

Taskforce on Nature-related Financial Disclosures

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

Version 2.0 October 2026



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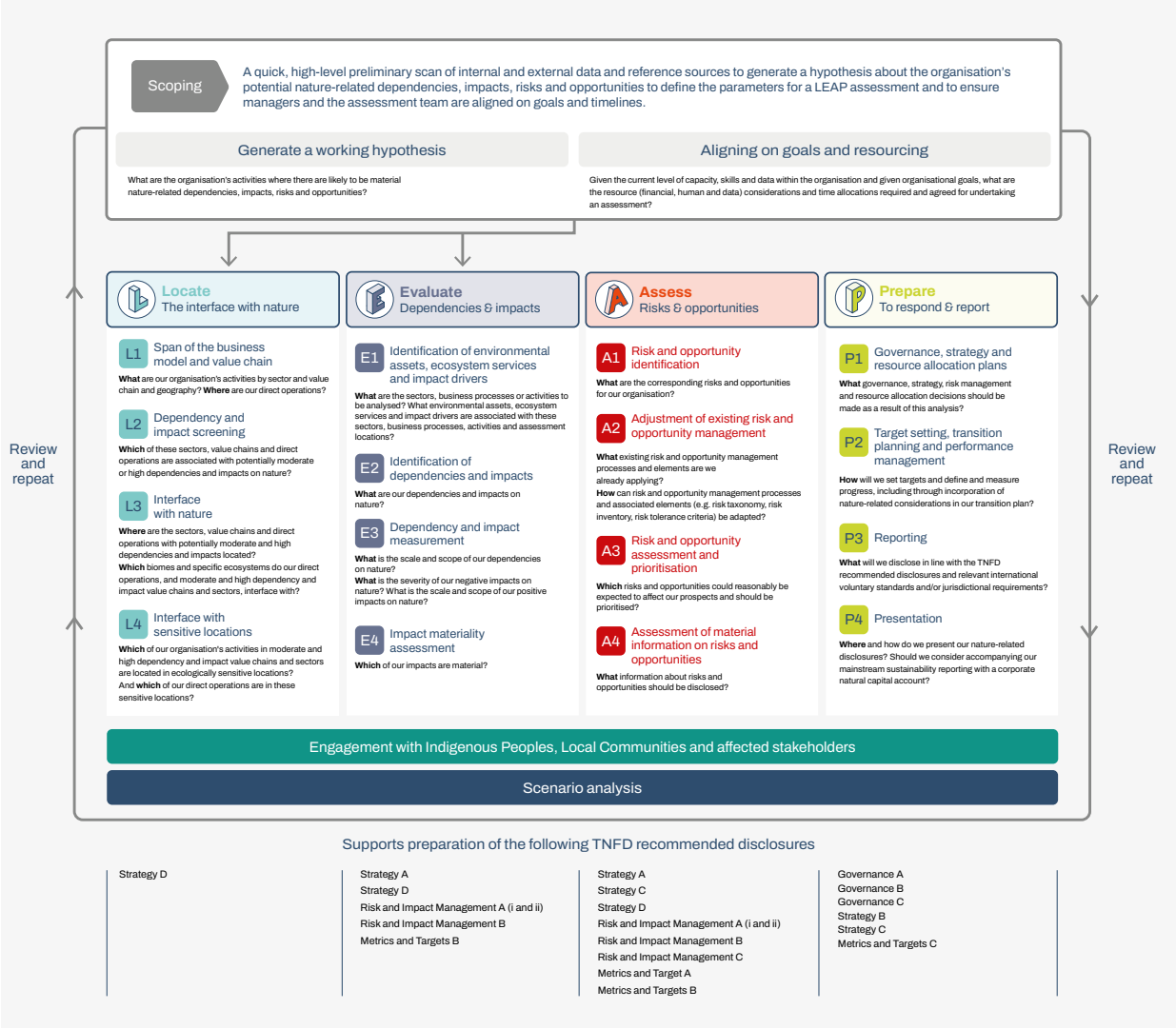
1. Introduction

From the outset of its work, market participants indicated to the Taskforce on Nature-related Financial Disclosures (TNFD) that accessible guidance outlining how to identify, assess and manage nature-related dependencies, impacts, risks and opportunities 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 identification and 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.

LEAP is designed to be used by an internal project team in your organisation and involves four phases: Locate, Evaluate, Assess and Prepare. These enable your organisation to:

- **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.

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). Organisations can use LEAP to identify and assess their nature-related dependencies, impacts, risks and opportunities, and be prepared to determine the information to disclose using the materiality definition of the International Sustainability Standards Board (ISSB) IFRS S1 *General Requirements for Disclosure of Sustainability-related Financial Information* as the baseline. LEAP is also consistent with jurisdictional approaches to materiality, including in China, the European Union and India, as well as the GRI impact materiality approach. It signposts to well-regarded scientific datasets 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.

The organisations that have produced the main frameworks, tools, metrics 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.

Over 300 institutions have pilot tested the LEAP approach, helping to ensure the guidance in this document is anchored in insights from a practitioner's perspective. 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. The Taskforce would like to thank all the organisations that contributed to the development of the LEAP guidance through their expertise, pilot testing and feedback.

The Taskforce has updated this document (v2.0) in October 2026, three years after the original publication of LEAP v1.0 in September 2023. This version includes additional insights and refinements. The v2.0 updates to LEAP include further guidance on:

- State of nature measurement in the TNFD framework, including the land, freshwater and ocean realms;
- Invasive alien species measurement in the TNFD framework;
- Nature-related risk assessment;
- Nature-related opportunities identification and assessment;
- Considerations of environmental crime throughout a LEAP assessment;
- Integrating nature in transition planning;
- Multi-stakeholder landscape and seascape approaches;
- Assessments for financial institutions' portfolios; and
- Interoperability with SBTN guidance for science-based targets.

LEAP v2.0 also includes up-to-date use cases based on recent market practice, covering a diverse range of sectors and geographies.

These refinements support the important role of LEAP in providing decision-useful information on nature that can be incorporated into corporate strategy, governance, risk management, resource allocation decisions, transition planning, target setting, engagement activities, investor stewardship, natural capital accounting and disclosures. Users can track different versions by referring to the version number on the front cover.

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



1.1. The use cases for LEAP

LEAP is an internal due diligence assessment process developed by the TNFD. It enables organisations to identify and assess nature-related issues and helps them to disclose material information, aligned with the TNFD's 14 recommended disclosures, to the primary users of their annual financial reports. 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 disclosures and use LEAP as a checklist to ensure that the process adequately addresses nature-related issues, in line with the TNFD's recommended disclosures.

Since the release of LEAP v1.0, a number of standard setters have added a reference to the LEAP approach for nature-related assessments, including the ISSB's work on standard setting on nature-related disclosures, GRI 101: Biodiversity 2024, ISO 17298:2025 - Biodiversity and the European Sustainability Reporting Standards (ESRS).

Beyond disclosure, since the release of LEAP v1.0, LEAP has also been used by corporates, asset managers, asset owners, banks, insurers and other stakeholders as a general assessment tool to support a range of other use cases. These have included corporate

strategy reviews to integrate nature-related considerations, transition planning, target setting, credit risk assessment, investment product design, and assessments of nature-related commercial and investment opportunities. This has helped organisations of all sizes and across sectors and geographies take effective action to better manage their dependencies, impacts and risks and identify new opportunities.

LEAP v2.0 addresses these broader potential applications of LEAP in the Prepare phase.

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** early on during the scoping phase and as they work their way through the LEAP approach, and to draw on third-party expert advice 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 and emerging market practice that the way in which some financial institutions might use LEAP is different from the way corporates might use LEAP. This is called out in specific sections for financial institutions throughout this guidance. While the guidance 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. LEAP is now referenced by global and jurisdictional standard-setters including in the ISSB's work on standard setting on nature-related disclosures, GRI 101: Biodiversity, ISO 17298 and the European Sustainability Reporting Standards (ESRS).

1.3. Applying TNFD data principles to LEAP

When using data throughout a LEAP assessment, assessment teams can refer to the TNFD's data principles to help evaluate whether datasets and tools are suitable for their intended purpose. These principles, published in the TNFD's recommendations for upgrading the

nature data value chain for market participants,[1] provide a practical reference point for considering data quality, usability, transparency and responsible use throughout LEAP. They reflect the best available scientific principles for nature-related data and the audit and assurance-related data principles in the ISSA 5000 General Requirements for Sustainability Assurance Engagements.[2]

Table 1: TNFD nature data principles in the context of a LEAP assessment

Principle	Definition
Transparent and reproducible	Understand how data was collected and processed. Gain visibility into methodologies, assumptions and processes to understand any resulting limitations in data quality, coverage and applicability. This may also allow an organisation to independently verify methodologies and reproduce findings across its value chain disclosures.
Credible	Use data that has been prepared by a competent, capable and trustworthy source recognised as having authority and managed under clear governance policies to support the reliability of the data. Access transparent metadata on provenance, governance and validation protocols to ensure data stand up to assurance and stakeholder scrutiny.
Accurate and complete	Assess data quality, level of accuracy, fit for context and completeness, using metrics such as taxonomic completeness, spatial fidelity (e.g. site versus basin level) and temporal cadence. Use clear error-reporting channels and revision logs when data gaps or misrepresentations arise.
Relevant and decision-useful	Determine if data meets the specifications for the specified use case and the relevant LEAP phases and components, to support purposeful decision making and analysis, and meet the specified key dataset and tool functionalities.[3]
Accessible and usable	Discover, download, interpret and use spatial and non-spatial nature data without restrictive licensing, proprietary lock-ins or excessive paywalls. Access comprehensive user guides, code libraries and support channels to streamline data extraction.

1 TNFD (2025) Recommendations for upgrading the nature data value chain for market participants.

2 IAASB (2024) International Standard on Sustainability Assurance 5000, General Requirements for Sustainability Assurance Engagements.

3 Key dataset and tool functionalities for each component of LEAP are outlined in the relevant section of this guidance.

Principle	Definition
Ethical and privacy protection	Integrate data that upholds ethical standards in data collecting and sharing by respecting individual rights, collective benefits, legal frameworks, licenses and Indigenous data sovereignty. This includes implementing controls to protect data integrity and avoid harm to biodiversity, Indigenous Peoples or communities involved in data collection and governance, in line with the CARE Principles for Indigenous Data Governance.
Networked and compatible	Ingest, overlay and join data directly into existing enterprise GIS pipelines, enterprise resource planning (ERP) systems and environmental, social and governance (ESG) disclosure software via standardised, machine-readable formats and application programming interfaces (APIs) (aligned with FAIR Guiding Principles for Interoperability).

1.4. How to use this document and supporting guidance

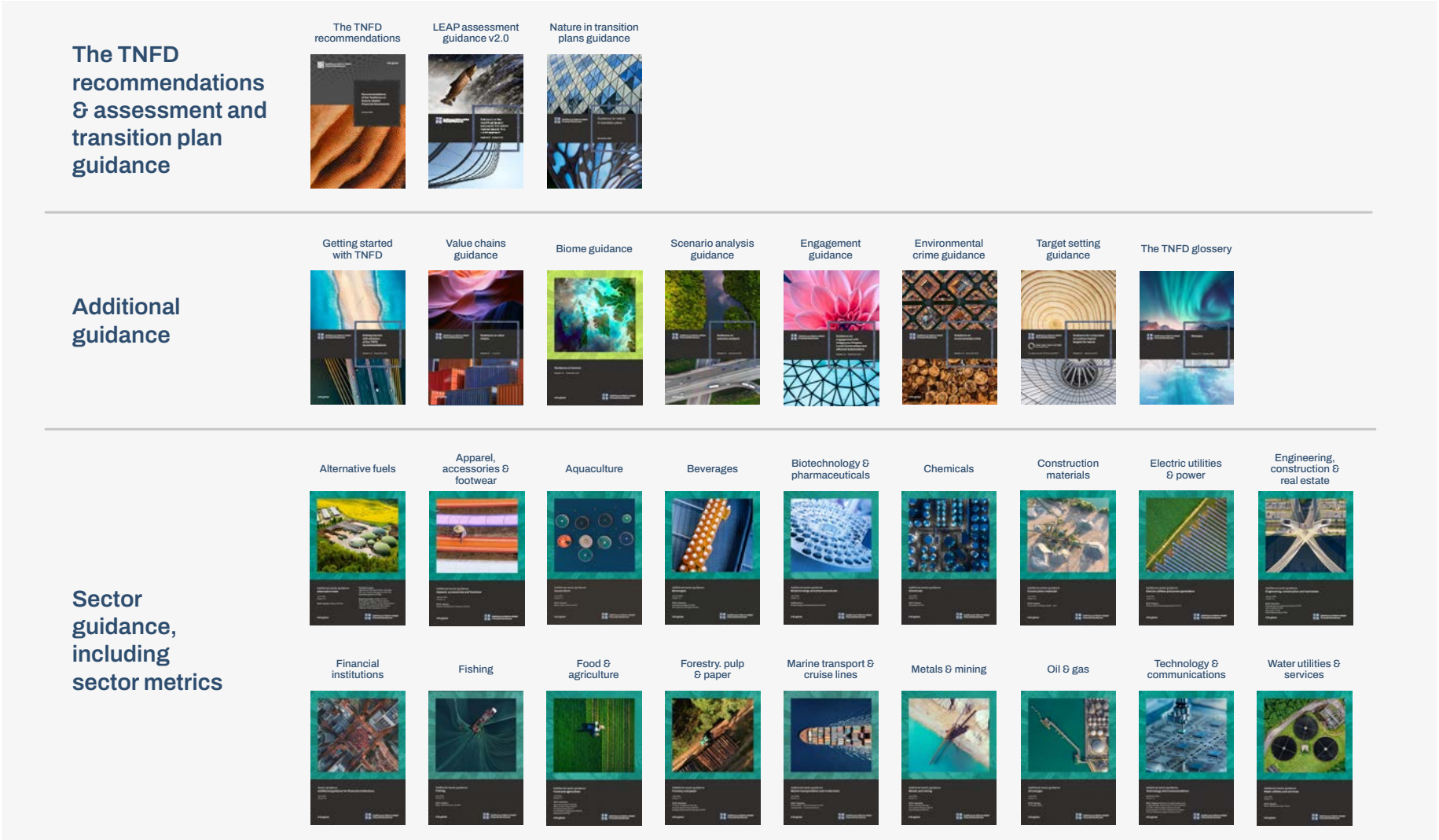
This document provides detailed guidance on how to undertake each component of the LEAP assessment approach. It is designed for use by the internal project team in your organisation tasked with undertaking an assessment of the organisation's nature-related issues (referred to as a LEAP assessment team).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

Use cases are provided throughout this guidance to illustrate how a variety of organisations around the world have approached the implementation of different components of LEAP. Further examples are available in the TNFD case study library.[4]

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

4 The use cases on the LEAP approach have been authored by the TNFD based on publicly available information or from piloting insights. Some have been adapted from existing reports to highlight their alignment with the LEAP assessment approach. Further real-world examples of corporates and financial institutions applying and interpreting the TNFD recommendations and guidance are available in the TNFD case study library, available at: https://tnfd.global/knowledge-hub/case-studies/.

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, the TNFD encourages 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, conservation and standard setting 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. A set of key definitions is provided in Annex 5 and a full set of definition is 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.[5] It is made up of four **realms**: land, ocean, freshwater and atmosphere (Figure 4).[6] 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.

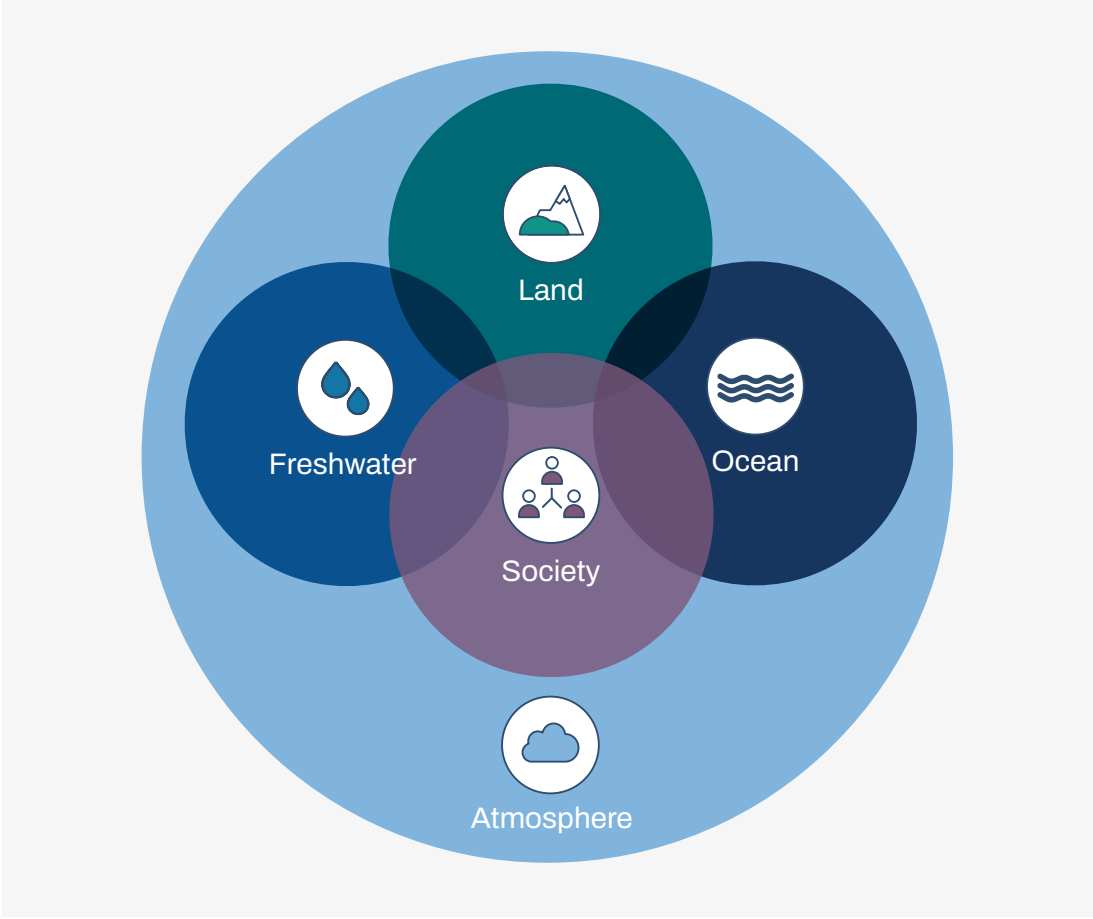
Biodiversity refers to the variability among living organisms across these realms. It is an essential and integral characteristic of nature that enables ecosystems to be productive, resilient and able to adapt.[7]

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

6 SBTN (2023) SBTN Glossary of Terms (now archived). 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.

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

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 the fact 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).

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. Biodiversity declines are 30% lower and 30% slower in Indigenous lands than in lands not managed by Indigenous Peoples.[8] 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 with Indigenous Peoples, Local Communities and affected stakeholders for the assessment, management and disclosure of nature-related dependencies, impacts, risks and opportunities by corporates and financial institutions.

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.[9] Natural capital consists of stocks of **environmental assets** – naturally occurring living and non-living components of the earth, such as forests, wetlands, coral reefs, agricultural areas, water and minerals.[10] Ecosystem assets are a subset of environmental assets that relate to diverse ecosystems.

The TNFD defines the **state of nature** as the condition and extent of ecosystems, and species population size and extinction risk. The state of nature can be measured at a single point in time, or over time to reflect positive or negative changes (against a baseline).[11] The state of nature can be assessed at a specific site or across a broader landscape or seascape.

An **ecosystem** is a dynamic complex of plant, animal and microorganism communities, and the non-living environment that interacts as a functional unit.[12] Ecosystems are classified into **biomes**, which can be thought of in simple terms as types of ecosystems. Biomes are global-scale zones, generally defined by the type of plant life that they support in response to

8 IPBES (2019b) IPBES Global assessment report on biodiversity and ecosystem services.

9 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.

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

11 Adapted from UN et al. (2021a) System of Environmental-Economic Accounting – Ecosystem accounting.

12 Adapted from UN et al. (2021a) System of Environmental-Economic Accounting – Ecosystem accounting.

average rainfall and temperature patterns.[13] 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 capital will have a negative effect on the provision of **ecosystem services**.

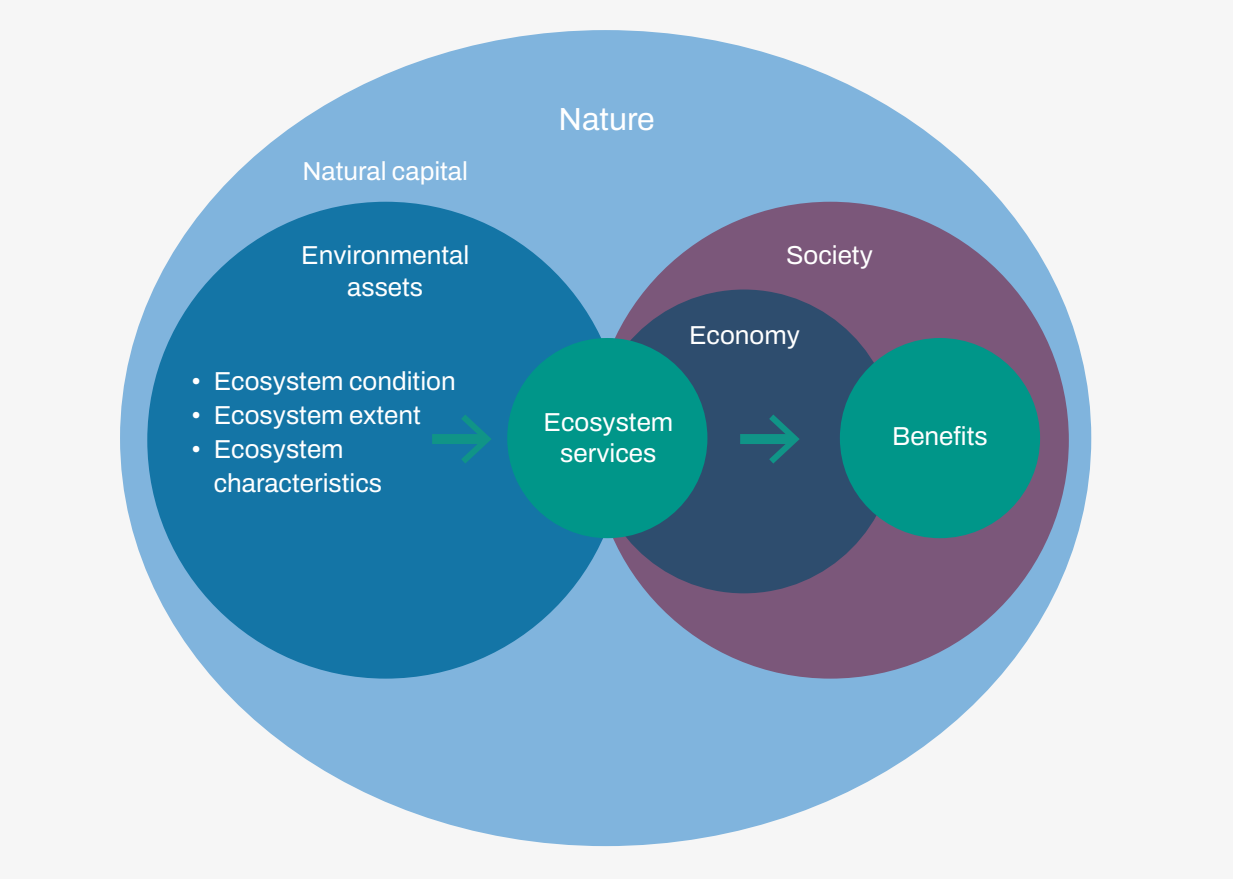
Ecosystem services fall into three categories:

- **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** result 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. Examples include 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; and
- **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. Examples include 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. through their value to tourism) or indirectly (e.g. as 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.

13 IPBES (2019b) Global assessment report on biodiversity and ecosystem services.

Figure 5: Nature, business and society



Box 2 provides more detailed definitions on 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.

State of nature: The extent and condition of ecosystems, and species population size and extinction risk, including positive or negative changes.[14]

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

14 NPI (2026) Initial Measurement Guidance; UN et al (2021) System of Environmental Economic Accounting – Ecosystem Accounting.

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 subset 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.

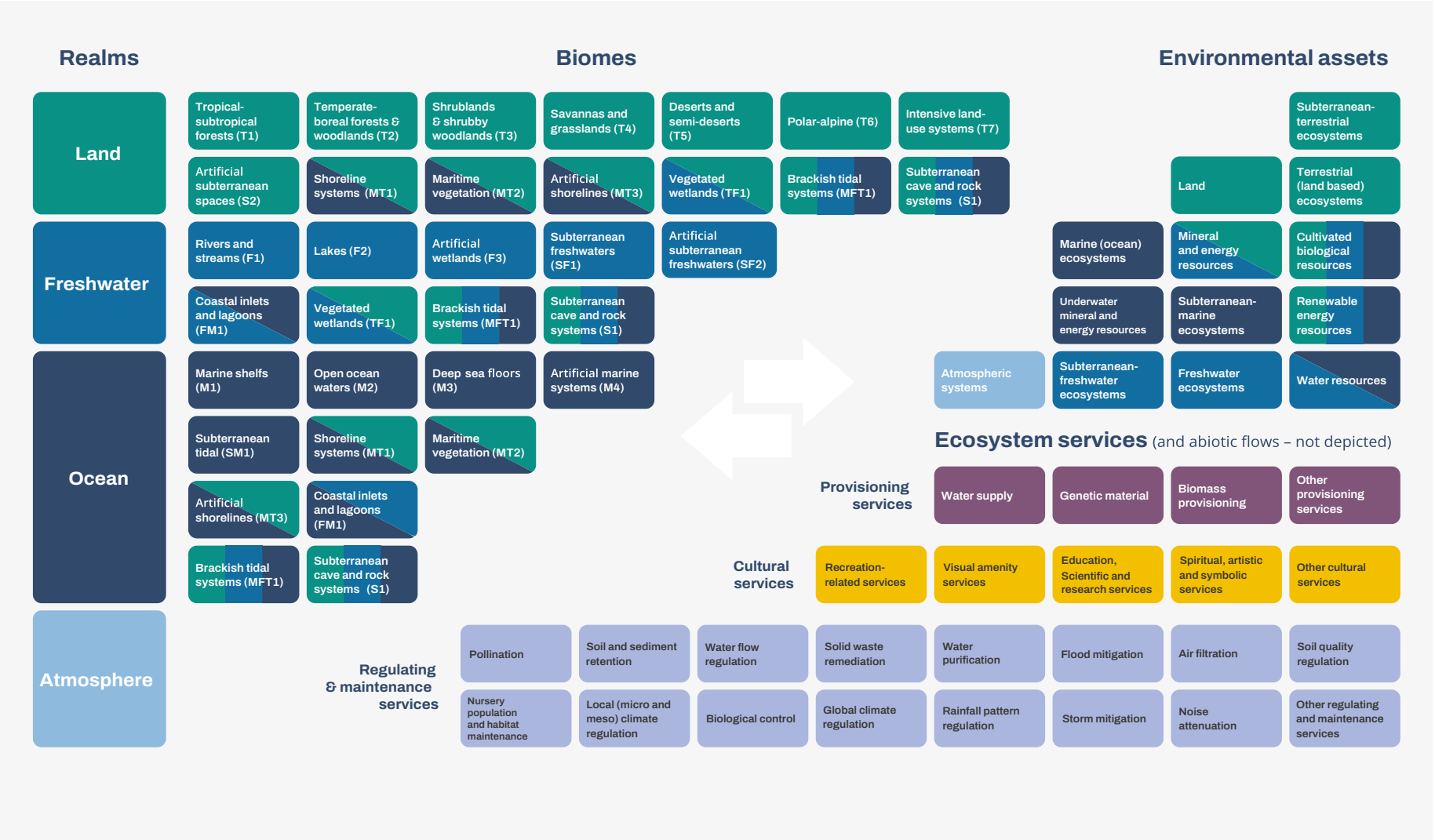
Natural capital: The stock of renewable and non-renewable natural resources such as plants, animals, air, water, soils and minerals that combine to yield a flow of benefits to people.

Sources include: 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 (2019b) Global assessment report on biodiversity and ecosystem services; UN et al. (2021a) 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[15] 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.

15 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



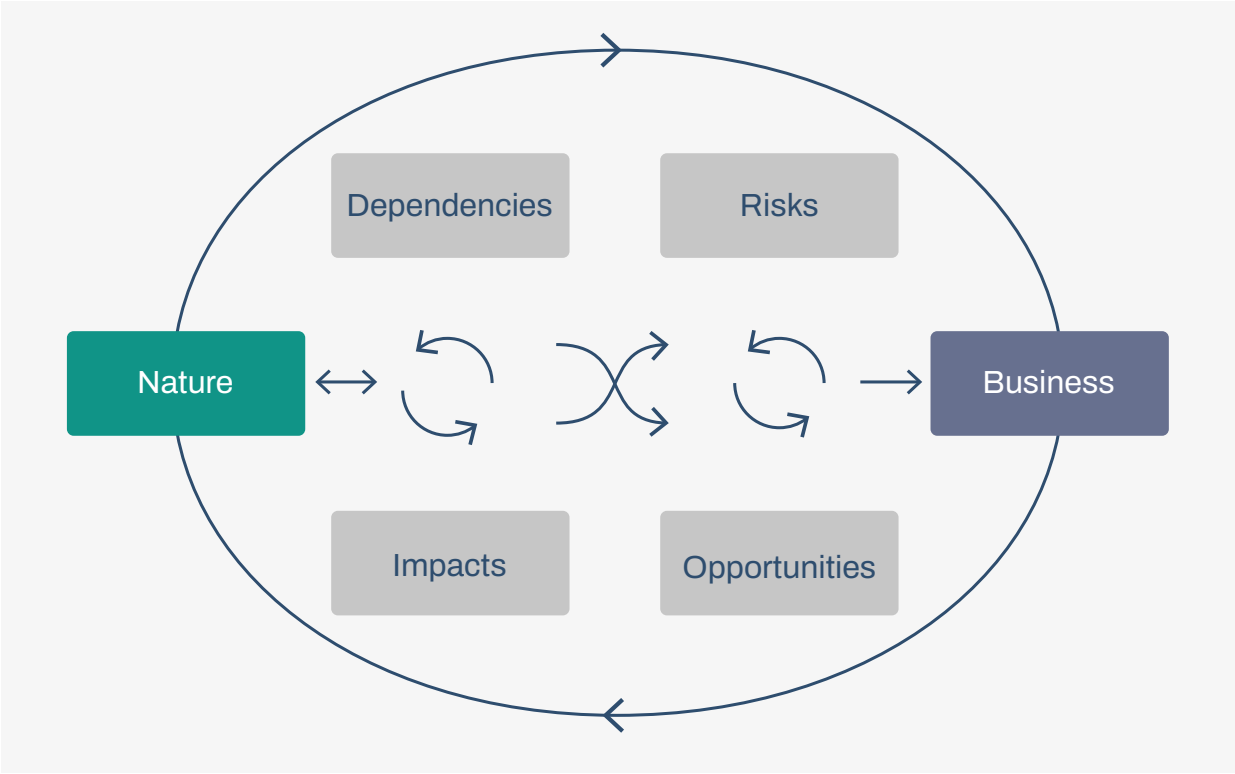
2.2. Nature-related issues

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 create positive outcomes for both the organisation and nature through positive impacts on nature or the 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 issue, as well as your organisation's responses to them.

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



2.2.1 Dependencies and impacts on nature

Organisations' business activities depend on reliable and cost-effective access to and supply of 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.

An organisation's impacts, and those of its value chain partners, may be legal or illegal, and its dependencies may be affected by other actors' own legal and illegal impacts on nature.[16]

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, which 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: SBTN (2023) SBTN Glossary of Terms; Capitals Coalition (2016) The Natural Capital Protocol; CDSB (2021) Application guidance for biodiversity-related disclosures.

16 See the TNFD's guidance on environmental crime for further support on consideration of illegal activities in the assessment.

Consistent with the Natural Capital Protocol, the TNFD recommends that dependencies and impacts, and the potential nature-related risks and opportunities that these may give rise to, 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, potentially giving rise to nature-related risks and opportunities.

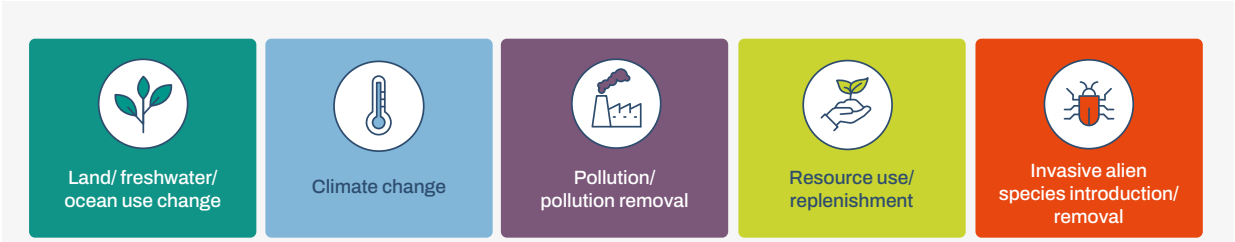
An **impact pathway** describes how, as a result of a specific business activity, a particular impact driver can lead to changes in natural capital (stocks of environmental assets) and flows of ecosystem services, and how these changes affect different stakeholders, including organisations, by potentially giving rise to nature-related risks and opportunities.

Organisations can refer to the Natural Capital Protocol and accompanying guidance,[17] to Section 5 on the Evaluate phase of LEAP (E2: Identification of dependencies and impacts), and to Section 6 on the Assess phase of LEAP 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 2). 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



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

Table 2: Impact drivers, mapped against the five drivers 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 (GHG)
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	Introduction, establishment, spread and removal of invasive alien species

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, the pollution released by another organisation, or illegal activities such as wildlife trafficking, illegal logging, illegal fishing or other environmental crimes. Frameworks such as Political, Economic, Social, Technological, Legal and Environmental analysis (PESTLE) and Social, Technology, Economic, Environmental and Policy analysis (STEEP) can be useful to identify broad categories of external factors, as outlined in the TNFD guidance on scenario analysis.

