1970 when routine environmental monitoring programmes started. For instance, The Living Planet Index uses species data collected in 1970 as a reference to assess changes;
- **Prescribed levels of a set of ecosystem condition variables:** These can be used to construct a bottom-up reference condition. Examples of these reference levels include zero values for emissions or pollutants, a specific number of species, established sustainability or threshold levels such as critical loads for eutrophication and acidification, and target levels in terms of legislated quality measures (air and water quality); and/or
- **Expert opinion.**

Data representing reference conditions for the ideal or target state of nature will depend on sector and on metric, but also whether an organisation is considering the materiality of impacts from a business perspective or a societal perspective. This may include a pristine natural state or may refer to some healthy stable or resilient state. In either case, reference conditions should be established by a credible third party and/or be subject to peer review or third-party verification and be transparent. The precautionary principle should be applied throughout.

Setting a reference condition (and metric selection)

Data to construct and support the selection of a reference condition can include all ecosystem characteristics. For these indicators, preference should be given to primary observational data and/or context specific modelled data from secondary sources. Where a pristine or otherwise appropriate reference condition does not exist, or cannot be established, modelled data may be required. For example, fisheries will model the maximum allowable biomass harvest yield to maintain target fish populations but may also require measures to protect areas of high conservation value with an established reference condition, such as target benthic seascape topography. The appropriate reference condition metrics and datasets will need to be established by sector, and potentially by company, depending on their identified potential impacts and operating geographies.

Measuring ecosystem condition

Fundamental trade-offs

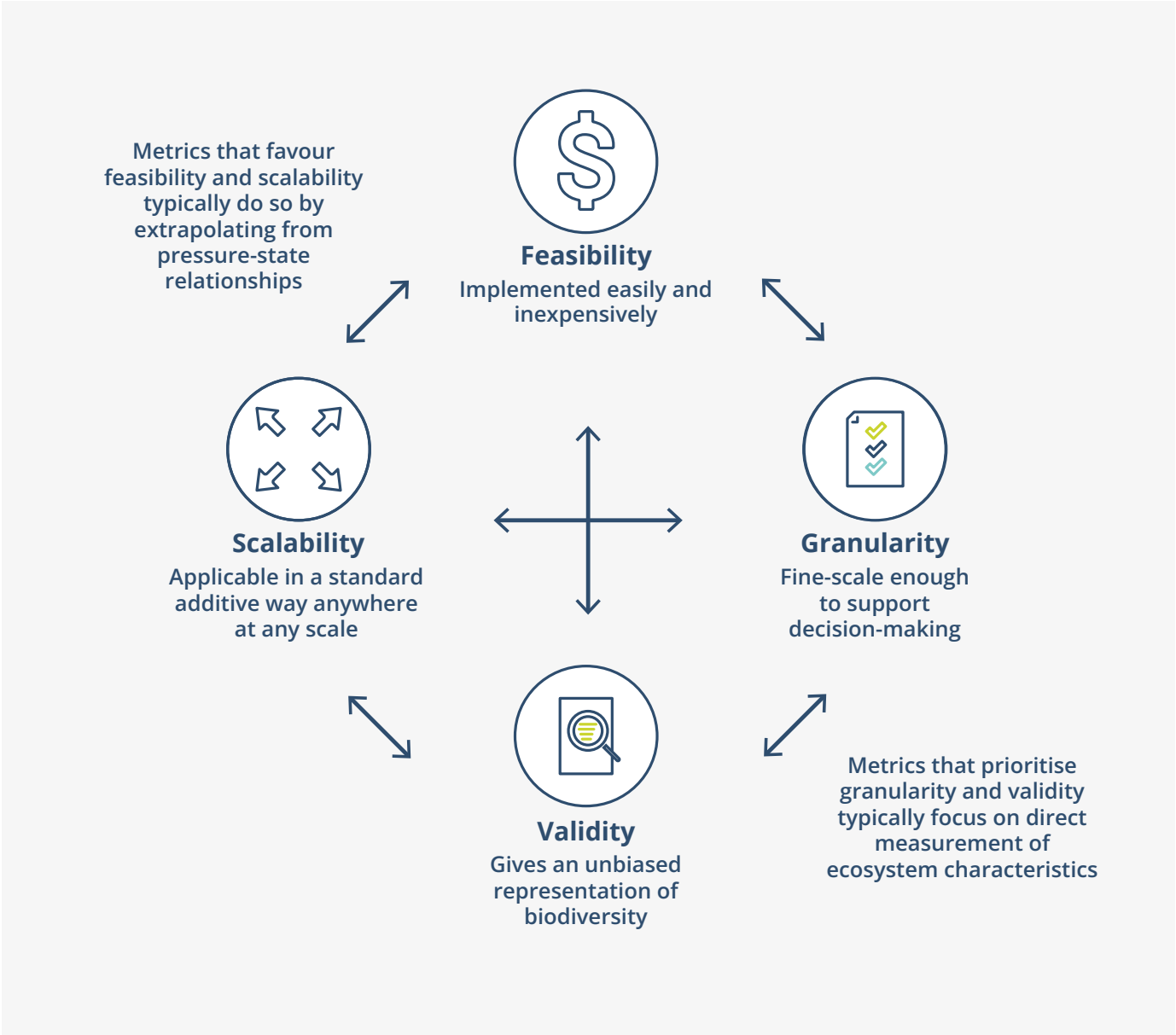
There are an **increasing number of metrics and approaches available to measure ecosystem condition.**[141] Despite this, practical challenges associated with measuring ecosystem condition remain and only limited data is available for some ecosystems and locations. The different components of ecosystem condition that are the most important or the most feasible to measure also vary between ecosystem types.

141 Nicholson, E. et al. (2021) Scientific foundations for an ecosystem goal, milestones and indicators for the post-2020 global biodiversity framework.

This means that **measuring ecosystem condition inevitably involves trade-offs** between desirable characteristics, such as feasibility, validity, scalability and granularity (Figure 33).

The structure, composition and function elements of ecosystem condition are interrelated, but these relationships are often not straightforward nor well understood. In practice, metrics focus on a subset of components expected to indicate ecosystem condition, often within one element, such as an ecosystem's structure or composition. To use ecosystem condition metrics appropriately, it is important to understand the elements and components included, and the trade-offs that a metric makes between desirable characteristics.

Figure 33: Commonly observed trade-offs between metric characteristics



Scale of metrics

Obtaining good data on the current state of ecosystem condition can require time, expertise and resources. For example, a granular and valid assessment may require site- and ecosystem-specific data on community composition and the presence of indicator species, vegetation structure and ecosystem processes. This can be costly and time consuming to collect.

The ecosystem condition metrics that are currently available can apply at three broad spatial scales. In relation to the IUCN Global Ecosystem Typology (GET), these are:

- **Individual ecosystem** – Metrics providing fine scale measures of ecosystem condition (levels 4-6 in the GET), often based on measurement of direct state, and specific to particular ecosystems. They can be supplemented by additional data on impacts. Often these metrics combine measurements of multiple components of ecosystem condition that are most relevant to the ecosystems of interest. Examples include the Accounting for Nature (AfN) Econd® metric framework[142] and the UK Biodiversity metric;[143]
- **Biome** – Metrics providing information applicable across multiple ecosystem types within a biome (levels 2 and 3 in the GET). They are often based on some limited information on state of ecosystem condition and combined with information on impacts. Examples include the Forest Landscape Integrity Index and Forest Structural Condition Index; and
- **Realm** – Metrics applicable to an entire realm (level 1 in the GET) are not usually specific to individual ecosystems and do not rely on primary data collection. Rather, they often apply information on impacts to model estimates of ecosystem condition across multiple biomes and ecosystems. In some cases, they can be supplemented by remotely sensed state measurements. Examples include the Ecoregion Intactness Index,[144] Mean Species Abundance (MSA) and Potentially Disappeared Fraction (PDF).

Inferred or modelled relationships between **pressure and state** can be a practical way to scale up measures of ecosystem condition. For example, the Human Footprint Index combines scores for a range of pressures including agricultural land, population density, night-time lights, railways, roads and waterways[145] to provide a pressure-based index of condition. The GLOBIO model[146] extrapolates condition estimates globally based on studies of how particular pressures affect a condition measure (Mean Species Abundance) locally. Pressures are generally easier to measure and track, and to compare across ecosystems, than the components of ecosystem condition.

Typology of metrics

Available metrics vary in what aspects of ecosystem condition they are measuring, the type and quality of input data, the geographical and ecological scope, and how well they capture important ecosystem characteristics. They also vary depending on whether they are measuring the state of ecosystem characteristics directly, or whether they are inferring ecosystem condition by measuring pressures.

For each of the scales identified, Table 31 gives an illustrative example of a metric that can be used to measure ecosystem condition, and how it could be applied within the LEAP approach.

142 Accounting for Nature (2022) Accounting for Nature Certification Standard Version 3.1.

143 Natural England (2023) Biodiversity metric: calculate the biodiversity net gain of a project or development.

144 Beyer H.L. et al. (2020) Substantial losses in ecoregion intactness highlight urgency of globally coordinated action.

145 Venter, O. et al. (2016) Sixteen years of change in the global terrestrial human footprint and implications for biodiversity conservation.

146 Schipper, A. M. et al. (2020) Projecting terrestrial biodiversity intactness with GLOBIO 4.

Figure 34: The broad characteristics of different ecosystem condition metrics at the ecosystem, biome and realm scale

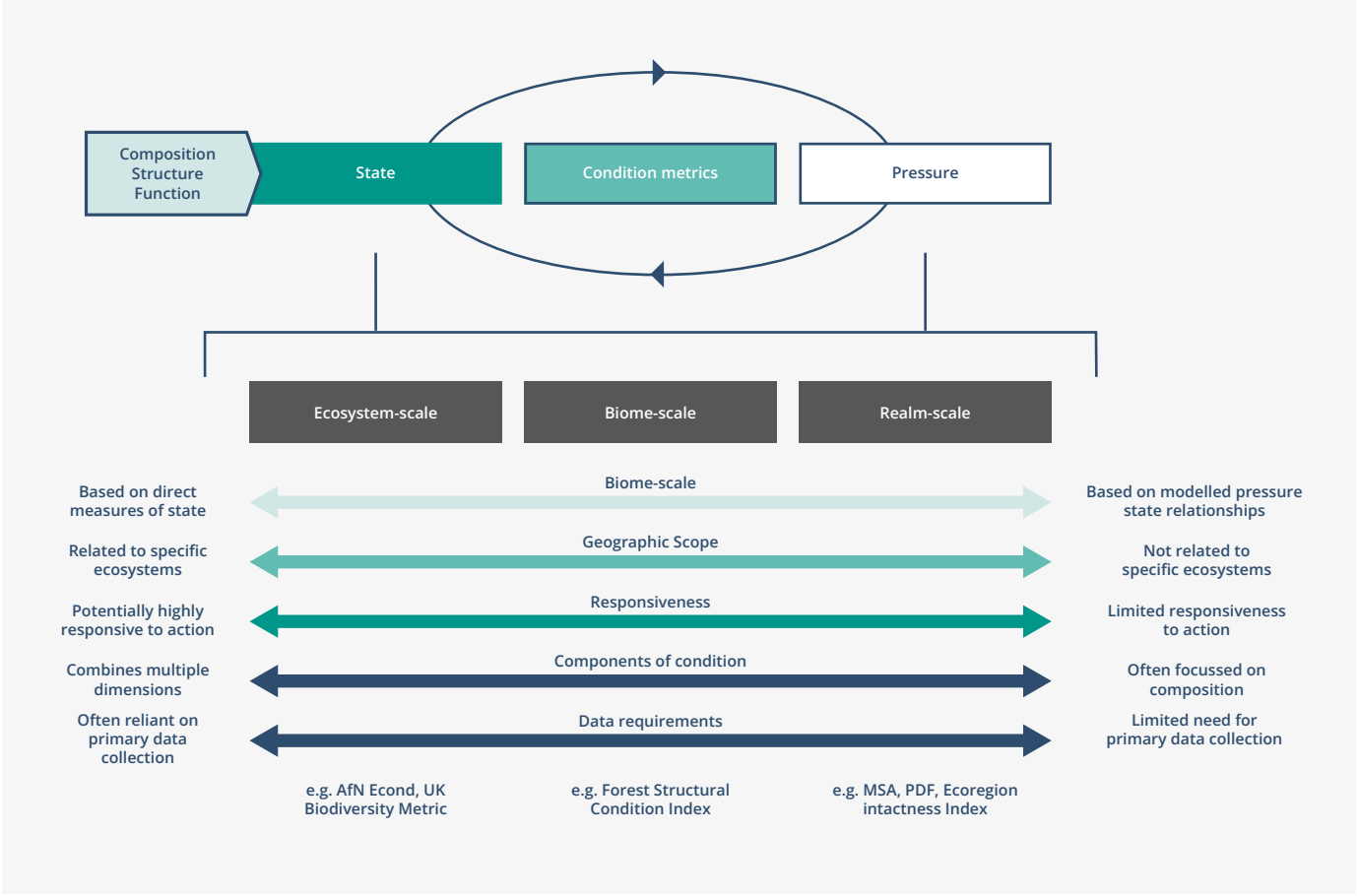


Table 31: Illustrative examples of ecosystem condition metrics at biome, realm and ecosystem scales

Metric	Level	What does it do?	Coverage	Example of use within LEAP
MSA	Realm	Measures species composition by the average abundance of selected species groups compared to a reference state. Available as modelled estimates based on pressure information.	Global, land and freshwater	Identifying impact hotspots across a value chain (indirect control) or investment portfolio (LOCATE). Providing an initial assessment of impacts (EVALUATE). If calibrated with field data, and combined with additional data on ecosystem extent, can inform responses (PREPARE).
Forest Structural Condition Index	Biome	Integrates broad datasets of canopy height, tree cover and time since disturbance to create an index of forest ecosystem condition. This is combined with data on pressures to calculate the related Forest Structural Integrity Index.	Land, for tropical forests only	Identify directly owned assets in forested ecosystems of high condition, or areas within direct control in value chains (LOCATE).
Accounting for Nature Econd®	Ecosystem	Provides a system for measuring, verifying, certifying and publicly reporting Environmental Condition Accounts ('Environmental Accounts') at a local, regional or landscape scale in Accounting for Nature® accredited Method. Methods use indicators specific to an Environmental Asset or ecosystem type to create a score that can be used to track ecosystem condition and compare different areas.	Land, freshwater & ocean	Detailed assessments of ecosystem condition in areas of direct operational control to calculate potential negative impacts (EVALUATE). Together with ecosystem extent data (included in Environmental Accounts) can be used to inform responses in areas of direct or significant operational control (PREPARE).

There is no single best, universally applicable ecosystem condition metric. Each metric can provide valuable information for specific purposes and in specific contexts.

Where appropriate, using multiple metrics that complement each other can help to address the limitations of individual metrics. For example, a metric that only uses modelled estimates of ecosystem composition (e.g. MSA) could be complemented with a metric that includes measures of ecosystem structure (e.g. Forest Structural Condition Index).

Different types of metrics are better suited at different stages of the LEAP approach. At the earlier stages of the LEAP approach, realm-level metrics (based on modelled data and not linked to specific ecosystems) can be used to identify broad areas of risk and opportunity through a high-level impact screening across the value chain. As an organisation starts to look at impacts, risks, opportunities and potential management actions in greater detail, there is greater need for metrics based on direct measurement and connected to specific ecosystems. At this stage, biome- and ecosystem-level metrics start to become more appropriate. For example, these could be used to generate accurate and ecosystem-specific measurements of impacts from direct operations.

Ideally, detailed ecosystem-level metrics would be available and applicable across the LEAP approach so that ecosystem-specific data at fine spatial scale could guide all stages of the process. Using such metrics reduces the risk of overlooking important ecosystem characteristics, areas of high value or appropriate actions to be taken. However, this is often unfeasible at present due to the limited availability of appropriate data. As both metrics and data collection technologies advance, more granular metrics should become available.

Key criteria for metrics selection

The key criteria that make ecosystem condition metrics reliable and relevant to organisations are outlined in Table 32.[147] These criteria are categorised into those deemed essential, important and desirable, but the weight put on each criterion will depend on the individual organisation's circumstances.

147 These criteria and their classification reflect the perspectives of an expert group involving scientists engaged in ecosystem condition assessment on the key attributes for ecosystem condition metrics in TNFD and can help guide business in the selection of metrics.

Table 32: Essential, important and desirable criteria for metrics used to assess ecosystem condition

Criterion	Sub-criteria	Rationale	Importance
1. Credible and science-based	• Based in ecological theory • Derived from empirical data, such as pressure-state relationships • Has undergone extensive empirical and scenario testing • The underlying logic of the model, and how the metric is calculated and what it shows, are fully documented • Methodology and results are explicit about uncertainties and caveats about interpretation • Preferably published in reputable peer-reviewed scientific publications	Help ensure that data guide business actions that address key risks and deliver biodiversity gains.	Essential
2. Ecologically connected	• Clear relationship between values of the metric and ecosystem integrity, with ecologically meaningful thresholds, where relevant • Sufficiently granular in scale to capture the local realities of ecosystem condition	Ecosystem condition can be measured in a variety of ways, more or less connected to which ecosystem condition components are key to the integrity of different ecosystem types. A strong connection between the values measured and these important components of ecosystem condition is therefore important.	Essential

Criterion	Sub-criteria	Rationale	Importance
3. Responsive	• Responds measurably, reliably and predictably to change • Responds to changes that are meaningful to key structuring characteristics of the ecosystem • Responds to realistic changes in pressures • Is responsive both to increases and decreases in ecosystem condition	Allows impacts of businesses (both positive and negative) to be tracked.	Essential
4. Relevant	• Can inform decisions at spatial/ temporal scale relevant to company or investor actions • Responds to all relevant IPBES pressures • There are clear and well-documented relationships between impact drivers and values of the metric	The metric must meaningfully inform business strategy and actions, preferably across the full suite of potential pressures related to business activity.	Essential
5. Verifiable	• The results can be empirically verified in the field	The ability to audit is important to ensure effective reporting and action across businesses. Some metrics rely on complex modelling and varied assumptions, making them difficult to verify externally.	Essential
6. Accessible	• Packaged such that end users can use it without undue effort	Easily accessible information is important to promote widespread use of metrics and allow comparisons between organisations.	Important

Criterion	Sub-criteria	Rationale	Importance
7. Flexible	• Relationships between impact drivers and values of the metric can be applied at varying levels of spatial resolution • Can be adapted to different scales and methods of data collection • Within the metric's scope, applicability to any location, either through an existing data layer or as a potential derivation	Often there will be varying qualities of company data and/or data on ecosystem condition in different regions. A metric that can be used flexibly with data of differing quality can be widely applied and enable a broader range of comparisons within and between businesses.	Important
8. Forward-looking	• Methodological framework is sufficiently adaptable to incorporate improved datasets and/or models and/or methods in future	Substantial improvements in the availability and accuracy of data relevant to ecosystem condition are likely in the future. It is important that metrics are able to accommodate these advances.	Important
9. Timely	• Input data collected recently enough for current data layers to be meaningful • Can readily be recomputed to track change over time • Has institutional support to be regularly updated with new data	As well as up-to-date current information on ecosystem condition, time-series information is needed to enable change to be tracked in the future.	Important
10. Ecosystem-explicit	• Can be related to a particular ecosystem at a particular location, at minimum, the biome type within an ecoregion or a country	Allows information to be related to a specific location and its characteristics, enabling identification of ecologically relevant risks and opportunities.	Important

Criterion	Sub-criteria	Rationale	Importance
11. Socially connected	• Tracks levels of ecosystem service provision, directly or via highly correlated component(s) of ecosystem condition	Tracking components of ecosystem condition that are linked to the provision of ecosystem services is desirable to help track ecosystem function and associated dependencies.	Desirable
12. Understandable	• Represents an intuitive concept that can easily be communicated to users	In order to usefully inform biodiversity strategy, support target setting and catalyse action, a metric should be communicable and easily understood by a range of users.	Desirable
13. Aligned	• Has broad acceptance by a wide range of users, as demonstrated by inclusion in relevant frameworks, regulation or targets	Use of metrics that are already adopted and implemented for other purposes helps to reduce potential duplication of effort and to improve communication and comparability.	Desirable

Guiding principles for use of ecosystem condition metrics

Guiding principles for the appropriate use of ecosystem condition metrics within both internal assessments and disclosures are shown in Table 33. Applying these should promote consistency of application across users, make it clear which approaches have been taken, and help users to understand assumptions and interpret information.

Assessing ecosystem condition at the ecosystem level, where metrics exist or are feasible to develop (especially for direct operations and areas of significant control), will provide the greatest granularity and confidence in the assessment of nature-related risks and opportunities. If realm-level metrics are used, the good practice principles set out here can support appropriate interpretation and communication.

Over time, organisations should seek to increase the proportion of their positive and negative impacts assessed using ecosystem- or biome-level metrics.

Transparently documenting how ecosystem condition metrics have been used is particularly important because of the wide range of different approaches, which are sometimes unfamiliar to many actors, and where key assumptions and information can be obscured. Some metrics, for example, combine information on different impact drivers and across sites, making interpretation of results complex. Clear reporting can also help prepare an organisation for verification and audit processes.

Table 33: Guiding principles for selecting, applying and reporting ecosystem condition metrics

No.	Guiding principle	Rationale
1	Consider the type of metric appropriate to the LEAP phase and the business and ecological contexts.	Different metrics are differently suited for particular applications. Using a metric that is appropriate for the context will produce more meaningful results.
2	Consider complementarity between different metrics in the components measured.	Combining complementary metrics can give a more complete and useful picture of ecosystem condition. However, there is limited value in combining metrics that use similar approaches to assess the same component of condition.
3	Choose indicators evidenced to be reliable, relevant and measurable indicators of condition for the biome or ecosystem type in question.	Different potential state or pressure indicators have different relevance and measurability for different kinds of ecosystems. It is important to consider the ecological context (and for pressures, the causal connection with condition).

No.	Guiding principle	Rationale
4	Document and justify any interpolation or customisation of the metric and steps taken to validate or ground-truth.	It is often necessary to interpolate or customise metric calculations as data (e.g. land use intensity categories) used by models may not map to real life scenarios. Interpolation may not be standardised and can significantly change the results.
5	State assumptions and ecological rationale for estimates of how impacts may change owing to specific actions to manage risks and opportunities.	Allows verification of whether estimates are ecologically plausible.
6	Specify the time period over which periodic impacts are assessed (e.g. annual).	Allows an understanding of the rate of accumulation of impacts.
7	Demonstrate that assumptions are conservative (i.e. more likely to overstate negative impacts and understate positive impacts).	Application of the precautionary principle is important to avoid underestimating negative impacts or overestimating positive gains.
8	Ensure direct measurements are made in standardised, repeatable ways and across the full range of ecosystem condition present.	When making direct measurements (including via remote sensing), a standardised approach, stratified across different levels of ecosystem condition, if relevant, is essential to minimise observational 'noise' and allow detection of change over time.
9	Report the ecosystem condition metric(s) used.	Different metrics will represent nature in different ways.
10	Where possible, report separately on both extent and condition, as well as combined, for extent x condition ecosystem impact measures.	A decrease in condition of 10% over 10 ha is ecologically different from a complete loss (decrease of 100%) of 1 ha, even if the overall quantity of calculated biodiversity loss is the same. Reporting only on the combined measure can mask important aspects of biodiversity impact.
11	Where relevant, report the different condition components measured separately as well as combined.	Transparent reporting for the different components of condition will avoid masking of high or low condition scores for some components and allow clearer identification of risks and opportunities.

No.	Guiding principle	Rationale
12	Report the impact drivers included in the assessment and disaggregate impacts by impact driver where possible.	Some metrics can only be linked to certain impact drivers, so it is important to state which drivers are included. Both the form and robustness of pressure-impact relationships may differ by impact driver. Understanding this breakdown can help prioritise management actions to address impacts.
13	Report enough information to identify input data layers (e.g. reference to the specific version of the metric used), including dates of assessment.	For some metrics, different vintages of the data layers exist, sometimes with considerable differences in methodology and dates. These differing data inputs may influence results.
14	Report impacts disaggregated at the finest geographical level available, preferably at: i) ecosystem level for direct operations (GET level 5 or 6), ii) biogeographic ecotype for upstream and downstream value chain (GET level 4); and iii) at least at biome level for all scopes.	Biodiversity is place-specific and so information on specific geographies is important for understanding risks and opportunities and designing appropriate mitigation strategies.
15	As well as organisational positive and negative impacts, report contextual baseline ecosystem condition and its rate of change and Red List of Ecosystem threat status where available.	Understanding the baseline and its rate of change is important to interpret the materiality of impacts.
16	Report thresholds used (e.g. to identify areas of high integrity or high rates of integrity change) and any sensitivity analysis conducted around thresholds.	Choice of thresholds may significantly change results.
17	Where possible, report distinct estimates of each of the following: 1) residual state of nature, 2) accumulated company impacts (existing impacts), 3) periodic negative ongoing and new impacts, 4) periodic positive ongoing and new impacts, 5) projections of future impacts.	While it is possible to combine these types of information, they have very different biodiversity impacts. If combined, much of the information is lost and difficult to interpret.

Developed using the following sources: UN SEEA-EA methodology (UNSEEA 2021), ALIGN Guidance (UNEP-WCMC et al. 2022), Biological Diversity Protocol (BDP 2021) and associated publications, BBOP Guidance (BBOP 2012), Accounting for Nature standard (Accounting for Nature 2022), GHG Protocol Land sector guidance (World Resources Institute & World Business Council for Sustainable Development 2022), guidance from ecosystem metric expert group.

Illustrative ecosystem condition metrics

The following table contains further illustrative examples of metrics that can be used to measure changes to ecosystem condition.

Table 34: Illustrative ecosystem condition metrics

Metric	Description
Accounting for Nature® Econd®	The Accounting for Nature® Framework provides a system for measuring verifying, certifying and publicly reporting Environmental Condition Accounts. AfN is not a metric in itself, but a framework for developing Environmental Accounts that summarise the condition of an environmental asset into a single metric that describes the condition of an individual Environmental Asset based on site-level data. – the Econd®. Under the Framework, Environmental Accounts are comprised of individual Environmental Asset Accounts, each of which must be developed in accordance with an Accounting for Nature® accredited Method[148] (see example[149]). An Environmental Asset Account describes the condition and change in condition of a specific Environmental Asset over time. The Framework can be applied at local, regional or landscape scales to measure the condition of environmental assets (including ecosystem assets) based on a series of indicators and data collection techniques.
Forest Landscape Integrity Index	The Forest Landscape Integrity Index (FLII) provides a global layer of ecosystem condition in forested ecosystems. The index creates a measure of forest integrity based on data layers of forest extent; threatening processes that influence ecosystem condition, including infrastructure presence, agriculture and habitat loss; and reductions in forest connectivity.[150] This metric is a biome-level metric for forested ecosystems globally. It incorporates information on several types of human pressure that impact ecosystem condition and a direct estimate of ecosystem structure at the landscape level, measured as change in connectivity in forested ecosystems.

148 Accounting for Nature. Method Catalogue.

149 Rossini, R. et al. (2021) Koala Population and Habitat Method.

150 Grantham, H.S. et al. (2020) Anthropogenic modification of forests means only 40% of remaining forests have high ecosystem integrity.

Metric	Description
Forest Structural Condition Index/Forest Structural Integrity Index	Available for the humid tropics, the Forest Structural Condition Index (FSCI) provides an estimate of ecosystem condition in the forest biome based on newly available datasets of biodiversity state. The FSCI combines data on forest extent, with data on forest structure (canopy height), and measures of previous forest loss to estimate the structural condition of forests across the tropics. Building on this dataset, the Forest Structural Integrity Index (FSII) adds to this metric information on human pressures. This allows structurally complex habitats with low human pressure to be identified. The two metrics are presented in a scientific paper,[151] with the dataset available on the UN Biodiversity lab.[152]
Potentially Disappeared Fraction	Potentially Disappeared Fraction (PDF) of species is a metric developed for life cycle impact assessments (LCA) as a measure of local loss of ecosystem condition caused by specific anthropogenic pressures. Variations of the PDF metric exist across different LCA tools, relying on differing datasets and methodologies. PDF is calculated based on a database of scientific studies demonstrating changes in local species richness with changes in anthropogenic pressures. Note: While PDF is often considered an ecosystem metric, come applications of it are actually more closely related to measures of species extinction risk (e.g. the Verones et al. Global Extinction Probability[153] is related to STAR – see guidance on species extinction risk metrics).
Mean Species Abundance	The Mean Species Abundance (MSA) metric was developed for use in the GLOBIO model[154] to estimate ecosystem condition as function of select anthropogenic pressures on terrestrial and freshwater ecosystems. It measures condition in terms of the average abundance of species in selected groups compared to a natural reference state. MSA uses information on various pressures to model changes in ecosystem composition (the average proportion of remaining species abundance) as an estimate of changes in ecosystem condition. It is a realm-level metric, applicable across ecosystems, that incorporates many different pressures on biodiversity.

151 Hansen, A. et al. (2019) Global humid tropics forest structural condition and forest structural integrity maps.

152 The UN Biodiversity Lab, UN Biodiversity Lab.

153 Verones, F. et al. (2022) Global extinction probabilities of terrestrial, freshwater and marine species groups for use in Life Cycle Assessment.

154 Schipper, A.M. et al. (2020) Projecting terrestrial biodiversity intactness with GLOBIO 4.

Metric	Description
Ecoregion Intactness Index	The Ecoregion Intactness Index (ErII) provides a global measure of ecosystem condition for terrestrial habitats. The index creates a measure of ecosystem intactness based on data layers of habitat extent, threatening processes that influence ecosystem condition (including infrastructure presence, agriculture and transportation networks) as a proxy for habitat quality, and habitat fragmentation, relative to a theoretical undisturbed reference state.
Marine Cumulative Human Impacts	The Marine Cumulative Human Impacts (MCH) metric combines information on multiple anthropogenic stressors (including 17 global pressure datasets) in marine environments to create a spatial layer of cumulative impacts from human activities in different marine ecosystems, where the stressors are weighted by ecosystem vulnerability to each threat.[155] Global assessments have been conducted in 2008,2015[156] and 2019[157]., with the latter two assessments showing changes between these periods The metric is broadly equivalent to the Human Footprint Index applied in terrestrial ecosystems.
Proportion of Land Degraded	The Proportion of land degraded (PLD) is a metric that measures the level of degradation of ecosystems, developed as an indicator for the Sustainable Development Goals.[158] It is a composite metric of complementary, non-additive sub-indices: land cover class change, land productivity and carbon stocks. The output of the method produces a binary classification of degraded or not degraded. Degradation in one sub-index means that the area is classed as degraded. The metric is designed to be universal so that countries can use their own definition of degraded and their own datasets. It has been calculated globally and for a subset of regions and continents.

155 Halpern, B. et al. (2008) A Global Map of Human Impact on Marine Ecosystems.

156 Halpern, B. S. et al. (2015) Spatial and temporal changes in cumulative human impacts on the world's ocean.

157 Halpern, B. S. et al. (2019) Recent pace of change in human impact on the world's ocean.

158 Sims, N.C. et al. (2021) Good practice guidance. SDG indicator 15.3.1, proportion of land that is degraded over total land area. Version 2.

Metric	Description
Ecosystem Health Index	The Ecosystem Health Index (EHI)[159] uses data from the IUCN Red List of Ecosystems to measure changes in ecosystem health over standardised timeframes. It is applied at the level of an ecosystem to assess degradation compared to a baseline state, and towards a specified threshold beyond which it is predicted the ecosystem will collapse. The EHI uses information on the extent of ecosystems (as per the EAI) but incorporates information on ecosystem specific variables used to assess the condition of the biotic and abiotic environment in the Red Listing process for ecosystems.
Ecosystem Area Index	The Ecosystem Area Index (EAI) uses data from the IUCN Red List of Ecosystems to measure changes in ecosystem area over standardised timeframes.[160] It provides complementary information to other area-based metrics as it is used for all ecosystem types and explicitly incorporates progress towards ecosystem collapse. The metric is an area-based metric, so looks at the extent of ecosystems, rather than their condition. However, it does integrate information on thresholds for ecosystem collapse, based on the IUCN Red List of Ecosystems methodology, so does integrate an aspect of ecosystem function. The EAI can be calculated for marine, terrestrial and freshwater ecosystems and is scalable from single ecosystem, to national to global.
Ecosystem Integrity Index	The Ecosystem Integrity Index (EII) combines structural, compositional and functional information (all scaled 0-1 to a natural baseline) to provide a scalable metric of ecosystem integrity at 1km resolution for the global land realm. The structural component is derived from maps of anthropogenic pressure. The compositional component is the Biodiversity Intactness Index. The functional component is Net Primary Productivity. The value of the index is whichever one of the three components is lowest. The methodology has been published online as a pre-print[161] and is awaiting formal scientific peer review.

159 Rowland, J.A. (2019) Ecosystem indices to support global biodiversity conservation.

160 Rowland, J.A. et al. (2019) Ecosystem indices to support global biodiversity conservation.

161 Hill, S.L.L. et al. (2022) The Ecosystem Integrity Index: a novel measure of terrestrial ecosystem integrity with global coverage.

Metric	Description
Red List of Ecosystems	The Red List of Ecosystems[162] is the global standard for assessing risk of ecosystem collapse and identifying threatened ecosystems, and is applicable to all marine, freshwater, and terrestrial ecosystem types. Red List of Ecosystems assessments collate and analyse standardised knowledge and data about ecosystems, and apply quantitative criteria to estimate relative risk of ecosystem collapse. The criteria address different symptoms of risk, including change in distribution and integrity. Integrity is assessed using ecosystem-specific indicators that are standardised to enable comparison across ecosystems. The criteria assign ecosystem types to ordinal risk categories denoting their threat status (e.g., Endangered, Vulnerable). Through this process, a wealth of data and knowledge is collated, synthesised and analysed in a structured and standardised manner. These include ecosystem maps (typically past and current), ecosystem descriptions, and in most cases data (often spatial data) on integrity, depending on the scope of the assessment, and the resources and data available. The outcomes of Red list of Ecosystems assessments can be used in several ways, including to map threatened ecosystems, and to calculate several metrics, including the Ecosystem health index, which summarises trends in integrity across a set of ecosystems, the Ecosystem Area index, which summarised trends in distribution, and the Red List Index of Ecosystems.

162 Nicholson, E. et al. (2023) Beyond the headline: roles of the Red List of Ecosystems in implementing the Kunming-Montreal Global Biodiversity Framework.

Future outlook for ecosystem measurement

New, updated metrics and data layers

The methods and datasets that can provide information on ecosystem condition are rapidly advancing. In the next few years, many existing metrics may be improved through the incorporation of new and updated datasets. Completely new metrics may also be developed using, for example, new technologies to collect data on community composition (see next section).

For example, the Accounting for Nature Econd® approach currently has a number of proponent-developed methods accredited for use, representing a limited number of ecosystem types globally. As new ecosystem-specific assessment methods are developed, this will become a more feasible approach for more organisations. Similarly, many current metrics use relatively out-of-date data layers on human impact drivers to estimate ecosystem condition. Incorporating updated information on impact drivers would improve the reliability and relevance of these metrics for use in the LEAP approach.

Technological developments

New technologies are rapidly developing that can improve data collection for assessing ecosystem condition, including for business monitoring.[163] Examples include satellite imagery, hyperspectral imaging, environmental DNA, machine learning and acoustic monitoring.[164, 165] New technologies can support ecosystem condition measurement in a range of ways (Table 35).

163 White, T.B. et al. (2021) Using technology to improve the management of development impacts on biodiversity.

164 Berger-Tal, O. and Lahoz-Monfort, J.J. (2018) Conservation technology: the next generation. Conservation Letters 11: e12458.

165 Speaker, T. et al, (2022) A global community- sourced assessment of the state of conservation technology. Conservation Biology 36.

Table 35: Potential benefits of technological advances to measure ecosystem condition

Benefits	Examples
Quality – Improved quality and accessibility of data from established approaches	Remote sensing data, including the resolution of satellite imagery, are rapidly improving, improving the availability and accuracy of maps of, for example, ecosystem extent, threatening processes (e.g. deforestation and infrastructure) and structure (e.g. biomass and vegetation height).[166, 167]
Types – Availability of new types of data that were previously difficult or impossible to collect	Advances in acoustic monitoring technology and data analysis approaches allow ecosystem condition indicators to be derived from the complexity, and species present, in the recordings.[168] Similarly, advances in eDNA can provide information on the health and composition of communities.[169]
Scale – Large volumes of data available for extensive geographic areas	Biodiversity data platforms, such as eBird[170] and GBIF[171], are enabling compilation of large quantities of data on species' presence and trends over time, for increasingly large parts of the globe, which could inform measures of ecosystem condition.
Cost-effective – Efficiencies in data collection make new data collection and analyses feasible	New or enhanced existing technologies, including UAVs, remote sensing, camera trapping, acoustic monitoring and eDNA can obtain large amounts of data quickly and cost-effectively compared to traditional field methods.
Analytical power – Advances in data processing analysis can generate new insights into ecosystem condition	Machine learning and computer vision are quickly advancing with high potential for improving conservation monitoring. For example, advances in data analysis are allowing the automated detection of species' presence[172], or near real-time monitoring of threatening processes and condition.[173]

166 Curnick, D.J. et al. (2022) SmallSats: a new technological frontier in ecology and conservation? Remote Sensing in Ecology and Conservation 8: 139–150.

167 LaRue, M. et al. (2022) High-resolution satellite imagery meets the challenge of monitoring remote marine protected areas in the Antarctic and beyond. Conservation Letters 15: e12884.

168 Alcocer, I. et al. (2022) Acoustic indices as proxies for biodiversity: a meta-analysis. Biological Reviews 97: 2209–2236. Burivalova, Z., et al (2022) Loss of temporal structure of tropical soundscapes with intensifying land use in Borneo. Science of The Total Environment 852: 158268.

169 Beng, K.C. and Corlett, R.T. (2020) Applications of environmental DNA (eDNA) in ecology and conservation: opportunities, challenges and prospects. Biodiversity and Conservation 29: 2089–2121.