2.2.3 Changes to the state of nature

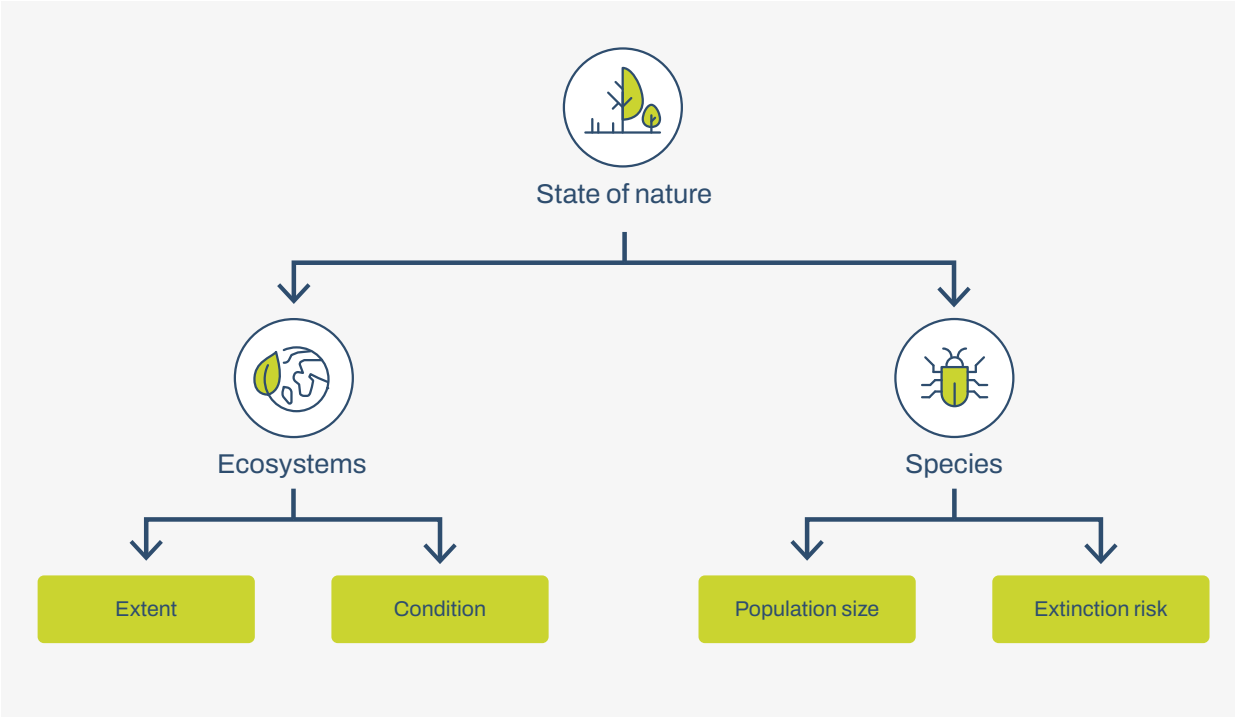
As illustrated in Figure 9, changes to the state of nature can be positive (enhancement) or negative (degradation), and refer to changes to:

- The extent and condition of the ecosystems; and
- Species population size and extinction risk.[18]

18 Adapted from UN et al. (2021a) System of Environmental-Economic Accounting – Ecosystem accounting.

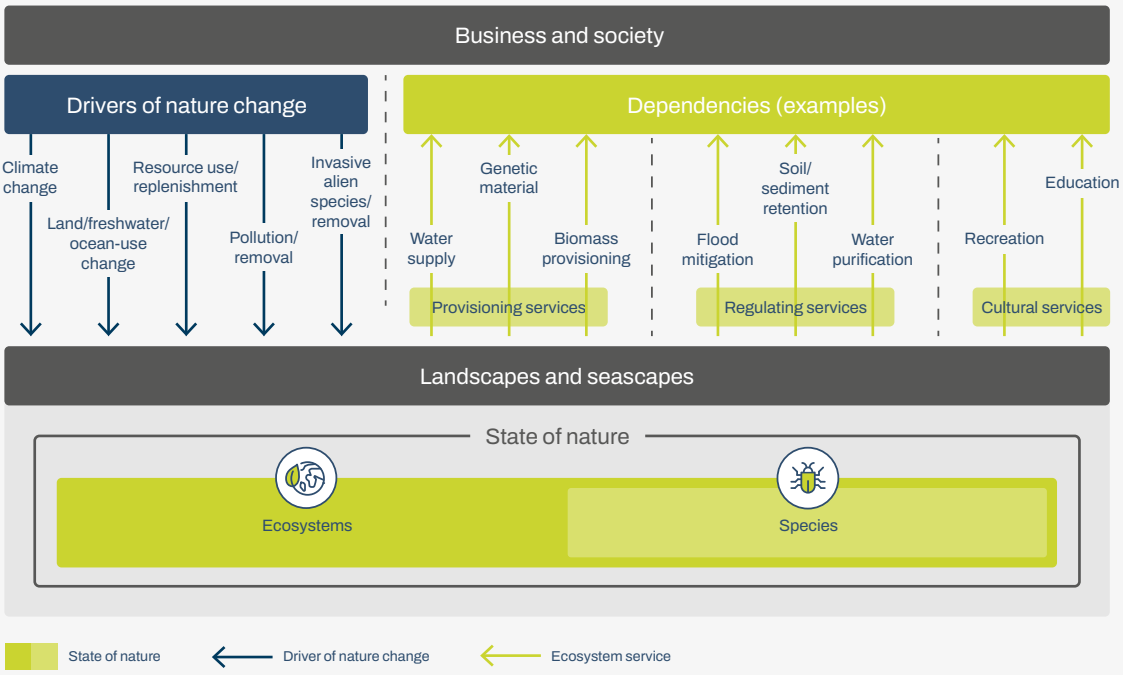
Further guidance on measuring the state of nature, including ecosystem extent and condition and species, is provided in Annex 2.

Figure 9: Components of state of nature measurement



The capacity of ecosystems to generate ecosystem services depends on the state of nature: it is a function of their extent and condition, including the abundance of species that play key functional roles.

Figure 10: The state of nature can be impacted by human activity and underpins business and societal dependencies



Box 4: Examples of dependency and impact pathways

Dependency pathway example

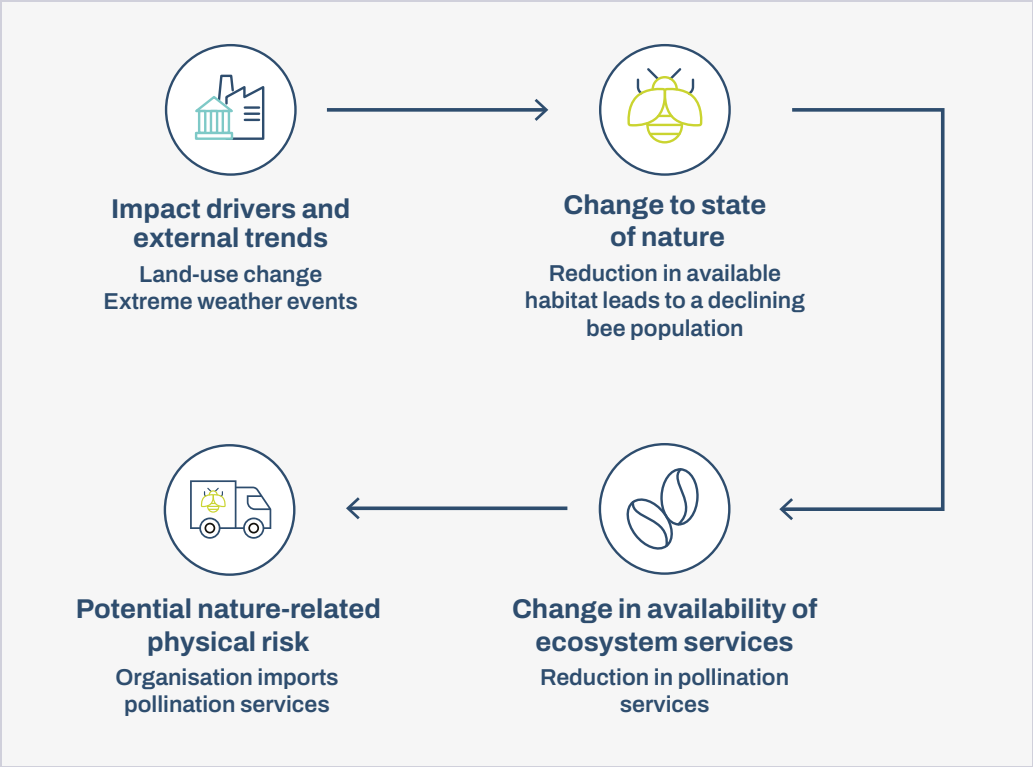
A coffee production company has a dependency on the ecosystem service of pollination by a wild bee population that lives around its suppliers' coffee farms and the underlying environmental asset supporting this population (the forest providing habitat for the population of bees). This bee population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

The related dependency pathway leading to potential nature-related risks and opportunities to the organisation includes:

- **External factors:** Neighbouring farmers are expanding their fields and illegal deforestation by other actors in the landscape is reducing forest habitat;
- **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;
- **Change in ecosystem service provision:** This decline in the bee population leads to a reduction in the pollination service that the organisation depends on; and

- **Potential nature-related risks and opportunities for the organisation:** The coffee suppliers' yields fall, so the coffee production company faces physical risks related to the potential for increased costs resulting from finding additional suppliers or paying a higher price for coffee to meet the cost of importing pollinators.

Figure 11: Example of a dependency pathway

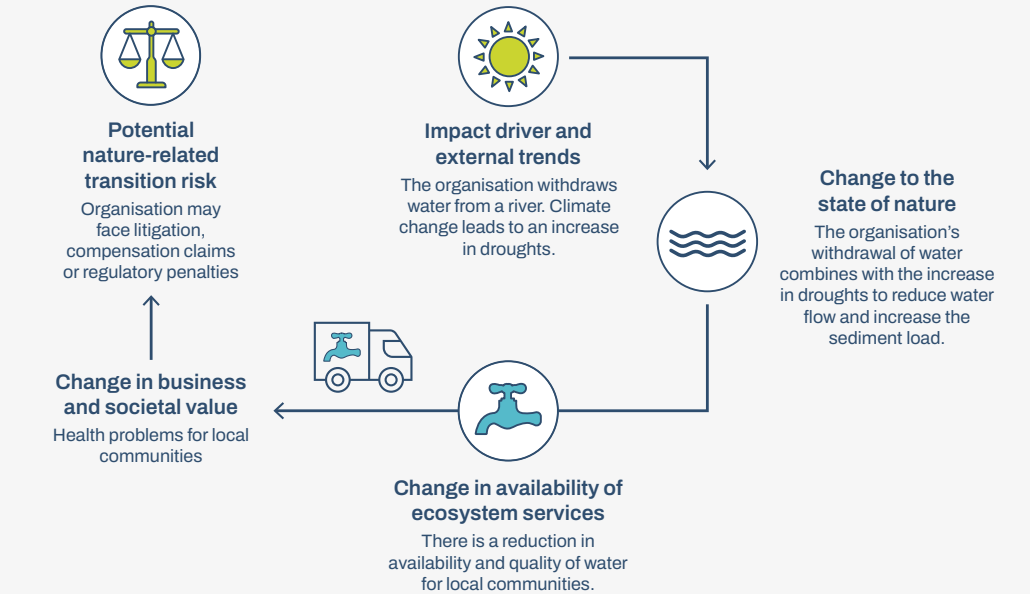


Impact pathway example

An organisation extracting water from a local 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;
- **Change in societal and business value:** Change in availability and quality of water creates health problems for local communities; and
- **Potential nature-related risks and opportunities for the organisation:** The company may face litigation, compensation claims or regulatory penalties related to its actual or perceived contribution to water scarcity or declining water quality (transition risks).

Figure 12: Example of an impact pathway



Consideration of positive impacts

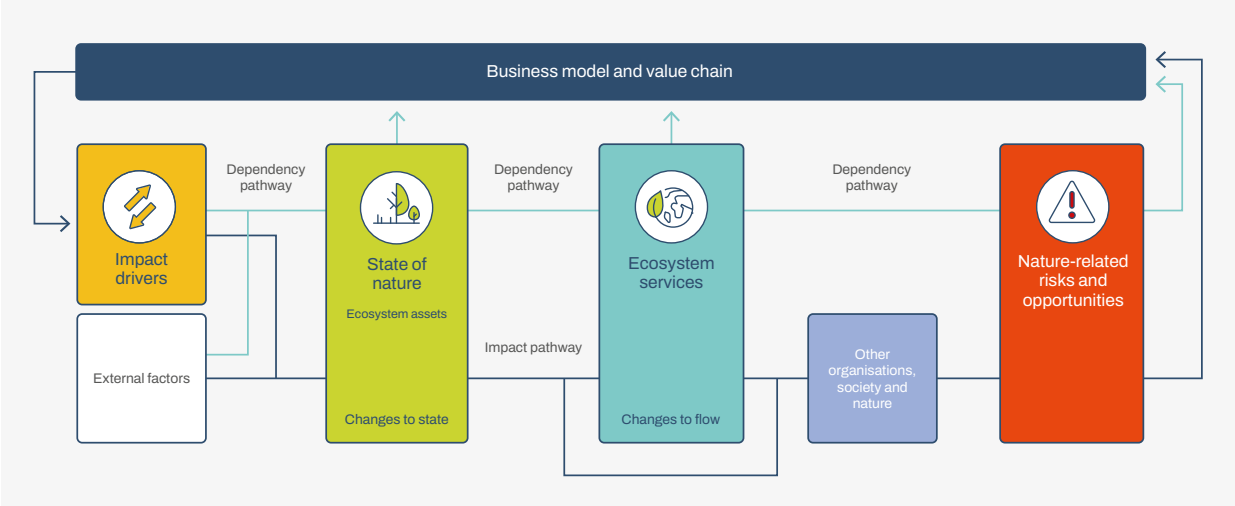
Organisations can have positive impacts on nature as well as negative. Negative impacts arise when activities contribute to drivers of nature loss and degradation, such as climate change, land and ocean-use change, pollution, resource use, or the introduction and spread of invasive alien species. Positive impacts arise when activities contribute to drivers of change that improve the state of nature and nature's capacity to supply ecosystem services, such as conserving, restoring or regenerating nature.

For example, business processes, products, services and innovations can support nature conservation and restoration, improve ecosystem health and resilience, enable regenerative agricultural practices, or cultivate biotic materials in ways that enhance ecosystem condition. Positive impacts may be generated directly through an organisation's operations and value chain, or indirectly through products, services or financing that enable positive outcomes for nature.

Reducing negative impacts on nature is not the same as creating positive impacts on nature. Actions that avoid, reduce or mitigate harm are important for lowering pressures on nature, but they do not necessarily improve the state of nature. Positive impacts generally require activities that contribute to conserving, protecting, maintaining, enhancing, restoring or regenerating ecosystems, species, ecological functions or ecosystem services.

The TNFD's approach recognises both negative and positive impacts, which are included in its suggested set of assessment metrics to help organisations to apply the LEAP approach (see Annex 1).

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



See Section 6 (Assess phase of LEAP) for more details on how dependencies and impacts on nature may give rise to nature-related risks and opportunities to the business.

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.[19]

19 ISO (2018) ISO 31000, Risk Management – Guidelines.

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.[20] 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 3). 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.

Table 3: 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 4: 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 resulting from 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.

20 CDSB (2021) Application guidance for biodiversity-related disclosures; TCFD (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; FSB (2022) FSB Supervisory and Regulatory Approaches to Climate-related Risks Final report; IAIS (2021) Application Paper on the Supervision of Climate-related Risks in the Insurance Sector; OECD (2023a) A supervisory framework for assessing nature-related financial risks: identifying and navigating biodiversity risks.

Category	Description
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 the 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 evolve, the incident or probability of contingent liabilities arising from an organisation may increase.[21]

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, conserving, restoring, regenerating and/or reducing negative impacts on nature. These risks can be prompted, for example, by changes in regulation and policy, legal precedent, technology, investor sentiment or consumer preferences. Categories of nature-related transition risks include policy risk, market risk, technology risk, reputational risk and liability risk (Table 4).[22]

21 Adapted from TCFD (2021) Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures. In July 2023, the Financial Stability Board (FSB) announced that the work of the TCFD had been completed, with the ISSB Standards marking the 'culmination of the work of the TCFD'. Having fulfilled its remit, TCFD disbanded in October 2023.

22 Liability risk is included as a sub-category of transition risk in the TNFD framework, as it relates to potential financial losses stemming directly or indirectly from legal claims. Some literature 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 subset of both physical and transition risk categories.

Nature-related systemic risks

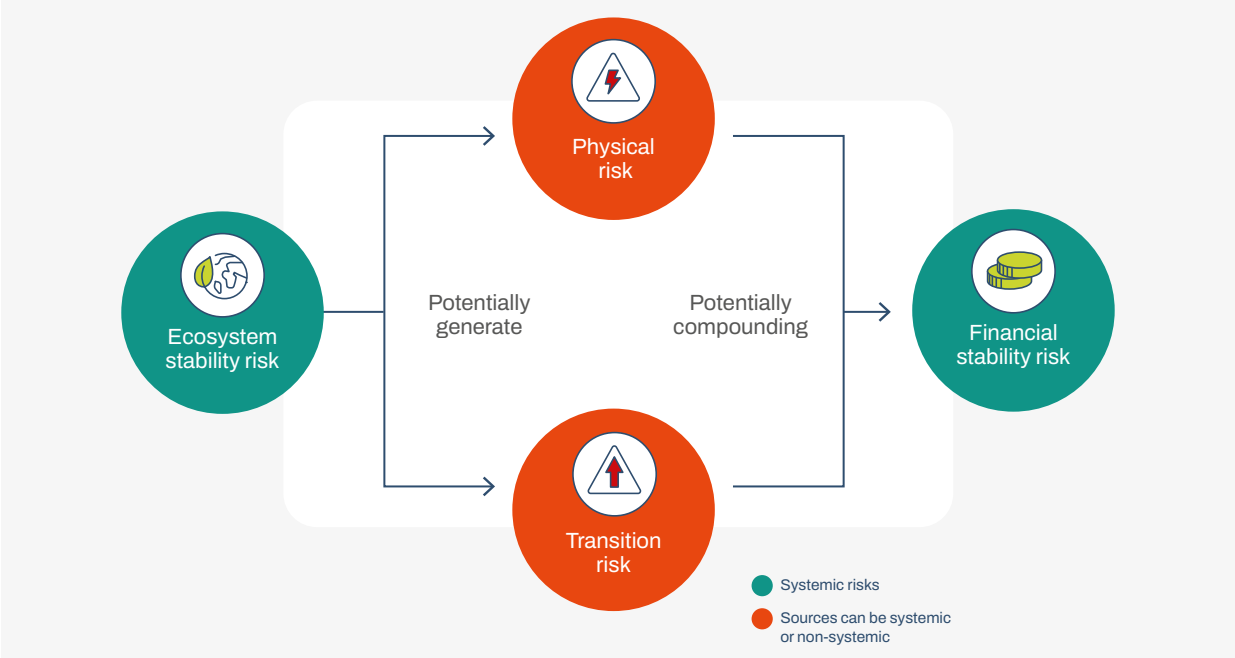
Nature-related systemic risks are risks to an organisation that arise from the breakdown of the entire system, rather than the failure of individual parts. These risks are characterised by modest tipping points combining indirectly to produce large failures, where one loss triggers a chain of others, and prevents the system from reverting to its prior equilibrium (Figure 14).[23]

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; 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.

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 organisations, given the potential for them to have unforeseen and significant financial implications for the business.

Figure 14: Nature-related risk categories



23 Goldin, I. and Mariathasan, M. (2014) The Butterfly Defect: how globalisation creates systemic risks and what to do about it; IRGC (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?; NGFS (2023) Nature-related Financial Risks: A conceptual framework to guide action by Central Banks and Supervisors; OECD (2023a) A supervisory framework for assessing nature-related financial risks: Identifying and navigating biodiversity risks.

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

- Changes to the **state of nature**, caused by business impact drivers or external factors;
- Changes to the flow of **ecosystem services** and the reliability of those flows, 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

Nature-related opportunities are activities that create positive outcomes for organisations and nature by creating positive impacts on nature or mitigating negative impacts on nature. They can involve the development, adaptation, replication, scaling or implementation of new or existing products, services, financial instruments, methods, processes, technologies or business models.

Figure 15 illustrates the anatomy of a nature-related opportunity comprising two parts:

- The positive **business and nature outcomes** of a nature-related opportunity; and
- The **elements (action and output)** that produce these outcomes.

Figure 15: Anatomy of a nature-related opportunity



Nature-related opportunities may arise through an organisation's dependencies and impacts on nature, including in its direct operations, upstream and downstream value chains, products, services, markets and financing activities. They may be identified where an organisation avoids, reduces, mitigates or manages nature-related risks, or where it adapts or transforms its business model, products, services, markets or investments in ways that contribute to halting and reversing nature loss.

Outcomes of nature-related opportunities

Nature-related opportunities produce benefits for both the organisation pursuing the opportunity (business performance benefits) and for nature (Figure 15).

Business performance benefits for both corporates and financial institutions may be financial and non-financial.

Nature-related opportunities can be considered through two broad and complementary categories:

Opportunities that mitigate negative impacts on nature
These opportunities reduce harmful pressures on nature by addressing the drivers of nature loss and degradation. For example, they may include circular economy measures that reduce, reuse, recycle and share materials; reduce water use and other resource extraction; prevent and reduce waste; or prevent, reduce or control pollution.

Opportunities that generate positive impacts on nature
These opportunities contribute to conserving, restoring, regenerating or enhancing nature and its associated ecosystem services. They may include actions that increase the health, integrity, function and productivity of ecosystems or their components, and sustainable production and operational practices that conserve, enhance and restore ecosystems and biodiversity, including nature-based solutions. This could be achieved through, for example, the removal of invasive species, the restoration of coral reefs or the protection of forests.

These categories are not mutually exclusive. A single activity may reduce negative impacts on nature while also contributing to positive impacts on nature. Organisations should consider the nature-related outcomes of these activities, as well as their relevance to the organisation's strategy, risk management, performance and prospects.

The Kunming Montreal Global Biodiversity Framework (GBF) sets out a global societal mission to halt and reverse biodiversity loss by 2030 and a vision of living in harmony with nature by 2050. This global goal is increasingly referred to by businesses, financial institutions, governments and civil society organisations as a goal to achieve 'nature-positive' outcomes globally, although the GBF does not use the term explicitly. The Nature Positive Initiative defines nature positive as a global societal goal to "halt and reverse nature loss by 2030 on a 2020 baseline, and achieve full recovery by 2050".[24] Nature-related opportunities can improve measurable state of nature outcomes and contribute to the nature-positive societal goal. Corporates and financial institutions can contribute to halting and reversing nature loss and thus make a contribution to a nature-positive outcome by altering the drivers of nature change.

24 NPI (2026) What is Nature Positive?

Elements of a nature-related opportunity

Innovation is key to nature-related opportunities. However, in addition to developing something new, an opportunity could also involve adapting an existing solution, scaling or replicating a new or existing solution, or implementing a solution. The solution may be a physical product, a service, a financial instrument or business model, or a process method. These may be developed and applied internally to an organisation or by one organisation for wider application across a sector or locations.

Responding to nature-related issues: The Pressure-State-Response model and the mitigation hierarchy

Organisations can manage risks and opportunities by responding in a variety of ways.

Negative impacts on nature can be reduced and positive impacts increased, based on an understanding of impact pathways. In the Pressure-State-Response model used by the OECD (see Figure 16), the pressure corresponds to what the TNFD defines as an impact driver, which can result in a change in (impact to) the state of nature.[25]

Figure 16: Pressure-State-Response framework



In this model, a response by an organisation can decrease or increase the pressure (impact driver), which in turn (following an impact pathway), can improve or worsen the state of nature and the supply of ecosystem services. Through such responses, organisations can strategically apply their influence in landscapes, seascapes and value chains.

25 OECD (2025a), Environment at a Glance Indicators, based on the OECD Pressure-State-Response framework.

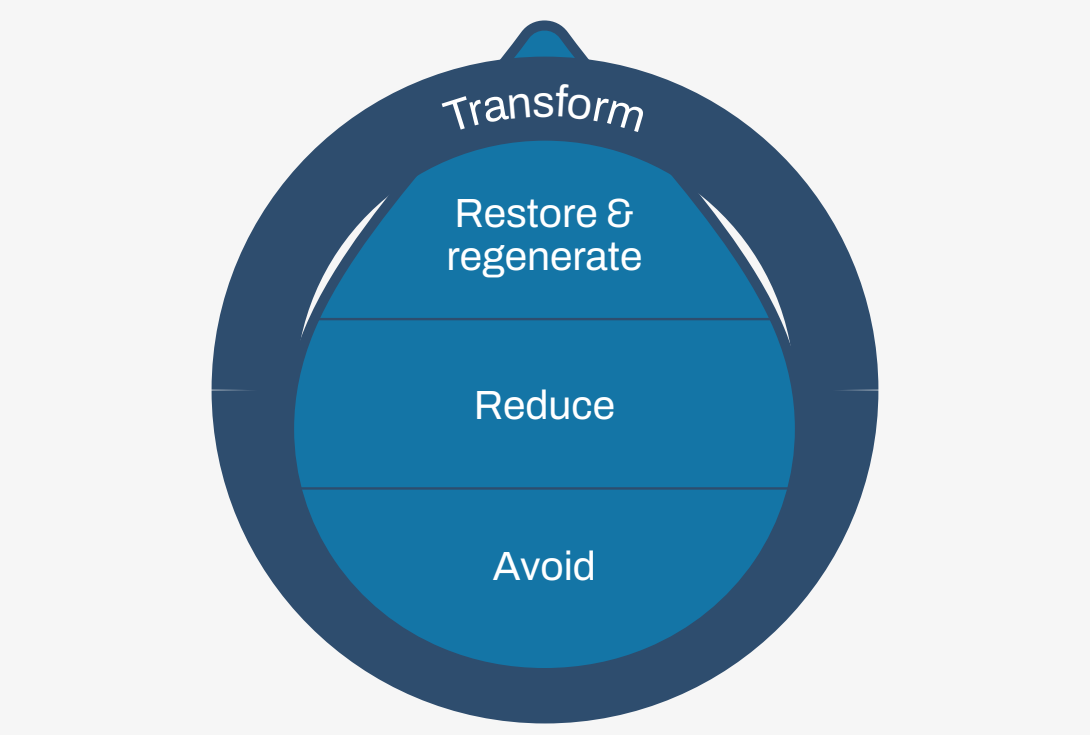
In considering alternative responses, business actions that avoid or minimise negative impacts on nature should be prioritised over the pursuit of restoration efforts or the mitigation of existing damage through reconstructive or compensatory measures. This is in line with mitigation hierarchy principles such as the SBTN AR3T framework (see Figure 17).[26]

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 17: SBTN AR3T framework



Source: SBTN (2023c) Step 4. Act

26 Adapted from: WWF (2022) A Biodiversity Guide for Business; SBTN (2023c) Step 4. Act.

2.3. Understanding effects on the organisation's prospects

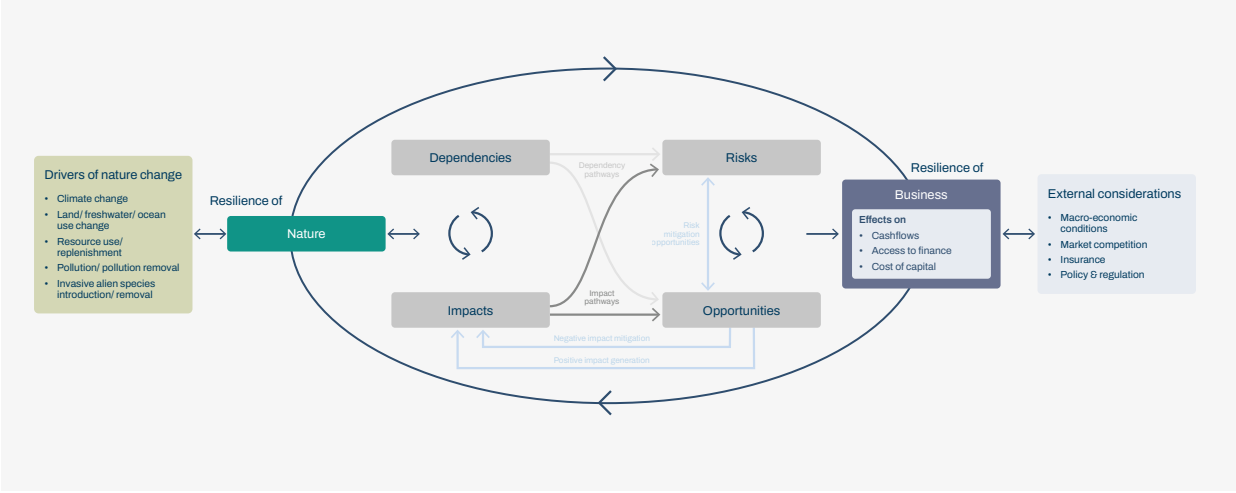
The assessment of nature-related risks and opportunities helps the organisation understand the implications such risks and opportunities may have on its cash flows, access to finance and cost of capital (effects on prospects). This can be in the form of quantitative or qualitative information. This assessment can also be helpful to inform the identification of the current and anticipated financial effects of nature-related risks and opportunities.

The concept of transmission channels can help organisations to understand these effects of nature-related risks and opportunities. Transmission channels for nature-related risks are pathways through which sources of nature-related risks translate into physical and transition risks that can affect the economy at micro, sectoral/regional/ value chain and macro levels. These effects can propagate through the economy via businesses and their supply chains and/or the financial system. Considerations on engagement with Indigenous Peoples and Local Communities can also be relevant for the assessment of these effects on prospects.[27]

The transmission channel framework should be considered in conjunction with the dependency and impact pathway (see Section 2.2.1 and component A1), which helps organisations understand how dependencies and impacts on nature can give rise to such sources of nature-related risks.

Figure 18 shows these linkages.

Figure 18: Sources and effects of nature-related risks and opportunities on businesses



27 Shift Project (2026) Community Engagement, Nature and Financial Materiality: An evidence review on the financial effects of engagement with Indigenous Peoples and local communities on nature-related issues.

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 organisations have 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 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 direct operations, 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.

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.

In identifying the key components of the organisation's direct operations and upstream and downstream value chains, a LEAP assessment team may draw on established approaches for identifying the activities and value chains to be considered within an assessment, such as those applied by the GHG Protocol and SBTN methods.[28] While such approaches offer an established and credible starting point for determining assessment scope, assessment teams should be aware that material nature-related dependencies, impacts, risks or opportunities may arise outside of these boundaries, in upstream and downstream value chains, areas of influence and shared landscapes and seascapes.

> Some companies that applied 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 for as part of the supplier onboarding process. Others 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

28 See Greenhouse Gas Protocol (2015) A corporate accounting and reporting standard. SBTN (2025g) SBTN Technical Guidance Step 1.

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; and
- A global financial institution, such as a pension fund, asset manager or insurance company, may 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 readily identifiable, where are those of our value chain partners?

Organisations may also consider whether **environmental crime** could be relevant to the sectors, value chains, commodities or geographies included in the initial scope, both as a potential source of nature-related risk and opportunity and as a source of uncertainty in the assessment (see TNFD guidance on environmental crime).

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.

The team should also consider how the selected scope relates to the organisation's wider activities, business units and geographies, or specified organisational boundaries, to ensure any exclusions are clear and deliberate. This may be expressed in terms of metrics such as share of revenue, production volume or operating expenditure covered.

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 creating potential competitive advantage; 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, due to 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, risk management 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. **Inform integrating nature in transition plans,** through which organisations specify how they will respond and contribute to the transition implied by the Kunming-Montreal Global Biodiversity Framework (GBF), and how they will manage the synergies and trade-offs associated with other transition objectives, including those related to global policy priorities such as net zero, consistent with the Paris Agreement;[29]
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 in the TNFD recommendations 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.

29 For further guidance, see TNFD (2025) Guidance on nature in transition plans.

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 should be 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.[30]

Organisations may also want to refer to the timeframes agreed in the 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 screenings can be periodically repeated, the baseline will offer a good basis for assessing how risks have evolved. To measure 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.[31]

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 may increase costs.

30 See ISSB (2023) IFRS S1 General Requirements for Disclosure of Sustainability-related Financial Information.

31 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.

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, and 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, including the scope relative to the wider organisation, with the ultimate objective of assessing (and reporting, where relevant) 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.

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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 Sustainability Accounting Standards Board (SASB) sector classification, SICS® industries. In identifying the key components of its direct operations and upstream and downstream value chains, an organisation may draw on established approaches for setting organisational boundaries, such as those used in the GHG Protocol and SBTN methods.
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 • Integrated Biodiversity Assessment Tool (IBAT) • Nature Finance – The Climate-Nature Nexus • 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	• TNFD Case study library • Capitals Coalition Sustain project 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 • GRI and TNFD Case studies on Identifying risks and opportunities to organizations arising from dependencies and impacts on nature

4. Locating the organisation's interface with nature

4.1. Why

The Locate phase of LEAP helps organisations to focus their time and resources for assessment on the parts of their business or capital portfolio most likely to have material dependencies and impacts on nature that might give rise to risks and opportunities that could reasonably be expected to affect the organisation's prospects. It also ensures that an assessment of dependencies, impacts, risks and opportunities is grounded in evidence on the state of nature. Analysis in the Locate phase does this by providing LEAP assessment teams with assessment criteria and filters to identify and prioritise potential nature-related issues by sector, value chain and geography.

Nature-related dependencies and impacts – the ultimate sources of risks and opportunities – are placed-based. 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 can be complex. Gathering and disclosing data and insights on every issue in every location may not be feasible or proportionate, particularly for financial institutions. The Locate phase therefore helps organisations filter and prioritise where to focus their attention before undertaking more detailed data gathering and analysis as outlined in the Evaluate and Assess phases.

By applying these filters, this phase of LEAP helps assessment teams to identify the following types of locations within their organisations and value chains:

1. **All locations** of interest to the business because they influence its current and future prospects – this includes direct, upstream and downstream locations;
2. **Assessment locations** – geographic locations derived from the assessment team's initial screening (e.g. in L2) of sectors, value chains and direct operations that have potentially moderate or high dependencies and impacts on nature;
3. **Sensitive locations** – locations deemed by the best available science to be particularly sensitive or significant ecologically. A set of sensitive location screening filters are applied in the L4 component of LEAP;
4. **Material locations** – locations that the company determines to be associated with material nature-related dependencies, impacts, risks and opportunities and therefore

should be disclosed following its chosen or required approach to materiality. These are not determined until an organisation has completed its analysis of dependencies and impacts in the Evaluate phase, and risks and opportunities in the Assess phase; and

5. **Priority locations** – locations that should be disclosed in line with the TNFD's Strategy D recommended disclosure. These include all locations deemed material locations or sensitive locations.

For most organisations, a subset of your organisation's interfaces with nature will likely include dependencies and impacts in ecologically sensitive geographic locations, for example, areas of high biodiversity importance, high ecosystem integrity or rapid decline in ecosystem integrity. 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.

For financial institutions and large corporates with complex global supply chains, such as consumer goods manufacturers, retailers and technology service providers, geographic location will likely be most important in your value chain or portfolio rather than your direct operations: in other words, the geographic locations of the direct operations of your suppliers, clients and customers. TNFD provides additional sector guidance, and guidance on assessing dependencies, impacts, risks and opportunities in value chains.