170 Available at: https://ebird.org/home.

171 Available at: https://www.gbif.org/.

172 Stowell, D. et al. (2019) Automatic acoustic detection of birds through deep learning: The first Bird Audio Detection challenge. Methods in Ecology and Evolution 10: 368–380.

173 Drakopulos, L. et al. (2023) Making global oceans governance in/visible with Smart Earth: The case of Global Fishing Watch. Environment and Planning E: Nature and Space 6: 1098–1113.

Additional guidance on how to measure species extinction risk

Introduction

This section provides an overview of current species metrics and their potential application to the TNFD LEAP approach. It focuses mainly on extinction risk in the context of Goal A and Target 4 of the Kunming-Montreal Global Biodiversity Framework (GBF), but also briefly outlines relevant species population metrics.

This section:

- Outlines key concepts and frameworks referencing species;
- Provides an overview of the measurement of species at different scales; and
- Outlines future considerations.

Key concepts

Overview of species

Species is a fundamental category for the classification and description of organisms defined in various ways but typically on the basis of reproductive capacity; i.e. the members of a species can reproduce with each other to produce fertile offspring but cannot do so with individuals outside the species.[174]

Approximately 1.6 million to 2 million species have been described, but this represents only a small fraction of the world's total species diversity[175, 176, 177], with estimates suggesting there may be around 10 million species on Earth.[178] The world's diversity of living organisms is dominated by insects in terms of number of species,[179] by plants in terms of biomass, and by bacteria in terms of cumulative evolutionary history and metabolic innovations.[180]

Overview of species extinction risk

A species becomes globally extinct when it ceases to exist. For an individual species, extinction is usually a gradual process where threatening processes cause a species to decline over time in number and/or its area of occupancy. As a result, the species' susceptibility to environmental shocks or demographic hazards increases. A species may reach a point where it is still present but can no longer replenish itself, which is often referred to as functional extinction.

Human pressures on the environment, through the five drivers on nature change, are placing species under threat and have greatly increased the extinction rate above the geological background rate. Presently, one million species are estimated to be threatened with extinction[181] and current trends signal an imminent 'sixth mass extinction'.[182, 183]

In terrestrial ecosystems, land-use change, leading to habitat loss and degradation, and resource use are the largest threats to species' populations.[184] In ocean environments, direct exploitation of species, such as resource use through fisheries and bycatch, pollution and climate change are the dominant threatening

174 Levin, S. A. ed. (2009) The Princeton Guide to Ecology (Princeton, NJ: Princeton University Press).

175 Díaz, S. and Malhi, Y. (2022) Biodiversity: Concepts, Patterns, Trends and Perspectives. Annual Review of Environment and Resources, 47(1), 31–63.

176 Ruggiero, M. A. et al. (2015a) A Higher Level Classification of All Living Organisms. PLOS ONE, 10(4), e0119248.

177 Ruggiero, M. A. et al. (2015b) Correction: A Higher Level Classification of All Living Organisms. PLOS ONE, 10(6), e0130114.

178 Curnick, D.J. et al. (2022) SmallSats: a new technological frontier in ecology and conservation?

179 Stork, N. (2018) How Many Species of Insects and Other Terrestrial Arthropods Are There on Earth? Annual Review of Entomology, 63, 31-45.

180 Díaz, S. and Malhi, Y. (2022) Biodiversity: Concepts, Patterns, Trends and Perspectives. Annual Review of Environment and Resources, 47(1), 31–63.

181 Díaz, S. et al. (2019) Pervasive human-driven decline of life on Earth points to the need for transformative change.

182 Barnosky, A. D. et al. (2011) Has the Earth's sixth mass extinction already arrived?

183 Curnick, D.J. et al. (2022) SmallSats: a new technological frontier in ecology and conservation?

184 Jaureguiberry, P. et al. (2022) The direct drivers of recent global anthropogenic biodiversity loss.

pathways. In freshwater ecosystems, pollution is a particularly significant threat, often driven by land-based activities such as agriculture and/or industrial waste and changing use of freshwater (e.g. for irrigation or hydropower) is also a key driver.[185, 186]

Global extinction of a species is irreversible. However, global extinctions are typically preceded by local extinction of species from sites, regions or countries.[187, 188]

The Red List: A global standard for assessing species' extinction risk

The IUCN Red List is the global standard for assessing species' extinction risk. Species are assessed on a scale from Least Concern to Critically Endangered and can also be classified as Extinct in the Wild, Extinct or Data Deficient.

Red List assessment is based on a set of detailed criteria,[189, 190] related to five categories that contribute to elevated extinction risk:

1. Population reduction;
2. Restricted geographic range;
3. Small population size and decline;
4. Very small or restricted population; and
5. Quantitative analysis.

Kunming-Montreal Global Biodiversity Framework

The Convention on Biological Diversity recognises biodiversity as the variation within species, between species and of ecosystems.[191] In line with this, the Kunming-Montreal Global Biodiversity Framework (GBF) sets goals for ecosystems, species and genetic diversity within species.[192]

The species element of **Goal A** is that:

> "Human induced extinction of known threatened species is halted, and, by 2050, the extinction rate and risk of all species are reduced tenfold and the abundance of native wild species is increased to healthy and resilient levels."

Target 4 focuses on species and calls for *"urgent management actions to halt human induced extinction of known threatened species and for the recovery and conservation of species, in particular threatened species, to significantly reduce extinction risk."*

This target reflects the importance of focusing on species, and particularly reducing extinction risk, as a key component of halting and reversing biodiversity loss. Species form a part of ecosystems, and restoring and conserving ecosystems will benefit species. However, actions and measures focused only on ecosystems will be only partly effective in halting species extinctions and enabling species recovery. To meet Target 4, actions need to be directed at the most important places and pressures to reduce extinction risk and actions tailored to particular species' circumstances will often be needed to deliver effective positive outcomes.

Targets 5 and 6 also focus on species, but in relation to addressing pressures from harvesting and invasive alien species, as well as reducing risks of pathogen spill over.

Relevance for business

An organisation's dependencies and impacts on species can generate both transition and physical risks, as well as opportunities.

185 Dudgeon, D. (2019) Multiple threats imperil freshwater biodiversity in the Anthropocene.

186 Rosselló-Mora, R. and Amann, R. (2001) The species concept for prokaryotes.

187 Kempel, A. et al. (2020) Nationwide revisitation reveals thousands of local extinctions across the ranges of 713 threatened and rare plant species.

188 Curnick, D.J. et al. (2022) SmallSats: a new technological frontier in ecology and conservation?

189 IUCN Red List (2012) IUCN Red List Categories and Criteria (version 3.1) (Second edition).

190 Rodríguez, J. P. et al. (2015) A practical guide to the application of the IUCN Red List of Ecosystems criteria.

191 Convention on Biological Diversity (1992) Convention on Biological Diversity.

192 Convention on Biological Diversity (CBD) (2022) Kunming-Montreal Global Biodiversity Framework.

Transition risks: Organisations have a responsibility to contribute towards the achievement of Target 4 and Goal A, as part of a whole society approach, by reducing business impacts on threatened species and pursuing opportunities to improve their status. Countries will be setting national targets for priority species in revised National Biodiversity Strategies and Action Plans. Targets and concern for species will be reflected, increasingly, in regulatory requirements for reporting and action.

There is strong public interest in many wild species, particularly, but not only for, so-called charismatic species, and public expectations for species conservation are high in many parts of the world. This creates reputational, market, policy and liability risks for organisations that engage in activities that appear to be damaging particular species.

Physical risks: Species extinctions increase the risks of ecosystem deterioration and collapse, creating physical risks for businesses. Certain species have important roles in ecosystem processes and the conservation of these species, which are often also threatened, is key to maintain functioning ecosystems and sustain the ecosystem services they supply. The contribution to ecosystem collapse also has the potential to create **systemic risks**.

Opportunities: Organisations may have opportunities to make interventions that contribute to reducing species extinction risk, and to improving the status of particular species. These could be either through addressing their own impacts or as additional conservation actions. Such actions generate potential business benefits, e.g. through positive profile and publicity, staff engagement or operational cost savings.

Species metrics within the TNFD framework

The TNFD identifies species metrics, for population size or extinction risk, as being complementary to ecosystem metrics for assessing changes to the state of nature. Since species form just one part of ecosystems, ecosystem metrics are often seen as more fully encompassing of the state of nature than species metrics. However, there are many situations where ecosystem metrics alone will be inadequate and the measurement of changes to species population size/ extinction risk will be necessary to identify and manage nature-related dependencies, impacts, risks and opportunities.

Examples of industries where species metrics may be required as primary metrics include wind energy (fatalities and displacement to certain species caused by wind turbines), transmission and distribution lines (fatalities caused by collisions and electrocutions), hydropower (barriers to migration for fish populations), fisheries (harvesting of target fish and bycatch) and selective logging (harvesting of target tree species). In such cases, the primary impacts, and consequent risks and opportunities, relate to particular species, while ecosystem condition may or may not be affected.

At present, global information on species' status and threats is better developed than for ecosystems. The IUCN Red List of Species is long established, regularly updated, includes rich contextual datasets and covers an increasing number of taxonomic groups fully at a global level. The IUCN Red List of Ecosystems, though rapidly advancing, remains a work in progress. This means that it is practical for organisations to apply species metrics for elements in LEAP, such as screening locations for high biodiversity importance at a site level.

Examples of how species-focused metrics can support the LEAP approach are outlined in Table 36. Note that certain metrics based on species richness and abundance are used primarily to measure ecosystem composition as an indicator of ecosystem condition and therefore feature in both the 'species' and 'ecosystem' categories (e.g. Mean Species Abundance and the Biodiversity Intactness Index).

Table 36: Examples of potential application of species-focused metrics in phases of the LEAP approach.

Locate	Evaluate	Assess	Prepare
***L4** – For our organisation's activities in moderate and high dependency and impact value chains and sectors, which of these are in ecologically sensitive locations? And which of our direct operations are in these sensitive locations?* Use a range-rarity metric, such as STAR	***E3:** 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?* Use BICS for priority species or range-rarity metrics, such as STAR	***A2** – What existing risk and opportunity management processes and elements are we already applying?* *How can risk and opportunity management processes and associated elements (e.g. risk taxonomy, risk inventory, risk appetite) be adapted?* Understand whether additional management practices could reduce species-related risks or enhance opportunities (e.g. using STAR) Understand which management practices are already reducing species-related risks (e.g. using Global Extinction Probabilities with Potentially Disappeared Fraction) ***A3** – Which risks and opportunities should be prioritised?* Understand the significance of impacts and dependencies on species to risks and opportunities to the organisation using population metrics for priority species	***P1** – What risk management, strategy and resource allocation decisions should be made as a result of this analysis?* Cost-benefit analysis of different strategic and resource allocation decisions (e.g. options for threat abatement or restoration based on STAR, or relative positive or negative impacts from land-use change using Persistence Score) ***P2** – How will we set targets and define and measure progress?* Supported by calibrated and realised STAR ***P3** – What will we disclose in line with the TNFD recommended disclosures?* Use population metrics or BICs for priority species

Species metrics within other frameworks

Organisations complying with other frameworks, such as the European Union's Corporate Sustainability Reporting Directive (CSRD), European Sustainability Reporting Standard (ESRS) E4 Biodiversity and Ecosystems, and the Science Based Targets Network (SBTN) will also need to use species metrics. An organisation following the ESRS E4[193] standards will need to disclose whether it has operations that affect threatened species, and if it has material impacts on species, disclose the metrics considered relevant.

An organisation following the SBTN recommendations[194] will need to include any species listed as threatened by IUCN or CITES threatened species in the scope of their assessment, and submit the species name, sourcing location and sourcing quantities of those species in Step 1. Organisations are required to use a metric on the state of biodiversity in their Step 2 prioritisation. In special cases, they may be required to use both an ecosystem and species biodiversity metric in their analysis. Organisations are always recommended to use complementary ecosystem and species-level biodiversity metrics to capture different aspects of nature.

Measurement of species extinction risk

A Red List Index of extinction risk that shows changes over time can be calculated for taxonomic groups that are fully assessed on the Red List[195], or through a sampled approach for other groups.[196,197] It can be applied globally or to national or regional Red Lists.

However, shifts between Red List categories depend on a formal assessment process that takes time to process information. The Red List Index is therefore not sensitive to small shifts in species extinction risk. It also is only suitable to apply at the geographic scale of Red List assessments (usually national, regional or global) and on relatively long timescales (five years or more). This means that the Red List Index is not a practical metric for business application in isolation and organisations will also need to draw on other species extinction risk metrics.

These metrics differ in their detailed methodologies, accessibility and stage of maturity. However, they are all closely related conceptually and mathematically.[198] Choosing which one to use will depend on requirements and practicalities. An overview of relevant metrics is provided in Table 37.

193 Commission Delegated Regulation supplementing Directive 2013/34/EU of the European Parliament and of the Council as regards sustainability reporting standards (2023).

194 SBTN (2023) SBTN Technical Guidance Step 1 and 2.

195 Butchart, S. H. M. et al. (2005) Using Red List Indices to measure progress towards the 2010 target and beyond; Butchart, S. H. M. et al. (2007) Improvements to the Red List Index. PLoS ONE, 2(1).

196 Henriques, S. et al. (2020) Accelerating the monitoring of global biodiversity: Revisiting the sampled approach to generating Red List Indices. Conservation Letters, 13(3).

197 Henriques, S. et al. (2020) Accelerating the monitoring of global biodiversity: Revisiting the sampled approach to generating Red List Indices. Conservation Letters, 13(3).

198 Rossberg, A.G. (2022) Quantifying Biodiversity Impact. Relations amongst local and global metrics, why they matter, and how to offset impacts. Technical report, Queen Mary University of London; Goedkoop, M. et al. (2022) Bridging the Gap Between Biodiversity Footprint Metrics and Biodiversity State Indicator Metrics. Understanding the purposes and relationships between biodiversity metrics with a special focus on the Living Planet Index and PDF-based footprinting metrics. White paper, PRé Sustainability.

Table 37: Summary of extinction risk metrics potentially relevant for the LEAP approach

Metric	What does it do?	Scope
Species Threat Abatement and Restoration (STAR)	Uses IUCN Red List data, estimates a location's potential to contribute to reducing global species extinction risk through restoration or abating relevant threats.	Global data layer available for business use through the Integrated Biodiversity Assessment Tool (payment required), but restricted to amphibians, birds and mammals. Marine and freshwater global layers, and inclusion of other terrestrial groups, in development, together with guidance for ground-truthing estimates and measuring outcomes.
Potentially Disappeared Fraction (PDF) and Global Extinction Probability (GEP)	PDF is measure of local extinction, presented as the mean change in species richness, relative to a local reference site, within a known area and time frame. GEP is a scaling factor that adjusts the PDF estimates of localised impacts to estimate global extinction risk. It uses species range sizes, global status on the Red List and species richness to indicate the extent that localised impacts may contribute to global species extinction risk.	PDF is widely used in Life Cycle Assessment (LCA) as an ecosystem condition metric. GEP covers all realms and a wide range of taxa and is designed to interface with LCAs.
Persistence Score (PS)	Uses species-specific habitat suitability models to link land-use changes with changes in the likelihood that species populations will persist (i.e. not become extinct), based on maps of current Area of Habitat compared to historical Area of Habitat, and summed across species.	Explicitly links land-use change to extinction risk (inferred from proportional Area of Habitat reduction). Can be used to prioritise land to conserve and restore, or to assess the relative significance of impacts. Currently limited to terrestrial realm, to land-use change, and to fully assessed species groups with mapped Areas of Habitat (amphibians, birds and mammals).

Metric	What does it do?	Scope
Biodiversity Impact Credits (BIC)	Based on an assessment of how changes in species population size affect long-term extinction risk in relation to environmental stochasticity (abiotic factors and changes in abundance of other species) that create population size fluctuations.	May be particularly applicable for small, well-documented populations.

Going forward

It is already feasible and practical for organisations to measure their contributions to increasing and/or decreasing species extinction risk.

The key advantage of species extinction risk metrics is that they are directly tied to corresponding pressures on biodiversity, which makes it practical to link an organisation's actions, both positive and negative, to changes in biodiversity. This makes them particularly suitable for assessing opportunities and response options.

Over the next one to two years, existing species extinction metrics will cover an increasingly broad range of species groups and become more spatially refined and field-tested. The increased use of new technology for rapid biodiversity data collection, and better data on the climate impacts on species, will speed up the pace of Red List assessments and improve the accuracy of species extinction metrics. Metrics not yet ready for business use are likely to become so, and new metrics and tools may emerge. These anticipated developments are welcome, but the tools exist to start today.

Annex 3: Valuation of dependencies and impacts

Valuation in the TNFD LEAP approach

This annex provides an overview of relevant guidance for corporates in the Natural Capital Protocol on valuation of dependencies and impacts on nature. There are signposts to the Natural Capital Protocol[199] throughout for further details.

Valuation is the process of determining the importance, worth or usefulness of something in a particular context. A valuation exercise can help corporates define the consequences of dependencies and impacts on nature for both business and society, determine the relative significance of associated costs and benefits, and determine the value of these costs and benefits in the given context. Understanding the social, environmental and/or economic context is essential to allow organisations to estimate value meaningfully and correctly interpret results.

Valuation of the costs and benefits arising from your organisation's dependencies and impacts on nature can therefore help assess the relative importance of risks and opportunities to determine which are material for the business. This can help corporates apply risk and opportunity materiality assessment in the LEAP approach (component A4 of the Assess phase).

Table 38 shows the elements of the LEAP approach where valuation is relevant.

Table 38: Incorporation of valuation within the LEAP approach

TNFD LEAP approach component	Relevance of valuation
E3: Measurement of dependencies and impacts	Can include valuation of costs and benefits to business and society (qualitative, quantitative or monetary).
E4: Impact materiality assessment	Valuation can be used to identify and prioritise material impacts.

199 Capitals Coalition (2016) Natural Capital Protocol.

A4: Risk and opportunity materiality assessment	Valuation can help determine the magnitude and prioritise nature-related risks and opportunities. Valuation of impacts on society can be used to help identify and prioritise material financial risks and opportunities that result directly from the societal impacts created by business dependencies and impacts (e.g. through reputational damage or litigation fees).
P3: Reporting	Organisations may report results of valuation exercises in disclosure recommendations Metrics and Targets A and B.

Where there is existing guidance, methods and standards, the TNFD integrates these instead of developing new approaches. For valuation of dependencies and impacts, the TNFD recommends that corporates use the Natural Capital Protocol and its guidance on valuation techniques.

When corporates applying the TNFD framework undertake valuation of dependencies and impacts on nature, the TNFD recommends the use of the Natural Capital Protocol, developed by the Capitals Coalition.

Five steps for valuation of dependencies and impacts

If corporates undertake valuation when applying the TNFD's LEAP approach, they are encouraged to follow five steps:

Step 1 Specify the value perspective (i.e. to business or society). Be as specific as possible. This will affect the valuation method used and the final valuation.

Step 2 Define the consequences of dependencies and impacts on nature (for business and/or society), completed in the *Evaluate phase* of the LEAP approach.

Step 3 Determine the relative significance of associated costs and/or benefits.

Step 4 Select appropriate valuation technique(s).

Step 5 Undertake or commission valuation to contribute to the prioritisation of risks and opportunities in the A4 component of the LEAP approach*: Risk and opportunity materiality assessment.*

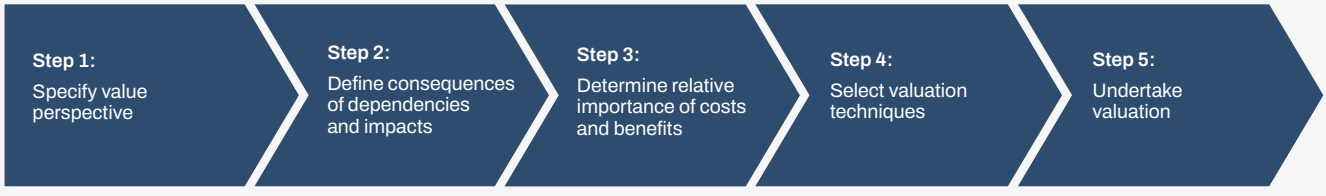
Table 39 provides a summary of the key features (including objectives, outputs and data requirements) of each step of valuation.

Table 39: Key features of each of step of valuation

Valuation Steps	Objective	Output	Data requirements
Step 1	Specifying the value perspective.	Value perspective (value to business/ value to society) selected.	No data requirements
Step 2	Defining consequences of dependencies and impacts for business and society.	List of dependencies and impacts to potentially value.	• Literature review • Expert advice
Step 3	Determining the relative importance of costs and benefits.	List of dependencies and impacts to value.	• Literature review • Expert advice
Step 4	Selecting valuation techniques.	Valuation technique selected.	• Natural Capital Protocol • Expert advice

Step 5	Undertaking valuation.	Value of dependencies and impacts.	• Primary data:
			  • On impact drivers and dependencies
			  • On changes on nature
			• Value factors

Figure 35: Five steps for valuation



Step 1: Specify value perspective

A key step is deciding which value perspectives to consider. Organisations may focus their assessment on the value to business or on the value to society. A complete assessment should include both value perspectives as they are integrally linked. However, there can be benefit in initially considering them separately in order to better understand each perspective.

An example of starting from the business value perspective is focusing on the financial implications to your organisation of water shortages in an area where the organisation has a dependency on water supply. To gain a more complete understanding, organisations should also consider the societal perspective by considering whether, while the organisation may have enough water, this could result in stakeholders having insufficient supplies, which could lead to indirect business risks (e.g. reputational costs or loss of license to operate). Values among different stakeholders will be different.

Table 40 provides additional advice on the selection of an appropriate value perspective.

Table 40: Key considerations when selecting the value perspective

Value perspective	Typically used to
Business value	• Assess how nature-related impacts and/or dependencies affect, positively or negatively, the financial performance of the company (i.e., the bottom line) and thus the value at risk. • Assess company exposure to risks and/or arising from its impacts and/or dependencies. • Minimise company expenses or liabilities and maximise company revenues/receivables. • Communicate to shareholders, budget control staff, management and creditors.
Societal value	• Understand the significance of your nature-related impacts to external stakeholders. • Assess which stakeholders are affected and how much. • Investigate potential nature-related risks and opportunities generated from impacts to society, including license to operate, and reputational issues. • Assess risks and opportunities associated with environmental externalities, either positive or negative. • Communicate to employees and external stakeholders (e.g. regulators, local communities, consumers, non-governmental organisations, suppliers, contractors and clients).
Both value perspectives	• Undertake a comprehensive assessment of nature-related dependencies, impacts, risks and opportunities. Assessing societal values, in particular your future impacts on society, enables all potential business values to be considered as well.

Source: Adapted from Accounting for Sustainability (2015) Natural and Social Capital Accounting: An introduction for finance teams.

Step 2: Define the consequences of impacts and/or dependencies on nature

Based on the measurement of impact drivers and associated changes in the state of nature and provision of ecosystem services in the Evaluate phase of the LEAP approach, organisations should be able to identify the types of consequences for business and society, including both costs and benefits, that may arise.

Organisations should list the potential costs and benefits associated with each relevant nature impact and dependency measured in E3 and E4 of the LEAP approach, including:

a) Consequences of impacts on nature for a business

Assessment of the consequences of impacts on nature for a business provides information to assess the magnitude of risks and opportunities.

Organisations that have dependencies on an ecosystem on which they also have an impact can face physical risks resulting from their own activities. Impacts on a business include any financial costs or benefits that directly affect the bottom line. They can also include less tangible impacts that may affect the bottom line indirectly, such as reputational damage (or benefits), delays in permitting, or the relative ease or difficulty of recruiting or retaining employees. Impacts on business may relate to the cost of production inputs (e.g. the purchase costs of water and timber), as well as the cost and/or benefit of outputs (e.g. increased cost of emission permits or increased revenue from waste recovery and recycling). Environmental market mechanisms, such as biodiversity credits or biodiversity offsets – where companies pay for their use of, or impacts on, nature or are paid for nature enhancements they provide – may create new costs and benefits for a business.

Organisations should also consider potential future impacts on nature. When doing so, organisations should consider the possibility that future consequences for the business may arise indirectly through a company's impacts on society.

b) Consequences of impacts on nature for society

Impacts on society include all costs or benefits accruing to individuals, communities or organisations that are not captured through current market systems and are external to a business. These are often referred to as 'externalities'. Impacts on society arise from changes in nature resulting from the impact drivers of the organisation. Relevant impact drivers may include business inputs (e.g. use of water and timber) and outputs (e.g. solid waste, air emissions and investments in ecological restoration). The potential long-term consequences of impacts on society may also be considered.

For example, in the case of water usage:

- A business activity may result in water withdrawals (the impact driver);
- These water withdrawals may result in reduction in local water reservoirs (the change in natural capital); and
- This may lead to water shortages to local communities (the impacts on society).

The consequences for society of an organisation's impacts on nature may result in nature-related transition risks. For example, authorities may change regulations, consumers may change their preferences and perceptions of a company's reputation may also change.

The assessment of impacts on society (of an organisation's impacts on nature) should therefore be complemented by an assessment of the likelihood of transition risks in a specific context. The likelihood of transition risks for a business may increase if the value of impacts on society is high.

The value of impacts on society will vary depending on the 'receptors' that are affected (e.g. people, buildings, agriculture). The same change in the state of nature may result in different impacts depending on the

location (e.g. the amount of cost to society depends on population density and number of economic activities dependent on water). Organisations will also need to consider how impacts change over time and how they can build up through cumulative effects. In the case of air pollutants, chemicals released into the atmosphere may have significant impacts on society only when they accumulate and breach certain thresholds, which may vary depending on the receptor.

Organisations should also consider trends and scenarios that could influence the valuation. For example, the organisation's use of water may not be an issue today but in 5 or 10 years, as a result of population increase, climate change and other pressures on resources, it may have far greater societal impact. When completing this step, organisations should consider the current, expected and possible future socioeconomic context, including other businesses reliant on a resource or ecosystem service, as well as relevant changes in nature over the assessment period, along with any other contextual variables. Organisations can refer to TNFD guidance on scenario analysis.

c) Consequences of dependencies on nature (for business)

Potential costs and benefits for the business associated with dependencies largely fall into two categories:

- Natural resources, or ecosystem goods, that the organisation relies on (e.g. water and timber), known as 'provisioning services'; and
- Services that nature provides that are often unseen and unpriced (e.g. natural flood, erosion control and aesthetic inspiration), known as 'regulating, maintenance and cultural services'.

Extraction of natural resources may also lead to impacts on society as others depend on those resources, and other ecosystem services that may be affected. These are captured through the consequences of an impact on nature to society, described previously.

Variations in resource availability will affect costs and benefits and may result in organisations needing to identify substitute resources, if available, which may be more expensive. Ecosystems such as forests may decline in size and quality thereby providing reduced benefits, such as flood protection. This may lead to increased flood risk or a need to spend money replacing the flood protection services that these ecosystems once provided.

The consequences of the organisation's dependencies for the business can provide useful information to assess the magnitude of risks and opportunities.

Step 3: Determine the relative significance of associated costs and/or benefits

To identify the most significant impacts and/or dependencies – where organisations should focus their valuation efforts – organisations should assess the relative significance of each associated cost and benefit (referring to the Evaluate phase of LEAP and Steps 04, 05 and 06 of the Natural Capital Protocol). For example, an organisation may identify water use as important in the Evaluate components E1 and E2 and Step 04 of the Natural Capital Protocol, and then identify the associated changes to the state of nature and ecosystem services (e.g. impacts on nearby wetlands and recreational opportunities) in the Evaluate component E3 and Steps 05 and 06 of the Natural Capital Protocol.

In order to complete a valuation exercise that considers risks and opportunities related to consequences for society, it is necessary to complete these steps not only for changes to natural capital that affect the organisation, but also those that affect society.

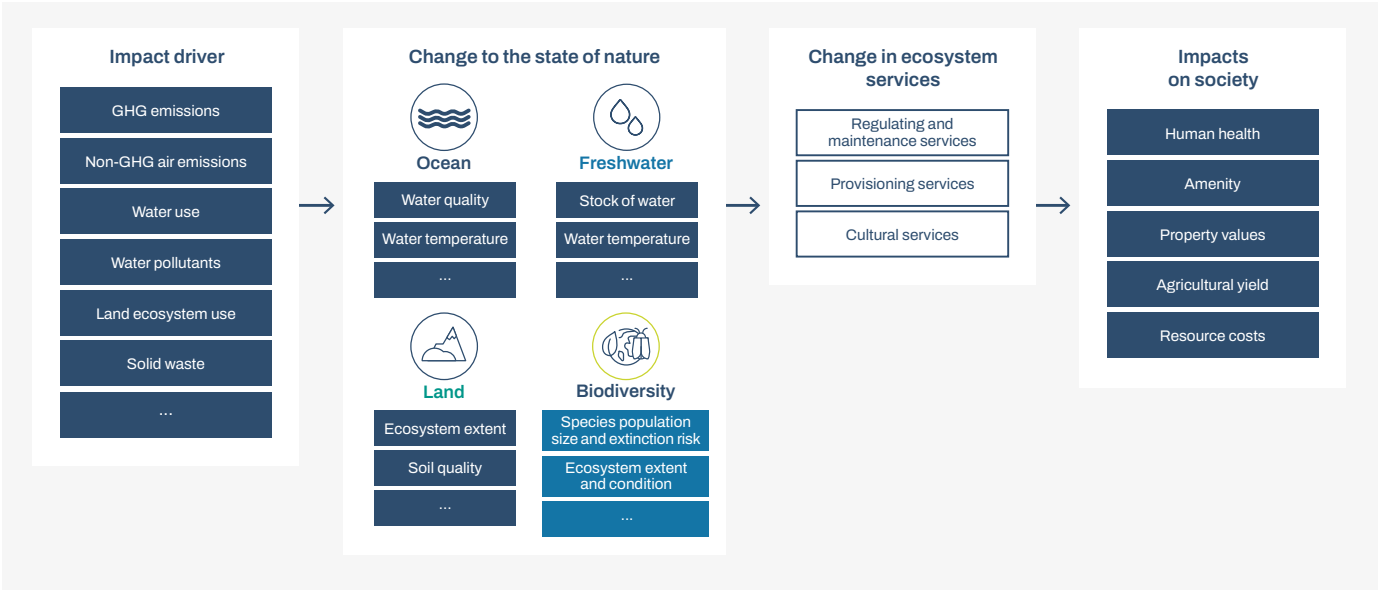
Depending on the scope of an assessment, your organisation may need to consider the extent of the impacts and/or dependencies both now and in the future, the likelihood of market and/or regulatory change, the geographic area over which dependencies and impacts occur, and the relevant time horizon of the assessment.

Box 27: Assessing value to society through impact drivers and impact pathways

The valuation of impacts on society caused by an organisation's impacts on nature is an evolving discipline. However, as with impacts to the business, there is emerging consistency in the use of impact drivers and impact pathways as an approach to assess them.[200] When assessing impact to society, impact pathways include the impact drivers resulting from business activities, changes in the state of nature, and the resulting impacts (as costs and benefits) to society. The impact drivers commonly assessed include greenhouse gas (GHG) emissions, non-GHG air emissions, water use, water pollution, land use and waste.

Figure 36 shows the impact pathways that have been described within the Transparent methodology and guidance. Other relevant impact drivers should also be considered.

Figure 36: Impact pathways as described in the Transparent methodology



200 The EU funded Transparent project has developed impact pathways as part of the Transparent methodology and guidance. Value Balancing Alliance et al. (2023) Standardized Natural Capital Management Accounting: A methodology promoting the integration of nature in business decision making.

Step 4: Select appropriate valuation technique(s)

Valuation is the process of determining the importance, worth or usefulness of something in a particular context. Understanding the social, environmental and/or economic context is essential to allow organisations to estimate value meaningfully and correctly interpret results. Much of the contextual information needed will have been identified in the Locate and Evaluate phases of LEAP and Steps 01 to 06 of the Natural Capital Protocol. It is important to review this on an ongoing basis.

For each cost and/or benefit identified, organisations will need to select an appropriate valuation technique, based on whether they intend to assess values in qualitative, quantitative or monetary terms:

- **Qualitative valuation techniques** are used to identify the scale of costs and/or benefits, expressed through qualitative, non-numerical terms (e.g. high increase in health impacts from emitted pollutants, low decrease in recreation visits);
- **Quantitative valuation techniques** are used to provide numerical data as indicators for costs and/or benefits (e.g. 20% increase of health impacts from emitted pollutants, 0.5% decrease in number of people benefitting from recreation visits); and
- **Monetary valuation techniques** translate quantitative estimates of costs and/or benefits into a single common currency.

The choice of valuation technique depends on:

- Which natural capital dependencies and impacts are being assessed;
- The chosen value perspective (business, societal or both);
- The ultimate objective of an assessment; and
- The time and resources available.

There may be trade-offs between different valuation techniques in terms of their relative precision, time, cost and utility for the desired use in decision-making. All valuation methods have advantages and disadvantages.[201] Generally, a sequential, pragmatic approach that starts by identifying and estimating costs and/or benefits qualitatively, followed by quantification and monetisation, when possible, is recommended.[202] An important valuation limitation can be uncertainty around potential future costs or benefits, particularly in relation to critical ecosystem thresholds and tipping points and potentially irreversible ecosystem changes. A precautionary approach is therefore advisable (for further guidance, see Box 8.1 of the Natural Capital Protocol).

Table 41 outlines a number of commonly used valuation techniques. These techniques may be used to assess the value of marginal changes in natural capital stocks or ecosystem service flows. The same techniques can be used to assess the total (aggregate) value of natural capital stocks, although this is rarely necessary or decision useful and may require additional analysis.

Annex B of the Natural Capital Protocol provides further guidance on using each of the valuation techniques.

201 The Economics of Ecosystems and Biodiversity (2010) The Economics of Ecosystems and Biodiversity: Ecological Economics Foundations.

202 The Economics of Ecosystems and Biodiversity (2011) The Economics of Ecosystems and Biodiversity in National and International Policy Making.

Table 41: Overview of different valuation techniques

Technique	Description
Qualitative valuation	
Opinion surveys*	Surveys designed to represent views through a series of questions e.g. semi-structured interviews.
Deliberative approaches	Facilitated group discussions or focus groups that can involve debate and learning, such as brainstorming sessions/workshops/focus groups/in-depth discussions.
Relative valuation	Use of high/medium/low values to determine relative value of benefits and/or costs in categorical terms, using available data and expert judgment.
Quantitative valuation	
Structured surveys*	Structured surveys or questionnaires can be used to elicit quantitative values, such as one-to-one surveys employing a consistent set of questions including 'closed' response options (e.g. Y/N, scoring, numerical choices) that allow for statistical analysis.
Indicators*	Various indicators can be used to quantify information, such as air emissions, yield of produce per hectare, the risk of species extinction or visitor numbers.
Multi-criteria analysis (MCA) using scoring and weighting	Involves selecting a range of parameters and rating and ranking their value through scoring and weighting, using workshops, available data and/or expert judgment. It is the scoring and weighting that is effectively the valuation technique. Also considered an analytical tool to bring together an assessment of different parameters.

Technique		Description
Monetary valuation		
Market and financial prices		This includes several related approaches, including: • Costs/prices paid for goods and services traded in markets (e.g. timber, carbon, value of water bill or pollution permit); • Other internal/financial information (e.g. estimated financial value of liabilities, assets, receivables); and • Other interpretations of market data (e.g. derived demand functions, opportunity costs, mitigation costs/aversive behavior, cost of illness). Market prices may be adjusted for taxes, subsidies or other distortions.
Production function (change in production)		Empirical modelling approach that relates change in the output of a marketed good or service to a measurable change in natural capital inputs (e.g. the quality or quantity of ecosystem services).
Cost-based approaches	Replacement costs	The cost of replacing natural capital with an artificial substitute (product, infrastructure or technology). May be estimated, observed or modelled.
	Damage costs avoided	The potential costs of property, infrastructure and production losses due to natural capital degradation, treated as a 'saving' or benefit from conserving natural capital. May be estimated, observed or modelled.
Revealed preference (indirect)	Hedonic pricing	Based on the observation that environmental factors are one of the determinants of the market price of certain goods (e.g. the environmental quality of a neighbourhood affects the prices of properties located there). This technique models variations in market prices, controlling for other variables to isolate the environmental factor of interest. The extent to which price varies with this factor reveals its value.
	Travel costs	Based on the observation that environmental and marketed goods and services are often complements (i.e. you need to spend money and valuable time on travel to visit a place where you can enjoy natural features). Measures travel and other costs incurred when visiting a natural asset for recreation or leisure, to elicit a value per visit. Assumes such spending is a minimum expression of the value of an individual's experience (otherwise people would not take the trouble).

Technique		Description
Stated preference	Contingent valuation (CV)	Infers ecosystem values by asking individuals their maximum willingness to pay (or willingness to accept compensation) for a specified change in the relevant non-market good or service from natural capital.
	Choice experiments (CE)	Individuals are presented with alternative goods/options with different characteristics (i.e. various attributes or levels, such as distance, number of species present, or some other aspect of natural capital), as well as different prices. They are asked to choose their preferred option, from which the value for the relevant non-market good or service from natural capital may be inferred.
Value Transfer		
Value transfer/benefits transfer		Values an impact driver in one context based on valuation evidence (identified using one or more of the above techniques) determined in another context. Specific adjustments should be made to account for differences between the two contexts.

** These approaches can elicit and express values but are not generally considered valuation techniques per se.*

Adapted from World Business Council for Sustainable Development et al. (2011) Guide to Corporate Ecosystem Valuation; World Business Council for Sustainable Development (2013) Business Guide to Water Valuation: An introduction to concepts and techniques; eftec (2010) Valuing Environmental Impacts: Practical Guidelines for the Use of Value Transfer in Policy and Project Appraisal; PwC (2015) Valuing corporate environmental impacts: PwC methodology document.

Box 28: Value transfer

A primary valuation based on detailed information specific to the study site will produce the most accurate results. However, it is frequently not possible due to resource, expertise or time limitations.

A popular valuation shortcut is value transfer, also known as benefits transfer. This involves using the results of previous valuations, rather than collecting primary data for a new analysis. Existing valuations are transferred from other contexts (the study site) to a new context (the assessment site). Values may be transferred spatially across different sites and over time.

Value transfer is an imperfect but sometimes valid alternative to primary valuation.[203] It must be done with care, as most natural capital values are context specific. Significant expertise and applied experience are required to conduct value transfer with confidence and to understand when it is appropriate.