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.

Desired outputs

Corporates:

- A list of business activities with potential moderate or high dependencies and impacts on nature;
- A list and/or map of the locations of those activities; and
- A list and or/map of business activities in ecologically sensitive locations, assessed according to location sensitivity criteria in direct operations, and where possible upstream and downstream value chains.

Financial institutions and very large corporates:

- An understanding of portfolio exposure to particular sectors, commodities and locations, and potential exposure to impact drivers and/or changes in ecosystem services;
- A list of prioritised portfolio companies or activities with potential moderate or high dependencies or impacts on nature;
- A list and/or map of the locations of prioritised portfolio companies or activities; and
- A list and/or map of prioritised portfolio companies or activities in ecologically sensitive locations, assessed according to location sensitivity criteria.

All organisations:

- An understanding of sources of significant assessment uncertainty, including, for example, uncertainty relating to the location of activities, and condition and integrity of ecosystems, including where such uncertainty may arise as a result of environmental crime. Assessment teams should be aware of these uncertainties during subsequent phases of LEAP.

Practical tips

- 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.

Key dataset and tool functionalities and illustrative examples are given throughout the document. The TNFD recommends organisations look beyond these resources, particularly to identify relevant sector- or biome-specific resources and datasets for the organisation's business model and value chain.

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 or 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 or portfolio 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 on nature. A sensitive location is a location that satisfies one or more of the location sensitivity criteria outlined in this guidance (L4).

- **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 very large corporates, including consumer goods manufacturers, retailers and technology companies:** The Taskforce recommends that you start by using sector-based and value chain-based filters on your key upstream supplier locations, and then your major downstream markets.
- **For financial institutions.** The Taskforce recommends starting 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.

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 the 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 or 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 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 it might locate sources of moderate or high nature-related dependencies and impacts in L2.

4.4.1 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 and, where easily possible to identify, those of our value chain partners?

4.4.2 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 SICS® (Sustainable Industry Classification System®).[32] Your organisation, however, should consider which sector classification will be most relevant, given its jurisdiction and activities. For instance, organisations may also use the Global Industry Classification Standard (GICS), which is used, among others, in SBTN methods.

32 SASB (n.d.) Sustainable Industry Classification System®.

Additional considerations for financial institutions

Financial institutions should identify the sectors associated with their portfolio companies or activities and their financial exposure to each of those sectors. Depending on the nature of their business, financial institutions may organise this analysis by sector, asset class and/or line of business, prioritising borrowers, investee companies, insured entities, other clients, activities and/or underlying assets.

4.4.3 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.

When mapping upstream value chains, organisations may find it useful to distinguish different types of upstream activities or inputs, where this helps to structure the assessment or supports later analysis. For instance, SBTN distinguishes between production inputs, capital goods, and operational support goods and services for upstream activities.

Where relevant, organisations may also find it useful to maintain disaggregated information on products or high-impact commodities, even where these relate to the same activity or site. This may better inform potential management responses during the Prepare phase, such as during target setting.

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

Additional considerations for financial institutions

Financial institutions that have already identified the sectors in their portfolios to which they are directly exposed may also consider indirect exposure to other sectors and commodities via their portfolio companies and activities. For example, several sectors in the portfolio may procure inputs through common supply chains or have commodities in common. This can reveal concentrations of exposure that are not observed when considering portfolio companies' direct operations only. One source of information about upstream and downstream connections is the ENCORE tool, which provides typical value chain linkages two tiers upstream and downstream.

4.4.4 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 Global Positioning System (GPS) coordinates and/

or polygons where possible. Organisations can start by identifying the geographic location of the organisation's direct operations and assess the coverage and quality of the organisation's asset-level data in its value chain from other due diligence activities.

Additional considerations for financial institutions

Identifying the locations of direct operations means the locations of offices and other operational locations. These may have dependencies and impacts on nature that create operational risks and opportunities for the organisation. The TNFD recognises in its additional guidance for financial institutions that it is unlikely that a financial institution's direct operations will have material dependencies and impacts on nature. A financial institution may also gather any readily accessible information on the location of companies and activities in its portfolio (e.g. jurisdiction) and its financial exposure to those jurisdictions.

Key dataset and tool functionalities for L1:

- Structure operations, upstream and downstream value chains, or portfolios using standard sector taxonomies (e.g. SICS®).
- Process and store precise spatial data (GPS points, facility addresses or polygon boundaries) for direct operational sites.
- Identify activities and commodities relevant to upstream and downstream value chains.

Types of resource with illustrative examples:

- **Sector taxonomies** e.g. SICS®, GICS.
- **Supply chain mapping and Multi-Regional Input-Output Models (MIRO)** e.g. spend-based Life Cycle Assessment (LCA)/MRIO modelling platforms (such as OpenLCA built on EXIOBASE or alternatives offering greater geographic granularity like Eora); qualitative tools illustrating typical value chain connections, either general (e.g. ENCORE) or sector specific (e.g. supply chain taxonomy for the textile, apparel and fashion industry).
- **Enterprise systems** e.g. internal Enterprise Resource Planning systems (ERPs), procurement platforms (such as SAP, Workiva).
- **Geospatial mapping tools** e.g. ArcGIS, QGIS and other tools enabling companies to upload their asset location data.

4.5. L2: Dependency and impact screening

L2: Dependency and impact screening	*Are any of these sectors, value chains and direct operations associated with potentially moderate or 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 and therefore should be prioritised for further assessment.

Additional considerations for financial institutions

This primarily refers to prioritisation across the portfolio, considering the sectors, value chains and commodities associated with portfolio companies and activities identified in L1.

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 or high dependencies and/or impacts on nature.

The organisation can compare the activities and commodities identified in L1 with the lists provided by ENCORE and SBTN (e.g. using SBTN's High Impact Commodity List) and identify those that appear most likely to be associated with moderate or high nature-related dependencies and impacts. This can be supplemented and guided by other information held by the organisation and by the resources in the TNFD sector guidance and guidance on environmental crime. An organisation could also adjust the ENCORE ratings to reflect the local context or break down sectors more granularly (e.g. individual crops) using other credible sources for potential dependencies and impacts on nature.

Organisations that wish to go deeper to get a fuller picture of potential dependencies and impacts on nature across the value chain may also consider the supply chain tools given as illustrative examples below. Heatmaps are a popular approach used by both corporates and financial institutions to capture this analysis. Figure 19 shows an illustrative output from a heatmapping exercise.

Organisations may also want to consider their exposure to activities, sectors, business models and commodities that are often associated with environmental crime. These may have additional or elevated dependencies or impacts, and pose additional risks for the organisation.

Box 5: Illegal sand mining in India

Environmental crime is often concentrated in specific commodities. Illegal sand mining in India illustrates how environmental crime can form part of a largescale organised criminal economy. Driven by rapidly increasing demand from the construction sector, sand extraction has become a high value illicit trade, facilitated by 'sand mafias' that operate across multiple states with support from complex networks of intermediaries and, in some cases, political actors.

The crime occurs primarily at the extraction stage, where sand is removed illegally from riverbeds, often at volumes far exceeding sustainable limits. This leads to significant environmental degradation, including altered river flows, erosion and species loss. The extracted material is then transported and sold into formal construction markets, effectively laundering illegal resources into the legitimate economy.

Source: GI-TOC (2019) Sand mafias in India: Disorganized crime in a growing economy

Additional considerations for financial institutions

Financial institutions may use tools such as ENCORE and the SBTN High Impact Commodity List to identify potential exposures to moderate or high dependencies or impacts on nature by sector and commodity. A heatmap can be an effective way to visualise concentrations of potential exposure by sector.

Going further, financial institutions may use ENCORE and other tools to identify concentrations of potential exposure to individual impact drivers or ecosystem service dependencies through their sector exposures.[33] This could, for example, take the form of assets under management (AUM) in sectors rated high or very high for a particular impact driver or ecosystem service.

Aggregation of qualitative ENCORE ratings across impact drivers and/or ecosystem services to create a quantitative dependency or impact score should be done with caution, as such an approach is likely to distort the prioritisation. For example, a sector rated very high for air pollution and very low for other impact drivers could end up with a lower score than a sector rated low and medium across all impact drivers. If undertaken, such aggregated scores should not be interpreted as a single composite score of dependency or impact for a sector or portfolio, and only supplemental to the underlying ratings that support prioritisation.

Biodiversity footprinting approaches can also support initial prioritisation as an alternative or complement to heatmapping approaches. Biodiversity footprints are an indirect measurement or proxy for the likely actual impact on biodiversity, with biodiversity being a proxy for the impact on nature. It is critical to understand what different approaches to biodiversity footprinting aim to measure, their limitations and how to contextualise the results if using such approaches. The TNFD discussion paper on biodiversity footprinting approaches for financial institutions provides further guidance.

Finally, financial institutions may want to consider whether there are any concentrations in the portfolio by jurisdiction, if such information was identified in L1, and any portfolio-level exposure to environmental crime through financial products or services, counterparties and relationships. Financial institutions can use existing customer and transaction information to analyse this, where available, and do not need to conduct a separate customer-by-customer review for the purposes of LEAP. Based on this analysis, financial institutions should be able to identify a subset of companies and/or activities in the portfolio for further assessment, based on identified potential exposures to moderate or high nature-related issues by sector, impact driver, ecosystem service, commodity and/or jurisdiction.

33 For insights from 50 examples of financial institutions using ENCORE for LEAP assessments, see: Global Canopy (2025) How financial institutions use ENCORE for TNFD risk assessments.

Figure 19: 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 6: A corporate using ENCORE-based heatmaps to visualise its business activities' dependencies and impacts on nature

Obayashi Corporation is a Japanese construction and civil engineering company headquartered in Tokyo, Japan.

Obayashi Corporation focused the scope of its LEAP assessment on its domestic building construction and domestic civil engineering businesses, which represented approximately 70% of consolidated sales. The company then identified business activities across its operations and value chain that were most likely to have material interactions with nature and prioritised three business activities for further assessment: design, construction and the extraction of raw materials.

To support this prioritisation process, Obayashi Corporation used ENCORE to assess potential dependencies and impacts on nature across these activities and their associated value chains. The resulting heatmap enabled the company to visualise which activities were associated with higher dependencies and impacts, helping to inform subsequent stages of the LEAP assessment. For instance, the company then used IBAT to carry out location-specific analysis of impacts on nature in relation to 'design and construction' and 'the extraction of raw materials'.

Figure 20: ENCORE-based assessment of dependencies and impacts associated with Obayashi Corporation's priority business activities.

Heatmap of analysis results using ENCORE

Dependencies/ impacts Medium: M High: H Very High: VH

Important business activities			Dependencies (*2)					Impacts (*3)						
			Provisioning services		Regulating and maintenance services		Cultural services	Ecosystems use						
Category	Subcategory	Sub-subcategory	Ground water, surface water, and water flow maintenance	Fibres and other materials	Flood and storm protection	Soil erosion control	Mitigation of sensory impacts	Use of terrestrial ecosystems	Use of freshwater and marine ecosystems	Disturbances	Water use	GHG emissions	Pollutants	Solid waste
Extraction of raw materials	Steel frames	Iron ore	H					VH	H	H	VH	H	H	H
		Coal	H					VH	H	H	VH	H	H	H
	Fresh concrete	Sand						VH	H	H		H	H	
	Cement	Limestone						VH	H	H	H	H	H	H
	Timber	Timber	VH	H				H		H		H	H	
Design and construction	Building construction	Offices and government offices			M	M	M	H	H	H	H	H	H	M
		Factories and power plants			M	M	M	VH	VH	H	H	H	H	M
		Houses			M	M	M	H	M	M	H	H	H	H
		Education, research, and culture			M	M	M	H	H	M	H	H	H	M
		Warehouses and logistics			M	M	M	VH	VH	H	H	H	H	M
	Civil engineering	Roads	M		M	M	M	VH	H	H	H	H	H	H
		Railroads	M		M	M	M	VH	H	H	H	H	H	H
		Soil and river conservation			M	M		VH	VH	H	H	H	H	M

Source: Obayashi Corporation (2024) Nature-Related Information Disclosure (Disclosure Based on TNFD recommendations).

Box 7: Financial institutions identify their exposure to sectors with high dependencies and impacts on nature

Banco Bolivariano

Banco Bolivariano, the Ecuadorian commercial bank, conducted a heatmap assessment using ENCORE to understand the exposure of its investment portfolio to sectors with a potentially high or very high impact or dependency on nature.

Figure 21: Banco Bolivariano's heatmap of potentially moderate or high dependencies on ecosystem services by sector

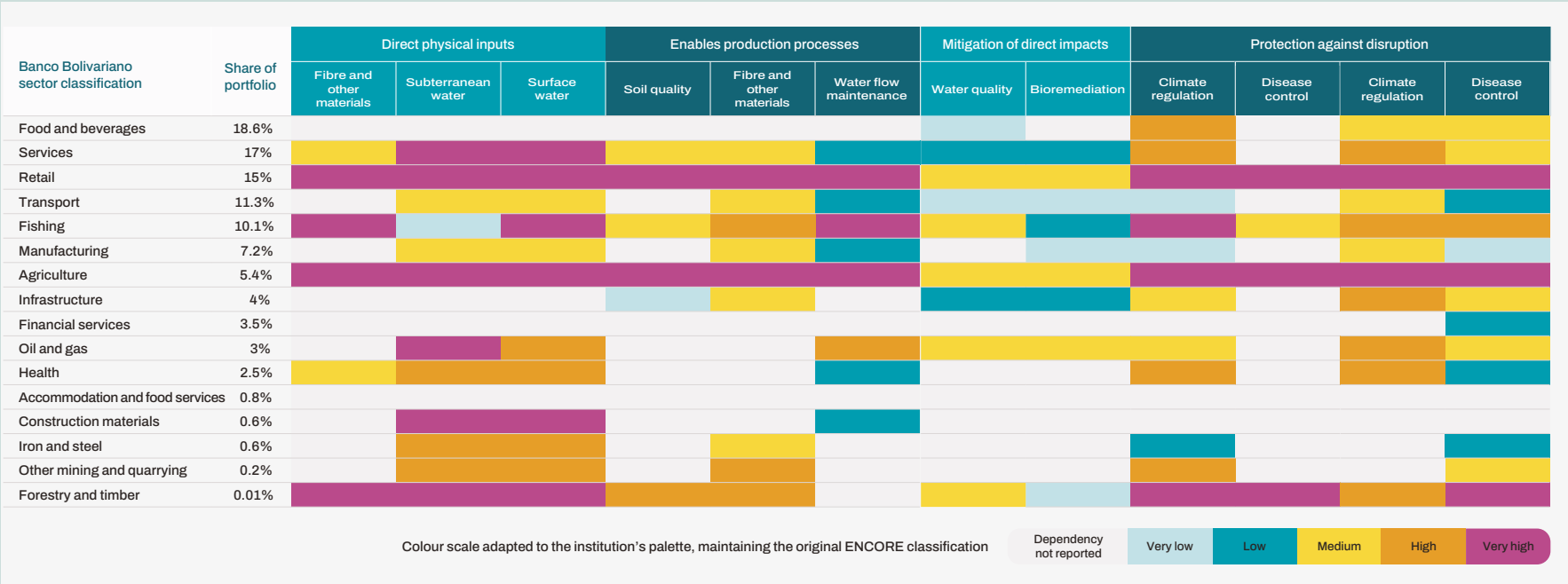


Figure 22: Banco Bolivariano's heatmap of potentially moderate or high impacts on nature by sector and impact driver



The heatmap enabled Banco Bolivariano to identify the ecosystem services and impact drivers of greatest relevance to its portfolio. The analysis highlighted sectors with the highest concentrations of dependencies, including trade, food and agriculture, forestry and fishing, as well as sectors associated with the greatest pressures on ecosystem services and environmental assets, including trade, services, oil and gas, iron and steel, and other mining and quarrying.

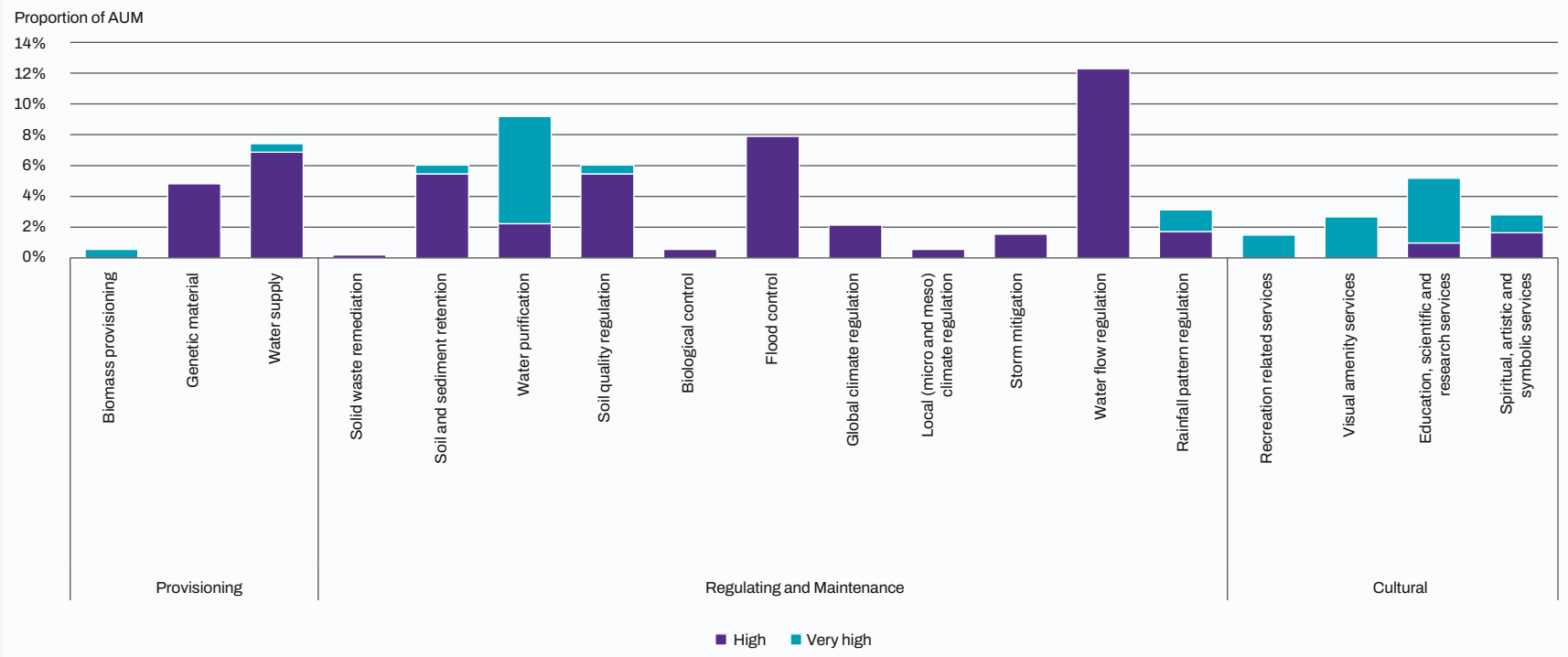
This initial screening provided a picture of where potentially moderate and high nature-related dependencies and impacts are concentrated by sector, helping the bank prioritise for more detailed analysis in the subsequent Evaluate and Assess phases of LEAP.

Schroders

Schroders, a London-headquartered global asset manager, assessed 62% of its total assets under management for nature-related dependencies, impacts, risks and opportunities, across public and private assets.

To complement this analysis, Schroders identified the ecosystem services its investments are particularly dependent upon. The assessment identified water supply, water purification and water flow regulation as the ecosystem services on which its holdings are most exposed.

Figure 23: Proportion of Schroders' AUM with 'very high' or 'high' dependency on ecosystem services



Source: Schroders, ENCORE. Data is as at 31 December 2025.

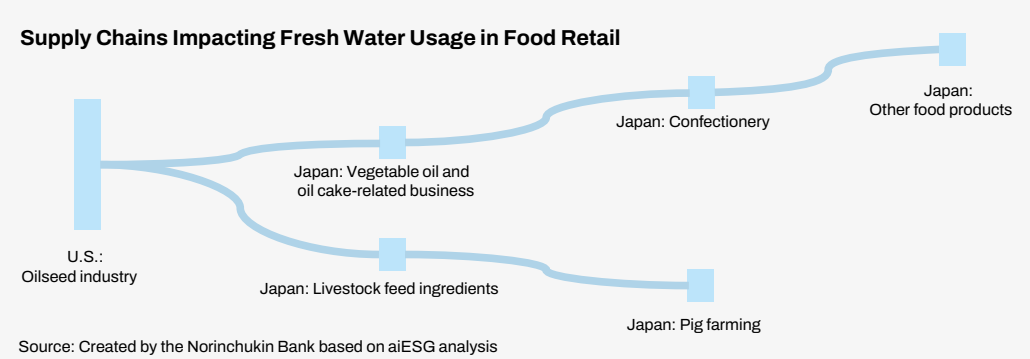
The Norinchukin Bank

The Norinchukin Bank, a Japanese financial institution focused on supporting the agriculture, fishery and forestry sectors, used a multi-regional input-output model analysis to identify potential supply chain dependencies and impacts of its portfolio investees and clients. It used ENCORE to identify consumer staples as one of the sectors within its investment portfolio with potentially high nature-related dependencies and impacts. Building on this sector-level screening, the bank analysed the supply chains of investees and borrowers across eight consumer staples sub-sectors to better understand where impacts and dependencies on nature occur along the value chain.

Drawing on academic research, AI-enabled analytics and a multi-regional input-output model, the analysis revealed that several sub-sectors relied on shared upstream supply chains. Tracing the supply chain of the food retail, consumer staples, retail and department store sub-sectors for several products identified a common exposure to US oilseed agriculture. The analysis highlighted US oilseed agriculture's significant dependencies and impacts related to water use.

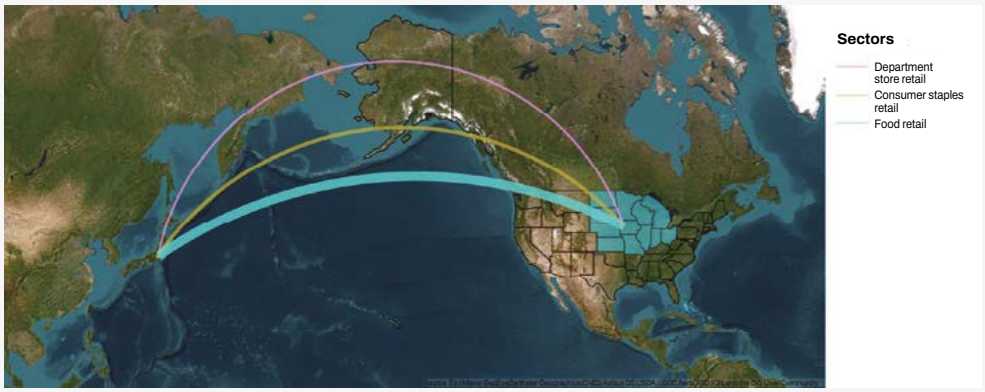
This example highlights how a financial institution can move beyond sector-level screening to identify common geographies, value chains and production systems where nature-related dependencies and impacts may be concentrated, helping to prioritise areas for further assessment and engagement with clients and investees. The bank found that understanding the complex structure of supply chains can inform potential collaborative approaches to risk management with investees, borrowers and other stakeholders.

Figure 24: The Norinchukin Bank's assessment of its exposure to US oilseed agriculture



Source: Created by the Norinchukin Bank based on aiESG analysis

Figure 25: Visualisation of The Norinchukin Bank's supply chain risks linked to US oilseed agriculture



Candriam

Candriam is a global multi-specialist asset management firm headquartered in Luxembourg, operating as an affiliate of New York Life. To screen the potentially moderate and high dependencies and impacts on nature of its investments and prioritise sectors for further in-depth evaluation, Candriam used a biodiversity footprinting approach based on modelled impacts on Mean Species Abundance (MSA), expressed in MSA·km². MSA estimates the condition of the biodiversity in land and freshwater ecosystems in response to selected pressures. 1 MSA·km² represents the degradation of 1 km² of land from 1 MSA (intact state) to 0 MSA (no original biodiversity left).

The model Candriam used takes a top-down, input-output approach to estimate companies' MSA impact based on the composition and geographic distribution of their activities. It uses company revenues by activity and region to estimate associated commodity inventories and environmental impacts. These impacts are aggregated into a biodiversity 'footprint'. As a result, each portfolio company is attributed a certain level of ecosystem integrity loss due to its activities.

Candriam noted a few limitations to this approach, including that geographical exposure through the model is based on revenue, not actual operations, which means that the geographic data used may not represent the actual region of activity.

Given these limitations, Candriam uses the model-based footprinting results primarily as a screening tool to identify and prioritise biodiversity-impact hotspots across its investments. Companies identified as the largest contributors are then subject to a more detailed life cycle assessment, which maps their value chains using physical resource flows and location-specific data. This analysis produces two complementary indicators: an ecological debt metric, representing the estimated annual investment required to restore the biodiversity losses identified, and a geographically explicit measure of nature-related risk. Together, these indicators provide a more granular view of where impacts occur, how significant they are and what resources may be required to address them.

Sources: Banco Bolivariano (2024) Informe integrado 2024; Schroders (2026) Nature Report; The Norinchukin Bank (2025) Climate and Nature Report 2025; Candriam (2026) Taskforce on Nature-related Financial Disclosures Report 2026.

Key dataset and tool functionalities for L2:

- Highlight sectors and industries, and specific business processes and activities within those sectors, with moderate to very high dependencies and impacts on nature.
- Identify key raw material inputs associated with large upstream land, water or biodiversity footprints.
- Identify sectors, business models, commodities, activities and related counterparties or financial relationships that may be associated with environmental crime exposure.

Types of resource with illustrative examples:

- **Sector screening tools** e.g. ENCORE for high-level screening of sectors and industries to identify those with potentially significant dependencies and impacts on nature, SBTN Materiality Screening Tool and SBTN High Impact Commodity List. UNEP-FI Sector Impact Matrix and sector-specific variants, like WBCSD Sector Roadmaps can be useful for early stage users.
- **Supply chain and company location screening platforms** e.g. Trase for forest-risk commodity trade mapping, Forest 500, the CDP Water Impact Index and the WWF Biodiversity Risk Filter.
- **Environmental crime resources** e.g. WWF and Themis Environmental Crimes Financial Toolkit, Global Nature Watch, Global Fishing Watch, Trase, Extractive Industries Transparency Initiative (EITI) resources, WWF Risk Filter Suite and EIA Global Environmental Crime Tracker.

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 for further assessment

Where not already done, the organisation should identify the geographic location of value chain activities resulting from the screening and/or heatmapping in L2, if it is possible to do so.

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. Third-party data providers are increasingly gathering location data and this

may be more readily available for high-fixed-cost, long-life operating sites, such as mines or infrastructure.

Analytical precision will need to be balanced against the cost of gathering the 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 (KYC) 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 at the outset whether this information can be independently assured once the LEAP assessment is complete. For example, in some cases, it may be sufficient to trace a commodity to the primary point of aggregation (e.g. mills, grinders, refineries, packing facilities and warehouses), or the landscape or seascape where it is produced, rather than to the individual primary production site, as nature-related issues will be common for that commodity across the landscape or seascape. 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 should also bear in mind that criminal activity can obscure the true origin of commodities or the true destination of products and waste, which can contribute to further uncertainty about the location of activities.[34] Value chains that pass through geographies, routes or nodes known to have an elevated presence of environmental crime, or activities that facilitate it, may merit further investigation. These could include:

- **Geographic locations associated with environmental crime**, including locations with weak enforcement; susceptibility to corruption; persistent illegal extraction; high value or highly traded natural resources, commodities or species; documented trafficking routes for wildlife, timber or other commodities; governance deficits; conflict over land and resources; or high levels of corruption affecting licensing and oversight;[35] and
- **Routes, aggregation points, nodes and locations associated with environmental crime**, such as transport corridors, airports, ports, border points, free trade and special economic zones, re-export locations, trans-shipment hubs and financial centres associated with movement, concealment and financing of goods and proceeds linked to environmental crime.

34 The TNFD guidance on environmental crime provides further guidance on the implications of criminal activity for the assessment.

35 Geographic prioritisation may be supported by geospatial, biome or governance related datasets that help identify where nature-related issues may be concentrated or difficult to assess reliably. For example, World Database on Protected Areas, IBAT and WWF Biodiversity Risk Filter.

Organisations should exercise caution before assuming that formal documentation alone is sufficient to identify where relevant interfaces with nature occur. Indicators such as weak traceability, opaque intermediaries, unusual routing patterns or inconsistencies in documentation may warrant additional investigation. Where uncertainty about origin, destination or location remains, organisations should document and carry forward that uncertainty into subsequent LEAP phases. Recording and carrying forward uncertainty is not, of itself, a substitute for proportionate follow-up. Further guidance on escalation and how to follow up on identified indicators of potential environmental crime is provided in the TNFD guidance on environmental crime.

Organisations are encouraged over time to deepen their understanding of the geographic locations 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.

The TNFD recommends that organisations – primarily corporates, but also financial institutions involved in project finance, for example – seek to understand their areas of influence[36] around the locations where they have activities (Box 8). Organisations should revisit this after having completed the Evaluate phase.

36 SBTN (2020) Initial Guidance for Business.

Additional considerations for financial institutions

Financial institutions should follow a similar process to corporates for companies and activities in their portfolio prioritised in L2. Financial institutions should start by reviewing information already available about the locations of companies' direct operations and/or of prioritised activities. For most sectors, this will need to go beyond the administrative headquarters of the company to consider its actual operating sites. Financial institutions may need to combine information from third-party data providers with information already held by the financial institution and public documentation such as financing applications, environmental impact assessments, corporate disclosures, corporate websites or sustainability certifications.

Where such data are not available, which may particularly be the case for portfolio companies' upstream and downstream value chain operations, financial institutions may adopt a modelling approach to gain a high-level view on the likely geographic location of the companies or activities in the portfolio. Where possible, such analysis should use company-specific information, such as disclosures on the geographic distribution of costs and revenues. The analysis may also use other information such as sector-level input-output tables and global production patterns to estimate likely geographies of activities. Tools such as EXIOBASE and Trase may support such analysis.

Having identified the locations associated with the portfolio companies and activities prioritised in L2, a financial institution should consider whether there are any concentrations of exposure at different geographic levels – e.g. by jurisdiction, country, biome, landscape or seascape.

Box 8: Areas of influence

Impacts on nature can arise beyond the immediate site boundary of an activity, which may generate nature-related risks and opportunities. 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 type and character 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.

Impact pathways in all nature realms should be considered, including freshwater, ocean and air, noting that areas of influence can include downstream components of water catchments and adjacent coastal and ocean areas, for example, in the case of pollution run-off from land. When an organisation's area of influence overlaps with those of other organisations, cumulative impacts should also be considered.

The concept of an 'area of influence' typically applies to impacts, but a similar logic applies to dependencies. An organisation may depend on environmental assets or ecosystem services generated beyond the site boundary. For example, a farm might depend on pollination by insects whose habitat is a neighbouring forest, or a factory might depend on consistent water flow in a river catchment and hence be affected by upstream catchment management practices (see guidance on service sheds in Annex 2). In identifying areas of influence, or areas associated with dependencies, organisations may find landscape or seascape approaches useful.[37]

Dependencies and impacts on nature within the area of influence can also interact. For example, a farm might apply excessive fertiliser, which causes nutrient run-off into a nearby water meadow. This run-off causes eutrophication, adversely affecting wildflowers that wild bees rely on for food. The farm has a dependency on wild bees to pollinate its crops. The impact on nature thereby affects the farm's crop yields.

An approach to outlining a project's area of influence for impacts is included in several good practice guidelines, such as IFC Performance Standard 6 and the Good Practices for the Collection of Biodiversity Baseline Data.[38]

Box 9: Delineating area of influence across land and ocean

Lyttelton Port Company (LPC) is the largest port in the South Island of New Zealand. LPC used the TNFD LEAP approach to delineate its area of influence around Lyttelton Port and identify the terrestrial and marine ecosystem types that intersect with its operations. By mapping its business activities, including its operational footprint across land and the ocean, LPC established the spatial foundation for identifying priority locations using the TNFD's criteria for sensitive locations, understanding nature-related dependencies and impacts, and assessing nature-related risks and opportunities.

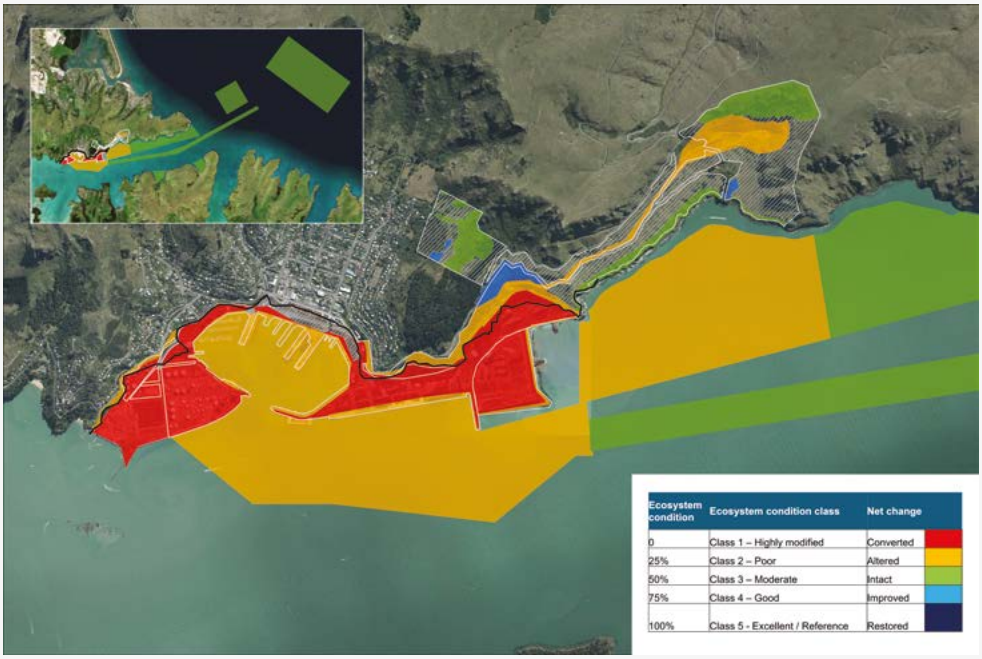
A port has operated commercially in Whakaraupō/Lyttelton Harbour since 1875. Using a 2020 baseline to assess impacts of port activities on nature would not account

37 Landscapes are socio-ecological systems, defined by a geographic area with common and interacting ecological and socioeconomic characteristics. A landscape may be delineated based on river basins, seascapes, ecosystems, jurisdictions, productive boundaries or in other ways. A landscape approach is a management approach focused on multi-stakeholder collaboration to advance shared sustainability goals and build resilience at a landscape scale. Landscape and seascape approaches set geographical scales that are influenced by distinct ecological, historical, political, economic and cultural processes and activities. In such approaches, geographical boundaries are determined by stakeholders and may correspond to, or be a combination of, natural boundaries, distinct land features, socially defined territories such as Indigenous territories and/or jurisdictional and administrative boundaries. The Landscape and Jurisdictional Initiatives Map provides a geolocated overview of existing landscape and jurisdictional initiatives.

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

for the most significant impacts to the ecosystems that occurred as a result of port development. To address this, LPC has mapped and assessed historical impacts of port activities over the period 1875 to 2020. Using a spatial dataset to map terrestrial and marine habitats for the year of 1875 and using photos and archaeological reports to describe the ecological condition at this time, LPC was able to quantify the change in ecosystem extent and condition to 2020. This assessment provides LPC with information for a historical impact statement on ecosystems. LPC has acknowledged the extent of habitats converted, altered or improved as a result of port activities.

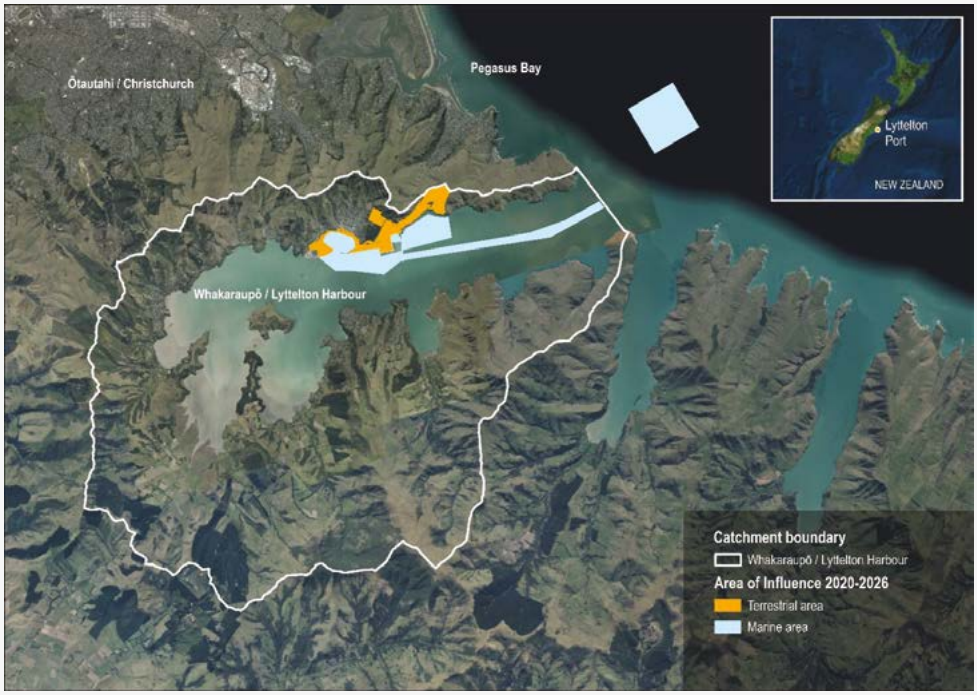
Figure 26: A historical assessment of LPC's activities between 1875 and 2020. The net condition change has been assessed and categorised to acknowledge historical and legacy impacts. Condition classes from NPI's state of nature metrics have been used for reference.



Using the TNFD framework for its assessments using a 2020 baseline year, LPC defined its direct area of influence for Lyttelton Port as 953 ha, covering current land ownership and operational footprint since 2020. Its area of influence includes:

- Footprint of operational activities on land and in the ocean;
- Reclaimed areas of the marine environment;
- Non-operational and undeveloped land within port ownership, including areas set aside for restoration;
- Vessel navigation channel; and
- Dredge spoil disposal areas beyond the harbour heads in Pegasus Bay.

Figure 27: LPC's area of influence distinguishing between activities intersecting with terrestrial and marine habitats

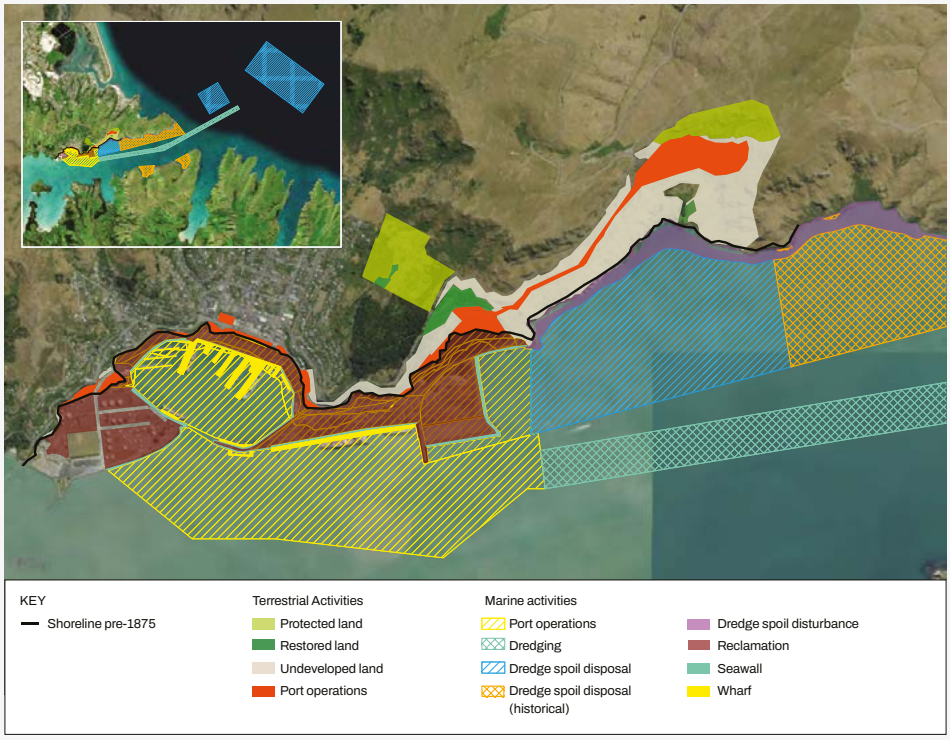


LPC then overlaid its area of influence with habitat information to identify the ecosystems intersecting with its operations. The assessment distinguished between activities intersecting with terrestrial and marine habitats, and categorised the value of the habitats at a regional scale.

To support this analysis, LPC undertook a spatial habitat assessment within its area of influence using spatial software (ArcGIS), published terrestrial and marine habitat datasets, aerial imagery and scientific literature. This enabled the company to characterise habitat types across its area of influence and improve the resolution of habitat information in locations where more detailed data was available. LPC intends to build on this work through future biodiversity assessments that incorporate species indicators as part of its Biodiversity Positive Roadmap.

Building on this analysis, in the Evaluate phase, LPC also mapped individual business activities across its area of influence and assessed each activity for the level of its impact on the drivers of nature change. To provide scientific rigour to its impact assessment, LPC has used an ecological assessment framework that considers ecosystem values and the magnitude of effects with a temporal and spatial component. Local datasets have been used to deliver outputs that are more accurate to the area, with the ability to scale the information to align with global classifications.

Figure 28: Port business activities mapped for assessment of impacts on habitats. The inset map shows the wider extent of activities within Whakaraupō/Lyttelton Harbour and into Pegasus Bay.



By delineating its area of influence using ArcGIS and identifying the habitats and business activities occurring within it, LPC established a foundation for understanding its nature-related impacts, dependencies, risks and opportunities across both the terrestrial and marine environments.

LPC then applied the Prepare phase of LEAP to develop a five-year biodiversity roadmap that commits additional resources to avoiding and reducing impacts on nature, restoring habitats and working in collaboration with others on improving ecological health and resilience at a catchment scale. Targets have been set with actions and budgets for LPC to achieve.

This analysis has informed decision making within collaborative initiatives such as the Whaka-Ora Catchment Management Plan, which sets out a long-term vision to restore the ecological and cultural health of Whakaraupō/Lyttelton Harbour, and identifies four priority action areas: sedimentation, pollution, terrestrial biodiversity and marine biodiversity.

Source: LPC (2024) Nature-related Disclosures; company-provided geospatial information and location maps, supplied to TNFD, 2026.

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, a corporate 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, a financial institution can start to consider which geographies are relevant to the potentially moderate and high dependency and impact sectors identified, and which biomes or ecosystems (e.g. peatlands in Indonesia and Scotland) are relevant to the activities of interest in those geographies.

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. 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 through the subdivision of realms (Level 1) – refer to the Global Ecosystem Typology for more detail.

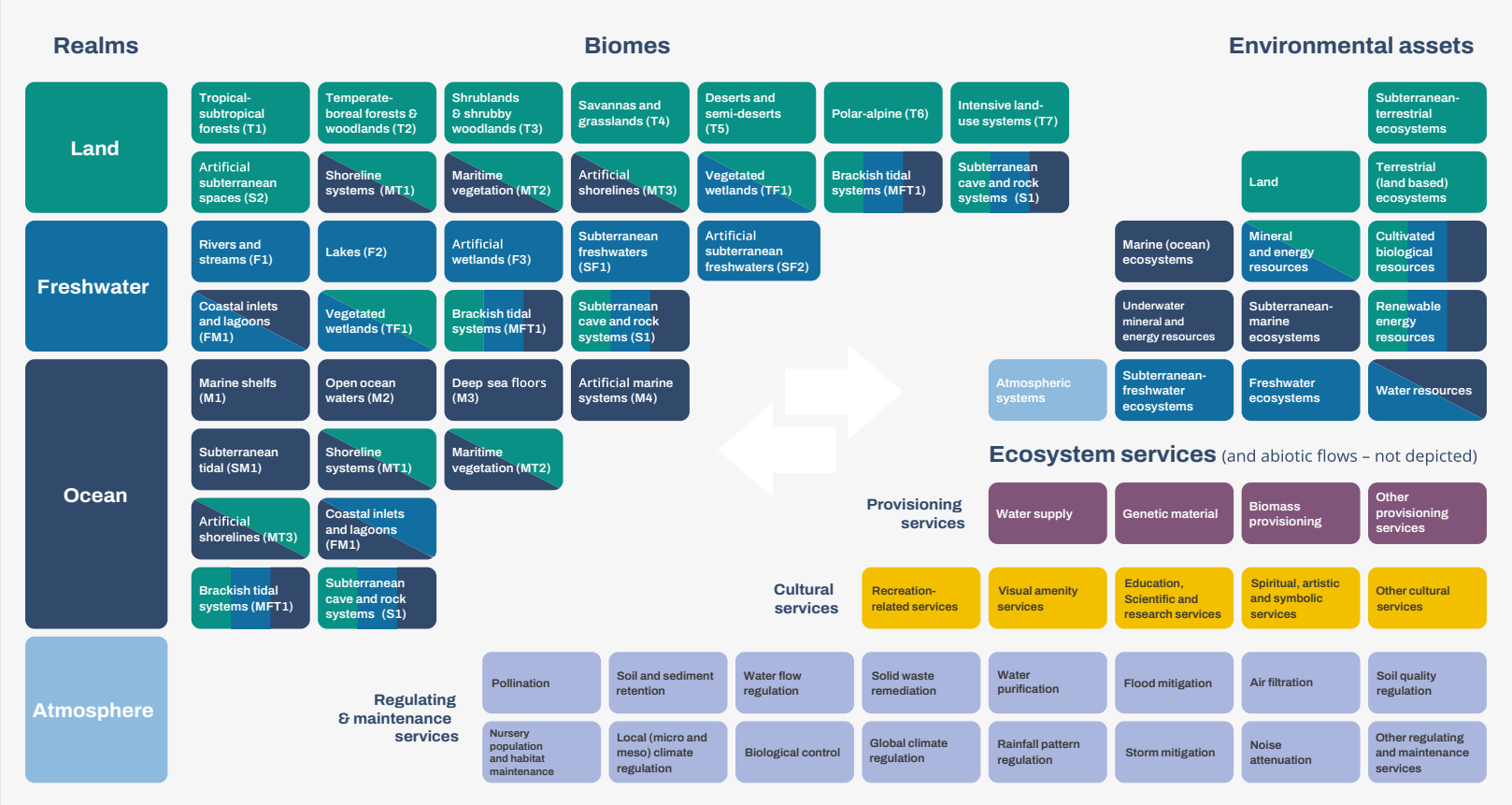
Environmental assets: The naturally occurring living and non-living components of the Earth, together constituting the biophysical environment, which may provide benefits to humanity.

For more information see Section 2.

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

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 System of Environmental-Economic Accounting Ecosystem Accounting (UN SEEA). These are summarised on the left-hand side of Figure 29 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 guide to the biomes, environmental assets and ecosystem services most likely to be relevant to their business model and value chain.

Figure 29: Fundamental concepts for understanding nature



Sources: IUCN (2026) A Global Typology for Earth's Ecosystems and UN 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 Global Ecosystem Typology (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 and UNEP WCMC Nature Tools Compass (see key dataset and tool functionalities for L3). For organisations seeking more detailed analysis throughout LEAP, the TNFD provides additional biome guidance.

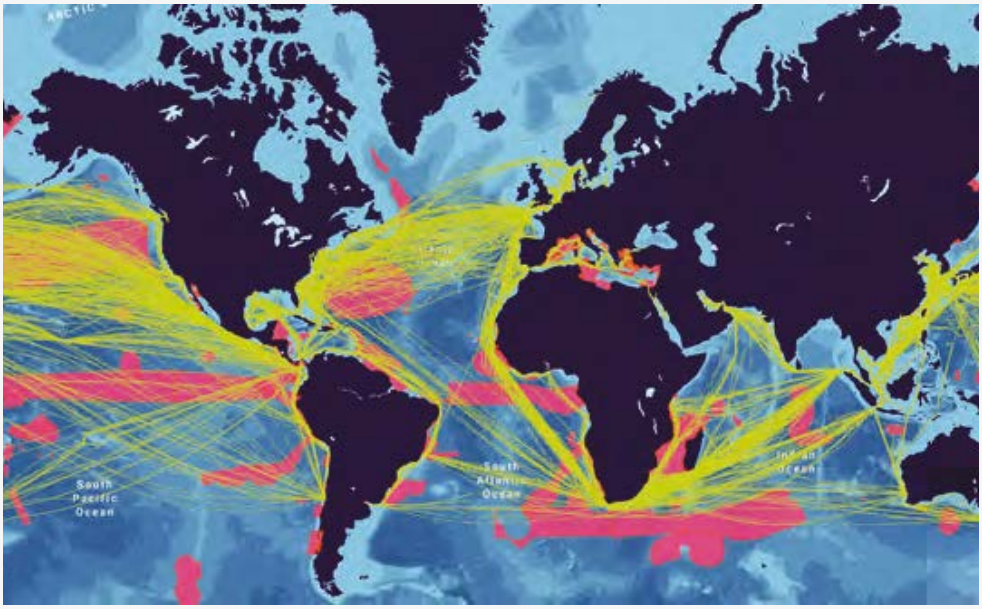
Box 11: Identifying the interface with nature across mobile marine operations

Wallenius Wilhemsen is a global marine transportation and logistics company headquartered in Norway that operates around 127 vessels on 15 trade routes.

In 2024, Wallenius Wilhelmsen conducted a biodiversity impact assessment aligned with the TNFD LEAP approach. The company defined a clear scope before beginning the assessment, focusing on its direct shipping operations, which represented its core business segment and approximately 75% of total revenue. The assessment focused in detail on the Locate and Evaluate phases, with a higher-level approach to the Assess and Prepare phases.

To locate its interface with nature, Wallenius Wilhelmsen used Automatic Identification System (AIS) data to map its global shipping routes in a Geographic Information System (GIS) platform. It then overlaid these routes with spatial data layers to identify areas where its operations intersect with sensitive locations, including Marine Protected Areas (MPAs), Ecologically or Biologically Significant Marine Areas (EBSAs), Marine Wilderness and Human Impact on the Oceans data layers. These layers were drawn from open sources, including the UN Biodiversity Lab and Hub Ocean, and helped the company understand where its vessels crossed or spent time in sensitive marine areas.

Figure 30: Wallenius Wilhemsen's AIS data and data on EBSAs globally



Given the scale and mobility of its global shipping operations, the company used this mapping to define case locations for further analysis. These locations were selected based on route frequency, overlap with EBSAs and MPAs, representation of different operational interfaces with nature – including high seas, straits, nearshore areas and harbours – and relevance to different biomes. The analysis was complemented by stakeholder dialogue with maritime experts and biologists.

Table 5: Interface with nature and screening of dependencies and impacts

Case area	Example locations	Example activity	Blome	Local biological considerations
High seas	North-West Atlantic; North Pacific	Open-water transit	Open ocean waters (M2)	Pelagic species (e.g. whales, tuna, seabirds), migratory corridors, oceanic carbon cycling
Straits Channels/ Canals	Panama Canal; Malacca Strait	In-zone speed-reduced transit	Marine shelf (M1), Shoreline systems (MT1), Brackish tidal (MFT1)	Whale and fish migration routes, shelf-edge biodiversity, benthic habitats
Close to shore	Brisbane to Melbourne, Cape Hope, Sri Lanka corridor	Nearshore passage	Shoreline systems (MT1)	Blue whales, coral reefs, seagrass meadows, artisanal fisheries, coastal tourism
Harbours	Yeosu (Korea); Baltimore (Chesapeake Bay)	Port approaches and anchoring	Artificial marine systems (M4), Coastal inlets and lagoons (FM1), Brackish tidal (MFT1)	Dolphins, estuarine nurseries, sediment ecosystems, noise-sensitive fauna

Wallenius Wilhelmsen then prioritised case locations by assessing exposure and sensitivity. Exposure was based on the time vessels spent in each area, measured as vessel hours, while sensitivity reflected the vulnerability of local marine mammals. Combining these factors enabled the company to identify three high-priority locations for further analysis: the Sri Lanka Corridor, Chesapeake Bay and the Panama Canal. To

increase the understanding of the exposure and sensitivity related to marine mammals, Wallenius Wilhemsen analysed Sri Lanka and Chesapeake Bay in more detail.

Figure 31: Assessing exposure and sensitivity to define priority locations

Location	Exposure	Sensitivity	Priority
Sri Lanka corridor	High	Very High	High
Chesapeake Bay (Baltimore)	Medium	High	High
Panama Canal	High	High	High
Brisbane to Melbourne	High	Medium	Medium
Yeosu	High	Low	Medium
Malacca Strait	Medium	High	Medium
Cape Hope	Medium	Very High	Medium
North-West Atlantic	Low	Medium	Low
North Pacific	Low	Medium	Low

This location-based screening helped Wallenius Wilhelmsen move from a global operational footprint to a more focused assessment of nature-related impacts. It provided the basis for deeper analysis of two selected trade lanes in the Evaluate phase, including potential impacts such as whale strikes and underwater noise, and helped the company identify where further mitigation, data improvement and stakeholder collaboration could support biodiversity management across its shipping operations.

Source: Wallenius Wilhelmsen (2025) Enhancing maritime biodiversity considerations: a marine transportation company applying the LEAP approach.

Key dataset and tool functionalities for L3:

- Map facility coordinates or regional supply sheds onto spatially explicit vector/raster layers defining nature realms, biomes and ecosystems.
- Classify ecosystems using recognised scientific frameworks.
- Account for direct facility boundaries as well as surrounding catchments or hydrological buffer zones subject to cumulative impacts.
- Highlight uncertainties relating to origin, destination or location data, including circumstances where limited traceability or potential environmental crime may obscure the location of nature-related interfaces.

Types of resources with illustrative examples:

- **Ecosystem typologies** e.g. IUCN Global Ecosystem Typology.
- **Spatial data and ecosystem mapping portals** e.g. Integrated Biodiversity Assessment Tool (IBAT), Ocean+ Habitats Data Viewer, Global Map of Ecoregions, HabitatMapper, Global Ecosystem Atlas and Resource Watch.

- **Land cover and remote sensing** e.g. Global Nature Watch to spatially identify the interface between business activities and ecosystems through land-cover mapping and satellite imagery, Trends.Earth, Copernicus/Landsat portals.
- **Criminality hotspots** e.g. WWF and Themis Environmental Crimes Financial Toolkit, Global Nature Watch, Global Fishing Watch, Trase, Extractive Industries Transparency Initiative (EITI) resources, WWF Risk Filter Suite and EIA Global Environmental Crime Tracker.
- **Invasive alien species-related impact potential:** e.g. IUCN Global Invasive Species Database (GISD), CBD biological invasion pathway classification, trade, transport and movement datasets (e.g. AIS vessel movement data, port call datasets, ballast water/hull-fouling risk tools, and customs or commodity flow data), sector-specific IAS tools and lists.

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.

Through identifying the sensitive locations they interface with, organisations complement their analysis of activities with potentially moderate or high dependencies and/or impacts. For example, the output of this analysis can support an understanding of:

- The overlap between high and moderate impacts and dependencies and sensitive locations; and
- Where there may be elevated nature-related risks due to sensitive locations, even where there is no evidence of potential moderate/high dependencies and impacts on nature. For example, an organisation with an office in a Key Biodiversity Area (KBA) may face reputational and/or transition risk (e.g. associated with planning regulation) due to its presence in this location or a telecommunications relay station may face restricted maintenance access under habitat protection rules.

This can support disclosures aligned with TNFD recommended disclosure Strategy D, which recommends disclosing 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 (including material and sensitive locations).

- **For corporates:** In addition to assessing potentially moderate or high dependencies and impacts in L2, organisations should screen the activities and/or assets in their direct operations against location sensitivity criteria. Where possible, organisations should also screen the activities and/or assets in their upstream and downstream value chains against location sensitivity criteria. As this can be more challenging, given data constraints for upstream and downstream value chains, an organisation may choose to prioritise these, for example, by focusing on those that were identified as having moderate/high dependencies and impacts in L2 and L3.
- **For financial institutions:** Financial institutions should look at the interfaces of their clients and investees with sensitive locations – as well as considering their own direct operations. They may draw on external providers of data layers related to the sensitive location criteria as well as information directly from clients and investees and local data where available. Where the location of portfolio companies' activities is only available at a low level of spatial resolution (e.g. by jurisdiction), financial institutions can assess the coverage of that area by the sensitive location criteria, for example, using statements such as "20% of the area of this jurisdiction is a Key Biodiversity Area". This provides an indicator of the portfolio company's potential exposure to sensitive locations. Based on this analysis, financial institutions should consider whether they have any concentrations of exposure to particularly sensitive locations or sensitive location types.

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.

Only one criterion needs to be met to constitute a sensitive location.

To operationalise this definition of sensitive locations, Table 6 provides a set of reference datasets for LEAP assessment teams to use as a filter.

For some criteria, organisations need to consider whether its locations are within, or in proximity to, areas that meet the criteria. In determining the appropriate spatial scale at which proximity will be considered, organisations may refer to their areas of influence, or relevance to dependencies, as illustrated in Box 8.

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 also consider, depending on the specifics of the organisation's business model and value chains.[39] 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. Relevant information may also be found through shared monitoring and stakeholder engagement mechanisms as part of landscape or seascape approaches.

Organisations should consider their degree of certainty about locations and the assessment of ecological sensitivity, for example, due to challenges in tracing or criminal activity that may obscure locations, reduce confidence in the available information about ecosystem condition, or drive ecological decline that is not reflected in official documentation.[40] Criteria for assessing this could include the regulatory adequacy of the jurisdiction. Organisations may consult sources that provide information about the geographic distribution of environmental crime to understand the potential for such effects. These could include public enforcement information, environmental crime toolkits, NGO and investigative reporting, and jurisdiction or commodity-specific datasets.

39 Metric functionalities for several sensitive location criteria, including biodiversity importance and ecosystem integrity, are discussed in Boakes, E. H., et al. (2026) Exploring the use of state of nature metrics to screen global business operations for ecological sensitivity and to select priority sites for disclosure and its accompanying guide.

40 The TNFD guidance on environmental crime provides further guidance on the implications of criminal activity for the assessment.

Table 6: Criteria for sensitive location identification and reference datasets and tools[41, 42]

Area	Criteria	Example indicator that the criteria has been met[43]	Reference datasets and tools
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).	• Location is within, or in proximity to, a protected or conserved area. • Location is within, or in proximity to, a sensitive ocean area (e.g. a Particularly Sensitive Sea Area (PSSA)).	• 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). • Multiple types of international, regional and national marine protected areas (MPAs) and related definitions of sensitive marine areas need to be considered (e.g. IUCN; OSPAR Convention; 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 (the BBNJ Agreement)); and Particularly Sensitive Sea Areas (PSSAs) and Special Areas under MARPOL.

41 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. Dunnett, S. et al (2025) An update to the global Critical Habitat screening layer.

42 Environmental crime could be a relevant consideration for several sensitive location criteria, for example: poaching of charismatic species can exacerbate direct exploitation impacts in areas of biodiversity importance; environmental crime could exacerbate pressure on ecosystem services; and, criminal water extraction can be a contributor to physical water risk.

43 Example indicators are illustrative and not intended to be comprehensive.

Area	Criteria	Example indicator that the criteria has been met[43]	Reference datasets and tools
	• Areas scientifically recognised for importance for biodiversity.	• Location is within, or in proximity to, a Key Biodiversity Area.	• Key Biodiversity Areas (that include IPAs, AZEs, IBAs). • Ecologically or Biologically Significant Marine Areas (EBSAs). • Important Marine Mammal Areas: IMMA e-Atlas – Marine Mammal Protected Areas Task Force. • Vulnerable Marine Ecosystems (VMEs).
	• 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. • Important feeding, breeding or migratory areas for threatened species (these areas may move spatially or temporally).	• Location flagged as high potential for reducing species extinction risk. • Location identified as likely to contain critical habitat.	• IUCN Red List of Threatened Species. • Minimum threshold for the Species Threat Abatement and Restoration (STAR) metric. • Ocean+ Habitats marine biodiversity spatial datasets. • World Shipping Council (WSC) Whale Chart. • Global Critical Habitat Screening layer. • WWF Biodiversity Risk Filter.

Area	Criteria	Example indicator that the criteria has been met[43]	Reference datasets and tools
Biodiversity importance	• Areas containing ecosystems that are rare, very localised or 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.	• Location contains ecosystem types listed as endangered under the IUCN Red List of Ecosystems.	• IUCN Red List of Ecosystems, seamounts or coastal upwellings. • Ocean+ Habitat datasets such as mangroves, seagrasses, coral reefs; World Database on Ecological Corridors World Database of Ecological Corridors (undergoing pilot testing). • Eurasian African Bird Migration Atlas. • Atlas on Migratory Ungulates (developed by Global Initiative on Ungulate Migrations (GIUM)). • Conservation Imperative Sites (terrestrial sites that harbour rare, range-restricted and threatened species, located outside currently protected areas).

Area	Criteria	Example indicator that the criteria has been met[43]	Reference datasets and tools
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 a 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.	• Location contains predominantly natural ecosystem types with high average integrity index value (e.g. over threshold guided by specific dataset). • Landscape has undergone high levels of ecosystem conversion in recent period (e.g. average of 0.5% of area per year within a consecutive five-year period)[44], as a proxy for decline in integrity. • Landscape has shown a decline in average integrity index values from a high integrity baseline (e.g. average decline in integrity index values per year over five-year period).	**Spatial datasets reflecting ecosystem conversion** • Global Nature Watch – tree cover loss. • SBTN Natural Lands Map. **Spatial datasets of ecosystem integrity indices** • Ecosystem Integrity Index (EII). • The Natural History Museum – Biodiversity Intactness Index (BII) (indicative 90% threshold for high integrity)[45]. • Mean Species Abundance layer (indicative 72% threshold for high integrity[46]). • Forest Landscape Integrity Index (value of 9.6 indicative threshold for high integrity[47]). • Ecoregion Intactness Index (ErII). • See also IUCN Red List of Ecosystems database for relevant condition data underpinning assessments. See Annex 2 for further information on the concepts of ecosystem condition and ecosystem integrity.

44 Buchadas, A., et al. (2022) Uncovering major types of deforestation frontiers across the world's tropical dry woodlands.

45 Newbold, T., et al. (2016) Has land use pushed terrestrial biodiversity beyond the planetary boundary? A global assessment.

46 Lucas, P. and Wilting, H. (2018) Using planetary boundaries to support national implementation of environment-related SDGs.

47 Grantham, H. S., et al. (2020) Anthropogenic modification of forests means only 40% of remaining forests have high ecosystem integrity.

Area	Criteria	Example indicator that the criteria has been met[43]	Reference datasets and tools
	• **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.	• Evidence of environmental crime may provide an additional indicator of impact drivers affecting the ecosystem that could contribute to rapid or undocumented declines in ecosystem integrity.	Datasets which indicate potential presence of environmental crime: • EIA Global Environmental Crime Tracker; • WWF Risk Filter Suite regulatory deficiency risk layers; • WWF and Themis Environmental Crime Financial Toolkit; • CITES e-permitting resources, Global Nature Watch, incorporating Global Fishing Watch; and • TRAFFIC resources.

Area	Criteria	Example indicator that the criteria has been met[43]	Reference datasets and tools
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.	• Location contains land/ freshwater/ocean identified as Critical Natural Assets. • Location within or in proximity to ICCA.	• Indigenous Peoples' and community-conserved territories and areas (ICCAs). • Global Land Governance Index LANDex Indicators. • The Indigenous Navigator. • LandMark (also available in the Global Nature Watch map). • ENCORE (that contains hotspots of natural capital depletion spatial layers). • InVEST (quantifies, maps and values ecosystem services). • WWF Risk Filter Suite. • Toolkit for Ecosystem Service Site-Based Assessment (TESSA). • Ocean Wealth (maps ocean ecosystem services). • Critical Natural Asset layers.

Area	Criteria	Example indicator that the criteria has been met[43]	Reference datasets and tools
Water physical risk	• Areas of limited water availability, flooding and/or poor quality of water. This also includes marine areas with high levels of land-based pollution.	• Location flagged as high water scarcity. • Location flagged as at high risk of flooding. • Location flagged as poor water quality. • Evidence of the presence of environmental crime may provide an additional indicator of impact drivers that could contribute to elevated physical water risks.	• WRI Aqueduct Water Risk Atlas and Tools. • WWF Water Risk Filter. • Ocean+ Habitats for information on marine biodiversity and critical marine and coastal habitats. • Proxies for the presence of environmental crime could include, for example, the regulatory deficiency layer in the WWF Water Risk Filter.

Organisations are encouraged to use this list of reference datasets and tools and draw on other relevant sources. As new tools and sources emerge over time, the TNFD will update the list of these reference datasets and tools in the TNFD Tools Catalogue. Organisations can also refer to the UNEP WCMC Nature Tools Compass.

Box 12 provides a case study for how a piloting organisation, Iberdrola, approached this.

Key dataset and tool functionalities for L4:

- Screen operational and supply chain coordinates against the sensitive location criteria, including (1) areas of biodiversity importance, such as protected areas; (2) areas of biodiversity importance, such as areas important to species or evolutionary processes; (3) areas of high/rapidly declining ecosystem integrity; (4) areas of high physical water risk; or (5) areas important for ecosystem service delivery and Indigenous Peoples' and community-conserved territories and areas.
- Incorporate spatially explicit datasets and indices measuring, for example, threatened species distributions, ecosystem integrity and baseline physical water stress.
- Assess the certainty around any sensitivity assessment and potential distortion due to the presence of environmental crime.

Types of resources with illustrative examples:

- **Biodiversity importance and corridors** e.g. World Database on Protected Areas (WDPA), Key Biodiversity Areas (KBA), Global Critical Habitat Screening Layer, IUCN Red List of Threatened Species, Species Threat Abatement and Restoration (STAR) metric layers, Ocean+ Habitats, Eurasian African Bird Migration Atlas, Ramsar Sites, Alliance for Zero Extinction (AZE) Sites, Conservation Imperative Sites.
- **Ecosystem integrity** e.g. Biodiversity Intactness Index (BII), Ecosystem Integrity Index (EII), IUCN Red List of Ecosystems.
- **Ecosystem service delivery importance** e.g. InVEST, TESSA, WWF Risk Filter Suite, Indigenous Peoples' and community-conserved territories and areas (ICCAs), Global Land Governance Index LANDex Indicators, The Indigenous Navigator, LandMark (also available in the Global Nature Watch map), ENCORE (containing hotspots of natural capital depletion spatial layers).
- **Physical water risk** e.g. WRI Aqueduct Water Risk Atlas, WWF Water Risk Filter (to identify facilities and supply chain locations located in areas of high physical water risk).
- **Potential presence of environmental crime** e.g. WWF Risk Filter Suite regulatory deficiency risk layers, WWF and Themis Environmental Crime Financial Toolkit, CITES e-permitting resources, Global Nature Watch, incorporating Global Fishing Watch, TRAFFIC resources, EIA Global Environmental Crime Tracker, or governance and corruption indicators.

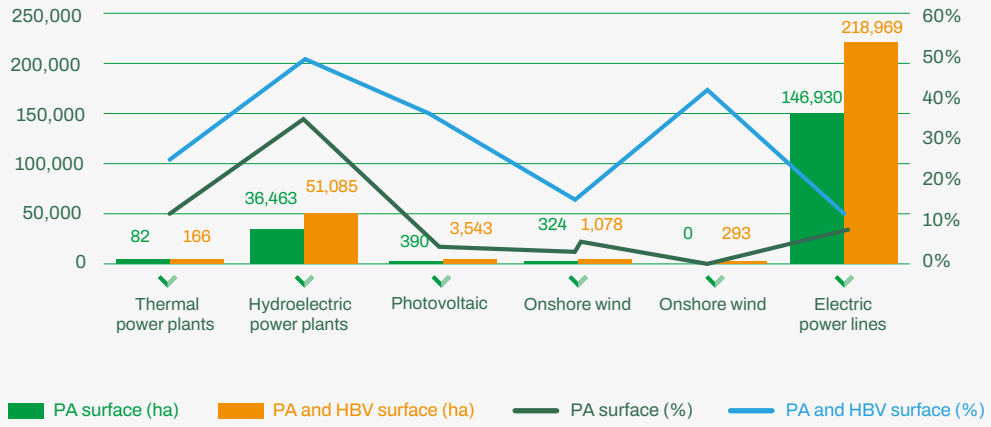
Box 12: Identifying sensitive locations

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, for both operational projects as well as projects under construction, and defined both the occupation area and the surrounding influence area for each facility.

Iberdrola combined its mapped assets with a range of data layers representing location sensitivity criteria (including biodiversity importance, ecosystem integrity, areas of importance for Indigenous Peoples and water stress) to identify potential sensitive locations as defined by the LEAP approach. Only the layers considered relevant for each technology and phase were used in the assessment, based on potential impacts and dependencies.

For each technology, the area overlapping sensitive locations was calculated. The figure below shows facilities overlapping protected areas or areas of high biodiversity value.