The Natural Capital Protocol provides further guidance on value transfer.

Various factors will influence which valuation techniques are best for your organisation's assessment. As well as identifying which are most appropriate for the chosen scope, organisations will want to take account of data availability, budget and time constraints, the level of stakeholder engagement desired, and the degree of accuracy required for their objective. Qualitative valuation techniques, for example, are good for eliciting contextual detail and intangible values, but do not provide numerical precision, measures of variance within a sample, or results that can be easily compared to financial costs and benefits.

Further detail about each technique to help select the most appropriate technique(s) can be found in the Natural Capital Protocol. Expert input is likely to be needed to identify the most suitable technique(s) in a given context.

All qualitative and quantitative valuation techniques are potentially applicable to the evaluation of all components, i.e. impacts on business, impacts on society and dependencies.

A key issue for all monetary valuations is to avoid double counting. Further guidance on how to avoid double counting can be found in the Natural Capital Protocol (Step 07).

203 Liu, S. et al. (2012) Environmental Benefit Transfers of Ecosystem Service Valuation. In van den Belt, M. and Costanza, R. (eds) Volume 12, 'Ecological Economics of Estuaries and Coasts'. In Wolanski, E. and McLusky, D. S. (eds) Treatise on Estuarine and Coastal Science. Waltham, MA: Academic Press.

Step 5: Undertake or commission valuation

Based on the assessment objective, the information compiled and the valuation techniques selected, organisations can either undertake or commission the relevant valuation for the chosen assessment.

Significant training and applied experience are generally required to apply natural capital valuation techniques with confidence. Further guidance on each of the techniques is provided in Annex B of the Natural Capital Protocol.

Outputs

The outputs of this step should include:

- A completed valuation (whether qualitative, quantitative and/or monetary) of costs and benefits; and
- Documentation of all key assumptions, sources of data, methods used and resulting values.

Box 29: Useful further resources on valuation

Further guidance on valuation and data needed to conduct valuation can be found on the Capitals Coalition website. The Capitals Coalition is the curator of the valuation movement with over 400 organisations at its core and more than 13,000 around the world contributing to the standardisation of natural, social and human capital value accounting.

The Capitals Coalition hosts two key initiatives on valuation approaches and data:

- Value Accounting Network to advance the role of value accounting in decision-making, governance and disclosure. The members of the Value Accounting Network aim to collaborate to harmonise and build consistency in the value accounting space and in how it is applied within organisations. The Network has published a Navigation paper to help users find the right valuation methodology to identify the value created, preserved or eroded; and
- Value Commission brings together over 30 expert commissioners from around the world to drive transparency and accountability across the application and use of value factors[204] by organisations. The Commission aims to co-design and develop a set of clear and transparent global criteria spanning the creation and use of value factors and consolidate existing efforts into an open access Value Database.

204 Value factors translate measurement of the flow of services and disservices that come from natural, social, human, and produced capital into qualitative or monetary value. Value factors are developed based on assessments and studies to measure the flow of services and disservices that come from natural, social, human, and produced capital. By translating the metrics of services and disservices into value factors help provide an essential context for decision-making. The value factors translate metrics into qualitative, quantitative, or monetary value and they are an essential element for organisations to understand the value that they create, preserve, or erode across the capitals.

Annex 4: Risk assessment methods

Heatmapping

Heatmapping is a tool that can be used to help qualitatively summarise potential or actual exposure to nature-related risk and opportunities, revealing whether activities and/or assets potentially materially depend upon or impact nature. Organisations can use heatmaps to help identify sectors with multiple dependencies and impacts rated high or moderate.[205] This can be particularly useful for component L2 of LEAP.

Figure 37 illustrates the outputs from a heatmap, showing an investor's portfolio exposure to a range of nature-related dependencies and impacts across several sectors. It is based on mapping an organisation's financial exposure and assets under management to ENCORE sub-industries, with their corresponding ENCORE impact and dependency ratings, using sector and industry classification system correspondence tables and then producing relevant metrics. While the ENCORE tool is currently widely used by the market, other data sources are also available.[206]

Figure 37: A heatmap helps identify sectors exposed to nature-related risks (illustrative)

	Dependencies		Impacts						
			Land use	Water use	Pollution				Low – High
SASB Sectors	Soil quality	Water quality	Land use	Water use	Air pollution	Solid waste pollution	Soil pollution	Water pollution	AUM (% of total)
1 Agricultural products and tobacco	High	High	High	High	Low	Low	High	High	2%
2 Consumer goods	Low	Low	Low	High	Moderate	Low	Moderate	Moderate	5%
3 Extractives and minerals processing	Low	Moderate	High	High	High	High	Moderate	High	14%
4 Financials	Low	Low	Low	Low	Low	Low	Low	Low	16%
5 Food and beverage (ex. agriculture and tobacco)	Low	Moderate	Low	High	Low	Moderate	Low	Low	11%
6 Health care	Low	High	Low	High	Low	Moderate	High	High	6%
7 Infrastructure (ex. utilities and generators)	Low	High	High	Low	Low	High	Low	Low	2%
8 Renewable resources and alternative energy	Low	High	Low	High	Low	Low	High	High	3%
9 Resource transformation	Low	Low	Low	High	Moderate	High	High	High	6%
10 Services	Low	Low	Low	Moderate	Low	Low	Moderate	High	12%
11 Technology and communications	Low	Low	Low	Low	Low	Low	High	High	15%
12 Transportation	Low	Low	Moderate	High	Moderate	Moderate	High	High	5%
13 Utilities and electricity generators	High	High	High	High	High	High	High	High	3%

AUM: Assets under management

205 Heatmaps may be a particularly useful risk assessment approach for asset classes where detailed data at the financial asset level is difficult or costly to obtain.

206 As referenced in TNFD guidance, some examples of other data sources include: Science Based Targets Network (2023) Materiality Screening Tool; SASB: Materiality Finder; and GRI: Sector Program.

In this illustrative example:

- The utilities and electricity generators sector ranks high across all dependencies and impacts;
- The agricultural products and tobacco sector ranks high across most dependencies and impacts;
- Most sectors rank high or moderate for water use, soil pollution and water pollution impacts;
- The extractives and minerals processing sector has relatively high financial exposure and ranks high or moderate across most dependencies and impacts; and
- The technology and communications sector ranks high on two impacts and has a high share of financial exposure, representing 15% of assets under management in the portfolio.

Heatmapping as an approach comes with the advantage that the required data sources are readily available and straightforward to use. Financial sector reports often already use the publicly available ENCORE tool or the WWF Biodiversity Risk Filter to assign a qualitative rating to each sector for each nature-related category, similar to the SBTN Materiality Matrix, and organisations can adjust qualitative ratings derived from a data source based on the report preparer's relevant factors.[207] Organisations can also incorporate value chain considerations in a heatmap-type assessment instead of focusing exclusively on direct dependencies and impacts.[208]

However, the approach also has some drawbacks:

- The qualitative rating assigned to each category is often agnostic to financial exposure or to the individual companies that make up the portfolio. This reflects potential, rather than actual dependencies, impacts or risks for financial institutions;
- A basic heatmap generally does not consider dependencies and impacts that arise across the value chain of a given sector or sub-sector;
- It is more difficult to account for opportunities as this involves forward-looking assessments of nature-related pools of value and revenue potential. No reports reviewed to date consider nature-related opportunities in the context of a heatmap;
- Published heatmaps are not forward-looking, but usually focused on the present or the short-term future and do not typically involve scenario analysis; and
- Heatmaps represent an aggregated view that does not provide nuances below the sector or sub-sector level, and data sources typically used to produce heatmaps, such as ENCORE, do not yet provide data about unconventional sectors and sub-sectors.

In light of these drawbacks, preparers of heatmaps should consider:

- The relevant level of aggregation;
- Incorporation of location-specific information;
- Incorporation of value chain impacts;
- Dependencies and impacts;
- The rating methodology;
- The balance between comparability and specificity;
- The links between dependencies and impacts, and risks and opportunities; and
- Prioritisation of risks according to financial exposure.

The relevant level of aggregation

Aggregate (either global or sector-level) heatmaps enable rapid screening and comparison across sectors, but disaggregation will likely be required to generate decision-useful insights. For example, a sector is often comprised of multiple sub-sectors that can greatly vary

207 For example, Moody's adjusts the qualitative risk rating assigned to specific categories of risk based on the track record of specific sectors when it comes to risk mitigation.

208 For example, the World Economic Forum (WEF) makes use of an input-output table. World Economic Forum (2020) Nature Risk Rising: Why the Crisis Engulfing Nature Matters for Business and the Economy.

in their nature-related dependencies and impacts. In the SASB classification system, the food and beverage sector includes agricultural products, food retail and restaurants. Report preparers may therefore wish to use sub-sector classifications to generate more specific insights.

Although the standard heatmap is produced at the global level, it is possible to produce a heatmap for a specific region, geography, biome or ecosystem. This could involve applying expert judgement to adjust global-level qualitative risk ratings derived from ENCORE or other data sources, potentially accompanied by additional research related to geography-specific dependencies and impacts.

Incorporation of value chains

The main shortcoming of a basic heatmap is the lack of consideration for the dependencies and impacts that arise across the value chain of a given sector or sub-sector.

Risk ratings derived exclusively from the ENCORE tool currently only account for a sector's direct dependencies and impacts on nature, to the exclusion of dependencies and impacts that arise upstream or downstream. The food and beverage sector, for example, may not be seen as particularly high risk on the heatmap, because its links to the upstream agricultural sector are not accounted for in the rating scores that it is assigned.

As the ENCORE tool provides information only on direct dependencies and impacts on nature of all sectors of the economy, financial institutions need to extract data on the sectors and production processes in their portfolios to screen their potential financed dependencies and impacts. Excluding these could be misleading when assessing the financial sector's nature-related risk, or the risk for other sectors with material dependencies and impacts along the value chain. Collecting information on the financial flows within the portfolio would be a way to gain a greater understanding of onward flows from the finance sector to real economy sectors. Alternatively, modelled or aggregated data could be used as proxies for which sectors/countries finance is flowing to from the finance sector.

ENCORE is being further developed in response to user feedback, which will include the addition of value chain links and integration of quantitative data to underpin the materiality ratings.

Organisations should therefore aim to supplement a heatmap approach with more complex risk assessment approaches that incorporate value chain considerations, such as bespoke risk rating methodologies for upstream or downstream sectors. For example, financial institutions could account for financed dependencies and impacts, and downstream consumer goods companies could account for risks linked to deforestation in the value chain.

Organisations could also approximate downstream risks by combining ratings for upstream sectors that feed into a downstream sector. This can be done using a global multiregional input-output table,[209] such as EXIOBASE.[210] This could be supplemented with regional data specific to individual financial assets, which begins to move from heatmapping to an asset tagging approach.[211]

A simpler option is to look at the dependency and impact ratings assigned to a sector's key supplier industries and devise a methodology to adjust the sector's rating on the heatmap, without the use of trade data. For example, the agricultural products sector is a key supplier for the food and beverage sector. If land use impacts for the agricultural products sector are rated high, the devised methodology might require land use impacts for the food

209 As seen in the World Economic Forum (2020) Nature Risk Rising: Why the Crisis Engulfing Nature Matters for Business and the Economy.

210 EXIOBASE is a global, detailed Multi-Regional Environmentally Extended Supply-Use Table and Input-Output Table.

211 As seen in Banque de France (2021) A "Silent Spring" for the Financial System? Exploring Biodiversity-Related Financial Risks in France.

and beverage sector to have an elevated rating to reflect the impacts in its supply chain.

In all cases, organisations should be transparent about whether and how value chain considerations have been incorporated in the heatmap that they produce.

Range of dependencies and impacts included

Heatmaps are defined by the dependencies and impacts they examine, which is why the selection of relevant dependencies and impacts is key. The TNFD guidance lists specific categories of dependencies and impact drivers, with impacts disaggregated in line with Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) drivers of nature change. These can be used as default categories to structure a heatmap. The TNFD additional guidance by sector and biome can help to select the most potentially material categories in a specific context and allow for more comparability across heatmaps. Data sources such as the ENCORE tool can help report preparers select dependency and impact categories.[212]

The rating methodology

Qualitative ratings assigned can depend on the choice of methodology and underlying data used. The data source most often used for heatmapping is the ENCORE tool, which investor feedback suggests is simple to interpret, publicly available and broadly comparable across sectors. However, the archetypal heatmap output produced with ENCORE lacks transparency about how ratings for dependencies and impacts are derived because it does not reveal the factors considered when assigning a qualitative rating.

For example, according to ENCORE, the impact driver of solid waste includes "volume of waste by classification (i.e. non-hazardous, hazardous and radioactive), by specific material constituents (e.g. lead, plastic), or by disposal method (e.g. landfill, incineration, recycling, specialist processing)". Looking at a heatmap that synthesises only impact materiality ratings, and does not include the justifications for links between production processes and impact drivers available in ENCORE, it is not immediately clear which of these aspects drive a high rating in a given sector, or how the impacts of a high volume of plastic waste should compare to the impacts of a small amount of hazardous waste when the qualitative rating is assigned.

Since ENCORE provides information on potential dependencies and impacts of sectors and production processes and reflects the relationship between these and nature at a global level, it does not capture the specific context of each company within the given sector or using the given production process. Conducting additional research could enable report preparers to tailor ratings to the context of specific companies, countries or regions. An organisation may choose to adjust ENCORE ratings to incorporate more considerations or to create its own ratings. For example, heatmap ratings could potentially represent the degree of dependency/impact, consider the state of nature in a particular geography being assessed, or include the likely level of policy or consumer action in specific impact categories to draw out the risk implications.

Striking a balance between comparability and specificity

A heatmap provides broad comparability across sectors, as well as dependencies and impacts, but this is at the expense of specificity and accuracy. Use of the same qualitative rating scale across dependencies and impacts may obscure the relative importance of each impact and dependency. For example, land use change contributes more to nature loss than pollution,[213] but this would not be conveyed on a heatmap, where both land use and pollution impact drivers may have

212 Capitals Coalition (2016) Natural Capital Protocol also offers long lists of dependencies and impacts.

213 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (2019) Global Assessment Report on Biodiversity and Ecosystem Services.

a high rating for a sector. Heatmaps are a useful first step but should be complemented by additional risk assessment approaches that allow for a more granular and robust assessment.

Prioritising according to financial exposure

Depicting both risk ratings and financial exposure by sector on the heatmap for assets under management can enhance its usefulness at very low cost.

Plotting sectoral or sub-sectoral financial exposure on the heatmap allows organisations to identify rapidly and cross-reference where dependency/impact ratings and sector-level financial exposure may be high and warrant additional investigation. Financial exposure can help determine which sectors merit a deep dive using a more complex risk assessment approach.

Organisations may need to decide whether to prioritise higher-risk sectors with lower financial exposure or lower-risk sectors with higher financial exposure.

Alternatively, reporting organisations could choose to prioritise a specific impact or dependency, such as land use change through deforestation, across multiple sectors, regardless of financial exposure.

Asset tagging

Asset tagging deepens the heatmap method by using data specific to financial or corporate assets to determine the exposure to dependencies and impacts. It assesses the degree to which organisations are exposed to nature-related dependencies and impacts through qualitative, quantitative or location-based metrics. Asset tagging helps identify individual portfolio companies or corporate assets with high impacts or dependencies on nature, which might be associated with nature-related risks.

In the financial sector, this approach is usually applied to a sub-section of a financial institution's portfolio or assets, focusing on areas where nature exposure is expected to be material, such as impacts on forests through deforestation. Compared to a heatmap approach, the asset tagging approach offers the potential to move:

- From the sector level to the physical or financial asset level to provide a more granular and specific understanding of risk; and
- Towards the use of more quantitative data (at the process, product, geography and/or physical asset level), to improve understanding of the magnitude of risk.

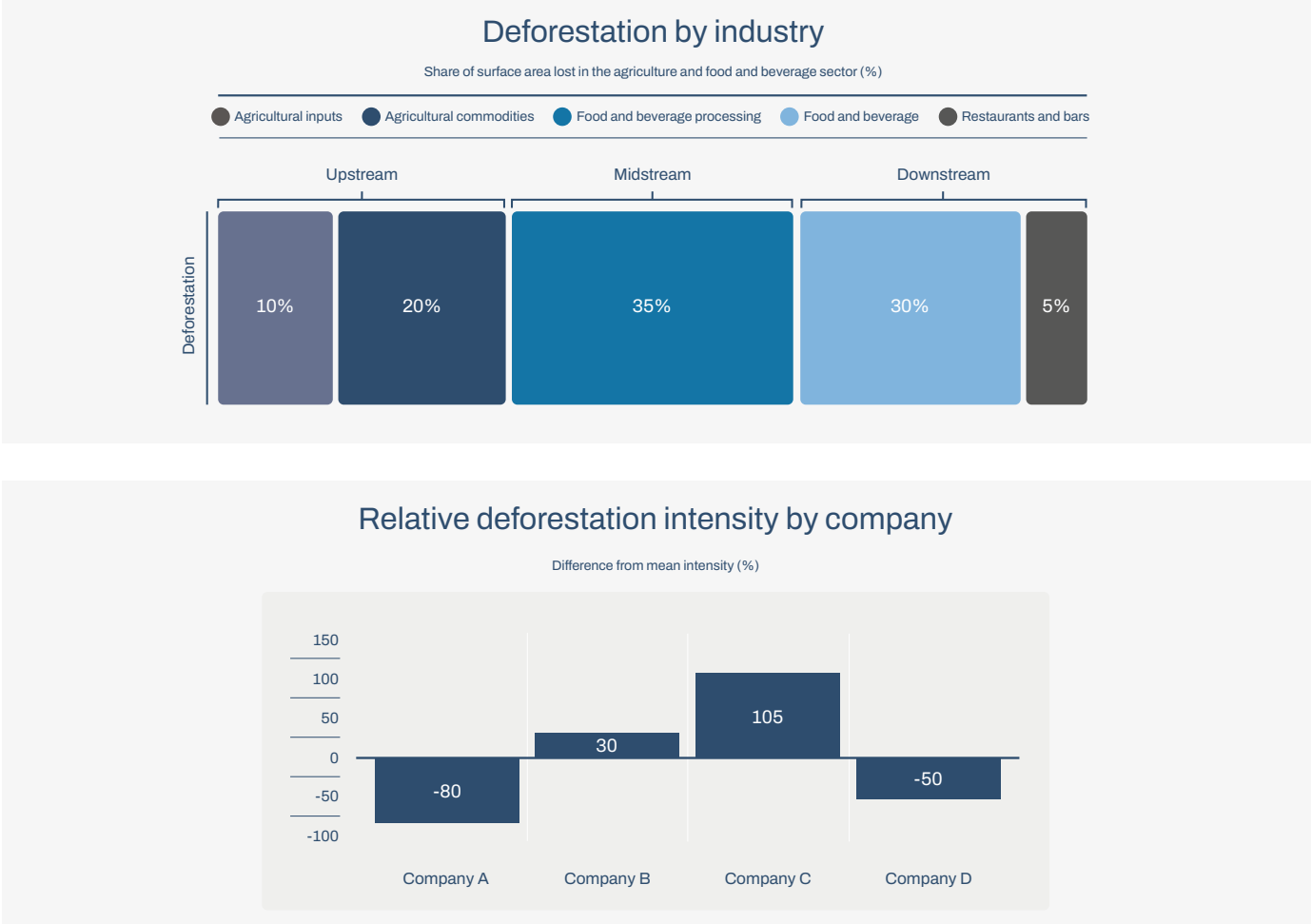
Input data for asset tagging can vary widely and typically falls into two categories:

i. Sector, process, product or location data, detailing a corporate's operations; and
ii. Nature exposure and risk data, which links the above data to nature-related dependencies, impacts or risks qualitatively or quantitively.