Figure 32: Iberdrola Group interface with protected areas or areas of high biodiversity value



Iberdrola has also considered overlap with species distribution. For facilities under construction, all taxa were assessed, while for operational facilities, only taxa that could potentially be affected by the specific technology were considered. Iberdrola identified threatened species included in the IUCN Red List, with habitats overlapping areas where Iberdrola has facilities. This helped Iberdrola understand regions where it has assets potentially interfacing with hotspots for endangered species.

IUCN Red List of Threatened Species[48]					
	Critically endangered (CR)	Endangered (EN)	Vulnerable (VU)	Near Threatened (NT)	Least Concern (LC)
Spain	13	42	100	122	1,190
United Kingdom (Scottish Power)	1	3	2	9	127
United States/ Canada (Avangrid)	2	13	10	11	36
Brazil (Neoenergia)	5	20	43	35	928
Mexico (Iberdrola Mexico)	0	5	10	15	417
Iberdrola Energía International IEI	2	3	22	22	309
Totals	22	81	172	188	2,568

Source: Iberdrola (2024) Biodiversity Report.

Box 13: Identifying sensitive locations in financial institution portfolios

ING

ING, the Netherlands-headquartered global bank, developed industry-level assumptions to estimate the countries in which its clients were likely to operate, based on global production patterns from EXIOBASE. ING then linked this analysis with indicators including ecoregion intactness, ecoregion intactness change, species status and water stress to identify countries with high significance for nature and the industries most likely to operate within them.

This example illustrates how a financial institution can use proxy location data and nature-related indicators to identify the geographies where nature-related dependencies and impacts are most likely to be concentrated by sector, helping to prioritise further assessment.

48 Total threatened species numbers reflect the fact that, in some cases, the same species is found in multiple locations.

Banco de Bogotá

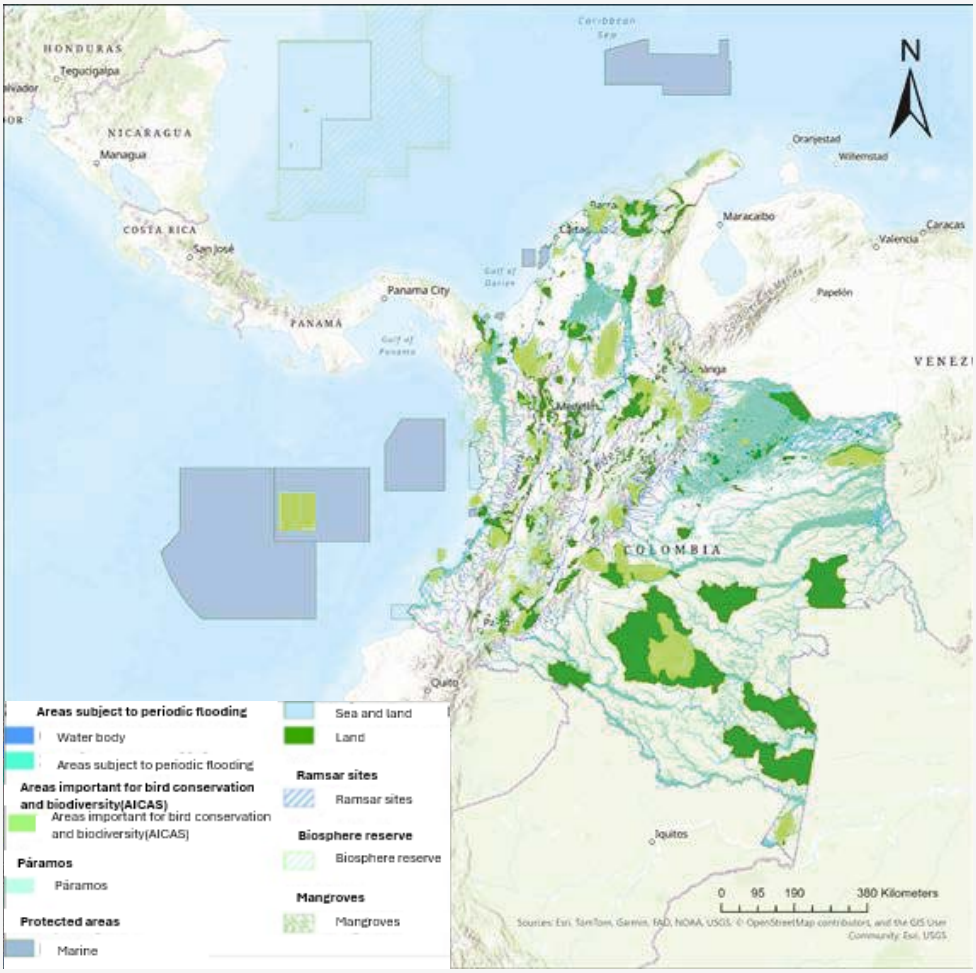
Recognising the importance of understanding the location of financed assets, Banco de Bogotá, a Colombian commercial bank, first conducted a sector-level assessment of nature-related dependencies and impacts. This assessment enabled the bank to prioritise sectors and clients for a more granular geolocation process, including a manual search for information on the location of their productive assets.

The initial sector-level assessment identified 122 clients operating in sectors with potentially significant dependencies and impacts on nature. The bank then incorporated a location-based dimension by identifying an additional 202 clients located in or near municipalities exposed to water scarcity or excess water within the Magdalena River Basin, considered a high-interest area due to its strategic importance to Colombia and its inclusion among the Water Resilience Coalition's 100 Priority Basins. Together, these two criteria defined a group of 324 priority clients for which the bank conducted a targeted search for geographic information to support subsequent analysis and monitoring.

Coordinates were obtained through manual searches of productive assets, geolocation data previously collected through the bank's environmental and social risks assessments and, where exact operational locations were unavailable, commercially available information used to estimate the relevant area of influence. Through this process, the bank identified the locations associated with 90% of the portfolio balance of the 324 priority clients.

Banco de Bogotá then overlaid these locations with spatial datasets on environmentally sensitive locations. This enabled the bank to identify where priority clients may interface with sensitive locations and ecosystems, helping to inform its subsequent assessment of nature-related risks and opportunities.

Figure 33: Banco de Bogotá's assessment of sensitive locations in Colombia



E.SUN

E.SUN Financial Holding, a large private-sector financial institution headquartered in Taipei, used geospatial analysis to identify priority locations across its direct operations, supply chain and financing and investment portfolio.

Recognising the distinctive geographic characteristics of its core market, including biodiversity-rich mountainous landscapes, limited developable land and growing pressure on freshwater resources, E.SUN focused its analysis on four location-specific criteria: areas projected to experience future water supply gaps, Freshwater Resource Areas, developable sloped areas and Key Biodiversity Areas (KBAs).

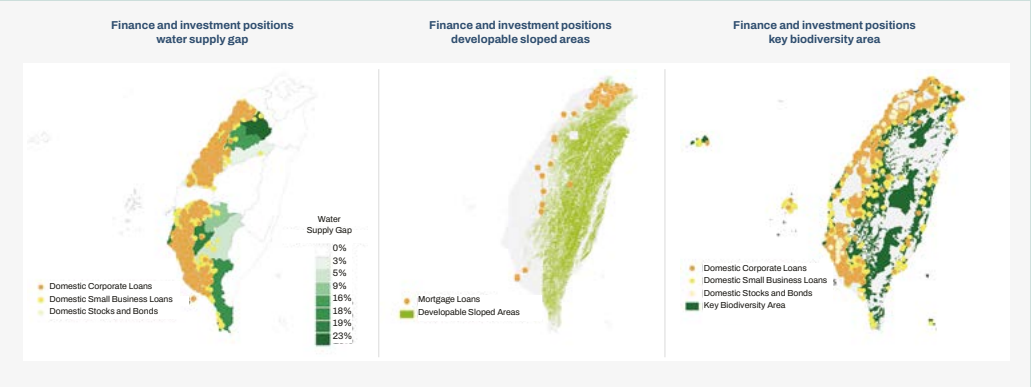
The bank mapped its direct operational sites, supplier locations, total credit balance and mortgage collateral against these sensitive location criteria to identify where nature-related dependencies and impacts may be concentrated. Freshwater Resource Areas

were defined as primary regulated groundwater areas, reservoir catchment areas and river zones, while projected water supply gap areas reflected locations where water shortages were expected to occur by 2036 in the absence of additional investment in water infrastructure. Biodiversity analysis calibrated global KBA data with local ecological datasets, wildlife habitats and biodiversity hotspots. Developable sloped areas were defined as lands with a slope of grade six or above, excluding recognised landslide and geological hazard sensitive areas. E.SUN included developable sloped areas in its analysis due to the dependency of operational sites and mortgage collateral on ecosystem services related to soil retention and erosion prevention.

The analysis found that 15.7% of the bank's total credit balance was located in areas with a projected water supply gap exceeding 10%, while 0.2% of its total mortgage balance was situated within developable sloped areas, and 20.7% of financing and investment exposure overlapped with KBAs. The assessment also highlighted the relevance of freshwater resource areas across the portfolio.

This analysis enabled E.SUN to identify locations where nature-related dependencies and impacts may be concentrated, providing a foundation for the subsequent phases of LEAP.

Figure 34: E-SUN's financing and investment portfolio mapped as overlapping with areas with a water supply gap, sloped land or KBA



Sources: ING (2024) ING's Nature Approach; Banco de Bogotá (2025) Riesgos y oportunidades de la naturaleza; E-SUN (2023) 2023 Climate and Nature Report.

4.8. Taking assessment locations forward to other LEAP phases

After identifying locations with potentially moderate or high dependencies and impacts and sensitive locations in the Locate phase, organisations can further refine their assessment locations in the Evaluate and Assess phases (Figures 35 and 36).

Figure 35: Assessment of priority locations: sensitive locations and locations with material nature-related issues

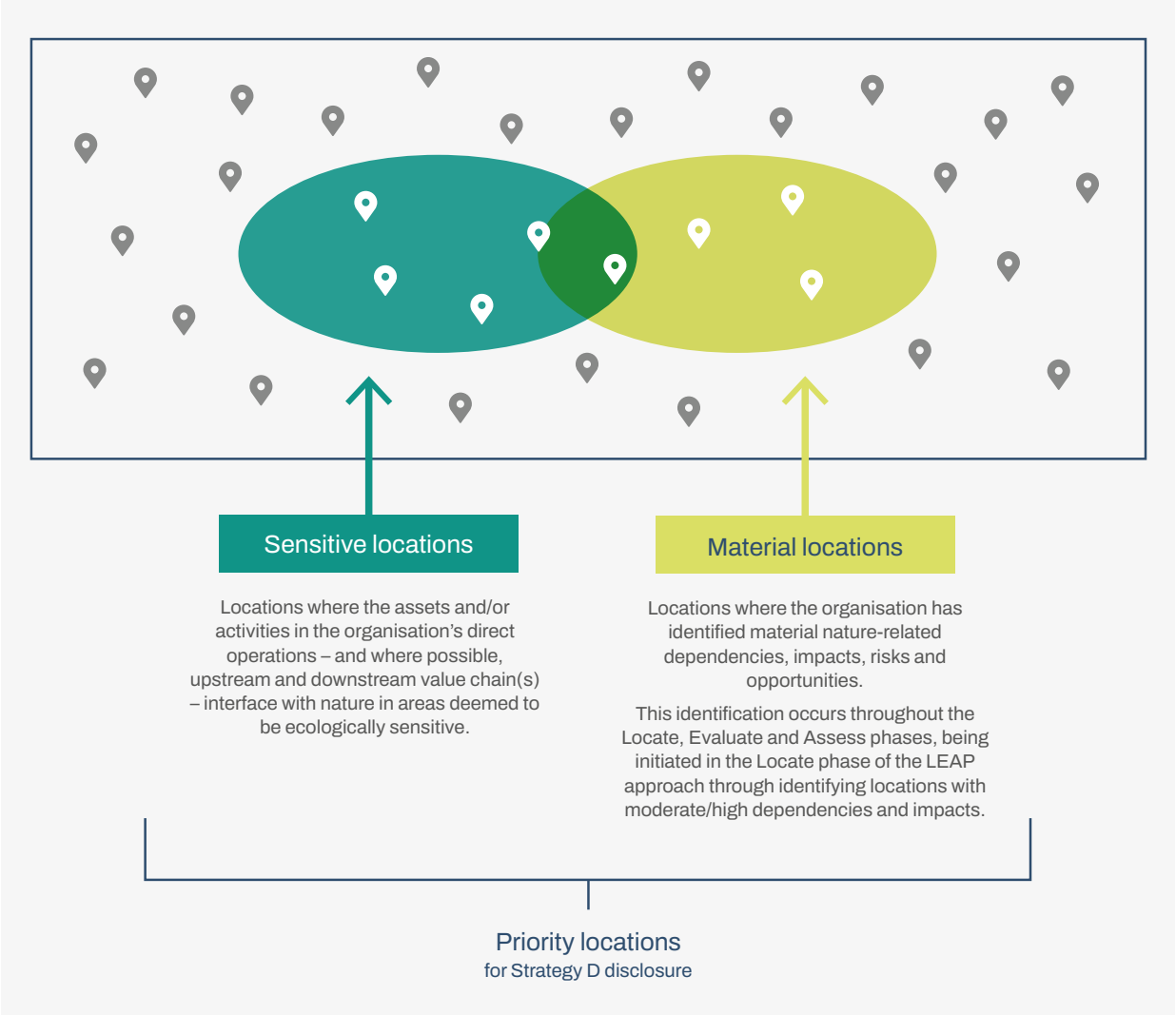
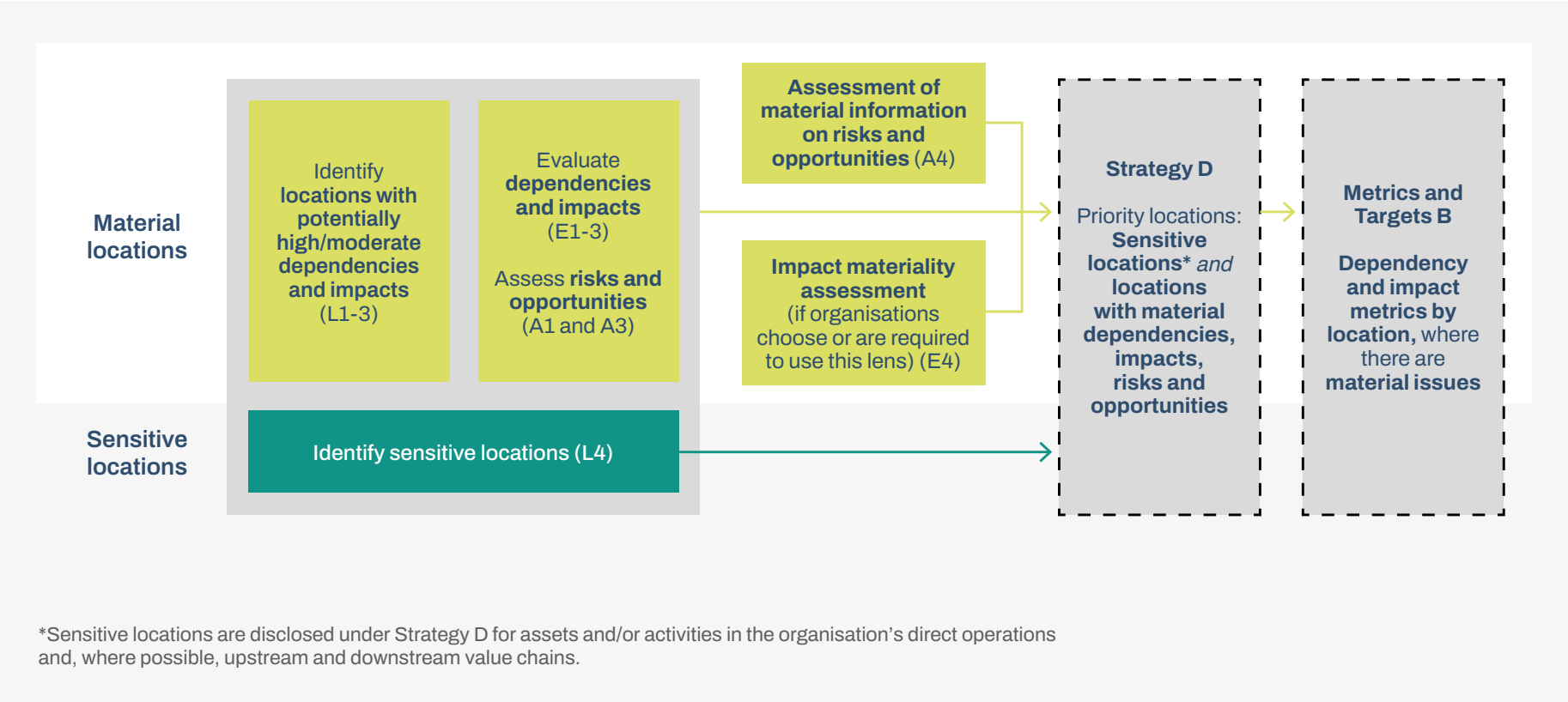


Figure 36: Refinement of an organisation's list of locations throughout the assessment process



*Sensitive locations are disclosed under Strategy D for assets and/or activities in the organisation's direct operations and, where possible, upstream and downstream value chains.

4.8.1 Further prioritising locations for analysing dependencies and impacts in more detail in the Evaluate phase

The TNFD recommends evaluating dependencies and impacts in all identified assessment locations. However, if an organisation needs to further understand where to begin – for example, if the number of assessment locations is very high – assessment teams may consider, for example, beginning with a set of highest priority locations in the Evaluate phase. These may include (a combination of): [49]

- Locations assessed as **both sensitive and** with activities and/or assets associated **with moderate or high dependencies and/or impacts on nature**;
- Locations where activities and/or assets are associated with the **highest potential dependencies and/or impacts** on nature;
- Value chains that pass through geographies, routes or nodes known to have **elevated presence of environmental crime or its facilitation** (see L3), particularly where this may create uncertainty regarding location, traceability, dependencies or impacts and therefore warrant further evaluation in the Evaluate phase;
- Locations with the **highest sensitivity** for one criteria and/or that meet multiple sensitive location criteria. For example, areas that have high integrity ecosystems that are also highly threatened or have high importance for species;
- Locations with the **highest priority scores using established ranking methodologies**, such as set out in SBTN Step 2; and
- Locations assessed as sensitive, and/or associated with potentially moderate or high dependencies and/or impacts on nature, where **stakeholders may have highest vulnerability**, such as where Indigenous Peoples and Local Communities are likely affected.

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

49 In prioritising locations, organisations may also consider how to enhance the usability of the LEAP outputs in other uses cases. For instance, organisations may decide to preserve a scope that includes at least one realm, value chain segment and business unit combination, which would align with a minimal scope for setting SBTN targets following the organisation's 'Accelerated Pathways'.

4.9. Desired outputs from the Locate phase

The purpose of the Locate phase of the LEAP assessment process is to provide a structured, scientific approach to considering all direct, upstream and downstream locations of relevance to the organisation's business model or capital portfolio. Organisations should produce a shortlist of sensitive locations and locations where there is a likelihood of moderate or high nature-related dependencies and impacts on nature that could give rise to risks and opportunities that could reasonably be expected to affect the organisation's prospects.

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

For corporates:	For financial institutions:
• An initial list and/or map of assessment locations to take forward to the Evaluate phase. This includes locations where the organisation has activities and/or assets in its direct operations and value chains with moderate and high dependencies and impacts on nature (identified in L2), which could give rise to material dependencies, impacts, risks and opportunities. **Note:** These locations will be refined from this initial list through the Evaluate and Assess phases where materiality is assessed. Impact materiality is assessed in E4 and financial materiality in A4 (Figure 36). After further analysis in the Evaluate and Assess phases, the final list of material locations should be disclosed following TNFD recommended disclosure Strategy D, and used as the basis for reporting of dependency and impact metrics following TNFD recommended disclosure Metrics and Targets B. • An initial list and/or map of sensitive locations: locations where the organisation has activities and/or assets in its direct operations and, where possible, value chains that meet the TNFD criteria for sensitive locations (L4). **Note:** Sensitive locations where the organisation has assets and/or activities in its direct operations – and, where possible, upstream and downstream value chain(s) – are disclosed following TNFD recommended disclosure Strategy D. • This could include locations where uncertainty regarding origin, destination, traceability or ecological condition may affect the assessment, including where environmental crime may be relevant or indicate potentially elevated nature-related risks.	• A heatmap of potentially material sectors (L2). • High-level geographies of potentially material sectors and prioritised parties, geographies activities and/or underlying assets, and analysis of the types of ecosystem or biome likely to be associated with them (L3). • An analysis (most likely by portfolio) of its clients/investees' interface with sensitive locations. • Identification of location-related uncertainties relevant to the LEAP assessment, including those arising from environmental crime or indicating potentially elevated nature-related risks. **Note:** These outputs provide an initial basis for identifying potentially material nature-related issues within portfolios and should be refined through the Evaluate and Assess phases where materiality is assessed.

4.10. Resources to support the Locate phase

There are a range of data, tools and methods that can be used to inform the Locate phase. Key functionalities of these resources with illustrative examples are provided above for L1-L4.

Further tools can be found through the TNFD Tools Catalogue and UNEP-WCMC Nature Tools Compass. These two sources signpost to a large number of relevant resources, but are not exhaustive. The example datasets and tools for each LEAP component are not exhaustive. Compendiums of useful data have been developed by the European Business and Biodiversity Platform, WWF and UNEP-WCMC and the Finance for Biodiversity Initiative. Data availability varies within resources across geographies, biomes and sectors.

Further tools 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 6); and
- Heatmapping tools to help identify locations of potentially material nature-related dependencies, impacts, risk and opportunities.

Most of the tools and datasets listed in this LEAP guidance are freely available, but some are provided on a fee-for-service basis. The TNFD Tools Catalogue includes both freely available and fee-for service resources, while the UNEP-WCMC Nature Tools Compass includes only freely available resources.

4.10.1 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, the 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.

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 assessment of ecosystem condition.

While the TNFD recognises that current data constraints may mean that early attempts at undertaking this analysis may be 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.

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.[50] For those organisations that need or want to report on their impacts on nature using an impact materiality lens, for example using GRI Standards or in accordance with regulatory requirements, component E4 is aligned with the GRI impact materiality test to help define nature-related impacts that should be disclosed.

The Evaluate phase of LEAP helps the LEAP assessment team refine its understanding of an organisation's dependencies and impacts on nature through its activities in assessment locations. Therefore, the type and depth of analysis an organisation can undertake may depend on the number of assessment locations in scope, the level of certainty about their location, and the level of specificity and granularity of information on activities at assessment locations. For example, financial institutions are likely to have large numbers of assessment locations once they consider the relevant locations in the operations of portfolio companies.

Guidance for the Evaluate phase, including guiding questions, is provided for corporates and financial institutions distinctly. Guidance considers that financial institutions are likely to have more assessment locations and a lower level of certainty about their precise geo-location. Large corporates with complex value chains and large numbers of assessment locations may also find the guidance for financial institutions useful and relevant for them.

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 primarily concerns the dependencies and impacts of their portfolio companies.

Organisations depend on the reliable and cost-effective supply of ecosystem services from nature that are essential to their business processes and those of the organisations in their value chains, including the portfolio companies of 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 an organisation and its capital providers.

50 Capitals Coalition (2016) Natural Capital Protocol.

Organisations also have impacts on nature and the supply of ecosystem services. These impacts may be positive or negative. An organisation's negative impacts on nature can degrade environmental assets and undermine the supply of ecosystem services on which the organisation and others depend. This can create both physical and transition risks, as well as systemic risks if the impacts lead to the destabilisation of a critical natural system, so it can no longer provide ecosystem services in the same manner as before. Conversely, an organisation's positive impacts on nature can enhance environmental assets and the supply of ecosystem services, contributing to the resilience of nature and its capacity to provide ecosystem services, and creating potential opportunities for the organisation.

Objective

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

Desired outputs

- A list of the organisation's dependencies and impacts on nature, including relevant impact drivers, environmental assets and ecosystem services;
- Analysis of potentially material dependencies and impacts on nature; and
- A list of potentially material dependencies and material impacts for disclosure. Impact materiality can be assessed where desired or required, using an impact materiality approach, such as GRI, and jurisdiction-specific standards, such as in China, Europe and India.

Practical tips

- Source a range of skills and expertise including internal and external experts;
- Consider when direct measurement is necessary, and when publicly available information, secondary or modelled data could be used; and
- Set feasible goals and build up over time.

An organisation's impacts on nature today can shape its dependencies on nature in the future, and therefore the organisation's ability 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, organisations that contribute positively to the health and resilience of nature can secure and enhance the flow of future ecosystem services on which the organisation and its value chain partners depend.

- **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

the 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 and activities within priority sectors, and companies with activities that are in, or potentially 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). Relevant information may be available through shared monitoring and stakeholder engagement mechanisms as part of landscape or seascape approaches.

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 risks and opportunities that could reasonably be expected to affect the organisation's prospects.

5.2. What

In the Evaluate phase, a LEAP assessment team identifies and assesses the dependencies and impacts on nature in its business model and value chain.

The Evaluate phase goes beyond the information used to undertake the initial screening of potentially material dependencies and impacts on nature in L2. The analysis in L2 uses information about the typical ecosystem services and impact drivers associated with particular activities. In the Evaluate phase, the LEAP assessment team considers the actual dependencies and impacts of the activities in its specific business model and value chain – or portfolio in the case of financial institutions – in the locations identified in the Locate phase.

In E4, the project team identifies impacts on nature that are material according to an impact materiality approach (for example, for disclosure aligned with the use of GRI standards).

- **For corporates:** The starting point for the identification of dependencies and impacts on nature should be an 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 refined in L3 and L4.
- **For financial institutions:** The focus should start with understanding the dependencies and impacts associated with the companies and/or activities in their portfolios. The aim is to understand and verify their potential exposures to dependencies and impacts on nature in the locations identified in the Locate phase and the significance of these dependencies and impacts within the context of the management efforts undertaken by portfolio companies and other relevant parties.

A financial institution might advance different parts of the Evaluate phase at different paces or to different levels of specificity. For example, it might focus on dependencies on a specific ecosystem service, expanding to other parts of the dependency or impact pathway or other topics over time. Or it might consider one type of evidence, such as a company's governance of relevant nature-related issues in the first iteration and expand to other sources in further iterations.

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** (see Figure 36 in the Locate phase).

Environmental crime, data limitations and traceability gaps identified in the Locate phase may create hidden dependencies and impacts or affect their assessment. Such uncertainties should be carried forward and inform analysis in the Evaluate phase. Further guidance on incorporating these considerations into the Evaluate phase can be found in the TNFD guidance on environmental crime.

The outputs of the Evaluate phase provide the basis for the Assess phase, in which the LEAP assessment team identifies and assesses nature-related risks and opportunities that arise from dependencies and impacts on nature and material information to disclose about these risks and opportunities.

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 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?	Which companies or activities in our portfolios should be analysed? What are the environmental assets, ecosystem services and impact drivers associated with these companies or activities in their locations? Is there any concentration of potentially material dependencies and impacts in specific geographic locations, sectors or value chains?
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

E1: Identification of environmental assets, ecosystem services and impact drivers	***For corporates*** *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?*	***For financial institutions*** *Which companies or activities in our portfolios should be analysed? What are the environmental assets, ecosystem services and impact drivers associated with these companies or activities in their locations? Is there any concentration of potentially material dependencies and impacts in specific geographic locations, sectors or value chains?*

Corporates: Building on the analysis in the Locate phase, the LEAP assessment team can engage line and 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.

Corporates can start with the sectors, activities and value chains identified as having potentially moderate or high dependencies and impacts 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 with which their activities interface.

When considering locations, corporates should recognise in their analysis that dependencies and impacts can occur, or affect stakeholders, in locations at a distance from where business processes and activities are based (see also Box 8 on areas of influence).

For financial institutions: Informed by the outputs of dependency and impact screening (e.g. analysis in the Locate phase (L2)), the LEAP assessment team first identifies the companies, the activities of those companies and/or the locations to be prioritised for further dependency and impact assessment. This prioritisation should be based on the potential exposures to dependencies and impacts on nature and sensitive locations identified in the Locate phase. For example, a financial institution may choose to focus on companies in a particular sector

or asset class in its portfolio, companies in a particular location, companies that depend on a particular ecosystem service or those associated with particular impact drivers.

The team then combines disclosed company data, third-party data, its own modelling and information from engaging with portfolio companies to produce:

- A qualitative list of impact drivers that are associated with these business activities and processes in those locations; and
- A qualitative list of relevant environmental assets and ecosystem services in the associated locations.

Financial institutions may use the outputs of L2 to form initial hypotheses for this analysis, as well as the TNFD biome guidance. In the Evaluate phase, they should seek to verify the relevance of that information to the specific context of the focal companies and locations.

5.4.1 Identifying relevant impact drivers

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

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 7, although this is not exhaustive. Other impact drivers that are also relevant to the organisation, but not included in the table, should also be considered. Organisations may wish to refer to the Natural Capital Protocol,[51] which provides examples of impact drivers, and the TNFD sector guidance and biome guidance for impact drivers associated with specific sectors and biomes.

51 Capitals Coalition (2016) Natural Capital Protocol.

Table 7: Impact drivers, by driver of nature change

Drivers of nature change	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 or fish spawning Areas of infrastructure that alter ecosystem connectivity, such as roads or railways Areas of infrastructure using 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
Pollution/pollution removal	**Business outputs** Non-GHG air pollutants Water pollutants Soil pollutants Solid waste Disturbances	Volume of fine particulate matter (PM2.5) and coarse particulate matter (PM10), volatile organic compounds, mono-nitrogen oxides, sulphur dioxide and 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 and plastics) or by disposal method (e.g. landfill, incineration, recycling and specialist processing) Decibels and duration of noise at site of impact Lumens and duration of light at site of impact

Drivers of nature change	Categories of impact driver and external driver of change	Examples
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
Invasive alien species (IAS) introduction/ removal	**Business outputs and associated pathways** Introduction, establishment, spread and removal of invasive alien species*	Presence/absence of IAS by location Number of newly introduced, established or newly detected IAS, by species Abundance or density of IAS, by species Extent affected by IAS (km^2) Area cleared, under control or under restoration (km^2) Number of IAS escape incidents or escaped individuals, by species biological invasion pathway indicators Volume of ballast water discharged Volume of soil, aggregate or other material transported between locations Number of transfers of machinery and equipment Number of aquaculture escape events and escaped individuals, by species Volume of imported planting material, nursery stock or seeds

*Note on IAS measurement: Direct IAS measurement focuses on the occurrence, establishment, spread or removal of IAS. Pathway indicators may support risk identification, prioritisation and monitoring design, but should not be considered a substitute for direct IAS measurement. Further guidance on IAS measurement is provided in Annex 4.

Sources: Adapted from IPBES (2019) Global assessment report on biodiversity and ecosystem services and Capitals Coalition (2016) Natural Capital Protocol.

5.4.2 Identifying relevant environmental assets and ecosystem services

Environmental assets and ecosystem services that organisations should consider are summarised in Figure 6 and outlined in more detail in Section 2 of this document on 'Foundations for understanding nature and nature-related issues'. Organisations can refer to these lists to complete this component.



Additional considerations for financial institutions

The LEAP assessment team should identify the environmental assets and ecosystem services associated with the prioritised locations and the business activities and processes in those locations. This includes the environmental assets and ecosystem services that the companies being assessed may depend on, and those that they may have impacts on. The LEAP assessment team can use sector and value chain screening analysis (such as information gathered in L2) and information from the TNFD sector and biome guidance as a starting hypotheses. In the Evaluate phase, it should verify the relevance of that information to the particular locations and the focal business activities and processes. The team may also want to iterate with components L3 and L4 of the Locate phase and with E3 to narrow down the set of environmental assets and ecosystem services that are likely to be relevant.

This could include considering both company-specific information and information on the context in which the company is operating:

Company-specific information:

- The company's nature-related disclosures (including mitigation actions the company is taking to reduce impacts and sustainably manage dependencies);
- Information about the company's choices of technology. For example, a company using one technology may depend on a different set of ecosystem services from a company using another; and
- Third-party data and reports about the company's activities, including positive or adverse press coverage, Environmental Impact Assessments or planning applications.

Information about the locations where the company is operating:

- Information about the ecosystems and biomes which the company has an interface with, drawing from L3;
- Information about location sensitivity gathered in L4, which may include information about particularly important environmental assets and their condition – e.g. particular habitats or species, and the degree of water stress – as well as the ecosystem services that people depend on;

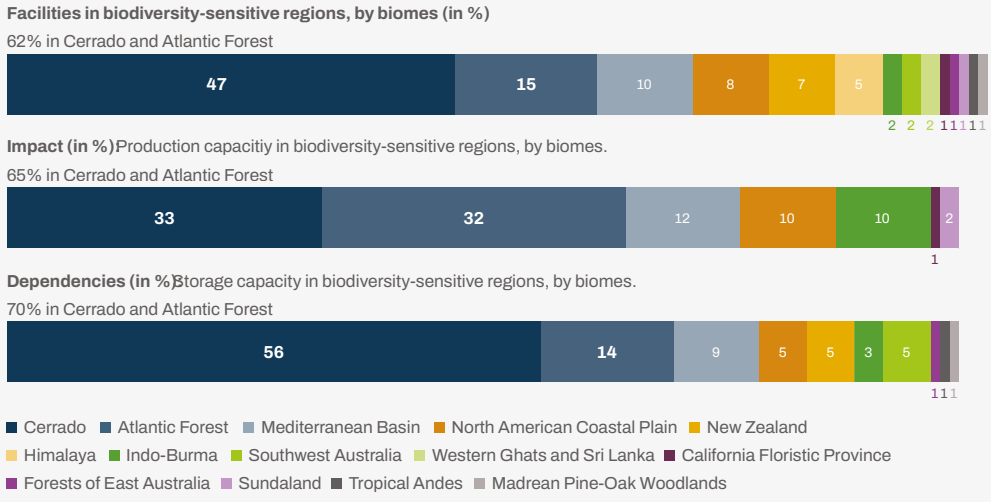
- The principal ecosystem services depended on by other actors in the location. This could consider, for example, the sectors that these other actors operate in and the ecosystem services those sectors typically depend on, using tools like ENCORE;
- Some environmental assets, such as forests, rivers, lakes and other ecosystems, may be identified with publicly available maps; and
- Information about other environmental characteristics, social factors or the legal and regulatory environment associated with the locations, which might reveal the likely relevance of particular ecosystem services. For example, flood mitigation services may be more relevant in a flood plain with infrastructure situated near forested areas.

Box 14: Identification of environmental assets and ecosystem services

Bunge is an agrifood commodities trader, connecting farmers to consumers across a global network spanning more than 50 countries.

Bunge's 2026 biodiversity assessment identified that most of its sourcing facilities in biodiversity-sensitive areas were in the Brazilian Cerrado and Atlantic Forest (also known as Mata Atlântica). These regions also had Bunge's highest dependencies and impacts. Considering facilities in biodiversity-sensitive areas, these two biomes account for 62% of the company's facilities in such regions, 65% of its production capacity and 70% of its storage capacity in the identified biodiversity-sensitive biomes, which also have a high degree of endemism and face significant habitat loss.

Figure 37: Results of Bunge's sensitive location, dependency and impact screening



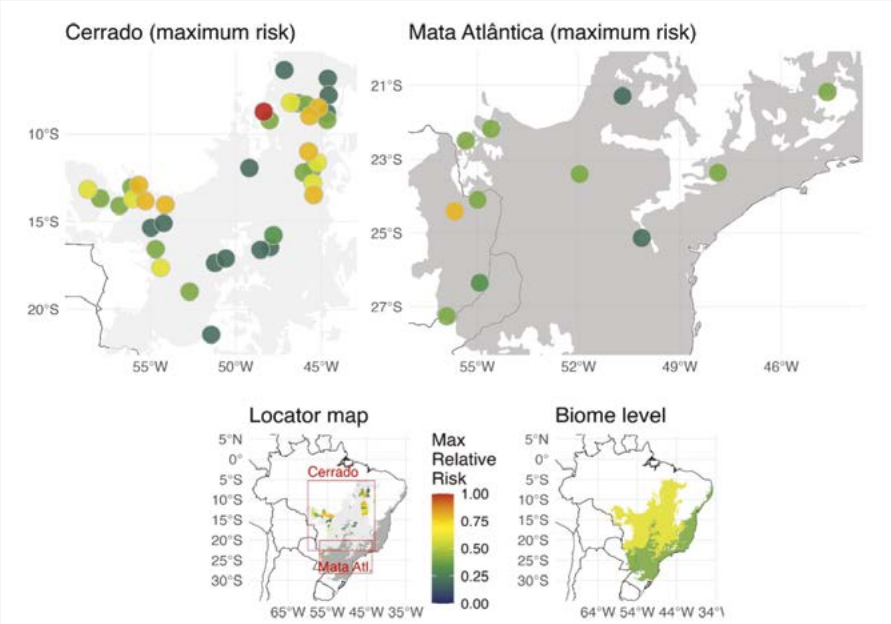
To prioritise locations within these regions for further analysis, including for potential restoration and conservation activities, Bunge assessed the ecosystem service

dependencies of its sourcing facilities in the Cerrado and Mata Atlântica. The assessment evaluated ecosystem services critical to agricultural resilience, including soil retention, water regulation, pollination and biological control.

Building on the ecosystem service analysis, Bunge used a dependency-based approach to better understand how changes in biodiversity and ecosystem services may affect agricultural supply chains in the selected regions. This focused on how the condition of ecosystem services derived from biodiversity intersects with the commodities Bunge sources in the Cerrado and Mata Atlântica. Six primary commodities were in scope: castor beans, cotton, corn, soybeans, sugarcane and wheat. For each crop, the assessment evaluated dependencies across eight ecosystem service categories, reflecting how reliance on services, such as soil regulation, pollination and biological control, varies by crop type.

The resulting insights help inform Bunge's approach within the sourcing regions of the Cerrado and Mata Atlântica, supporting efforts to reduce direct and indirect pressures on nature and to improve the state of nature, including through engagement in multi-stakeholder and landscape-level initiatives.

Figure 38: Bunge's sourcing locations within the Cerrado and Mata Atlântica, assessed for dependencies on prioritised ecosystem services



Overall Maximum Sourcing Risk due to declines since 2001 in seven ecosystem services in the Cerrado (top left panel) and Mata Atlântica (top right panel) of Brazil and Paraguay. The biome boundaries are shown as light gray (Cerrado) or dark gray (Mata Atlântica) shading on the map. The final Overall Maximum Sourcing Risk is the maximum Commodity Sourcing Risk across the seven ecosystem services for all one to six commodities sourced by Bunge in the municipality. The color ramp in the bottom center applies to all maps: municipality points (top maps) and municipality and biome polygons (bottom maps).

Source: Bunge (2026) 2026 Global Sustainability Report

Key dataset and tool functionalities for E1:

- Provide structured taxonomies of impact drivers and ecosystem services, aligned with recognised categories of drivers and ecosystem services.
- Enable organisation- and location-specific analysis, building on outputs from screening tools.
- Identify environmental assets and ecosystem services by location.
- Match operational inputs/outputs to impact drivers and ecosystem services at the asset or site level.

Resource types with illustrative examples:

- **Ecosystem typologies** e.g. IUCN Global Ecosystem Typology.
- **Ecosystem mapping tools** e.g. Global Ecosystem Atlas and other tools recommended in L3.
- **Internal platform tools** e.g. mapping platforms connecting operational activities to environmental assets.
- **Certification scheme data:** Depending on the certification scheme, companies may be able to use certification scheme monitoring, audit and performance data as evidence to identify and measure dependencies and impacts (see Boxes 43 and 50).

5.5. E2: Identification of dependencies and impacts

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

Organisations should start with the following questions:

- **External factors:** What are the external factors affecting our business or portfolio processes and activities, and each assessment location?
- **Ecosystem service supply:** What ecosystem services do our business or portfolio 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, or our portfolio companies', 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?

- **Implications for society and stakeholders:** What might these changes in the supply of ecosystem services and the state of nature mean for Indigenous Peoples, Local Communities and stakeholders in or around assessment locations?
- **Identification of dependencies and impacts:** What are our, or our portfolio companies', 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?

The E2 component of LEAP takes the analysis from E1, provides additional context on the locations and creates causal narratives about:

- How an activity depends on environmental assets and ecosystem services, and changes to those environmental assets and ecosystem services;
- How the impact drivers associated with each activity combine with external factors to cause changes in the state of nature and the flow of ecosystem services to other actors in a location; and
- How these dependency and impact pathways interact in particular locations.

Whereas the L2 component in the Locate phase provides information on typical dependencies and impacts by sector, the E2 component considers an organisation's actual dependencies and impacts in the locations where it operates, integrating qualitative and quantitative data.

Additional considerations for financial institutions

The aim of component E2 is to use screening and location information (e.g. information from Locate phase analysis) and E1 to obtain a more complete description of the prioritised portfolio companies' and/or activities' dependencies and impacts. Using this information, the financial institution can gain a greater understanding of the salience of the potential concentrations of exposures to nature-related issues in their portfolio.

The level of detail in a financial institution's analysis will depend on the resources and information available. It could be a qualitative assessment based on contextual information about nature in the location and the company's technologies and governance processes, which can be used to infer the likely dependencies and impacts on nature. It could also be a detailed quantitative assessment based on the company's disclosures, modelling and third-party data.

A financial institution might also progress different parts of the analysis at different paces. For example, a financial institution might start with a focus on dependencies on a specific ecosystem service, broadening and expanding the scope over time to include impacts and a wider range of topics. Or it may consider one type of evidence in the first iteration (e.g. a company's governance of relevant nature-related issues) and expand to other sources in further iterations.

5.5.1 Understand the 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 dependencies;
- A list of the ecosystem services the organisation and others – including local communities – depend on (prepared in E1). For **financial institutions,** this includes their portfolio companies and activities; and
- An understanding of how the impact drivers and external factors can influence the state of nature, and consequently ecosystem service supply 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 15).[52]

Box 15: Dependency and impact pathways

Dependency and impact pathways are fundamental to evaluating dependencies and impacts on nature, as set out in the Natural Capital Protocol.[53]

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

52 Capitals Coalition (2016) Natural Capital Protocol.

53 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.

- Value impacts:
  - Identify/measure changes in ecosystem service supply (qualitative/quantitative/monetary valuation).

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 supply (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.

Dependency and impact pathways can support organisations in their identification of drivers of nature-related risks (and opportunities) as described in Section 2 and the Assess phase of LEAP.

Box 16: Dependency and impact pathways for organisations with coastal sites

Ocean, land, freshwater and atmosphere realms are interconnected. For many organisations, ocean impact and dependency pathways arise indirectly through impact drivers generated on land via the freshwater-marine continuum, including nutrient run-off, sediment, pesticides and industrial wastewater.

Dependency pathway: Coastal tourism's dependency on coral reefs – Iberostar Hotels and Resorts

Iberostar Hotels and Resorts identified that its coastal tourism business model depended on the health and resilience of coral reefs as environmental assets. As of 2020, approximately half of Iberostar Hotels and Resorts' global operations are based on coastlines facing the Caribbean basin, with 80% of Iberostar's beachfront properties in this region of the Caribbean having reefs within 5 km of their properties. The resulting almost 6 km^2 of reefs were recognised by Iberostar as providing ecosystem services to Iberostar's hotels, operations and the local community, including coastal protection, marine biodiversity and fish biomass, all of which contribute to the quality and attractiveness of their coastal destinations and therefore hotel occupancy rates and group earnings.

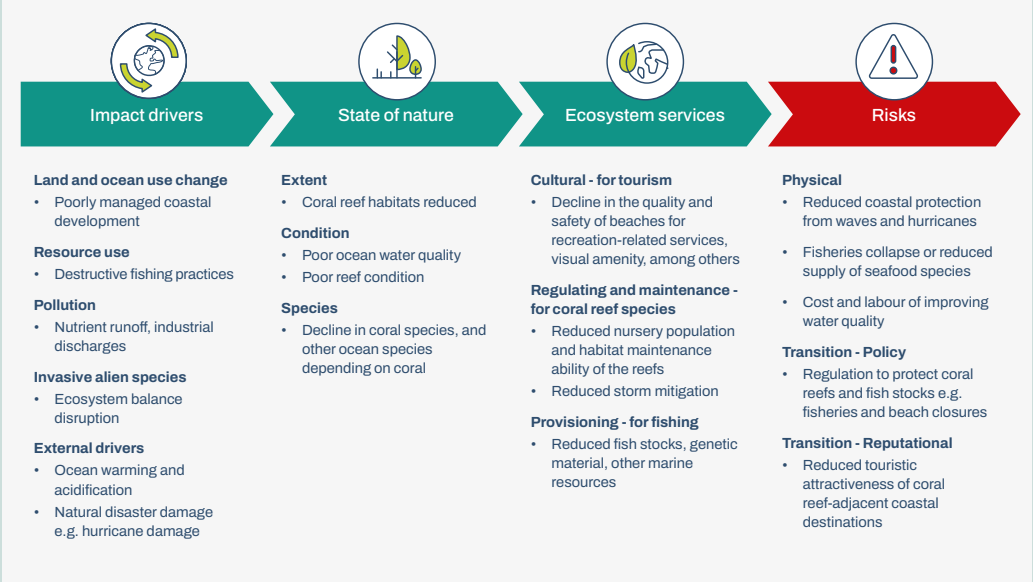
Observed and potential changes in coral reef condition, driven by global factors such as ocean warming and acidification, and local pressures such as destructive fishing practices, hurricane damage, nutrient and sediment pollution, and poorly managed coastal development, could therefore affect the condition of these environmental assets and the supply of ecosystem services upon which Iberostar's business model depends. Degraded reefs may create physical risks for the company, including reduced coastal protection from waves and hurricanes as well as market and commercial risks if declining reef condition, beach quality or recreational value reduce the attractiveness of coastal destinations to guests and tour operators.

To manage these nature-related dependencies and associated risks, Iberostar Hotels and Resorts developed a collaborative reef restoration and resilience strategy aimed at restoring reefs. This has evolved from coral restoration into a broader ecosystem-based reef resilience approach, integrating coral reef condition, biodiversity, fish biomass and ecosystem function, including coastal protection services, that healthy reefs provide to coastal destinations and communities.

Recent site-specific hydrodynamic assessments in front of its properties in the Mexican Caribbean found that submerged reefs can locally reduce significant wave height by up to approximately 1.5m, depending on reef characteristics and wave conditions, reinforcing their role as nature-based coastal protection. The strategy is further supported by research on reefs adjacent to its hotels.

This has enabled the company to measure the progress of its reef restoration work and to monitor resilience through changes in indicators of ecosystem extent and condition, as well as species abundance, including coral condition, biodiversity, fish biomass, ecosystem services and the recovery of key ecological processes.

Figure 39: Iberostar Hotels and Resorts' coastal tourism business model depends on the health and resilience of coral reefs



Dependency pathway: Coastal business operations dependency on mangrove ecosystems – JSW Steel

JSW Steel is a steel manufacturer in India with coastal industrial operations, including its Dolvi operations, located near Dharamtar Creek on the Amba River in Raigad district, Maharashtra. JSW Steel recognises mangroves as environmental assets that support ecosystem services that are relevant to industrial sites and surrounding communities, including erosion control, buffering against waves and floods, water quality regulation, habitat provision and soil stability. The degradation of nearby mangroves and coastal vegetation could reduce the supply of these ecosystem services, potentially increasing physical, operational and stakeholder-related risks for nearby industrial infrastructure, agricultural land and coastal communities.

JSW Steel's mangrove restoration programme in the Dolvi–Dharamtar Creek/Amba River landscape illustrates an ecosystem-based adaptation response. By planting over 2 million mangrove saplings, the programme aims to restore mangrove belts that can strengthen natural buffers against floods, storms and landslides, support biodiversity and reduce vulnerability in a shared coastal landscape. By increasing the resilience of the mangrove ecosystem, the company is lowering the potential future costs that could materialise from a range of physical and transition risks. The programme has been

evaluated as generating community benefits, including livelihood-related outcomes and increased community ownership, which helps show how changes in ecosystem service supply can affect both the company's operating context and local stakeholders.

Impact pathway: Aquaculture's impact on benthic ecosystems – Mowi

Mowi ASA is one of the largest seafood companies in the world and the world's largest producer of Atlantic salmon, with harvest volumes of 559,000 tonnes in 2025, equivalent to a global market share of approximately 20%.

In its 2025 TNFD report, Mowi describes several nature-related dependencies, impacts, risks and opportunities across its value chain. One impact pathway the company describes occurs through its marine aquaculture operations and their interaction with benthic ecosystems (the deepest zone in a body of water). Mowi notes that benthic impacts result from the release of excess organic substances, such as feed and faeces, which can accumulate on the seabed and have a potential negative effect on the ecosystem below the farm.

Mowi identifies that benthic impact poses short- and medium-term risks in cases where a site fails to meet criteria for benthic status. This can be understood primarily as a transition risk (policy and liability) where poor benthic status leads to monitoring or regulatory consequences, and as a reputational risk, where poor benthic conditions create negative reputational effects. The associated financial effects may include longer fallowing periods and imposed reductions in biomass.

Mowi therefore takes action through good management practices, optimal site selection, fallowing and thorough monitoring programmes. The company states that benthic monitoring and fallowing are integral components of its farming practices, helping to reduce impacts and facilitate seabed recovery between production cycles.

Sources: Blanco-Pimentel, M., et al (2022) All-Inclusive Coral Reef Restoration: How the Tourism Sector Can Boost Restoration Efforts in the Caribbean; JSW Steel (2025) TNFD Report 2025; JSW Steel (2026) Biodiversity; Mowi (2026) About us; Mowi (2026) TNFD report.

5.5.2 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 can include natural forces, such as natural hazards, rivers changing routes or geological activity, and human activities beyond the business, such as climate change, land-use change, increased water use and pollution. Human behaviours are driven by socio-economic and institutional factors.

As part of their assessment of dependencies and impacts, organisations should consider the external factors that already affect, or could reasonably affect, the state of nature and the environmental assets and ecosystem services on which they depend over the short, medium and long term. 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 or industrial operation.

Environmental crime may also be a relevant external factor. Illegal activities such as illegal logging, illegal fishing, illegal mining and illegal waste disposal may influence the state of nature in ways that are not fully reflected in official data, corporate disclosures or other information sources. Illegal activities may accelerate ecosystem degradation beyond that expected from legal activities alone and may create uncertainty in ecosystem extent, condition and trends. Organisations can refer to the TNFD guidance on environmental crime for further information.

External factors are also relevant to evaluating impacts as they may interact with the organisation's own impact drivers, potentially leading to cumulative impacts which could trigger ecological tipping points.[54] For example, pollution, water abstraction or land-use change occurring upstream may affect the condition of environmental assets where the organisation or its value chain partners operate.

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[55] and use scenario analysis to explore a range of external factors, as outlined in the TNFD scenario analysis guidance.

54 A tipping point is when a level of change in system properties is reached, beyond which a system reorganises, often abruptly, and does not return to the initial state even if the drivers of the change are abated (See Box 17 on tipping points). See IPBES Glossary.

55 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.

Organisations may discover information on external factors through participation in landscape or seascape approaches, which consider different stakeholder interests and their interface with nature at a landscape or seascape level. Collaborative approaches may be considered as a useful way of taking cumulative dependencies and impacts into account and managing them sustainably, where multiple actors are involved.

Organisations can also consider global climate models to understand the relevance of the effects of climate change to a location as a driver of change and what climate models imply, for example, with respect to water availability or extreme weather events. They could also consider what other sectors are operating in the location and use tools such as ENCORE to understand the typical impact drivers of those sectors to gain insight into the potential dynamics in the location. For example, an organisation might expect a forest to shrink if the area is dominated by sectors typically associated with forest conversion.

5.5.3 Incorporating an understanding of 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. This should include different aspects of the state of nature: ecosystem extent and condition, species population and species extinction risk (see Section 2 and Annex 2 of this document).

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, time lags, cumulative impacts, possible 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 (several decades);
- 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.

While various tools, metrics and reports provide useful resources (see Section 5.6.2 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 assessment. In some cases, the assessment may require an understanding of potential ecosystem tipping points (Box 17).

The TNFD encourages organisations to start forming this assessment by drawing on analysis in L3, which identified the biomes and ecosystem types of 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 (such as through landscape or seascape approaches), 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.

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.

Additional considerations for financial institutions

Analysis of changes in the state of nature is relevant from both a dependency and an impact perspective. Guidance for financial institutions on impacts on the state of nature is presented here. Guidance on dependencies is presented in the next section on ecosystem services.

From an impact perspective, the **financial institution** could try to identify qualitatively the potential impacts that the companies or activities in their portfolio might be having. One way to do this would be to consider how the impact drivers identified in E1 could combine with external factors to lead to a change in the state of the environmental assets also identified in E1.

A first analysis could consider high-level potential connections between impact drivers and information on the state of nature already collected. For example, identifying companies and activities associated with air pollution (E1) that are operating in areas with poor air quality (L4/E1), or companies withdrawing water (E1) in a water-stressed area (L4). This analysis could utilise footprinting and Life Cycle Analysis (LCA) methods and tools.[56]

More specific analysis could consider:

- More particular circumstances, such as whether the company being assessed emits water pollutants (E1) and whether this could be contributing to a decline in the population of a vulnerable aquatic species (L4 and E3); and

56 TNFD (2023) Discussion paper on biodiversity footprinting approaches for financial institutions.

- Assessment based on more detailed information from the company's disclosures or third-party modelled or actual data, combining information on the company's impact drivers and more specific observed changes in the state of nature.

Such analyses could be refined, considering the company's own disclosures, including any information it might have about governance of the identified potential nature-related issues.

Location-specific information – such as the relevant regulatory framework or the extent of external factors compared to the company's own activities in the location – could also provide useful context. The financial institution could also consider how the company's impact drivers might interact with or compound external factors to further drive nature loss.

A financial institution could also consider third-party sources showing trends in the state of nature, where available, to support verification of these hypotheses.

As an output, a financial institution will have identified a subset of the prioritised companies and activities that potentially have impacts on nature and qualitatively assess what those impacts are. A financial institution may want to provide a rating for the certainty of its assessment, based on the context, such as whether it is based on company-specific information.

A financial institution may also want to consider at this stage whether it has many portfolio companies with impacts in particular locations or associated with particular impact drivers.

Box 17: Thresholds and tipping points

Organisations analysing their dependencies and impacts should consider the potential for threshold effects and what scientists refer to as tipping points.

While atmospheric concentrations of greenhouse gases lend themselves well to long-term modelling and the sort of predictive forecasting that underpins today's climate scenarios, the same is not true for many other aspects of nature. The relationship between impact drivers and external factors, changes in the state of nature and the availability of ecosystem services will not always be gradual and predictable. In some cases, the accumulation of impact drivers and external factors can reach a point that triggers a sudden, rapid acceleration in changes to the state of nature and the availability of ecosystem services. This presents business and capital providers with exposure to the risk of acute, rapid-onset hazards.

When a threshold effect or tipping point occurs, 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. The relationship between ecosystem condition and the delivery of ecosystem services is complex and can be non-linear: changes to the state of nature as a result of impact drivers can elicit diverse ecosystem service responses.[57] 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 that are 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.

Source: IPBES Glossary

Useful guidance on thresholds is available through the concept of planetary boundaries framework and online databases of tipping points,[58] while guidance on specific issues such as pollutants can be found in national legislation and pollutant release and transfer registers.[59] Where quantitative thresholds are available, this will act as a useful input to E3 and E4.

57 Liu, C. et al. (2024) Dynamics of ecosystem services and nonlinear responses to increased anthropogenic pressure.

58 Steffen, W. et al. (2015). Planetary boundaries: Guiding human development on a changing planet. Biggs, R. et al. (2018) The Regime Shifts Database: a framework for analyzing regime shifts in social-ecological systems; Resilience Alliance and Santa Fe Institute (2004) Thresholds and alternate states in ecological and social-ecological systems.

59 Defra (2026) UK Pollutant Release and Transfer Register. Threshold List.

5.5.4 Understanding the supply of ecosystem services

The organisation will have identified the ecosystem services present in each location in E1. Building on that understanding, it is now helpful to create an inventory of ecosystem services relevant to the organisation, identified by which entity depends on the ecosystem service (the organisation, other stakeholders) and which environmental assets support the flow of ecosystem services.

While environmental 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:

- In the specific geolocation (GPS coordinates or polygon) of their direct operations and those of their value chain;
- In the area of influence around those locations (see Box 9 in Section 2); and
- 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 to understand the 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.[60] Table 8 contains examples of how changes to the state of environmental assets are connected to the supply of ecosystem services.

In linking business activities to ecosystem services, the organisation may use the results from L2 as a starting hypothesis, but in E2 the organisation should verify that connection in the context of the activity and location being assessed (see Table 8 for examples).[61]

- **From a dependency pathway perspective**, the organisation should review which of these ecosystem services the organisation depends on for its business activities, and

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

61 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 UN et al (2021) System of Environmental-Economic Accounting—Ecosystem Accounting. A crosswalk is available if required from UN et al. (2021) System of Environmental-Economic Accounting—Ecosystem Accounting, Online supplement: Ecosystem Services Reference List Crosswalk to Selected Ecosystem Services Classifications and Typologies.

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.[62]

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

Additional considerations for financial institutions

Dependency perspective for financial institutions

A first analysis could seek to identify potential dependencies that may be the least resilient using information the financial institution has already collected. A financial institution could consider potential connections between the typical sectoral dependencies identified in L2 and information on the state of nature already collected. For example, a financial institution could start by focusing on the companies in sensitive locations, considering whether the sensitivity criteria provide information on the likely resilience of those companies' dependencies. For example, a real estate company dependent on visual amenity services in areas of rapid decline in ecosystem integrity might be less resilient.

Going deeper, a financial institution can identify the likely dependencies of the focal companies in their specific contexts, going beyond the information from L2, and consider whether any changes in the state of nature may affect the flow of those ecosystem services and the resilience of the dependencies.

Identification of dependencies

A financial institution should use the information on typical sector dependencies on ecosystem services from L2 and seek to verify this in the context of the company in question. This will draw on the list of ecosystem services present in the locations identified in E1. For example, if L2 identified that companies in that sector are typically dependent on flood mitigation services, but the organisation is not operating in a flood plain and no flood mitigation services were identified as relevant in E1, it may be reasonable to discount this service from consideration.

A financial institution may also want to consider:

- Company-specific information:
  - The company's nature-related disclosures;

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

- Information about the company's choices of technology: a company using one technology may depend on a different set of ecosystem services from a company using another;
- Information about the scale of the company's operations in the location;
- The company's environmental governance and policies, which may provide confidence that a particular dependency is not associated with that company's activities or is sufficiently well managed as to be considered a lower priority for further analysis. For example, a company that has a high dependency on a supply of water, but has effective drought management policies may not be considered as high a priority for analysis; and
- Third-party data and reports about the company's activities, including positive or adverse press coverage, Environmental Impact Assessments or planning applications.

- Information about the context in which the company is operating:
  - Information about location and location sensitivity gathered in L3 and L4 may provide information about likely dependencies for the company. For example, a company in a sector that typically only has a moderate dependency on soil retention may have a more significant dependency if it is operating on highly sloped land.

Identification of changes in the flow of ecosystem services

Having confirmed the list of ecosystem services the company is likely to depend on, the financial institution can assess the resilience of that dependency and whether changes in the state of nature might affect it in the future.

A financial institution might want to consider any changes in the state of nature resulting from the company's impacts identified earlier in E2, as well as other changes in the state of nature that could affect the supply of ecosystem services the company depends on.

A financial institution could draw on:

- The company's nature-related disclosures;
- Information about location sensitivity gathered in L4. For example, a company dependent on water and operating in a water-stressed area may have a less resilient dependency, while a company on sloped land dependent on an ecosystem for soil retention may have a less resilient dependency if that ecosystem is seeing rapid decline in integrity;
- Information about the governance of nature in the location. For example, a company that depends on a particular fish stock for its fish products may have a more or less resilient dependency based on how well governed fishing of that stock is;

- External factors identified earlier in E2. For example, a tourism company dependent on the stability of a delta ecosystem for cultural services might see that ecosystem affected by sand mining upstream; and
- Third-party sources showing trends in the state of nature, where available.

Going further again, a financial institution might undertake an assessment using more detailed information from the company's disclosures or third-party modelled or actual data, combining information on the company's dependencies on ecosystem services and observed changes in the state of nature. Such analyses could be refined using the company's disclosures, including any information about governance of the identified potential nature-related issues.

As an output, a financial institution would have identified the probable dependencies of the prioritised companies, and a subset where these dependencies are potentially less resilient due to changes in the state of nature.

A financial institution may also want to consider at this stage whether it has many portfolio companies with dependencies in particular locations or associated with particular impact drivers.

Impact perspective for financial institutions

From **an impact perspective**, a financial institution should consider whether the impacts identified on the state of nature might have knock-on effects on the supply of ecosystem services in the location. This could consider the ecosystem services identified in E1. Going further, a financial institution could assess the consequences of such changes, considering whether the location is important for the delivery of any ecosystem services (L4), the Indigenous Peoples, Local Communities and stakeholders in the location, and what the typical dependencies are of other sectors operating in the area.

Table 8: Illustrative examples of changes in the state of nature affecting the supply 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

Ecosystem service	Change in the state of environmental asset affecting the flow of ecosystem service
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
Biological control services, pest and disease regulation	Degradation of native habitat reducing natural regulation of invasive alien pests and pathogens
Various cultural services	Loss of iconic species, habitats and attractive landscapes

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

5.5.5 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 'longlist' 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 shortlisted to be measured quantitatively, where possible.

Box 18: Approaches taken by financial institutions to prioritise nature-related dependencies and impacts in their portfolio

Norges Bank Investment Management (NBIM)

Norges Bank Investment Management (NBIM), the asset management unit responsible for managing the Norwegian Government Pension Fund Global, has holdings in approximately 7,200 companies worldwide.

NBIM's initial screening identified that the agriculture sector was typically associated with high dependencies and impacts on nature, and that the specific companies in that sector in the portfolio had 9% of assets located near Key Biodiversity Areas, 37% in areas of very high water stress and 46% in areas of high drought risk. NBIM therefore decided to prioritise this sector's exposure to water-related dependencies and land-use impacts for more detailed analysis.

To understand which companies were most likely to have dependencies or impacts that could give rise to risks, NBIM analysed how well prepared the companies were to manage the related risks. They compared company-level impact intensity data from a third-party provider with an assessment of how well the companies met NBIM's expectations for managing nature-related risks.

Overall, 36% of portfolio companies met the overall nature expectations, but this varied by topic. 23% met biodiversity expectations and 45% met water management expectations. 14 large cap food and beverage companies had relatively high scores for land-use change, indicating high impacts, and met less than 60% of biodiversity expectations.

Barclays

Barclays, the global financial institution headquartered in London, England, applied the LEAP approach to clients in its Mining and European Power portfolios, covering approximately 30 mining companies and around 40 power companies. The bank selected these sectors based on their relative importance to its business, their potential nature-related impacts and dependencies, and the availability of data to support asset-level analysis.

In the Locate phase, Barclays geolocated and assessed approximately 250 operational mines linked to the around 30 companies assessed, as well as approximately 9,000 power generation facilities linked to approximately 40 companies. Around three-quarters of mines and one-third of power facilities were identified as overlapping with sensitive locations, particularly areas exposed to water-related physical risks.

Building on the asset-level geospatial mapping undertaken in the Locate phase, Barclays evaluated dependencies and impacts on nature at the level of individual operational assets, prioritising the impact drivers of land-use change, water use and air pollution alongside water-related dependencies for analysis.

The bank combined asset location and production data with state of nature indicators describing the condition and vulnerability of local ecosystems.

Where asset-level data was not disclosed, Barclays used secondary and proxy data to estimate dependencies and impacts. For example, the bank estimated asset-level impact data using intensity factors linked to assets' production volumes. Barclays developed a data quality framework and hierarchy, which reflected its level of confidence in the different approaches applied.

Figure 40: Barclays' data collection approaches and assigned data quality scores

Data collection approach (ranked highest to lowest confidence)		Granularity	Source	Data source	Data quality score
Asset-level data – Company disclosed	Asset-level value disclosed by company, with no calculation by Barclays required	Asset	Company	Reported	DQ1
Asset-level data – Third party	Asset-level data disclosed by a credible third-party data provider with no calculation by Barclays required	Asset	Third party	Primary + estimated	DQ2
Company-level data attributed to asset – Company disclosed	Company-level value provided by the company, allocated to asset in proportion to the asset's revenue share (Mining) or power generation share (Power)	Company	Company	Reported	DQ3
Company-level data attributed to asset – Third party	Company-level value provided by credible third-party data provider, allocated to asset in proportion to the asset's revenue share (Mining) or power generation share (Power)	Company	Third party	Estimated	DQ4
Intensity-based or sector average estimations	Factor intensity-based estimates or fallbacks using commodity, generation technology type, country or portfolio averages	Sector / country	Internal, third party	Estimated	DQ5

Key findings for the Evaluate phase included:

- For Barclays' Mining portfolio: the bank identified that mines extracting copper, lithium (both critical minerals for the energy transition) and gold occupied the greatest overall area in high-integrity ecosystems potentially vulnerable to further disturbances from mining activities. Mines extracting copper collectively withdrew the greatest amount of water in water-scarce areas.
- For Barclays' European Power portfolio: the bank identified that wind farms occupied the greatest overall area in high-integrity ecosystems, followed by solar power. Hydropower plants were collectively responsible for the greatest overall water consumption in water-scarce areas, largely due to evaporation from reservoirs.

Through this analysis, Barclays was able to identify where nature-related impacts and dependencies were likely to be most significant across the assessed portfolios and link these findings to its financial exposures. The resulting insights informed the selection of regions for scenario analysis in the Assess phase and helped the bank develop an approach that is adaptable and scalable across other sectors in its portfolio.

Sources: NBIM (2024) Climate and Nature Disclosures 2024; NBIM (2025) Climate and Nature Disclosures 2025; Barclays (2025) Navigating Nature Risk: Applying the TNFD's LEAP Framework

Key dataset and tool functionalities for E2:

- Connect impact drivers, changes in the state of nature, and ecosystem service flows into complete dependency and impact pathways.
- Evaluate baseline ecosystem extent and condition and existing environmental pressures at regional and local scales.
- Characterise how current ecosystem extent and condition influence ecosystem service supply and organisational dependencies.
- Assess how the organisation's impact drivers affect Indigenous Peoples, Local Communities and stakeholders, including through affecting the ecosystem services they depend on.
- Assess interactions between multiple drivers of change (e.g. land-use change, pollution, invasive species, climate change and resource extraction) affecting ecosystem extent and condition and the supply of ecosystem services.

Resource types with illustrative examples:

- **Impact driver/pressure and condition datasets** e.g. WRI Aqueduct, WWF Biodiversity Risk Filter (used here to understand baseline ecosystem condition, water availability, biodiversity pressures and changing environmental trends that influence dependencies and impacts, rather than simply identifying high-risk locations), Global Nature Watch (used to assess historical land use change and ecosystem pressure trends).
- **Landscape or seascape data** (as part of external factors): Data locally available through landscape or seascape initiatives, such as those mapped in Landscape and Jurisdictional Initiatives Map.

5.6. E3: Dependency and impact measurement

E3: Dependency and impact measurement	*Corporates*	*Financial institutions*
	***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, environmental 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.

This generated a longlist of potentially material dependencies and impacts for prioritisation and further analysis.

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

- **For corporates:** Component E3 enables corporates 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 supply 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 dependencies and impacts 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.

Tools such as biodiversity footprinting approaches and Life Cycle Analysis may provide initial information about the relative magnitude of the dependencies and impacts identified and support prioritisation of further analysis, data collection and engagement. Such approaches should be used with a full understanding of the data sources, modelled content and other limitations. The TNFD discussion paper on biodiversity footprinting approaches for financial institutions provides further guidance on the use of such approaches.

Analysis in E3 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 IFRS standards, with a focus on risk management and how dependencies and

impacts on nature can give rise to risks and opportunities affecting an organisation's prospects (undertaken in the Assess phase (A4)); and

- An assessment meeting the material information needs of other stakeholders focused on both financial and impact materiality. In this case, the LEAP approach is aligned to both the IFRS and GRI materiality definitions and reporting standards (impact materiality assessment is undertaken in E4).

5.6.1 The challenge of measuring dependencies and impacts

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

Traceability considerations

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.

Limitations in traceability may also create uncertainty regarding the magnitude of dependencies and impacts. This uncertainty may be increased where environmental crime obscures the origin of products, the locations from which they originate or the state of nature in those locations.

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. However, where illegal land conversion or other environmental crime may be present, regional averages may understate or overstate the magnitude of impacts, creating additional uncertainty in the assessment that should be documented and considered when interpreting measurement results.

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.

Choosing 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.

Box 19: Stakeholder-led and participatory approaches to measure dependencies and impacts

Stakeholder-led and participatory approaches can be useful ways to measure dependencies and impacts at locations. For example, participatory mapping is a means of co-producing spatially explicit data with stakeholder and community interests. This can reveal, for example, how company activities may have impacts on ecosystem services with local value. Integrating Indigenous and local knowledge can also be a meaningful way to help define dependency and impact pathways, selecting relevant indicators and metrics to assess, and validating assessment results. Indigenous and local knowledge should be used on the basis of collaboration and agreement with knowledge-holders, in processes that include them in interpretation and decision making.[63] Stakeholder-led and participatory approaches may also be organised through landscape or seascape approaches, through which organisations can pool resources to establish collective multi-stakeholder assessment and monitoring mechanisms at a landscape or seascape level.