The specificity of the analysis and the insights gained will depend on the level of data available.

An illustration of two possible outputs from the asset tagging approach is shown in Figure 38.

Figure 38: Asset tagging determines the magnitude of risk using asset-level data within a particular sector, for a particular dependency or impact, at the portfolio level (top panel) and the company level (bottom panel) (illustrative)



Individual portfolio companies or business units identified as high risk can then be targeted for further engagement. This is the case for both qualitative and quantitative asset tagging:

- **Example of qualitative asset tagging** – A report preparer could use a qualitative score to indicate dependencies and impacts, first mapping each portfolio company to a particular production process (found in the ENCORE tool) and then summarising the scores at the portfolio level.
- **Example of quantitative asset tagging** – Country-level information about commodity-specific deforestation intensity can be mapped against the countries from which a palm oil processing company derives its palm oil. This can provide information on the likelihood of operations contributing to deforestation, which can then be translated into regulatory costs, such as policy-driven fines or reputation-based revenue losses.

The level of flexibility is an advantage of using this risk assessment method. This method can explore both negative and positive impacts to the business: for

example, BMO's company-level revenue alignment with UN Sustainable Development Goals[214] also consider metrics that demonstrate a positive impact on nature or the mitigation of negative impacts on nature.[215] Additionally, it is also possible to consider specific risks, such as reputational risk.[216]

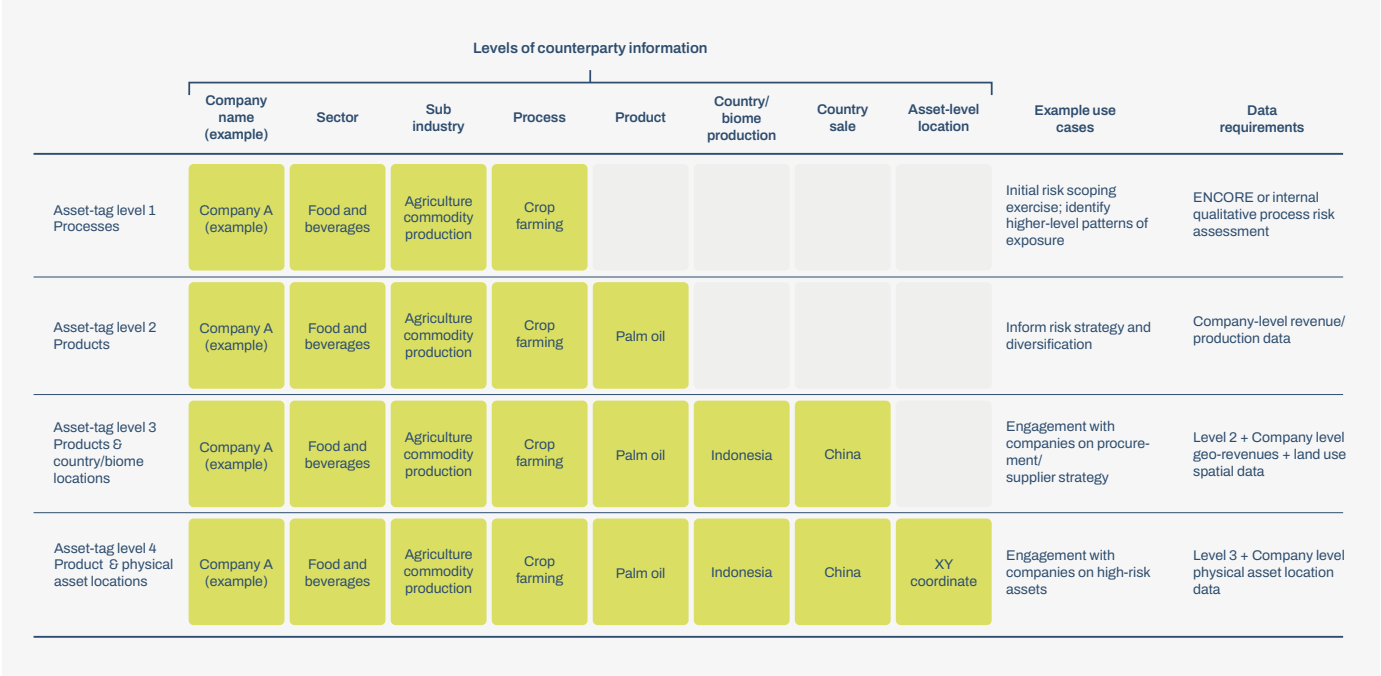
The metrics produced can be quantitative and absolute, such as the total biodiversity footprint in terms of Mean Species Abundance loss; related to revenue, such as the biodiversity footprint per million USD invested; or qualitative (high, medium or low). It is possible to compare metrics against external sources to indicate better or worse performance or measure a metric over time to show improvement.

One main disadvantage of this approach is current data availability, which often limits the specificity of metrics produced. For example, in the financial sector, many reports from banks apply sector averages to portfolio companies to produce relevant metrics, although more granular data could become available as corporate disclosures improve. Finally, the financial implications of nature-related risks are not usually considered when using the asset tagging method.

i. Use cases

There are four levels of asset tagging that your organisation can conduct, building on the heatmap approach with increasing granularity of data, as outlined in Figure 39.

Figure 39: Asset tagging can be conducted using a range of qualitative or quantitative evidence, depending on the report preparer's objectives (illustrative)



214 For example, this includes SDG 2.4, which involves implementing climate resilient and sustainable food production, and SDG 6.4, which involves increasing water-use efficiency to address water scarcity.

215 BMO Global Asset Management (2021) Responsible Global Equity Strategy ESG Profile and Impact Report 2021.

216 De Nederlandsche Bank (2020) Indebted to nature – Exploring biodiversity risks for the Dutch financial sector.

Approaches depicted in Figure 39 increase in depth and data granularity. In particular:

- Level 1 approaches move beyond heatmapping by focusing on processes that are linked to specific dependencies and impacts. These approaches do not typically differentiate well between different companies (especially companies engaged in the same processes) or locations;
- Level 2 approaches go a step further by introducing greater company-level variation to give reporting organisations more insight into risks stemming from different products, such as palm oil;
- Level 3 approaches add location considerations by differentiating in processes and products between producing and selling regions and potentially also incorporating biome-related data, such as data related to forests; and
- Level 4 approaches use physical asset-level data to pinpoint how specific assets interact with nature-related dependencies and impacts, with the possibility of including granular local-level considerations of biomes and specific ecosystems.

While Level 1 approaches may retain the discrete qualitative dependency and impact ratings seen in the Scoping phase with the heatmap approach (high, medium and low), they bring additional value by further disaggregating companies into processes. Deeper approaches help organisations unlock more specific metrics to assess dependencies, impacts and risks.

In terms of use cases, asset tagging can be used to zoom in on sectors or dependencies and impacts identified as potentially material in the context of the heatmap during the Locate phase of LEAP, for example by supporting production and tracking of metrics over time or by helping to identify portfolio companies, assets or operations for which to prioritise engagement.

ii. Considerations for report preparers

In light of the considerations above, report preparers making use of the asset tagging approach should consider:

- Striking a balance between comparability and specificity;
- Assessing challenges in linking assets to locations;
- Obtaining data for public versus private companies;
- Attributing dependencies and impacts across the value chain;
- Choosing appropriate output metrics; and
- Calculating economic and financial value.

Striking a balance between comparability and specificity

When selecting a specific level of the asset tagging approach, report preparers should consider:

- Use of qualitative data (in the Level 1 approach to asset tagging, seen in Figure 39) facilitates comparison, but does not offer much differentiation between portfolio companies. For example, differentiation between two companies who operate in the same sectors and use the same processes is low, limiting the usefulness of this approach in screening portfolio companies;
- Location-relevant and quantitative metrics add several more layers of insight, especially if informing specific topics for engagement, such as ways to reduce deforestation. They are produced by deeper levels of asset tagging, requiring more data and often increasing the complexity of the analysis. Because the insights produced are highly specific to individual portfolio companies, cross-sector comparability could decrease, especially because certain metrics may not apply to all sectors; and
- The option to conduct multiple levels of the asset tagging approach to produce some metrics with more comparability and others with more specificity. In making this decision, organisations should keep

in mind the aims they have defined for their risk assessment.

Assessing challenges in linking assets to locations

Guidance on linking financial or corporate activities and assets to geographic locations, biomes and specific ecosystems is covered in the Locate phase of LEAP, which provides references to relevant mapping tools.

The second layer of data is information on a portfolio company's revenue (split by geography) or a portfolio company's physical asset locations. While access to this data increases the accuracy of insights significantly, there are several issues that may prohibit financial institutions from using this data, such as lack of cross-sectoral data coverage, or patchy data within sectors or within companies.

It is possible to use proxies for location-specific data, but these proxies are often imperfect, such as with the use of country-level data, which enables an estimate of risks across countries. However, this approach does not locate physical assets within countries, which is meaningful information. Corporate report preparers may have a data advantage, since they would be expected to have location data for their operations available internally.

In the financial sector, investment and engagement strategies can be informed by knowledge on which countries or regions present high risks without needing the geographic coordinates of a portfolio company's factory. This is especially the case for transition risks, which often apply on a country-level basis.

Obtaining data for public versus private companies

Asset tagging requires financial institutions to describe accurately their financial assets such as portfolio companies in terms of processes, products and (ideally) location. This information is more easily accessible for publicly listed companies and can be obtained through several third-party data providers. For private companies, data availability is much more heterogeneous, and sourcing this data could be a barrier for financial institutions when assessing nature-related risks for their portfolios.

Engagement with portfolio companies can yield more granular data and nuanced asset tagging results. In the absence of data derived from individual portfolio companies, third-party data, such as a database of company-specific certified farming practices, could be incorporated into an asset tagging exercise.

Obtaining data for nature-related asset tagging is likely to be a resource-intensive process. In addition, the existence of several data providers with different information about a same company may require report preparers to make an assumed choice of data provider.

Attributing dependencies and impacts across the value chain

Asset tagging is more straightforward for upstream sectors because it is often sufficient to look at direct dependencies and impacts, while comprehensive accounting of dependencies and impacts for downstream sectors would ideally include value chain considerations, leading to an additional layer of complexity. This could entail:

1. Defining the value chain;
2. Assessing dependencies and impacts at each stage of the value chain; and
3. Determining a methodology to attribute some proportion of these dependencies and impacts to the downstream company of interest.

Conceptually, this is analogous to attributing Scope 3 emissions in the climate space.

Choosing appropriate output metrics

The aims of the risk assessment should inform the selection of metrics, which should be selected based on prior assessments indicating the materiality of specific dependencies and impacts, and the organisation's priorities. Data availability may also be a factor.

Simpler approaches to asset tagging that omit location data are more straightforward to implement, but limit understanding of nature-related risk exposure to global metrics. Approaches that incorporate location data introduce differences by geography but require more sophisticated assessment procedures. Quantifying the impacts or dependencies associated with these assets requires additional data or layers of assumptions to produce metrics, such as hectares deforested per unit of revenue. Because this is a more resource- and data-intensive process, report preparers may need to prioritise a small number of quantitative indicators to conduct this exercise in depth for part of a portfolio. These types of metrics can be tracked over time, and they are necessary inputs into the scenario-based risk assessment approach to assessing risk.

It is also possible to conduct scenario analysis as part of asset tagging to produce forward-looking metrics. An example of this is seen in the report produced by the DNB, which uses location data to determine financial exposure to companies active in protected areas, under different scenarios of protected areas expansion.[217]

Calculating economic and financial value

Translating metrics derived from an asset tagging exercise into financial metrics requires additional layers of data. For example, knowing the share of assets near protected areas gives an indicative sense of risk level, but this indicator cannot be translated into a financial implication without applying additional assumptions about how this location might affect costs and revenues. This requires seeking out additional information on, for example, the cost of relocation.

Financial impacts may also depend on market dynamics, so that company value can be affected by whether firms can pass costs through the value chain, either upstream to consumers or downstream – wheat producers could pass the costs of higher input prices to food companies who produce bread, for example. Inclusion of these types of market dynamics may require reporters to develop market-specific assumptions and modelling.

Presenting total financial implications as ranges instead of point estimates can be equally informative and advisable given uncertainties.

Scenario-based risk assessment method

i. Introduction to the method

A scenario-based risk assessment method builds upon the heatmapping and asset tagging methods. It translates exposure to nature-related risks into financial implications for organisations.

Conducting this approach requires several additional inputs, such as:

i. Economic and financial costs of nature-related risks;
ii. Modelling of changes in dependencies and impacts to allow conversion to, and estimation of, changes in costs and revenues; and
iii. Scenario analysis, including how drivers of physical and transition risk could impact transmission channels through which costs and revenues could be affected.

Illustrative outputs from the scenario-based risk assessment approach are shown in Figure 40. The primary metric used in the scenario-based risk assessment method is the expected loss under a given scenario. Loss (or gain) is best expressed in net present value terms for individual companies in a portfolio, which can then be aggregated to the portfolio level. An extension is to express changes in value in other financial metrics, such as equity or loan value. This requires an extra step in the modelling, since equity pricing models and bond pricing models are required. Similarly, extending the analysis to cover specific risk parameters such as changes in probability of default requires an additional layer of modelling to insert net present value changes into risk-based models.

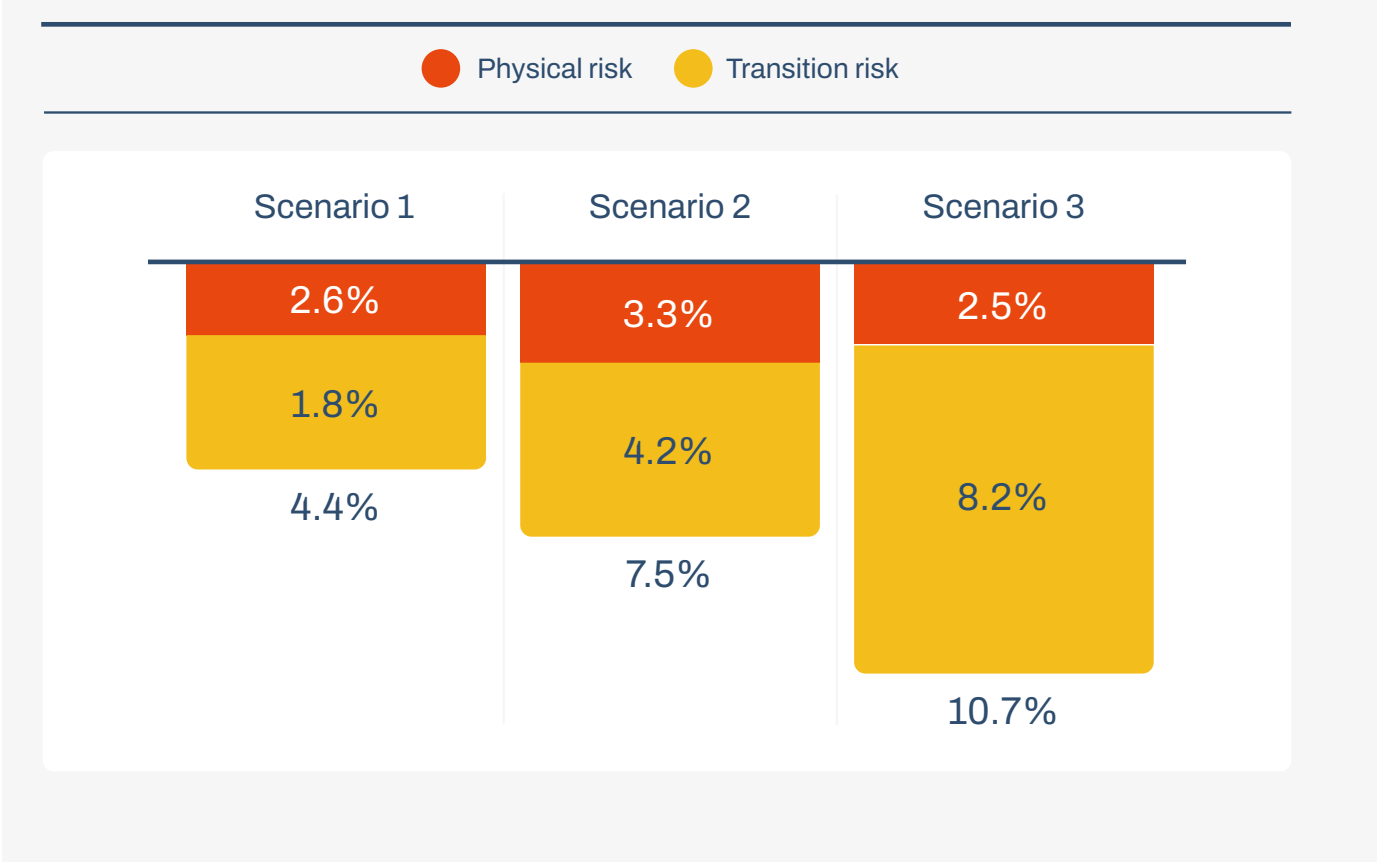
217 De Nederlandsche Bank (2020) Indebted to nature – Exploring biodiversity risks for the Dutch financial sector.

Several additional metrics could further disaggregate beyond an average loss or gain across the portfolio and between different scenarios. These could include:

- Share of loss between physical and transition risks;
- Share of loss between sub-sectors, particularly in sectors where impacts are varied, such as in agriculture and food, where impacts can depend on upstream and downstream exposure, or consumer goods sectors, where product variation can be large; or
- The percentage share of companies in expected loss cohorts.

Company-level metrics can also be of high value for financial institutions. Several metrics useful for investors, as well as corporates, are listed in Annex 1. These include reduction in revenue due to lower demand for products and services or increased costs of natural inputs. These metrics are important for disaggregating scenario-based risk analyses to understand drivers of company or sector value.

Figure 40: The scenario-based risk assessment method helps estimate potential change in company-level value due to nature-related physical and transition risks under different scenarios, aggregated to the portfolio level (illustrative representation using three scenario examples)



Among the main advantages of using this method:

- It provides detail for the estimation of financial effects of nature-related risks;
- It can account for certain types of opportunities. For example, a limited number of reports (Race to Zero, FSD Africa) account for opportunities linked to financial implications, such as cost pass-through or options for risk mitigation that could affect value;
- It allows for forward-looking assessment of risk through the use of scenarios, in line with the TNFD's guidance on scenario analysis; and
- There is the potential to integrate it in internal models and capital adequacy assessments.

The current main disadvantage is that off-the-shelf scenarios are not yet readily available, potentially requiring report preparers to develop their own scenarios. An example of bespoke scenarios can be found with the Inevitable Policy Response (IPR) Forecast Policy Scenario (FPS) + Nature and CISL case study, with Deutsche Bank and UBP. A limited number of reports such as Race to Zero use scenarios that are publicly available. Producing a bespoke scenario may require some familiarity with scenario analysis, which may be a limitation for report preparers.