63 IPBES (2026) Methodological assessment of the impact and dependence of business on biodiversity and nature's contributions to people; IPBES (2024c) Thematic assessment report on the underlying causes of biodiversity loss and the determinants of transformative change and options for achieving the 2050 vision for biodiversity.; IPBES (2022) Methodological Assessment Report on the Diverse Values and Valuation of Nature. See also TNFD (2024c) Guidance on engagement with Indigenous Peoples, Local Communities and affected stakeholders.

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 or corporate) 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 subset 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 9.

Table 9: Dependency and impact metrics categories with illustrative indicators

Dependency and 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-impact natural commodities sourced
	Invasive alien species (IAS) and other	Biological alterations	Measures against the introduction, establishment and spread of IAS Number/extent of established or newly introduced IAS

Dependency and impact metrics category	Sub-category 1	Sub-category 2	Indicator – Illustrative example
State of nature	Ecosystems	Extent	Area of natural and semi natural ecosystems Area of different ecosystem types
		Condition	Ecosystem condition by type of ecosystem, considering elements of structure, function and composition
	Species	Population size	Species population size
		Extinction risk	Contribution of the location to global 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

Measuring impact drivers

Prioritising impact drivers for measurement

Organisations will have identified a set of impact drivers linked to dependencies and impacts in E1 and E2. 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 supply, and to interpret or anticipate trends in state indicators at a corporate, national or regional level.[64]

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.

Impact drivers each have specific measurement considerations. For example, measuring the presence or extent of established or newly introduced IAS requires species detection and population monitoring methods. Where linking an impact driver metric to a location and providing full context is not yet possible due to capacity or data issues (for example, for locations in some financial institution portfolios or complex value chains), 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:[65]

- **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 17 on thresholds and tipping points);
- **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.[66] 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;

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

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

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

- **Regulation and governance:** Requirements established through regulation or other governance mechanisms 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 dependencies and impacts.

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

- Natural capital accounting frameworks, such as the Natural Capital Protocol,[67] the related Transparent methodology[68] and UN SEEA,[69] which has also been applied at a corporate entity level;[70]
- Existing corporate disclosure requirements such as GRI,[71] CDSB guidance on water and biodiversity[72] (CDSB is now incorporated into the ISSB), and the Corporate Sustainability Reporting Directive (CSRD)[73] 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;[74]
- Life Cycle Analysis approaches, such as the EU Corporate Environmental Footprint (CEF) and Product Environmental Footprint (PEF);[75]
- Environmental extended input–output models such as Exiobase, which may be useful for value chain analysis; and
- SBTN Step 1: Assess Technical Guidance Step 1b, Task 11, which sets out an approach to assess impact drivers (referred to by SBTN as 'pressures'), as part of the broader verifiable target setting process.

67 Capitals Coalition (2016) Natural Capital Protocol.

68 Transparent Project (2023) Standardized Natural Capital Management Accounting: A methodology promoting the integration of nature in business decision making.

69 UN et al. (2021a) System of Environmental-Economic Accounting – Ecosystem accounting.

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

71 GRI (2021) GRI Standards Glossary.

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

73 EC (2023) Delegated Regulation supplementing Directive 2013/34/EU.

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

75 EC (2021) Environmental footprint methods.

Additional considerations for financial institutions

Financial institutions may find Life Cycle Analysis and footprinting approaches helpful for understanding impact drivers, where direct measurement is not feasible (e.g. due to low levels of certainty about the location, or capacity constraints). The TNFD's discussion paper on biodiversity footprinting approaches for financial institutions sets out guidance to help financial institutions improve their understanding of the current available footprinting approaches and their limitations.

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

Box 20: Assessing water stress related risk

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 has previously assessed risks related to water stress at its manufacturing sites using publicly available tools, including the WRI's Aqueduct. However, in 2024, a group site that had not been classified as high risk under these tools experienced flooding damage associated with a hurricane. This led Kirin to recognise the need to review the alignment between tool-based assessments and actual conditions, as well as the granularity of the assessment and the range of water-related dimensions covered, and expand from water stress to also include flooding.

In response, Kirin undertook a comprehensive review of physical water stress-related risk at its production sites in 2025. Using the latitude and longitude of its own operating sites, Kirin assessed current and future water risks at basin level for 2030 and 2050. The assessment drew on multiple external tools and data sources, including WRI's Aqueduct, Aqueduct Floods, WWF's Water Risk Filter and hazard maps by Japan's Ministry of Land, Infrastructure, Transport and Tourism, which include all location-specific data on flooding likelihood.

Kirin then evaluated indicators related to water quantity, water quality, water-related disasters, governance and WASH,[76] taking into account operational water risks specific to the business context of each site. This allowed the company to consider both watershed risks and operational risks, and to identify priority sites where current risks were high, operational risks were high, or watershed risks were projected to increase in the future.

For major priority sites, Kirin conducted additional questionnaire surveys to confirm the actual status of water risk occurrence and operational disruptions, and to check

76 The acronym WASH stands for Water, Sanitation and Hygiene, specifically referring to the provision of water supply, drainage, toilets and waste disposal.

whether the tool-based assessment was consistent with on-site conditions. Based on this comprehensive evaluation, sites with a confirmed track record of water-related risk occurrence or associated cost increases were designated as 'top priority sites'. Kirin plans to prioritise responses for these sites, including setting water-related targets.

Figure 41: Results of Kirin's water stress-related risk assessment for its production sites.



* Water risks (both watershed-level and operational) are assessed across the following five dimensions, using the data sources outlined below. Priority is determined based not only on current risks (2020) but also on projected increases in risk toward 2030 and 2050, taking a forward-looking and comprehensive approach. Water quantity: Aqueduct (Seasonal Variability, Interannual Variability, Baseline Water Stress) (current and future) Water quality: Water Risk Filter. Water Quality (current and future) Flooding: Water Risk Filter Flooding (current and future); Overlay Hazard Maps (Japan, current); Aqueduct Floods flood depth (overseas, current and future) Governance: Water Risk Filter Basin Regulatory Risk (current and future)WASH: Water Risk Filter Infrastructure & Finance (current and future) In addition, operational risks are assessed for water quantity, water quality, and flooding using the following indicators: total water withdrawal (water quantity), total nitrogen and total phosphorus discharge (water quality), and financial impact of flood damage (flooding). Furthermore, where past risk incidents are identified through questionnaire surveys, sites are designated as priority or high-priority locations within the relevant category, depending on the severity of the impacts.

Source: Kirin (2026) Environmental Report.

Box 21: Measuring pollution-related impact drivers

LVMH is a luxury goods group owning 75 luxury brands across all major sectors of the luxury industry. In its 2025 sustainability reporting, to measure its pollution impacts, LVMH identified business activities and value-chain processes associated with pollution impact drivers. In its own operations, these included pollution associated with winemaking and distillation, tanneries, textile manufacturing and finishing, and crocodilian farms. Within its supply chains, relevant activities included the production and processing of agricultural, winegrowing and livestock commodities and the extraction and processing of mineral raw materials. The group also identified potential ecosystem pollution arising from the use or end-of-life management of substances of concern and very high concern.

LVMH considered pathways through which organic pollution, nutrient loading and hazardous substances may affect the state of nature. For example, pollution originating from terrestrial activities can enter waterways, creating potential pathways between terrestrial and freshwater ecosystems. Discharges containing organic matter, nitrogen or phosphorus can contribute to changes in water quality and, depending on local conditions and receiving environments, to ecological effects such as oxygen depletion or eutrophication. Substances of concern may similarly create ecotoxicological pathways affecting ecosystems.

To evaluate pollution-related impacts and potential pathways to changes in the state of nature, LVMH collects information across its own operations and certain supply chains on water and biodiversity footprints, which it consolidates annually. The group uses several indicators, including water and biodiversity footprints, the latter incorporating an ecotoxicology indicator – focusing on water pollution from organic pollution, nitrogen and phosphorus – and continuous monitoring of substances used to manufacture products. Together, this information helps LVMH characterise pollution-related impact drivers and understand how these could contribute to changes in the condition of terrestrial and freshwater ecosystems.

Source: LVMH (2026) Universal registration document - Fiscal year ended December 31, 2025.

Box 22: Measuring invasive alien species as an impact driver across realms

IAS are the only driver in 16% of documented animal and plant extinctions globally.[77] To understand IAS-related impacts, organisations can measure IAS as an impact driver. To do this, organisations can measure the number, presence and/or extent of established and/or newly introduced IAS. More information on IAS measurement is given in Annex 6.

77 IPBES (2023) Thematic Assessment Report on Invasive Alien Species and their Control.

A pulp and forestry processing site in South Africa provides an example of how terrestrial IAS can be measured in direct operations. The IAS management plan for the Saiccor mill owned by Sappi, a sustainable paper, pulp and packaging company, identified listed alien invasive plants across the facility, mapped areas where they were found, estimated the extent affected by IAS at 120 to 150 hectares, and set out monthly monitoring with photographic evidence and periodic specialist surveys. This type of approach can support metrics such as the number of established plant IAS by site zone, presence or absence by management area, and area affected in hectares.

A land restoration and biomass supply chain pilot in South Africa shows how IAS measurement can also be linked to active management. The Stewards of Nature, Coega Biomass Centre, RSB and WWF South Africa pilot measured 269 hectares of invasive alien plants cleared, 9,034 tonnes of invasive biomass removed and 844,711 cubic metres of water recovered. Its measurement approach used information on invasive alien plant density, GPS coordinates, species type, canopy cover, land cleared, precipitation and run-off. This illustrates how an organisation can measure the extent of IAS present or removed, while distinguishing these impact driver metrics from related outcome metrics, such as changes in water availability or ecosystem service supply.

Port and coastal infrastructure examples show how IAS can be measured in ocean and coastal ecosystems through baseline and repeat surveys. A baseline survey at the Port of Tauranga in New Zealand identified 316 species or higher taxa, including 12 non-indigenous species and 40 cryptogenic species, using methods such as diver pile scraping, benthic grabs, sled tows, dinoflagellate cyst coring (sampling sediment cores for the dormant stages of microscopic algae) and traps. This example supports measurement formats such as the number of non-indigenous species present, the number of newly detected species, presence or absence by sampling site, and survey effort by method and location.

Together, these examples show that IAS measurement in E3 could prioritise direct evidence of species presence, extent, establishment or new introduction, where such measurement is possible.

Source: Sappi Southern Africa Limited (2025) Sappi Saiccor mill Alien Invasive Species Management Plan; Stewards of Nature et al. (2025) Water impact claims from the removal of invasive alien plants in South Africa; BNZ (2006) Port of Tauranga: Baseline survey for non-indigenous marine species.

Key dataset and tool functionalities for measuring impact drivers and impacts:

- Utilise process-level LCA databases or MIRO models to estimate upstream and downstream value chain impacts. Organisations with large numbers of assessment locations may want to begin with estimates and progress to measurement over time.

- Measure pollution flows, land/freshwater/ocean conversion, water abstraction, resource extraction, and IAS indicators in standardised units.
- Distinguish negative impact drivers from positive impact drivers such as restoration or regeneration activities, without inappropriate netting.
- Use social impact and stakeholder mapping to understand who might be affected by changes to nature.
- Produce quantitative outputs compatible with the TNFD's suggested assessment metrics.

Resource types with illustrative examples:

- **Organisation's own measured data** e.g. from project environmental and social impact assessments.
- **Supply chain footprinting (MRIO and LCA)** e.g. tools and LCA software incorporating EXIOBASE, ecoinvent or alternatives such as Eora, depending on the required sectoral and geographic granularity.
- **Social impact and stakeholder mapping tools** e.g. Indigenous Peoples' and community-conserved territories and areas (ICCAs), Global Land Governance Index LANDex Indicators, The Indigenous Navigator, LandMark (also available in the Global Nature Watch map).
- **Mapping and site spatial tools** e.g. spatial platforms linking operational data with site or catchment state of nature changes (this could include SBTN's Natural Lands Map, where organisations are assessing their impacts in natural ecosystems).

5.6.2 Measuring changes in the state of nature

State of nature metrics are intended for application in the assessment locations identified in Locate (L2-4) and further refined in E1 and E2. The TNFD provides a set of assessment metrics for evaluating changes in the state of nature (see Annex 1) and additional guidance on assessing the state of nature (Annex 2). These metrics draw from the Nature Positive Initiative's Initial Measurement Guidance. The assessment guidance also draws from UN SEEA Ecosystem Accounting and the Align project, which provides a framework for incorporating biodiversity state and values into decision-making processes for businesses.

While consensus has been built on these metrics, the specific variables to measure and the appropriate approach to measure them will vary by location-specific context, including the values of local stakeholders. Where direct measurement of state of nature metrics is challenging (e.g. for some financial institutions, due to low levels of certainty about locations where their portfolio companies operate), screening tools can give an indication of ecosystem condition in an area, or the importance of the area to global species extinction risk (see Table 6 in the Locate phase).

Increasingly, 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 initial source of material for a LEAP assessment team. Where such independent authoritative assessments do not exist at a relevant spatial scale, organisations may need or wish to conduct their own measurement activities (or partner with others to do so), subject to capacity and financial resources.

The TNFD has provided metrics for the state of nature (Annex 1) and additional guidance on assessment of the state of nature (Annex 2), including key concepts and considerations when applying the recommended assessment metrics. This builds on NPI's Initial Measurement Guidance: State of Nature Metrics, which provides measurement specifications and guidance for measuring the NPI's consensus state of nature metrics, as well as drawing on UN SEEA Ecosystem Accounting and on the Align project, which provides a framework for incorporating biodiversity state and values into decision-making processes for businesses.[78, 79]

Aligned with the conceptual foundations for assessment outlined in Section 2, a dashboard of state of nature metrics, covering different components of nature in relation to assessment locations, should seek to provide insights about:

- **Changes in the state of ecosystems:**
  - **Ecosystem extent:** The area coverage of a particular ecosystem, usually measured in terms of spatial area (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.
- **Changes in the state of species:**
  - **Extinction risk-related metrics:** Metrics that reflect how activities or impact drivers contribute to local or global extinction risk, including the importance of the location to local or global extinction risk, and available habitat for species; and[80]
  - **Species population size:** Changes in the number of individuals of a species within an area.

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

79 NPI (2026b) Initial Measurement Guidance: State of Nature Metrics.

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

- **Changes in genetic diversity**, where feasible and relevant.

Where relevant to nature-related issues at assessment locations, and where data is available at reasonable effort and cost, organisations should assess the current state of nature against a reference condition, and measure changes in the state of nature compared to a baseline (Box 23).[81] This should consider the time period and geographic scale over which the dependency or impact could occur.[82] Metrics should also be put into context, for example, where the organisation is not the only actor contributing to the observed change.

Box 23: Reference condition and baselines

A reference condition is the condition against which past, present and future ecosystem condition (or another aspect of the state of nature) is compared 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. NPI recommends a baseline of 2020 where possible.[83]

Sources: UN et al. (2021a) System of Environmental-Economic Accounting – Ecosystem Accounting, CDSB (2021) Application guidance for biodiversity-related disclosures, NPI (2026b) Initial Measurement Guidance: State of Nature Metrics.

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 Nature Positive Initiative's Initial Measurement Guidance: State of Nature Metrics;

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

82 Multi-partner baseline setting can be an efficient approach. In an ocean context, examples include Good Environmental Status (GES) descriptors in European waters and the assessment frameworks established under the Convention for the Protection of the Marine Environment of the North-East Atlantic (the OSPAR Convention).

83 Annex 2 and NPI's Initial Measurement Guidance: State of Nature Metrics give more information on determining baselines.

- The TNFD Tools Catalogue and the UNEP-WCMC Nature Tools Compass 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.

For examples of how to present state of nature metrics in reporting, see Annex 2.

Measuring changes in ecosystem services

Understanding changes in ecosystem service supply is vital to measure the organisation's dependencies on nature. The resilience of the organisation's business processes and revenue streams depends directly on nature's capacity to sustain these services.

When choosing which ecosystem services to seek to measure and evaluate the resilience of, organisations should also consider:

- The changes in the flow of ecosystem services on which they depend (identified in E2) that could occur due to changes in the state of nature; and
- The implications of reduced ecosystem service supply to the business and society, the associated impacts on communities that depend on those services, and the business's own dependence on those communities.

Table 10: 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 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 UNEP-WCMC et al. (2022) Recommendations for a standard on corporate biodiversity measurement and valuation, Aligning accounting approaches for nature; and ENCORE Partners (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, if linking ecosystem services to location is not yet possible due to capacity or data issues (e.g. where a large number of assessment locations have been identified, or where portfolio or value chain traceability is limited), they could be measured in aggregate for your organisation and not contextualised to a specific location and still provide some useful insights.

While frameworks such as UN-SEEA,[84] the Measure and Value stage of the Natural Capital Protocol,[85] associated biodiversity guidance,[86] and complementary ISO and BSI standards on natural capital accounting for organisations[87] provide further guidance on the measurement of ecosystem services, direct measurement can be challenging and may not be necessary for all organisations. For example, without direct measurement, organisations can gain valuable information about likely ecosystem service delivery in specific locations from open-source ecosystem service modelling tools based on global and local data sets (e.g. InVEST, Box 24).

These frameworks, tools and datasets can provide corporates and financial institutions with estimates of ecosystem service supply and resilience based on an understanding of the state of nature and other dimensions, such as social and business context.

84 UN et al. (2021a) System of Environmental-Economic accounting – Ecosystem accounting; Capitals Coalition (2016) Natural Capital Protocol; BSI (2021) Natural Capital Accounting for Organizations.

85 Capitals Coalition (2016) Natural Capital Protocol.

86 Capitals Coalition and CCI (2020) Integrating biodiversity into natural capital assessments.

87 BS 8632:2021 Natural Capital Accounting for Organizations; ISO (2025) ISO 14054:2025 Natural capital accounting for organizations – Principles, requirements and guidance.

Box 24. Modelling ecosystem services

Modelling tools such as Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST®) use ecological data to estimate how ecosystems generate benefits for people and the economy. InVEST is an open-source suite of spatial modelling tools developed by the Natural Capital Alliance for mapping and quantifying the delivery of ecosystem services across landscapes and seascapes. The platform includes models for services such as pollination, water yield and water purification, carbon storage and sequestration, sediment retention, coastal protection, recreation and access to urban nature, and fisheries production. These models are widely used by governments, development banks, conservation organisations and businesses to assess how land, freshwater and ocean-use decisions influence ecosystem services and associated economic outcomes.[88]

Ecosystem extent and condition inputs:

All InVEST models rely on spatial data describing ecosystem extent and change over time, typically in the form of land use or land cover (LULC) maps and ocean and coastal maps. These datasets allow the models to represent the distribution of different ecosystem types (such as forests, wetlands, agricultural land, grasslands, urban areas, and coastal and ocean areas) and to simulate how changes in extent or condition affect ecosystem service delivery. For example, the carbon storage model estimates above- and below-ground carbon stocks associated with different land cover classes, while the sediment retention model assesses how vegetation cover and land management influence soil erosion and downstream water quality. In this way, metrics on ecosystem extent and condition serve as core inputs that translate ecological state into estimates of ecosystem service supply.[89]

Species-related inputs:

Some models incorporate species-related information to represent ecological processes that underpin ecosystem services. For instance, the crop pollination model focuses on the resource needs and flight behaviours of wild pollinator species, particularly bees. The model uses information about nesting habitat availability, floral resources and the distance pollinators can travel across landscapes. However, it does not require direct measurements of pollinator abundance or population size. Instead, the model converts land cover data into a habitat suitability index (scaled from 0 to 1) to produce a 'pollinator source map'. Higher values indicate landscapes that are more likely to support relatively greater pollinator presence and activity. This approach allows the model to estimate pollination service supply even where detailed species population data are unavailable, illustrating how state of nature indicators (such as ecosystem extent and condition) can act as practical proxies for modelling biodiversity-dependent ecosystem services.[90]

88 Natural Capital Alliance (2026) InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs).

89 Natural Capital Alliance (2026) InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs).

90 Natural Capital Alliance (2026) InVEST Model: Crop Pollination.

Key dataset and tool functionalities for measuring dependencies:

- Measure volumetric or physical reliance (e.g. cubic meters of water, soil retention) in traceable, auditable units.
- Measure the state of nature (i.e. status of and changes to ecosystems and species).
- Measure potential and actual ecosystem service delivery (e.g. pollination, flood mitigation).
- Capture seasonality, catchment trends and variability in ecosystem service supply.
- Provide spatially explicit biophysical and social information on ecosystem services, including the location of beneficiaries of those services.

Resource types with illustrative examples:

- **Spatial overlays** e.g. catchment-level spatial datasets overlaying asset coordinates with ecosystem service data layers.
- **Ecosystem and species datasets and tools**: e.g. Ecosystem Integrity Index (EII), Biodiversity Intactness Index (BII), IBAT (including STAR), LIFE metric.
- **Ecosystem service models** e.g. InVEST (Integrated Valuation of Ecosystem Services and Trade-offs), TESSA (Toolkit for Ecosystem Service Site-Based Assessment), WWF Water Risk Filter (used here to quantify dependency on water-related ecosystem services, including current and projected water availability and catchment conditions).

Box 25: Applying state of nature indicators to evaluate marine ecosystem dependencies

As part of its broader nature strategy, Nestle's Purina pet food business unit conducted a double materiality assessment of its value chain and developed a nature roadmap informed by the TNFD LEAP approach and other frameworks. This analysis identified ocean health as a key dependency linked to fish byproduct ingredients sourced from marine ecosystems. Purina assessed relevant environmental assets and ecosystem services using state of nature information, including indicators related to ecosystem extent, ecosystem condition and species populations.

Fish is part of Purina Europe´s supply chain because it uses fish byproducts, which are highly nutritious parts of fish that are not consumed by humans, but are valuable ingredients in pet food. As part of its sourcing strategy, Purina aims to source fish ingredients as locally as possible. This helped Purina Europe identify the Northeast Atlantic (FAO Area 27), from which a significant proportion of marine ingredients used within its European value chain are sourced, as a priority geography for restoration

efforts. In its assessment of ecosystem condition, extent and species populations, particular attention was given to habitats that provide nursery grounds for eggs, juvenile fish, feeding areas and shelter. By evaluating these dependencies, Purina identified seagrass meadows, oyster reefs and seaweed forests as habitats that play an important role in maintaining fish populations and the broader ecosystem resilience on which their supply of fish byproducts depends. Restoring these habitats has the potential to support the recovery of commercially important fish species while also enhancing wider ecosystem services, including habitat provision, biodiversity maintenance and water quality regulation.

Launched in 2024, Purina's Ocean Restoration Programme aims to restore 1,500 hectares of marine habitats across Europe by 2030, including seagrass meadows, oyster reefs and seaweed forests. The programme illustrates how state of nature measurement as part of a LEAP assessment can help an organisation understand its dependencies and inform actions to enhance the resilience of nature's ability to continue to provide the ecosystem services that drive financial value creation. The programme is implemented through partnerships with marine restoration organisations across Europe. For example, Purina Europe partnered with Oyster Heaven to support the deployment of at least four million oysters off the North Norfolk coast. Oyster reefs provide habitat for numerous marine species and help improve water quality through natural filtration processes. Improved water quality can in turn support other habitat-forming ecosystems. Purina Europe also supports restoration initiatives by organisations including Sea Ranger Service, SeaForester and Urchinomics, focused on restoring seagrass meadows, seaweed forests and other marine habitats across Europe. Through these partnerships, Purina Europe aims to contribute to the recovery of ecosystem extent and condition, while supporting the ecosystem services upon which marine species, and ultimately its value chain, depend.

Sources: Purina (2024) Purina Europe launches its first Ocean Restoration Program, aiming to restore 1 500 hectares of marine habitats by 2030; Purina (2023) Purina Europe announces its commitments towards a more regenerative future.

5.6.3 Data sourcing and use considerations

Having chosen its indicators and metrics with reference to the TNFD's assessment metrics, the organisation needs to choose which data sources to use to evaluate those metrics. 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.

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 and the supply of ecosystem services.

Once it has reviewed the data landscape, the organisation 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.

Data availability and quality considerations

Organisations may need to use a combination of primary, secondary, modelled and proxy data (Table 11). When using data throughout the Evaluate phase, assessment teams can refer to the TNFD's data principles to help evaluate whether datasets and tools are suitable for their intended purpose (see Introduction).

Data should be selected based on fitness for purpose, taking account of the assessment's purpose, the relevance and quality of available data, and the practical costs and feasibility of obtaining it. The categories in Table 11 describe the origin and use of data, rather than a hierarchy of data quality or decision usefulness.

Primary data can be particularly valuable for measuring organisation-specific impact drivers and the state of nature at specific locations. Impact drivers measured might include the volume of water consumed or quantity of solid waste produced. However, secondary data, including third-party and modelled data, and proxy data may be more appropriate or necessary in other circumstances. This may include assessments of changes in the state of nature, value chain or portfolio analysis, and circumstances in which direct measurement is not feasible, proportionate or sufficiently representative of the issue being assessed.

For example, air pollution associated with electricity use may be estimated by combining electricity consumption with air emissions factors for the relevant electricity grid. Modelled outputs may draw on primary, secondary and/or proxy inputs. Box 26 provides further guidance on the use of secondary data, including modelled and proxy data.

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

Where gaps exist (for example, where state of nature data at an appropriate spatial scale for asset-level analysis is limited), and subject to financial and capacity consideration, an organisation 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.[91] The organisation may refer to published research or publicly available datasets on populations of priority species, or work with local biodiversity or ecosystem experts to understand the ecosystem and species-related trends for the location.

Table 11: Types of sources for nature-related data

Data type	Definition	Illustrative examples
Primary data	Data collected specifically for the assessment, or direct measurements obtained by the organisation or on its behalf, of a relevant impact driver, ecosystem service or change in the state of nature.	Internal business data, such as metered raw material or water consumption and solid waste data, site-level data collected through surveys or sampling, data collected from suppliers or customers specifically for the assessment, and land cover change derived from satellite imagery for the assessment.
Secondary data	Data generated, compiled or curated for an earlier or different purpose and subsequently used for the assessment. This includes internally generated or third-party data reused for the assessment and may include modelled data.	Published peer reviewed and grey literature, life cycle impact assessment databases, industry, government or corporate reports, and third-party spatial datasets, including remote-sensing products and modelled estimates.
Proxy data *(a type of secondary data)*	Data or an indicator used as an approximation for a variable or outcome that cannot be directly measured for the specific assessment use case.	Using manufactured product output and estimated machinery water efficiency to estimate water consumption, using habitat extent as a proxy for species abundance, and applying sector or regional average intensities where entity-specific data are unavailable.

Note: These categories describe the origin and use of data, rather than a hierarchy of data quality or decision-usefulness. Modelled outputs may draw on primary, secondary and/or proxy inputs. Data should be selected based on fitness for purpose, taking account of the assessment's purpose, the relevance and quality of available data, and the practical costs and feasibility of obtaining it.

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

Box 26: Using secondary data

In some cases, organisations may judge that secondary data provide appropriate information for assessing nature-related issues, particularly where direct measurement or value chain traceability is limited. Such data may include data generated internally for an earlier purpose, as well as data from third-party providers, government, scientific and other authoritative sources.

Secondary data can make analysis more tractable, enabling an organisation to identify and assess likely nature-related dependencies, impacts, risks and opportunities without investing in new data collection or improved traceability. This may provide sufficient information to begin to disclose and address nature-related issues, provided the organisation is transparent about the data used, its limitations and the assumptions made.

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 – to assess the likely nature-related impacts of its supply chain.

Organisations should assess whether secondary data are sufficiently relevant, reliable and location-specific for the assessment purpose. See, for example, Boxes 43 and 50 on the use of certification scheme data.

Where improved traceability or direct measurement would materially improve decision-usefulness, organisations should seek to improve these over time, taking account of practical constraints, cost and feasibility.

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 an activity's impact, or the 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 understand the limitations of the proxy data and its use compared to direct measurements so they can be realistic about the validity of their assessments, based on 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).

Considerations for use of modelled data

Modelled data may be:

- Low detail/high-level methods (e.g. basic population dynamics models, flood risk assessments based on historical events, LCAs); or
- 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.

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.

When data is not available or lacks quality to support assessment

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 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. It should indicate that the data was not of sufficient reliability to undertake more detailed analysis to further qualify their materiality.

5.7. E4: Impact materiality assessment

E4: Impact materiality assessment	*Corporates* *Which of the identified impacts are material?*	*Financial institutions* *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 will need to undertake component E4 to arrive at a list of impacts that the organisation should consider disclosing. This component of LEAP is aligned to the GRI impact materiality approach, but organisations may have a different (e.g. jurisdiction-specific) approach to impact materiality to consider.



Additional considerations for financial institutions

This may relate to investment strategies, product offerings or investee/client engagement.

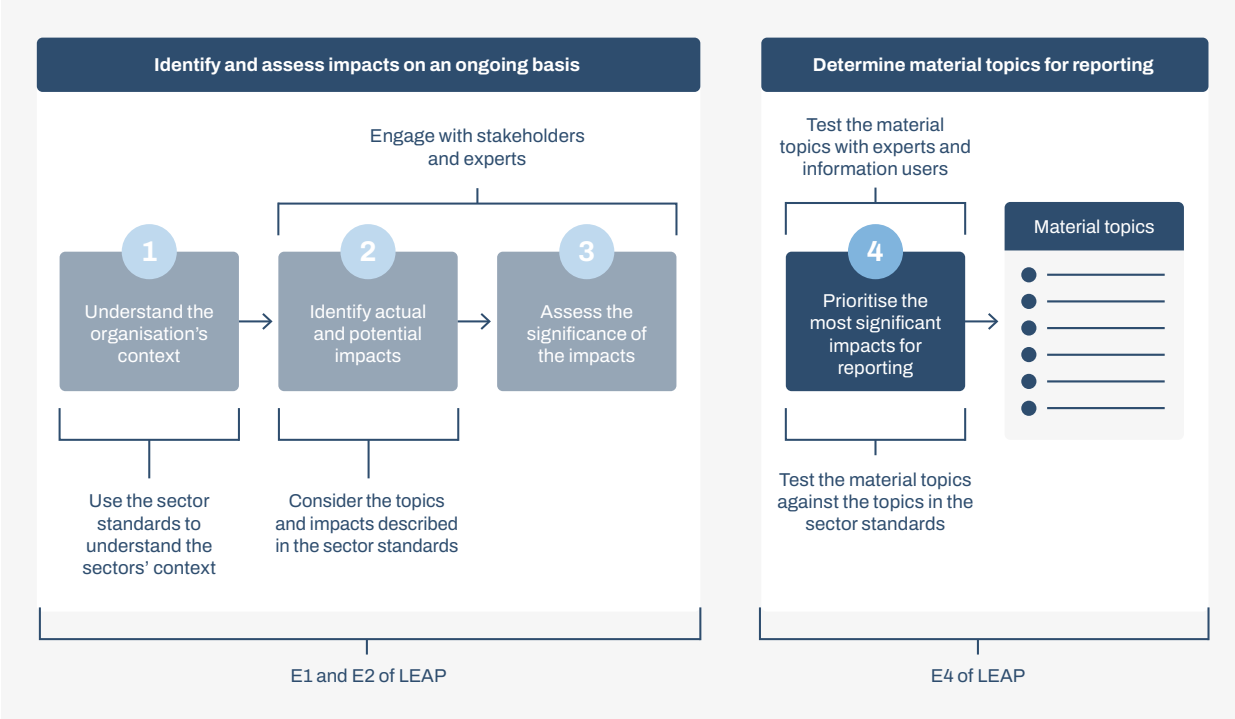
Organisations that do not intend to use an impact materiality approach can take their analysis from E3 and move straight to the Assess phase to consider how their identified dependencies and impacts inform their identification and assessment of risks and opportunities to the organisation.

Impact materiality typically requires organisations 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 also states 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.[92]

Figure 42 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). In this way, it determines its material topics.

92 See GRI (2023) Material Topics 2021. Both GRI and the ESRS also refer to OECD (2018) Due Diligence Guidance for Responsible Business Conduct.

Figure 42: 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).[93]

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).

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".[94]

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

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

Box 27: Jurisdictional approaches to materiality

The ESRS states that 'a sustainability topic 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', where 'for actual negative impacts, materiality shall be assessed based on the severity of the impact. For potential negative impacts, it shall be assessed based on a combination of severity and likelihood' and 'for actual positive impacts, materiality shall be assessed based on the scale and scope of the impact. For potential positive impacts, materiality shall be assessed based on the scale, scope and likelihood of the impact'. ESRS 1 also specifies that 'Impacts include those connected with the undertaking's own operations and its upstream and downstream value chain, including through its products and services, as well as through its business relationships in its upstream and downstream value chain. Business relationships are not limited to direct contractual relationships.'[95]

ESRS 1 also requires organisations to use a set of criteria to determine which of the impacts will be covered in its sustainability statement and are therefore defined as material.

Other jurisdiction-specific standards have different approaches to materiality. India's Business Responsibility and Sustainability Reporting (BRSR) does not prescribe a fixed materiality approach, but requires companies to identify what is material to them, building on India's National Guidelines on Responsible Business Conduct (NGRBC) principles.[96] China's Corporate Sustainable Disclosure Standards (CSDS) take a double materiality approach, and the guidelines require listed companies to identify the financial materiality and the impact materiality of topics and disclose relevant information accordingly.

95 EC (2026) Commission Delegated Regulation (EU) 2026/1563 of 3 July 2026 amending Delegated Regulation (EU) 2023/2772 as regards the simplification of certain sustainability reporting standards. The ESRS word 'undertaking' has been substituted with the word 'organisation' for consistency of terminology in this document.

96 IBBI (2025) Integrating Nature-related Aspects in Business Responsibility & Sustainability Reporting (BRSR) Disclosures using the Taskforce on Nature-related Financial Disclosures (TNFD) Recommendations; Ministry of Corporate Affairs, Government of India (2018) National Guidelines on Responsible Business Conduct.

Key dataset and tool functionalities for E4:

- Structure impact materiality determinations aligned with impact materiality reporting frameworks.
- Integrate social values, rights of Indigenous Peoples and Local Communities, and societal cost considerations (building on impact pathway analysis in E2).

Resource types with illustrative examples:

- **Materiality Approaches** e.g. GRI 3: Material Topics 2021 and GRI 101: Biodiversity 2024, ESRS 1 – General Requirements and other applicable jurisdictional impact materiality approaches and definitions.
- **Science-based limits** e.g. SBTN Step 1 and 3 guidance (Land, Ocean and Freshwater), Earth Commission 'Safe and Just' boundaries.
- **Social impact methods** e.g. IPLC and stakeholder engagement toolkits, impact valuation and social cost accounting frameworks (e.g. Impact Value Standards Board (IVSB) impact measurement and valuation methods).

5.8. 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 and activities. This is necessary to take forward for further detailed due diligence of risks and opportunities that could reasonably be expected to affect the organisation's prospects 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).