The TNFD's guidance on scenario analysis starts with a bottom-up approach for corporates to develop bespoke scenarios along a standardised two axis scenario framework. The scenario-based risk assessment approach brings additional detail and technical complexity.

ii. Use cases

As covered in the TNFD's scenario guidance, scenarios can be used as a risk assessment method to assess potential financial loss across different plausible futures – to determine whether investments or loans could change in value over time, for example. It can build on quantitative dependency and impact metrics derived from an asset tagging approach. For example, Figure 40 shows a portfolio-level potential value loss of more than 10% under one scenario, split between physical risk drivers and transition risk drivers (related to regulation/policies and demand shifts). This could suggest the need to rebalance the portfolio to reduce risk or engage with portfolio companies to help them address specific drivers of risks. Corporates can also conduct the scenario-based risk assessment and use it to justify changes in strategy.

The scenario-based risk assessment method can also be used to assess certain types of business-related opportunities or identify the need to think more strategically about nature-related opportunities. A scenario-based risk assessment approach could help determine whether your organisation grows in existing markets if, for example, there is growth in demand for alternative proteins or for products from sustainable product lines.

Dependencies and impacts are linked to financial implications via risk drivers that act on company-level costs and revenues. Financial outcomes under different scenarios can then be compared to a baseline when producing metrics. Scenarios are an integral part of exploring future financial implications and potential uncertainties.

iii. Considerations for report preparers

In light of the considerations above, organisations using the scenario-based risk assessment method should pay attention to the following aspects:

- Whether to build or select an existing scenario;
- Quantifying the portfolio impact at a sector or counterparty level;
- Quantifying physical risks;
- Quantifying transition risks;
- Incorporating value chain considerations; and
- Quantifying mitigating actions.

Quantifying the portfolio impact at a sector or counterparty level

Although scenario-based risk assessment exercises can be undertaken by building up analysis from the company level, many analyses apply sector-level trends to individual companies.

While a sector-level approach can be informative as it allows for the use of data at the country/geography level to derive expected company impacts, it often does not capture company-specific risks and opportunities from nature for two companies operating in the same sector. For example, a bottom-up approach would be needed to determine whether one of these two companies is certified to be deforestation free. Similarly, companies may differ in their ability to employ innovative technologies or techniques that are less harmful to nature, such as regenerative agriculture.

Counterparty scenario-based risk assessment methods require data about company-level products, processes and locations to quantify how changes in costs and revenue translate into company-level financial outcomes. Corporate report preparers have internal access to data about their own operations, but in the case of financial institutions, where such data is not available for private companies or smaller companies, report preparers face a decision about how to proceed. One option could be to exclude such companies from the analysis or conduct the scenario-based risk assessment exercise using proxy company data. An alternative solution would be for financial institutions to collect this data themselves using reports and disclosures issued by portfolio companies or by engaging with portfolio companies directly, or to obtain this data through a third-party data provider.

Quantifying physical risks

Quantifying the financial effects of physical risks through a scenario-based risk assessment method could be largely underestimated due to:

1. **Uncertainties about how physical risks may manifest and evolve over time:** Scientific understanding of nature-related physical risks is still developing, with uncertainties related to natural feedback loops, tipping points and the interaction between complex nature-related processes. One example is the relationship between growing pressures on biodiversity and the risks of new pandemics;[218]
2. **Difficulty in measuring the potential damages arising from these physical risks:** Another area of uncertainty stems from lack of data about how drivers of physical risk could affect costs.[219] For example, assessment of flood risk and damage is a well-developed topic in the realm of insurance, but the same level of understanding does not yet exist for how changes in soil quality affect agricultural productivity;
3. **Short time horizons and discounting:** The use of short risk assessment evaluation time horizons may also obscure the full implications of physical risks. When moving to longer time horizons, the effect of discounting plays an important role in valuation of risk. Risks further into the future receive a lower weight than risks closer to the present. This is a particular issue for assessing the present value impact of physical risks, which tend to have longer time horizons, versus transition risks, which often occur sooner, and is one reason transition risks typically feature as a substantial share. This issue is also a problem when assessing climate-related physical risks;[220] and

218 See for example Organisation for Economic Co-operation and Development (2020) Biodiversity and the economic response to COVID-19: Ensuring a green and resilient recovery; Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (2020) IPBES workshop on biodiversity and pandemics: Workshop report.

219 Which has also been the case for climate-related physical risks, as seen from Network for Greening the Financial System (2020) NGFS Climate Scenarios for central banks and supervisors.

220 Financial Stability Board (2020) The Implications of Climate Change for Financial Stability.

4. A more general possibility for error due to **inadequacies in the way risks are measured or valuation models are set up**. The so-called model risk stemming, for example, from incorrect model specification, incorrect model application or incorrect calibration of model parameters should be part of the category of operational risk and should be updated as part of the Assess phase of LEAP to take into consideration nature-related risks and opportunities.[221]

To better account for the uncertainty in physical and systemic risk estimates, uncertainty could be accounted for through sensitivity analysis around specific physical risks, such as the potential implications of reaching selected tipping points, as seen in one World Bank report.[222]

Assessment of many physical risks can often be improved by data about local-level physical processes and asset location but can significantly increase complexity. Certain physical risks can only be properly assessed by using granular, localised data (such as flood risk)[223] whereas sources of other physical risks such as water shortages can be quantified using less granular data. Increasing granularity may, though, increase complexity for two reasons:

1. Assumptions used for asset valuation would require additional local level variables – in the value of house prices, for example, to ensure granular data is accurate; and
2. The need to run consistent scenarios introduces the challenge of downscaling these to granular spatial scales.

Report preparers could explore whether granular location data will increase insights in proportion to complexity. In some cases, such as for assessing the risk for private infrastructure and mining, additional location data could add significant value. For other physical risks, such as country-level water scarcity, location data may not be needed.

Quantifying transition risks

Transition risks are usually linked to organisation-specific nature-related impacts, but they also reflect an organisation's broader context.

As detailed in this guidance, transition risks are affected by factors beyond nature-related dependencies and impacts, such as (i) policies and the regulatory context, (ii) technological innovation, (iii) changing market dynamics, and (iv) changing consumer preferences and demand.

An asset tagging approach can give an idea of the magnitude of some of these risks (for example, by understanding asset-level impacts on nature, like deforestation, that could become subject to regulation and increase costs).[224] The scenario-based risk assessment method can then help understand the implications of other transition risk drivers with the consideration of macroeconomic consequences and specific transition risk channels.

221 European Central Bank (2007) Model Risk: an Overview of the Issues.

222 World Bank (2021) The Economic Case for Nature: A global earth-economy model to assess development policy pathways.

223 In assessing localised physical risks, it can be difficult to match localised physical risk data with data available on financial exposure, which is typically found at a much coarser spatial scale. Corporates may have an advantage in that they are more likely to have physical asset-level data to use in place of financial exposure data.

224 For example, the EU's recent legislation on deforestation-free supply chains prohibits the sale of deforestation-linked products in the EU market. Companies with deforestation in their supply chains may incur fines, experience due diligence costs, and/or bear the cost of upgrading their operations to eliminate deforestation. Source: Council and Parliament Regulation (EU) 2023/1115 on the making available on the Union market and the export from the Union of certain commodities and products associated with deforestation and forest degradation and repealing Regulation (EU) No 995/2010 (2023).

Risks related to the broader market context may have significant implications for revenues in the longer-term, compared to risks tied to nature-related impacts, which could act in the shorter term. For example, a company may be required to pay a fine for deforestation, which would increase short term costs. Longer term, its market access could also be altered, or its ability to secure mining or forestry concessions could be affected, or market demand could dwindle due to a preference for deforestation-free products. This could translate into longer-term revenue loss or long-term revenue increase if new markets such as alternative proteins are pursued. These types of assumptions could be integrated into the scenario used to assess overall financial impacts.

Incorporating value chain considerations

Fully accounting for the value chain when assessing financial implications for downstream companies requires making assumptions about linkages with nature-related risks affecting upstream companies.

Downstream companies are directly and indirectly exposed to risk. Direct risk is derived from a company's direct operations, while indirect risk affects a company through its value chain. To account for indirect risk, it is first necessary to assess nature-related risks for upstream companies. The structure of the value chain also needs to be understood.

Understanding channels of risk transmission is the next step to consider. These could relate to several measures, including cost pass through supply chain disruption and potential reputational or regulatory exposure if, for example, companies are exposed to environmental controversies due to the actions of their suppliers.

Finally, translating value chain considerations into financial implications for downstream companies means assessing the extent to which upstream financial implications filter down the value chain. In a simple case, if the cost of producing a single agricultural commodity increases, is this cost fully passed through to food manufacturers and to what extent to food retailers?

Quantifying and attributing downstream dependencies, impacts or risks may require developing a view on what happens downstream. For example, a battery producer would need to take a view on how its batteries are disposed of by consumers. A beverage company could face costs linked to legislation requiring changing plastic packaging for non-plastic materials.

Quantifying mitigation actions

The scenario-based risk assessment method becomes more complex if organisations choose to treat the financial or business unit assets they are assessing as dynamic. For investors, this would involve the assumption that portfolio companies take specific actions to mitigate the risks outlined in the scenarios.

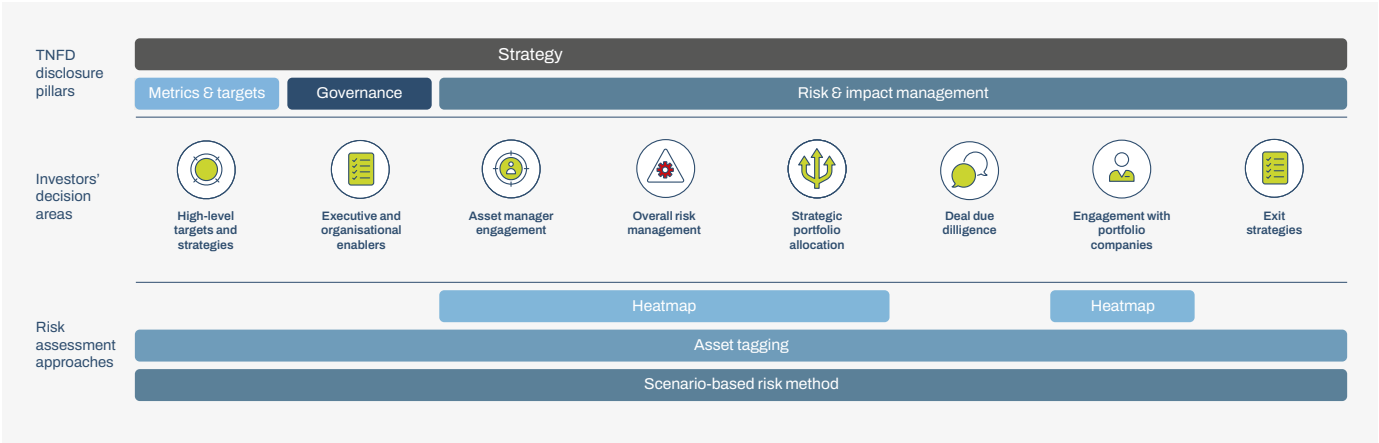
Accounting for mitigation actions may make the method more realistic, but it may be difficult to gauge a company's potential response accurately.

Organisations could choose to assess financial implications assuming portfolio companies do not take any actions to mitigate risks. This decision would need to be communicated in any report since it could significantly determine the size of impact. At the same time, risks and their related financial implications may be overestimated under the assumption that portfolio companies will make no changes. Report preparers employing this approach should be transparent about this shortcoming.

Use of risk assessment methods in decision making

Figure 41 suggests key junctures where nature could inform investors' decisions. Based on investors' experiences with climate risk assessments in recent years, these decision areas have been informed by climate risk and opportunity insights.

Figure 41: Key junctures where nature could inform investors' decisions, based on investors' experiences with climate risk assessments in recent years



High-level targets and strategies: Risk assessments could help determine which dimensions are appropriate and realistic for target setting and inform metrics to monitor progress towards reducing exposure to nature risks. Other strategic action could involve engaging with industry initiatives to make business models evolve collectively.

Executive and organisational enablers: Risk assessment methods are powerful tools to raise awareness throughout the organisation and with board members to explain strategic choices. The exercise could also compel talent management teams to provide staff with trainings on the topic of nature, and if nature-related targets are set, integrate these into portfolio managers' and/or executives' compensation as well.

Asset manager engagement: Risk assessments can also help asset owners prioritise and engage with asset managers on nature-related topics. Asset owners could start conversations with asset managers to encourage establishment of nature-related risk management processes and emphasise the importance of producing nature-related disclosures.

Overall risk management: Risk assessments are critical to enable investors to adjust their risk management structures and procedures. For example, risk assessments could inform the development of exclusionary policies for certain sectors, activities or geographies as well as define metrics against which to track progress. Risk assessment insights can trigger an organisation-wide discussion about risk limits and risk appetite.

Investing in tools or automated process could also help assess nature-related risk more efficiently, potentially leveraging resources cited in the TNFD's Tools Catalogue.

Strategic portfolio allocation: This could entail divestment or diversification from sectors and geographies identified to be high risk or directing capital to new sectors or businesses identified to be making a positive contribution to nature.

Deal due diligence: Similar to what many investors have done for climate, nature-related considerations from scenario-based risk assessments could be incorporated into due diligence processes to refine the asset valuation and inform value creation plans.

Engagement with portfolio companies: Investors are well-positioned to engage with the companies in their portfolios on nature-related issues. The asset tagging and scenario-based risk assessment approaches could help prioritise portfolio companies to engage with on the management of nature-related risks and opportunities

and also help prioritise specific dependencies and impacts for active engagement.

Exit strategies: Nature can be relevant when investors define exit strategies for specific investments. More specifically, nature-related risks can help prioritise companies for early exit, and nature-related opportunities that can be captured by companies could be used as value creation levers to maximise the value of investments pre-exit.

Table 42: Example of risk assessment methods

Organisation	Description
ABN AMRO	Asset tagging: Aggregates direct and value chain biodiversity impact drivers into a single metric, monetised based on the value of ecosystem service loss, using data from the Global Impact Database. Shows improvement in this metric over time.
Allianz	Asset tagging: Assigns qualitative risk score based on location of portfolio companies in relation to IUCN critically endangered species and important bird and biodiversity areas. Also scores companies based on the proportion of revenue derived from activities that impact biodiversity. Also scores companies based on their management of biodiversity risks and exposure to controversies.
AXA	Asset tagging: Quantifies biodiversity footprint across 27 industries, focusing on nature-related impacts to calculate km^2 mean species abundance (MSA) per million EUR invested. Uses the corporate biodiversity footprint (CBF) tool, which also considers companies' value chains.
BMO	Asset tagging: Produces a metric for intensity of water use per unit of revenue and compares this against the same metric for the MSCI World Index. Discusses individual companies with high intensity. Also maps how company-level sources of revenue map to SDG targets.
BNP Paribas	Asset tagging: Quantifies biodiversity footprint of 70% of assets under management using revenue and sector exposure of issuers rather than more granular data. Uses the CBF tool to determine relative biodiversity intensity per capital employed. Categorises this metric qualitatively (high/medium/low) by sector.
CISL (with Deutsche Bank and UBP)	Scenario-based risk assessment method: Develops bespoke scenario related to reduced fertiliser usage to assess valuation of two fertiliser companies. Extrapolates value loss to total equity value across the fertiliser sector. Assumes no mitigating actions are taken. Does not consider opportunities.

Organisation	Description
CISL (with HSBC)	Scenario-based risk assessment method: Assesses credit risk rating for heavy industry companies in an East Asian country with areas of very high water stress, under a scenario of water curtailment. Selection of the sector accounted for its water-related ecosystem service dependencies.
CISL (with NatWest)	Scenario-based risk assessment method: Uses two scenarios to assess profit implications for an average farmer facing land degradation, which is related to credit risk. Assumes no mitigating actions are taken. Does not use specific loan book data.
CISL (with Robeco)	Scenario-based risk assessment method: Uses scenario that assumes severe and longer-lasting yield reductions on degrading land due to extreme weather, focusing on Brazil. Considers effect throughout the food supply chain (from pre-production to consumption). Assesses change in market value of listed companies.
DNB	Multiple approaches: Uses three scenarios of protected areas expansion to assess exposure to companies active protected areas. Also calculates biodiversity footprint based on companies that comprise 80% of the share portfolio. Also considers exposure to companies with environmental controversies and exposure to companies with products and activities related to deforestation (and their reporting practices).
French Central Bank	Multiple approaches: Assesses dependencies at the sector level using ENCORE data in a heatmap format. Also computes sector-level upstream dependency scores by using a weighted average of dependencies in value chain sectors, based on asset-level data. Quantifies biodiversity footprint ($MSA.km^2$) for total securities portfolio of French financial institutions and breaks this down by sector, using data at the sector-region level. Assessed the dependencies and impacts of each issuer by measuring its footprint and aggregating up. Also looks at share of portfolio comprised of companies with different levels of dependency on a different number of ecosystem services.
FSD Africa (with McKinsey)	Scenario-based risk assessment method: Applies five scenarios and a baseline scenario to 2030. Considers both equity and loans. Measures change in asset value and financial performance as well as changes in expected losses for lending. Also considers opportunities in the form of cost pass through.
Impax Asset Management	Asset tagging: Identifies proportion of portfolio company revenue attributed to SDG-aligned activities as part of an asset tagging approach. Also looks at data availability for key impact metrics at the company level. Includes positive metrics in this assessment.

Organisation	Description
ING	Heatmap: Considers both physical and transition risks over a five-year time horizon, assessed qualitatively at the sector level in the form of a heatmap. An image of the heatmap itself is not published.
LFDE	Asset tagging: Assesses biodiversity footprint in MSA in part per billion. Uses sectoral data and ratios to produce company-level footprints. Compares fund-level footprints to an index to show better/worse performance.
Moody's	Heatmap: Creates a heatmap that includes five categories of risk and one overall risk score, assessed qualitatively at the sector level. Risk levels are influenced by sector-wide mitigating factors, but opportunities are not included. Does not mention the TNFD.
MSCI	Asset tagging: Uses MSA to determine locations sensitive to adverse impacts and finds share of index constituents with at least one physical asset in these biodiversity-sensitive areas. Also creates an industry-average biodiversity and land use risk management score, including environmental controversies.
MSCI	Asset tagging: Assesses potential contribution to forest loss based on location of physical assets in WWF Deforestation Fronts. Also considers deforestation-linked commodities in the supply chain. Also looks at company-specific policies related to deforestation.
Netherlands Enterprise Agency	Asset tagging: Produces four biodiversity footprint case studies using pressure-impact model ReCiPe combined with Life Cycle Impact Assessment to determine how environmental pressures contribute to biodiversity impact. Uses EXIOBASE data when it is not possible to collect company-specific environmental data.
Race to Zero	Scenario-based risk assessment method: Applies publicly available integrated climate and nature scenario along with a baseline scenario to estimate change in value of 40 food and agriculture companies to 2030 due to transition risks. Also considers opportunities in the form of market, operational and commercial responses.
Robeco	Heatmap: Does not explicitly produce a heatmap, but uses ENCORE data to assess dependencies and impacts, which are then summarised in a chart that shows financial exposure to sectors that have high dependencies and impacts for specific ecosystem services, demonstrating a heatmap-type approach.

Organisation	Description
Swiss Re	Heatmap: Assesses the state of ecosystem services by geography (per square km of land and at the country level) to create a heatmap. Combines 10 ecosystem services into a single qualitative risk score, underpinned by various quantitative metrics.
WEF (with PwC)	Heatmap: Does not explicitly produce a heatmap but maps direct and supply chain GVA at the industry level to high/medium/low nature dependency scores in a heatmap-type approach. Also qualitatively assesses nature dependency at the regional level.
Waldron et al. (2020)	Scenario-based risk assessment method: Develops multiple scenarios to explore the costs and benefits of implementing a 30×30 target. Estimates financial implications, including changes in sector-specific revenues.
World Bank	Scenario-based risk assessment method: Develops multiple scenarios, also accounting for nature-related tipping points for three ecosystem services and uses them to estimate potential GDP loss to 2030. Also uses scenarios to estimate positive GDP effects of coordinated policies that could benefit biodiversity and development, incorporating climate-related considerations.
World Bank (Brazil)	Multiple approaches: Uses a heatmap-type assessment to identify share of total credit with none to very high dependency on 21 ecosystem services, based on ENCORE data. Determines share of financial assets potentially operating in protected or priority areas. No use of scenarios but recognises that priority areas could become protected areas in the future. Also assesses exposure to companies with environmental controversies. Uses publicly available BAU (where no ecological tipping points are reached) and ecosystem collapse scenarios (that estimate effect on GDP) combined with a GDP to non-performing loan (NPL) ratio to extrapolate potential increase in corporate NPLs.
World Bank (Malaysia)	Multiple approaches: Uses a heatmap-type assessment and ENCORE data to assess both individual dependencies and impacts at the NACE sector level. Also produces a composite sector-level score. Determines proportion of commercial lending to sectors with high or very high dependencies or impacts. Maps location of commercial residential and non-residential purchase lending in relation to protected areas and non-protected Key Biodiversity Areas. Creates 21 physical and seven transition risk scenarios linked to dependencies and impacts identified in a heatmap-type assessment. Determines proportion of total commercial loans outstanding that would be exposed under each scenario (via identified dependencies/impacts).

Annex 5: Links between Kunming-Montreal Global Biodiversity Framework (GBF) targets and areas for targets under TNFD

	GBF target	Target area	Illustrative target for organisations
Reducing threats to biodiversity			
1	Ensure that all areas are under participatory integrated biodiversity inclusive spatial planning and/or effective management processes, addressing land and sea use change, to bring the loss of areas of high biodiversity importance, including ecosystems of high ecological integrity, close to zero by 2030, while respecting the rights of Indigenous Peoples and Local Communities.	Impact driver: Land and sea use change State of nature: Ecosystem extent	Increase share of area interacted with covered by biodiversity-inclusive spatial plans to 100% by 2030. Area of land used for cultivation held at 2020 levels by 2030.
2	Ensure that by 2030 at least 30% of areas of degraded terrestrial, inland water and coastal and marine ecosystems are under effective restoration, in order to enhance biodiversity and ecosystem functions and services, ecological integrity and connectivity.	State of nature: Habitat quality, ecosystem condition	Increase share of degraded ecosystems interacted with that are under effective restoration to 100% by 2030.

	GBF target	Target area	Illustrative target for organisations
3	Ensure and enable that by 2030 at least 30% of terrestrial, inland water and coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem functions and services, are effectively conserved and managed through ecologically representative, well-connected and equitably governed systems of protected areas and other effective area-based conservation measures. Recognising Indigenous and traditional territories, where applicable, and integrated into wider landscapes, seascapes and the ocean, while ensuring that any sustainable use, where appropriate in such areas, is fully consistent with conservation outcomes, recognising and respecting the rights of Indigenous Peoples and Local Communities, including over their traditional territories.	Governance	n/a
4	Ensure urgent management actions to halt human induced extinction of known threatened species and for the recovery and conservation of species, in particular threatened species, to significantly reduce extinction risk, as well as to maintain and restore the genetic diversity within and between populations of native, wild and domesticated species to maintain their adaptive potential, including through in situ and ex situ conservation and sustainable management practices, and effectively manage human-wildlife interactions to minimise human-wildlife conflict for coexistence.	Impact drivers: All State of nature: Species abundance, species extinction risk	100% of land areas interacted with in the direct operations and value chain assessed for the presence of threatened species by 2025, and 100% of those areas that are known to host threatened species are under effective management by 2030 to reduce threats, improve species health and increase species population.

	GBF target	Target area	Illustrative target for organisations
5	Ensure that the use, harvesting and trade of wild species is sustainable, safe and legal, preventing overexploitation, minimising impacts on non-target species and ecosystems, and reducing the risk of pathogen spill-over, applying the ecosystem approach, while respecting and protecting customary sustainable use by Indigenous Peoples and Local Communities.	Impact driver: Resource use	All fish stocks used or within ecosystems interacted with are managed within biologically sustainable levels by 2030. All fish catch certified under an internationally recognised sustainable fisheries scheme by 2030.
6	Eliminate, minimise, reduce and or mitigate the impacts of invasive alien species on biodiversity and ecosystem services by identifying and managing pathways of the introduction of alien species, preventing the introduction and establishment of priority invasive alien species, reducing the rates of introduction and establishment of other known or potential invasive alien species by at least 50%, by 2030, eradicating or controlling invasive alien species especially in priority sites, such as islands.	Impact driver: Invasive species	X% reduction by 2030 relative to 2020 levels in the population of invasive species at site Y, and within the area of influence of that site.
7	Reduce pollution risks and the negative impact of pollution from all sources, by 2030, to levels that are not harmful to biodiversity and ecosystem functions and services, considering cumulative effects, including: reducing excess nutrients lost to the environment by at least half including through more efficient nutrient cycling and use; reducing the overall risk from pesticides and highly hazardous chemicals by at least half including through integrated pest management, based on science, taking into account food security and livelihoods; and also preventing, reducing and working towards eliminating plastic pollution.	Impact driver: Pollution State of nature: Ecosystem condition	Reduce by X% pesticide use per area of cropland in areas interacted with by 2030, relative to 2020 levels.

	GBF target	Target area	Illustrative target for organisations
8	Minimise the impact of climate change and ocean acidification on biodiversity and increase its resilience through mitigation, adaptation and disaster risk reduction actions, including through nature-based solution and/or ecosystem-based approaches, while minimising negative and fostering positive impacts of climate action on biodiversity.	Impact driver: Climate change State of nature: Ecosystem quality	X% reduction in greenhouse gas emissions across all scopes by 2030 relative to 2020.
Meeting people's needs through sustainable use and benefit sharing			
9	Ensure that the management and use of wild species are sustainable, thereby providing social, economic and environmental benefits for people, especially those in vulnerable situations and those most dependent on biodiversity, including through sustainable biodiversity-based activities, products and services that enhance biodiversity, and protecting and encouraging customary sustainable use by Indigenous Peoples and Local Communities.	Impact driver: Resource use Ecosystem service: Provisioning services State of nature: Species abundance	All natural forest areas in direct operations and value chain managed according to internationally recognised, highly credible sustainable forestry certification standards by 2030, including effective sharing of benefits with Indigenous Peoples and Local Communities.

	GBF target	Target area	Illustrative target for organisations
10	Ensure that areas under agriculture, aquaculture, fisheries and forestry are managed sustainably, in particular through the sustainable use of biodiversity, including through a substantial increase of the application of biodiversity friendly practices, such as sustainable intensification, agroecological and other innovative approaches contributing to the resilience and long-term efficiency and productivity of these production systems and to food security, conserving and restoring biodiversity and maintaining nature's contributions to people, including ecosystem functions and services .	Impact driver: Resource use, pollution Ecosystem service: Provisioning services State of nature: Ecosystem condition	All agricultural, aquaculture, fisheries and forestry areas interacted with are managed in line with internationally recognised certification standards by 2030.
11	Restore, maintain and enhance nature's contributions to people, including ecosystem functions and services, such as regulation of air, water and climate, soil health, pollination and reduction of disease risk, as well as protection from natural hazards and disasters, through nature-based solutions and/or ecosystem-based approaches for the benefit of all people and nature.	Impact driver: All Ecosystem service: Regulating services State of nature: Ecosystem extent and condition	All bodies of water interacted with that have environmentally healthy ambient water quality and ecologically sound flow conditions by 2030.
12	Significantly increase the area and quality and connectivity of, access to, and benefits from green and blue spaces in urban and densely populated areas sustainably, by mainstreaming the conservation and sustainable use of biodiversity, and ensure biodiversity-inclusive urban planning, enhancing native biodiversity, ecological connectivity and integrity, and improving human health and well-being and connection to nature and contributing to inclusive and sustainable urbanisation and the provision of ecosystem functions and services.	Ecosystem service: Cultural services State of nature: Ecosystem extent and condition	Share of land area of new urban developments by the organisation that are public green/ blue space increased to X% by 2030 compared to Y% in 2020.

	GBF target	Target area	Illustrative target for organisations
13	Take effective legal, policy, administrative and capacity-building measures at all levels, as appropriate, to ensure the fair and equitable sharing of benefits that arise from the utilisation of genetic resources and from digital sequence information on genetic resources, as well as traditional knowledge associated with genetic resources, and facilitating appropriate access to genetic resources, and by 2030 facilitating a significant increase of the benefits shared, in accordance with applicable international access and benefit-sharing instruments.	Ecosystem services: Provisioning services	Commit USD X million of benefits stemming from the use of genetic resources and or digital sequence information towards conservation in relevant countries by 2030, working with Indigenous Peoples and Local Communities in accordance with access and benefit sharing instruments
Tools and solutions for implementation and mainstreaming			
14	Ensure the full integration of biodiversity and its multiple values into policies, regulations, planning and development processes, poverty eradication strategies, strategic environmental assessments, environmental impact assessments and, as appropriate, national accounting, within and across all levels of government and across all sectors, in particular those with significant impacts on biodiversity, progressively aligning all relevant public and private activities, fiscal and financial flows with the goals and targets of this framework.	n/a	X% of investment portfolio is in activities that support the conservation and restoration of nature by 2030, based on a recognised taxonomy. Reduction of X% in investments in activities that harm nature by 2030.

	GBF target	Target area	Illustrative target for organisations
15	Take legal, administrative or policy measures to encourage and enable business, and in particular to ensure that large and transnational corporates and financial institutions: (a) Regularly monitor, assess, and transparently disclose their risks, dependencies and impacts on biodiversity, including with requirements for all large as well as transnational corporates and financial institutions along their operations, supply and value chains and portfolios; (b) Provide information needed to consumers to promote sustainable consumption patterns; (c) Report on compliance with access and benefit-sharing regulations and measures, as applicable; in order to progressively reduce negative impacts on biodiversity, increase positive impacts, reduce biodiversity-related risks to business and financial institutions, and promote actions to ensure sustainable patterns of production.	n/a	Increase number of disclosures following the TNFD's recommendations from X to full disclosure by 2030.
16	Ensure that people are encouraged and enabled to make sustainable consumption choices including by establishing supportive policy, legislative or regulatory frameworks, improving education and access to relevant and accurate information and alternatives, and by 2030, reduce the global footprint of consumption in an equitable manner, including through halving global food waste, significantly reducing overconsumption and substantially reducing waste generation, in order for all people to live well in harmony with Mother Earth.	Impact drivers: All	Halve food waste in the value chain from 2020 levels by 2030.
17	Establish, strengthen capacity for, and implement in all countries in biosafety measures as set out in Article 8(g) of the Convention on Biological Diversity and measures for the handling of biotechnology and distribution of its benefits as set out in Article 19 of the Convention.	n/a	No target, but wider commitment to full compliance with biosafety rules.
18	Identify by 2025, and eliminate, phase out or reform incentives, including subsidies, harmful for biodiversity, in a proportionate, just, fair, effective and equitable way, while substantially and progressively reducing them by at least US$500 billion per year by 2030, starting with the most harmful incentives, and scale up positive incentives for the conservation and sustainable use of biodiversity.	n/a	100% of direct suppliers moved to new contracts that align incentives with nature protection by 2030.

	GBF target	Target area	Illustrative target for organisations
19	Substantially and progressively increase the level of financial resources from all sources, in an effective, timely and easily accessible manner, including domestic, international, public and private resources, in accordance with Article 20 of the Convention, to implement national biodiversity strategies and action plans, by 2030 mobilising at least US$200 billion per year, including by: (a) Increasing total biodiversity related international financial resources from developed countries, including official development assistance, and from countries that voluntarily assume obligations of developed country Parties, to developing countries, in particular the least developed countries and small island developing States, as well as countries with economies in transition, to at least US$20 billion per year by 2025, and to at least US$30 billion per year by 2030; (b) Significantly increasing domestic resource mobilisation, facilitated by the preparation and implementation of national biodiversity finance plans or similar instruments according to national needs priorities and circumstances; (c) Leveraging private finance, promoting blended finance, implementing strategies for raising new and additional resources, and encouraging the private sector to invest in biodiversity, including through impact funds and other instruments; (d) Stimulating innovative schemes such as payment for ecosystem services, green bonds, biodiversity offsets and credits, benefit-sharing mechanisms, with environmental and social safeguards; (e) Optimising co-benefits and synergies of finance targeting the biodiversity and climate crises; (f) Enhancing the role of collective actions, including by Indigenous Peoples and Local Communities, Mother Earth-centric actions and non-market-based approaches including community based natural resource management and civil society cooperation and solidarity aimed at the conservation of biodiversity; and (g) Enhancing the effectiveness, efficiency and transparency of resource provision and use.	n/a	X% additional finance leverage effect of nature-targeted investment by 2030.

	GBF target	Target area	Illustrative target for organisations
20	Strengthen capacity-building and development, access to and transfer of technology, and promote development of and access to innovation and technical and scientific cooperation, including through South-South, North-South and triangular cooperation, to meet the needs for effective implementation, particularly in developing countries, fostering joint technology development and joint scientific research programmes for the conservation and sustainable use of biodiversity and strengthening scientific research and monitoring capacities, commensurate with the ambition of the goals and targets of the framework.	n/a	No target, but commitment to support for and participation in initiative.
21	Ensure that the best available data, information and knowledge, are accessible to decision makers, practitioners and the public to guide effective and equitable governance, integrated and participatory management of biodiversity, and to strengthen communication, awareness-raising, education, monitoring, research and knowledge management and, also in this context, traditional knowledge, innovations, practices and technologies of Indigenous Peoples and Local Communities should only be accessed with their Free, Prior and Informed Consent, in accordance with national legislation.	n/a	No target, but commitment to make available biodiversity data accessible.
22	Ensure the full, equitable, inclusive, effective and gender-responsive representation and participation in decision-making, and access to justice and information related to biodiversity by Indigenous Peoples and Local Communities, respecting their cultures and their rights over lands, territories, resources and traditional knowledge, as well as by women and girls, children and youth and persons with disabilities and ensure the full protection of environmental human rights defenders.	n/a	100% of stakeholders participating in engagement activities respond that they feel the process was fairly conducted at the end/or close of each project by 2030.
23	Ensure gender equality in the implementation of the framework through a gender-responsive approach where all women and girls have equal opportunity and capacity to contribute to the three objectives of the Convention, including by recognising their equal rights and access to land and natural resources and their full, equitable, meaningful and informed participation and leadership at all levels of action, engagement, policy and decision-making related to biodiversity.	n/a	No target, but commitment to gender equality in implementation of wider strategy.

Annex 6: Abbreviations

AR3T – SBTN's action framework for the mitigation hierarchy (Avoid, Reduce, Regenerate, Restore and Transform)

AZE – Alliance for Zero Extinction. AZE sites are those Key Biodiversity Areas that are in most urgent need of conservation to prevent imminent global extinction.

BAU – Business As Usual

BBOP – Business and Biodiversity Offsets Programme

BCBS – Basil Convention on Banking Supervision

BII – Biodiversity Intactness Index

CBD – UN Convention on Biological Diversity

CDP – Carbon Disclosure Project

CDSB – Climate Disclosure Standards Board

CITES – Convention on International Trade in Endangered Species of Wild Fauna and Flora

COSO – Committee of Sponsoring Organizations of the Treadway Commission

EBSAs – Ecologically or Biologically Significant Marine Areas

EAI – Ecosystem Area Index

ECB – European Central Bank

EHI – Ecosystem Health Index

EII – Ecosystem Integrity Index

ENCORE – Exploring Natural Capital Opportunities, Risks, and Exposure

ErII – Ecoregion Intactness Index

ESRS – European Sustainability Reporting Standards

EU B@B – European Union Biodiversity & Business Platform

F4B – Finance for Biodiversity Initiative

FSB – Financial Stability Board

GBF – Kunming-Montreal Global Biodiversity Framework

GBIF – Global Biodiversity Information Facility

GET – Global Ecosystem Typology

GHG – Greenhouse gas

GICS – Global Industry Classification Standard

GIUM – Global Initiative on Ungulate Migrations

GMAP – Global Map of Environmental and Social Risks in Agro-Commodity Production

HICL – High Impact Commodity List

IAIS – International Association of Insurance Supervisors

IBA – Important Bird and Biodiversity Area

IBAT – Integrated Biodiversity Assessment Tool

ICCA – Indigenous Peoples' and Local Community Conserved Areas and Territories

IFC – International Finance Corporation

IFRS – International Financial Reporting Standards

INVEST – Integrated Valuation of Ecosystem Services and Tradeoffs

IPA – Indigenous Protected Area

IPBES – Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services

IRGC – International Risk Governance Council

ISIC – International Standard Industrial Classification of All Economic Activities

ISO – International Organization for Standardization

ISSB – International Sustainability Standards Board

IUCN – International Union for Conservation of Nature

KBA – Key Biodiversity Area

KYC – Know Your Customer

LCA – Life Cycle Analysis

LEAP – Locate, Evaluate, Assess, Prepare

MSA – Mean Species Abundance

NCFA – Natural Capital Finance Alliance

NGFS – Network for Greening the Financial System

NPL – Non-Performing Loan

OECD – Organisation for Economic Co-operation and Development

OECMs – Other effective area-based conservation measures

PA – Protected Area

PESTLE – Political, Economic, Social, Technological, Legal and Environmental

SASB – Sustainability Accounting Standards Board

SBTi – Science Based Targets initiative

SBTN – Science Based Targets Network

SDG – Sustainable Development Goal

STAR – Species Threat Abatement and Restoration metric

STEEP – Social, Technological, Economical, Environmental and Political

TCFD – Task Force on Climate-related Financial Disclosures

TEEB – The Economics of Ecosystems and Biodiversity

UN – United Nations

UNEP – United Nations Environment Programme

UNEP WCMC – United Nations Environment Programme World Conservation Monitoring Centre

UN SEEA EA – United Nations System of Environmental-Economic Accounting Ecosystem Accounting

WBCSD – World Business Council for Sustainable Development

WDPA – World Database on Protected Areas

WEF – World Economic Forum

WISE – Water Information for Europe

WRI – World Resource Institute

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WWF. Biodiversity Risk Filter. World Wide Fund for Nature.

WWF. Water Risk Filter. World Wide Fund for Nature.

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