For corporates	For financial institutions
After working through the four components of the Evaluate phase, the LEAP assessment team 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 impacts and potentially material dependencies 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 financial institutions, the outputs of the Evaluate phase will be: • A list of environmental assets, ecosystem services and impact drivers associated with the sectors identified through the portfolio 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, including evaluation of whether impacts are material and whether dependencies are potentially material.

5.9. Resources to support the Evaluate phase

As noted above in the lists of relevant functionalities and illustrative example tools and datasets for each component (E1-4), 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. 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;
- SBTN Steps 1 (v2) and 3 Guidance
- Nature Positive Initiative (2026b) Initial Measurement Guidance: State of Nature Metrics;
- Transparent Project;[97]
- Align Project;[98]
- Life Cycle Analysis will also be helpful and is summarised through the European Platform on LCA;
- GRI 3: Material Topics 2021;
- Ecosystem service modelling tools, such as InVEST and associated guidance;
- 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 Impact Value Standards Board (IVSB) and the Capitals Coalition; and
- Further tools available in the TNFD Tools Catalogue.

97 Transparent Project. (2023) Standardized Natural Capital Management Accounting: A methodology promoting the integration of nature in business decision making.

98 UNEP-WCMC et al. (2022) Recommendations for a standard on corporate biodiversity measurement and valuation.

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 its identified dependencies and impacts on nature.

The primary use case is to identify the nature-related risks and opportunities that might be relevant for the disclosure of material information in alignment with a financial materiality lens.

In this phase, organisations assess their nature-related risks and opportunities that could reasonably be expected to affect their cash flows, access to finance or cost of capital over the short, medium or long term. Consistent with IFRS Sustainability Disclosure Standards, these risks and opportunities are collectively referred to as 'nature-related risks and opportunities that could reasonably be expected to affect the organisation's prospects.

Identifying risks and opportunities in this way is aligned with IFRS S1 *General Requirements for Disclosure of Sustainability-related Financial Information*.[99, 100]

The Assess phase of the LEAP approach is designed to provide an 'on-ramp' to the use of IFRS Sustainability Disclosure Standards for the purpose of disclosing sustainability-related financial information. Organisations interested in using LEAP for this purpose should refer to the IFRS Foundation website.

The TNFD recognises that some users of LEAP may have specific jurisdictional requirements with a similar financial materiality approach that is not identical to the IFRS in its application. The guidance outlined below should still be broadly useful to support these jurisdictional requirements.

Beyond preparation of disclosures, the identification and assessment of nature-related risks and opportunities can also inform risk and opportunity management. This may require the adaptation of existing risk management processes to ensure nature-related risks are fully integrated into the organisation's enterprise or portfolio risk management approach and

99 ISSB (2023) IFRS S1 General Requirements for Disclosure of Sustainability-related Financial Information.

100 ISSB (2024) Educational material - Sustainability-related risks and opportunities and the disclosure of material information provides guidance to help organisations identify sustainability-related risks and opportunities that could reasonably be expected to affect their prospects and disclose material information about those risks and opportunities.

systems. The four components of the Assess phase of LEAP provide process guidance that can help adapt existing risk management processes.

For nature-related opportunities, the Assess phase helps an organisation to identify different types of opportunities that could reasonably be expected to affect its prospects.

> *Information about sustainability-related risks and opportunities is useful to primary users because an entity's ability to generate cash flows over the short, medium and long term is inextricably linked to the interactions between the entity and its stakeholders, society, the economy and the natural environment throughout the entity's value chain. Together, the entity and the resources and relationships throughout its value chain form an interdependent system in which the entity operates. The entity's dependencies on those resources and relationships and its impacts on those resources and relationships give rise to sustainability-related risks and opportunities for the entity.*
>
> *This Standard [IFRS S1] requires an entity to disclose information about all sustainability-related risks and opportunities that could reasonably be expected to affect the entity's cash flows, its access to finance or cost of capital over the short, medium or long term. For the purposes of this Standard, these risks and opportunities are collectively referred to as 'sustainability-related risks and opportunities that could reasonably be expected to affect the entity's prospects'.*
>
> IFRS S1 *General Requirements for Disclosure of Sustainability-related Financial Information*

By the end of the Assess phase of LEAP, an organisation should have a solid understanding of the nature-related risks and opportunities that could reasonably be expected to affect its prospects and the dependencies and impacts on nature from its direct operations and value chain that give rise to those risks and opportunities to the organisation (drawing on the outputs of the Evaluate phase). Having concluded the analytical components of LEAP, the organisation will be able to move onto the Prepare phase to begin preparing its corporate reporting and to consider other actions it can take to address its identified nature-related issues.

6.2. What

Through the Assess phase, the LEAP assessment team:

- Identifies nature-related risks and opportunities to the organisation stemming from the identified dependencies and impacts on nature;
- Develops an understanding of how to integrate nature-related risks and opportunities into the organisation's existing enterprise or portfolio risk management processes;

- Assesses the magnitude and likelihood of the effects of its identified nature-related risks, and assesses its opportunities, using qualitative and/or quantitative methods;
- Prioritises nature-related risks and opportunities;
- Estimates, either qualitatively or quantitatively, the effects on the organisation's prospects stemming from the risks and opportunities; and
- Is prepared to determine the material information to disclose using a definition of material information consistent with IFRS S1 as a baseline.

IFRS S1 defines material information as follows:

'In the context of sustainability-related financial disclosures, information is material if omitting, misstating or obscuring that information could reasonably be expected to influence decisions that investors make on the basis of those reports, which include financial statements and sustainability-related financial disclosures and which provide information about a specific reporting entity'.

IFRS S1 *General Requirements for Disclosure of Sustainability-related Financial Information*

Objective

To develop an understanding of nature-related risks and opportunities that could reasonably be expected to affect an organisation's prospects and help prepare the organisation to determine the material information to disclose about those risks and opportunities according to the requirements in IFRS Sustainability Disclosure Standards as a baseline.

Desired outputs

- A longlist of nature-related risks and opportunities stemming from dependencies and impacts on nature, which can be plotted into any existing risk matrix in use by the organisation;
- A shortlist of nature-related risks and opportunities that could reasonably be expected to affect the organisation's prospects;
- A list of dependencies and impacts that give rise to these 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.

Practical tips

- Organisations should be familiar with the conceptual foundations for disclosing sustainability-related financial information set out in IFRS S1;
- Organisations should consider a range of methods and tools to support their assessment. Examples of these are identified throughout the Assess phase. 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 Assess phase adapts and builds on the TCFD steps for integrating climate-related risks into risk management, with a focus on how dependencies and impacts on nature create risks and opportunities for an organisation's financial position and prospects.[101] It also draws on guidance developed by ISO,[102] COSO and the World Business Council for Sustainable Development (WBCSD) on integrating environmental, social and governance-related risks into risk management processes,[103] as well as other COSO documents. These forms of guidance provide a starting point for organisations to think through the integration of nature-related risks into existing risk management processes.

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 and opportunity management – 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 tolerance criteria) be adapted?

A3: Risk and opportunity assessment and prioritisation – Which risks and opportunities could reasonably be expected to affect our prospects and should be prioritised?

101 TCFD (2020) Guidance on Risk Management Integration and Disclosure. In July 2023, the Financial Stability Board (FSB) announced that the work of the TCFD had been completed, with the ISSB Standards marking the 'culmination of the work of the TCFD'. Having fulfilled its remit, TCFD disbanded in October 2023.

102 ISO (2018) ISO 31000, Risk Management – Guidelines.

103 COSO and WBCSD (2018) Enterprise Risk Management–Applying Enterprise Risk Management to Environmental, Social and Governance-Related Risks.

A4: Assessment of material information on risks and opportunities – What information about risks and opportunities should be disclosed?

For **corporates**:	For **financial institutions**:
The Assess phase supports the translation of the organisation's dependencies and impacts identified in the Evaluate phase into a clearly defined set of nature-related risks and opportunities for the business, across direct operations and value chains. This often involves aggregating location-specific risks and opportunities to the enterprise level.	The Assess phase considers how nature-related risks and opportunities associated with clients, counterparties, issuers, borrowers, insured activities, assets under management or portfolio companies may be transmitted through financing, investment, underwriting or advisory activities. The assessment may combine a bottom-up assessment of risks and opportunities, based on the company/asset-level assessment in the Evaluate phase, and a top-down assessment based on the potential exposures identified in the Locate phase. Financial institutions may therefore need to assess both the nature-related profile of counterparties, assets or activities, and the potential implications for their own risk profile, strategy and disclosures.

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 identified in the Evaluate phase, the LEAP assessment team now develops a longlist of potential nature-related risks and opportunities arising from those identified dependencies and impacts.

An organisation can familiarise itself with the concepts of nature-related risks and opportunities based on the overview provided in Section 2.

6.4.1 Nature-related risks

Types of 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.[104] In addition to shorter-term financial risks whose information is deemed material today or in the near term, organisations may be exposed to longer-term risks presented by past, present and future dependencies and impacts on nature.

Nature-related physical risks are risks to an organisation resulting 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 activity depends upon. These risks can be chronic, such as a gradual decline of the species diversity of pollinators resulting in reduced crop yields or water scarcity, or acute, such as natural disasters, forest fires or oil 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 3 in Section 2 for further details.[105]

Nature-related transition risks are risks to an organisation that stem from a misalignment of economic actors with actions aimed at protecting, conserving, restoring, regenerating 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.[106]

Liability risk is included as a sub-category of transition risk in the TNFD framework, as it relates to potential financial losses stemming directly or indirectly from legal claims. Some literature 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 subset of both physical and transition risk categories. See Table 4 in Section 2 for further details.

104 CDSB (2021) Application guidance for biodiversity-related disclosures; TCFD (2017) Recommendations of the Task Force on Climate-related Financial Disclosures; FSB (2022) FSB Supervisory and Regulatory Approaches to Climate-related Risks Final report; IAIS (2021) Application Paper on the Supervision of Climate-related Risks in the Insurance Sector; NGFS (2024) Nature-related Financial Risks: A conceptual framework to guide action by Central Banks and Supervisors; OECD (2023a) A supervisory framework for assessing nature-related financial risks: identifying and navigating biodiversity risks.

105 NGFS (2024) Nature-related Financial Risks: A conceptual framework to guide action by Central Banks and Supervisors.

106 NGFS (2019) A call for action: climate change as a source of financial risk; NGFS (2021) Climate-related litigation: raising awareness about a growing source of risk; FSB (2022) FSB Supervisory and Regulatory Approaches to Climate-related Risks Final report; OECD (2023a) A supervisory framework for assessing nature-related financial risks: identifying and navigating biodiversity 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 and cascading interactions of physical and transition risks, where one loss triggers a chain of others, and prevents the system from reverting to its prior equilibrium after a shock.[107]

There are two categories of nature-related systemic risk:

- **Ecosystem stability risk:** Risk stemming from a physical hazard leading 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 a financial system.

There are close relationships between these 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 risks by removing coastal marshes and mangroves when clearing land for urban development, leading to potential future damage costs linked to the 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 and mangroves, then whole regions and their economies and communities may face higher exposure to risks such as flooding from coastal storms. These events would create traditional sources of financial risk (e.g. operational risks), and potentially, through compounding, cascading and contagion effects such as the withdrawal of asset protection insurance,[108] would lead to one form of nature-related systemic risk (i.e. financial stability risk). See Figure 14 in Section 2 for further details.

107 Goldin, I. and Mariathasan, M. (2014) The Butterfly Defect: how globalisation creates systemic risks and what to do about it; IRGC (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?; NGFS (2024) Nature-related Financial Risks: A conceptual framework to guide action by Central Banks and Supervisors; OECD (2023a) A supervisory framework for assessing nature-related financial risks: identifying and navigating biodiversity risks.

108 NGFS (2024) Nature-related Financial Risks: A conceptual framework to guide action by Central Banks and Supervisors; OECD (2023a) A supervisory framework for assessing nature-related financial risks: identifying and navigating biodiversity risks.

Understanding the drivers of nature-related risks

The sources of nature-related risks are driven by two key elements:

- 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
- An organisation's dependencies and impacts on nature (see the Evaluate phase).

Other external factors can also be drivers of potential nature-related risks and are also important to consider, including:

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

When considering the sources of risk, the LEAP Assess phase leverages well established concepts in enterprise and portfolio risk management by considering a risk as the combination of three elements: hazard, exposure and vulnerability.[109] In A1, organisations should distinguish between the source of potential harm to the organisation and the conditions that determine whether, how and to what extent that harm may affect the organisation.

Nature-related **hazards** are the ways in which these sources of risk can manifest. They are defined by the TNFD as the potential occurrence of a natural or human-induced physical event (shock) that may cause loss of life, injury or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision and environmental resources. Following the NGFS, the TNFD distinguishes between:

- Physical hazards, which can be acute (i.e. an immediate 'shock' or disruption of ecosystem services) or chronic (i.e. a long-term decline in ecosystem services resulting from prolonged environmental degradation); and
- Transition hazards, which can be sudden (e.g. a new or unexpected change in environmental regulations) or gradual (e.g. a long-term, progressive tightening of environmental regulations or changes in consumer preferences).

109 University of Oxford's Resilient Planet Finance Lab, TNFD and Global Canopy (2025) Evidence Review on the Financial Effects of Nature-Related Risks; NGFS (2023) Recommendations Toward the Development of Scenarios for Assessing Nature-Related Economic and Financial Risks; IPCC (2014) Climate Change 2014: Synthesis report.

The existence of a hazard alone does not necessarily result in a nature-related risk that can reasonably be expected to affect an organisation's prospects. The extent of risk also depends on:

- The organisation's **exposure** to the hazard through the presence of people, livelihoods, species or ecosystems, environmental functions, services and resources, infrastructure, or economic, social or cultural assets in places and settings that could be adversely affected by the hazard; and
- The organisation's **vulnerability**, which is the propensity or predisposition to be adversely affected by the hazard, which includes sensitivity or susceptibility to harm and lack of capacity to cope and adapt.

Organisations should therefore identify nature-related risks by considering both the sources of physical and transition risks (hazards) and their exposure and vulnerability to those hazards, recognising that the same hazard may result in different levels of risk across organisations and business activities.

The presence of environmental crime in and around an organisation's value chain can increase uncertainty about the nature-related hazards that an organisation might face and its exposure to them. It can obscure or distort its assessment of dependencies or impacts. The TNFD's guidance on environmental crime provides further support on this. Where significant assessment uncertainty has been identified in previous phases of LEAP, organisations should consider its implications for the identification of hazards, exposure and vulnerability, and therefore for the identification of nature-related risks and opportunities.

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 identification of nature-related risks and opportunities and assessment of nature-related issues, see the TNFD guidance on scenario analysis.

The link with dependencies and impacts on nature – building on the Locate and Evaluate analysis

Nature-related risks arise primarily from an organisation's dependencies and impacts on nature (see Evaluate phase), as illustrated in the dependency and impact pathway graphic (Figure 13).

For **financial institutions**, this assessment is typically undertaken through the dependencies and impacts on nature of their portfolio companies, investees, counterparties or clients.

Figures 43 and 44 below show a more detailed overview of how dependencies and impacts on nature can lead to nature-related risks to the organisation through:

- **Changes to the state of nature**, caused by business impact drivers or external factors and trends;

- **Changes to the flow of ecosystem services and the reliability of those flows,** associated with the changes to the state of nature; and
- **Impacts to people** 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.

The TNFD-GRI case studies: Identifying risks and opportunities to organizations arising from dependencies and impacts on nature provide examples of how companies have identified nature-related risks and opportunities. Box 28 includes a specific example from Ecopetrol.

Box 28: Risk identification arising from dependency and impact assessment

Ecopetrol S.A. is a mixed-economy company with majority government ownership, linked to Colombia's Ministry of Mines and Energy. 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 a leading 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 identify priority ecosystems from a nature-related risk perspective by analysing biotic and abiotic factors as well as associated impacts, including water resource use.

During 2025, Ecopetrol advanced its efforts to identify, evaluate and analyse its dependencies, impacts, risks and opportunities related to nature as part of its first TNFD LEAP assessment, which was done by prioritising 10 production assets and two refineries (Barrancabermeja and Cartagena).

As part of this exercise, the company identified 15 potentially significant dependencies for operational continuity, including water resource supply and regulation, as well as global climate regulation. It also identified nine significant impacts, mainly related to GHG emissions, water use and land transformation.

In identifying risks arising from its dependencies and impacts, Ecopetrol assessed the potential relationship between dependencies and physical risks, and between impacts and transition risks, while recognising that both types of risks may arise from multiple nature-related drivers. For example, the company identified:

- Potential reputational transition risks associated with stakeholder expectations. These risks are related to evolving regulatory requirements and public perceptions regarding the company's environmental management and management of nature-related issues; and

- Physical risks related to flooding that stems from its dependency on the ecosystem service of flood and storm regulation.

Additionally, Ecopetrol considered a systemic risk related to potential changes in ecosystem health and functioning, recognising that changes in ecosystem condition may affect multiple dependencies, impacts and business activities. To support the analysis, Ecopetrol conducted an economic valuation of ecosystem services using the benefit transfer approach. For analytical purposes, Ecopetrol defined two spatial buffers around the 10 prioritised asset clusters and the two refineries included in the assessment: a 10-kilometre buffer and an extended 15-kilometre buffer. The 10-kilometre distance was established in line with the Integrated Biodiversity Assessment Tool (IBAT) recommendation for onshore oil and gas operations. In addition, given that several assets are located near water bodies, a broader 15-kilometre buffer was adopted as a precautionary approach to better capture the potential scope of nature-related dependencies and impacts on both terrestrial and aquatic ecosystems. This approach enabled a more conservative and comprehensive assessment of nature-related risks, as well as the presence of protected areas and other biodiversity-sensitive features. Separately, ecosystem cover within the assets and areas relevant to the assessment was mapped and classified using the Map of Colombia's Continental, Coastal and Marine Ecosystems (MEC), supporting the characterization of ecosystem types and nature-related considerations across the study area.

Ecopetrol's TNFD LEAP pilot collected inputs and allowed the inclusion of one of the business risks related to an inadequate management of climate change, water and biodiversity as one of the company's main risks. This risk relates to the "company's vulnerability to adverse impacts [that] arises from a limited ability to respond promptly, efficiently and effectively to commitments, obligations and expectations associated with climate change, water and biodiversity".

The company also advanced its assessment of nature-related issues within its supply chain for nine prioritised materials (calcium carbonate, clarifiers, humectants, breakers, catalysts, reinforced steel pipes, cement, bentonite and wood). As an initial screening, supported primarily by secondary information, the assessment identified nature-related risks associated with natural resource availability, regulatory changes and biodiversity pressures across nine prioritised materials. These findings provide a basis for further assessment and integration of nature-related risks into value-chain management.

Sources: Ecopetrol (2026) Integrated Management Report 2025; GRI and TNFD (2025) Identifying risks and opportunities to organizations arising from dependencies and impacts on nature.

Dependency and impact pathways to nature-related risks

Dependencies and impacts on nature can give rise to both physical and transition risks via the realisation of physical or transition hazards. Dependencies on nature are primarily associated with physical hazards, given that a change in the state of nature or flow of ecosystem services can directly affect the business that depends on them. Impacts on nature are often primarily associated with transition hazards as they can affect other organisations and society (in addition to nature), which can prompt transition-related shocks. These can include, for example, new or unexpected changes in environmental regulations or changes in consumer preferences, representing a potential source of risk for the organisation.

As outlined above, hazards represent sources of risks only when considered along with an organisation's exposure and vulnerability to those hazards. While vulnerabilities should be assessed using organisation-specific information (across its operations, value chains and, where relevant, portfolios), the extent to which an organisation is exposed to a hazard is strongly associated with its dependency or impact on nature, i.e. with the organisation's relationship with nature. In the case of physical risks, for example, an organisation is only exposed to a hazard resulting from the decline in ecosystem services if it is dependent on that service.

Figure 43: Dependency and impact pathway: Connections between nature-related dependencies, impacts and physical risks

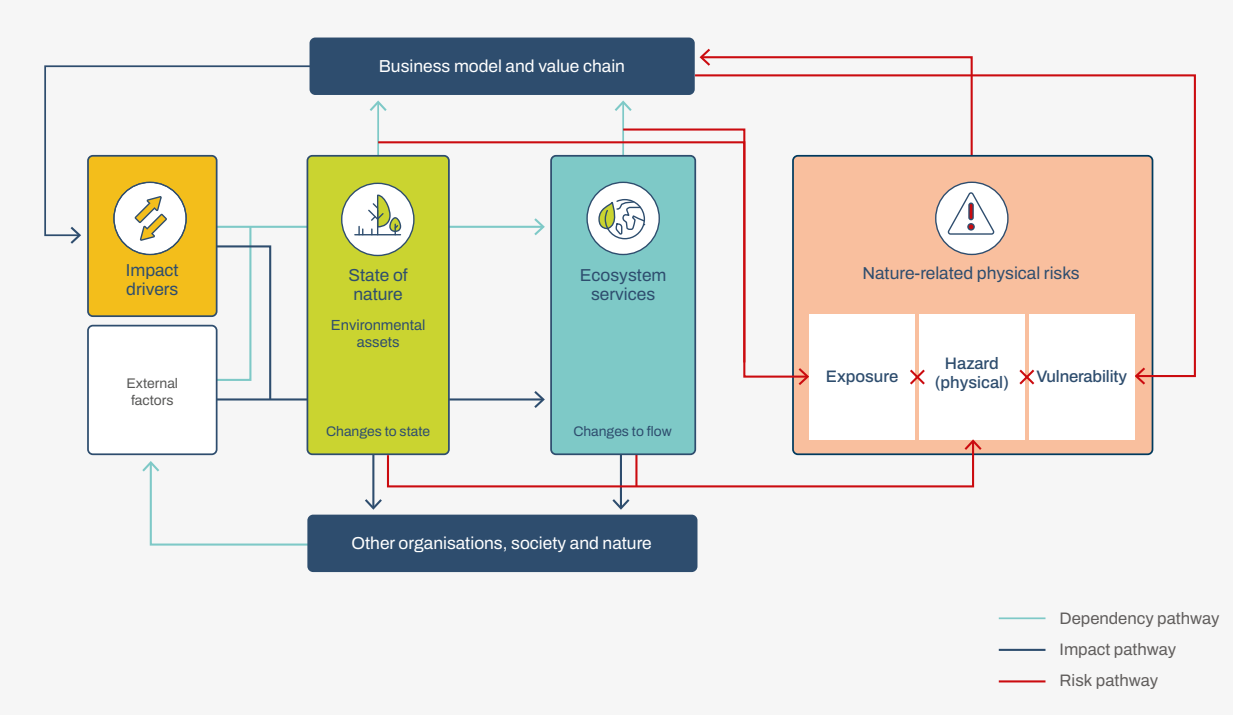
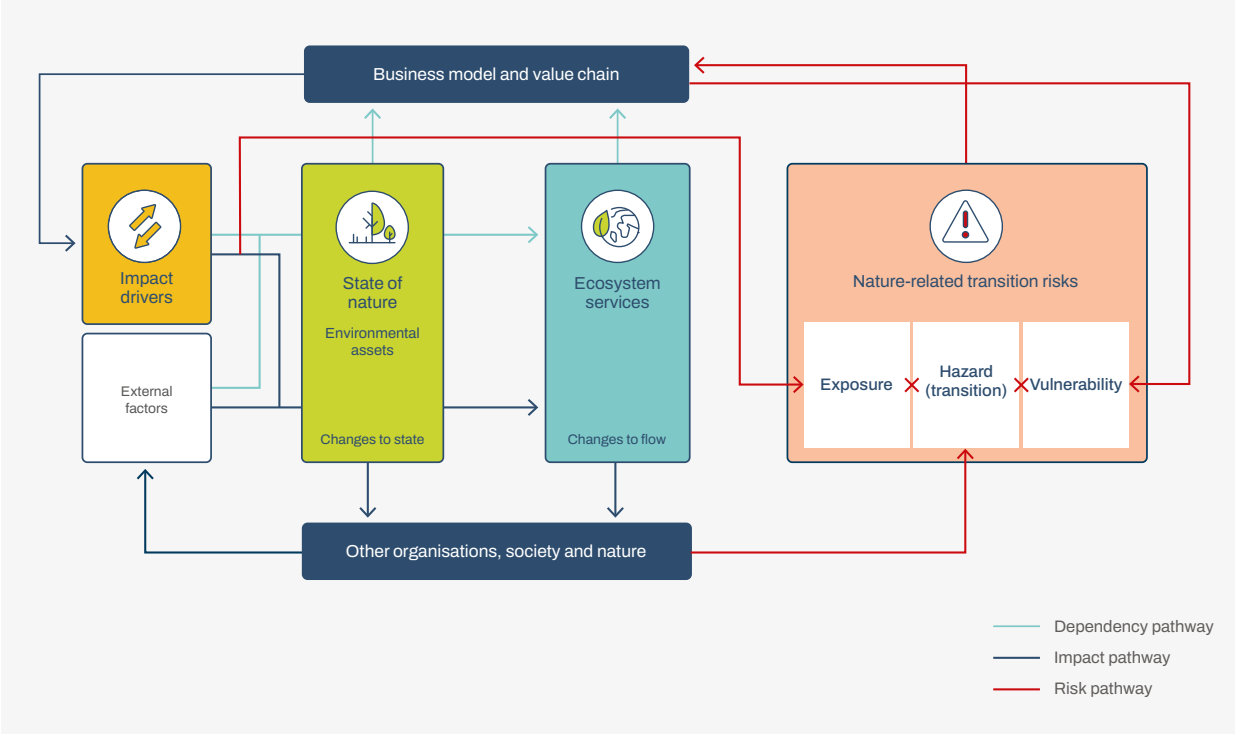


Figure 44: Dependency and impact pathway: Connections between nature-related dependencies, impacts and transition risks



The relevance and transmission of hazards, along with an organisation's exposure and vulnerability, may vary based on its sector, business activity, project lifecycle stage and supply chain context. For more information on sector-specific assessment of nature-related issues, see the TNFD's sector guidance.

Figure 45 in Box 29 shows an example of a dependency pathway to physical risk for a company's orange juice supply chain.

Box 29: Invasive alien species, nature-related dependencies and physical risks in orange juice supply chains: the case of citrus greening

A North American beverages company, Naked Juice LLC, with a large orange juice portfolio experienced significant supply chain and financial risks linked to reduced orange availability and higher orange procurement costs.

Citrus greening is a crop disease associated with the Asian citrus psyllid, *Diaphorina citri*, an insect vector native to Asia, and invasive in regions where it has been introduced, including parts of the Americas. The species can damage citrus plants directly and acts as a vector for citrus greening disease, which can reduce citrus production.

In 2024, both Moody's Ratings and S&P Global Ratings downgraded Naked Juice's credit rating due to orange supply shortages from severe drought, citrus greening and adverse weather, resulting in an almost 20% reduction in Naked Juice's adjusted EBITDA outlook.

This case illustrates how drivers of change affecting crop production could be reasonably expected to affect downstream companies' prospects through:

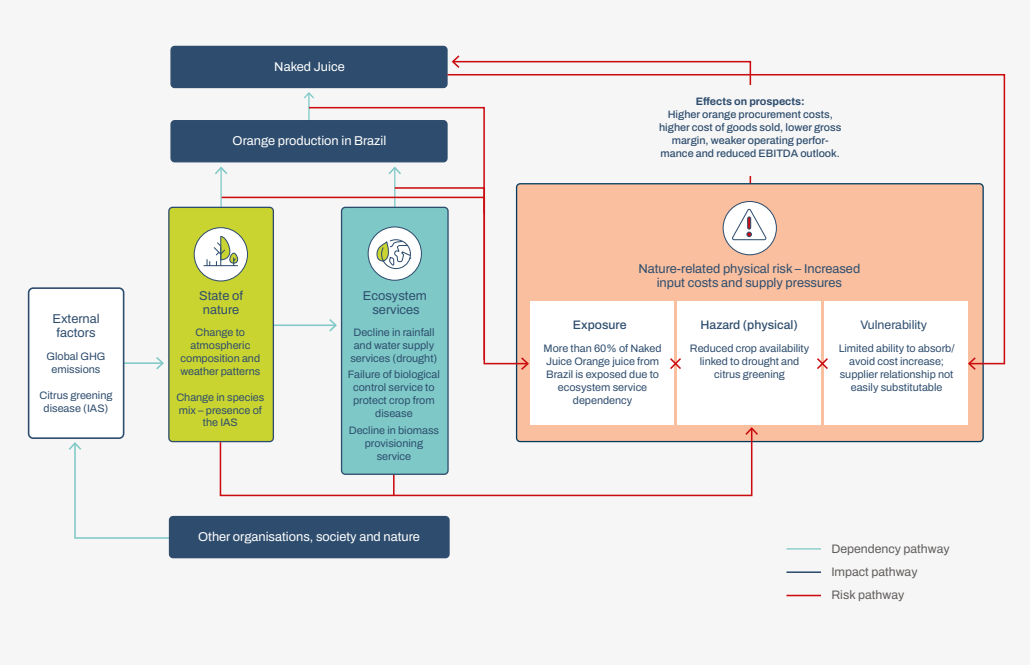
- Invasive species-related biological pressures: in this case, citrus greening. Invasive alien species in the context of risk to organisations and invasion pathways are discussed further in Annex 4;
- Dependency on regulating ecosystem services: This case illustrates the business dependency on pest and disease regulation or biological control, because disruption to these functions can affect the availability, quality and cost of agricultural inputs; and
- Value chain transmission: Nature-related risks can materialise beyond an organisation's own operations, as biological pressures affecting crop production can be transmitted through sourcing relationships, input availability and procurement costs to downstream business performance.

This case should also be read as an example of interacting biological, climate, supply chain and financial factors, rather than as a single-cause credit event.

Invasion pathways are discussed in Annex 4.

Figure 45 provides a description of each step of the impact and dependency pathway for this use case, highlighting connections between the nature-related dependencies, impacts and physical risks described above.

Figure 45: Dependency and impact pathway: Example of an orange juice supply chain



Sources: Moody's Ratings (2024) Rating Action: Moody's Ratings downgrades Naked Juice's CFR to Caa1 from B3, outlook is stable; Moody's Ratings (2025) Naked Juice LLC: Update to credit analysis following upgrade of CFR to Caa2; S&P Global Ratings (2024) Naked Juice LLC Downgraded To 'CCC+' From 'B-', Outlook Negative, Debt Ratings Lowered.

Connections between climate and nature-related risks

Climate change is one of the five drivers of nature change.[110] Conversely, nature loss contributes to climate change. Consequently, the climate-related risks an organisation may already be aware of – particularly physical climate risks – are closely related with nature-related risks. These connections can affect how an organisation assesses its climate and nature-related risks.

For example, nature loss can lead to climate-related hazards because 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,[111] which is around 15% of the estimated 50 billion tonnes of greenhouse gases emitted annually.[112] Nature's absorption of greenhouse gas emissions slows atmospheric CO_2 concentrations, but with nature's capacity to sequester greenhouse gases currently far below

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

111 Harris, N. L. et al. (2021) Global maps of twenty-first century forest carbon fluxes.

112 Ritchie, H. and Roser, M. (2020) CO2 and GHG Emissions – Emissions by Sector.

global annual emissions, there is an imbalance that leads to global warming. This, in turn, drives impacts on nature.

Moreover, other drivers of nature loss, 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 climate-related risks associated with climate change that could reasonably be expected to affect the organisation's prospects, the role of nature loss in climate feedback loops and tipping points should also be considered, along with potential trade-offs, synergies and unintended consequences. Connections between nature-related and climate-related risks should also be considered – for example, whether particular assets or activities are vulnerable to both nature-related and climate-related risks.

Organisations should assess not only direct connections between climate-related and nature-related risks, but also how they may interact, amplify or offset one another. This may include considering whether multiple climate and nature-related hazards occur simultaneously or sequentially, whether they create cascading or compounding effects, and how these interactions affect the likelihood, magnitude, timing and manageability of risks.

Organisations should also make use of capabilities developed through climate-related risk assessment, scenario analysis, enterprise risk management and financial planning, where these can provide a useful foundation for assessing connected nature-related risks and opportunities. However, nature-related assessment may require additional analysis, including greater location specificity, consideration of ecosystem services, cumulative impacts, ecological thresholds and non-linear change.

Table 12: 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 with adaptation 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 NGFS (2024) Nature-related Financial Risks: A conceptual framework to guide action by Central Banks and Supervisors.

Specificity and aggregation considerations

Nature-related risks may be identified at different levels of analysis, including at a site, asset, activity, value chain, landscape/seascape, counterparty, enterprise or portfolio level. Some risks, particularly physical risks, may be identified through location-specific assessment and then aggregated to determine their relevance at a business unit, enterprise or portfolio level. Other risks, particularly transition risks, may arise from aggregated impacts, external factors or business model characteristics and may therefore be identified directly at an enterprise or portfolio level.

Organisations should therefore not assume that local risk scores developed and used by a LEAP assessment team can be rolled up into enterprise-level risk. They should consider concentration, correlation, scale, substitutability, geographic diversity, sector context, time horizon, existing controls and the threshold at which location-specific or value chain-specific issues could affect the organisation's prospects. This means that a portfolio or enterprise-level risk may affect an organisation's prospects even where individual local risks are not assessed as affecting an organisation's prospects in isolation, and vice versa.

Additional considerations for financial institutions

Financial institutions will identify the risks their own organisations face through their relationships with clients, counterparties, investees, insured parties and other financed, facilitated or supported activities. These risks 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);
- Systemic risk (for example, increased inflation due to droughts);
- Underwriting risks (as insurance may become more costly to provide);
- Reputational risk (for example, lending to a client depleting a watershed in a controversial context); and
- Regulatory risk (for example, financing companies with value chains associated with deforestation under EU regulations).

These risks may arise both from concentrated exposure to a specific counterparty, sector, geography or asset class, and from correlated exposures across multiple counterparties with common dependencies, impacts, locations or value chain characteristics.

6.4.2 Nature-related opportunities

As outlined in Section 2, the TNFD defines nature-related opportunities as activities that create positive outcomes for organisations and nature through positive impacts on nature or mitigating negative impacts on nature. They can involve the development, adaptation, replication, scaling or implementation of new or existing products, services, financial instruments, methods, processes, technologies or business models. Table 13 provides some examples of nature-related opportunities.

A nature-related opportunity comprises two parts:

- The expected positive outcomes for both business and nature from pursuit of the opportunity; and
- The elements (action and output) that produce these expected outcomes (see Figure 15 in Section 2, which provides further details on outcomes and elements of nature-related opportunities).

Distinguishing between reducing negative impacts and positive impacts

Importantly, the TNFD definition of nature-related opportunities recognises efforts undertaken by an organisation to (i) reduce existing negative impacts on nature and (ii) deliver positive impacts on nature. These are categorised as two broad and complementary types of opportunities. Both can contribute to financial and non-financial benefits to business (Figure 46).

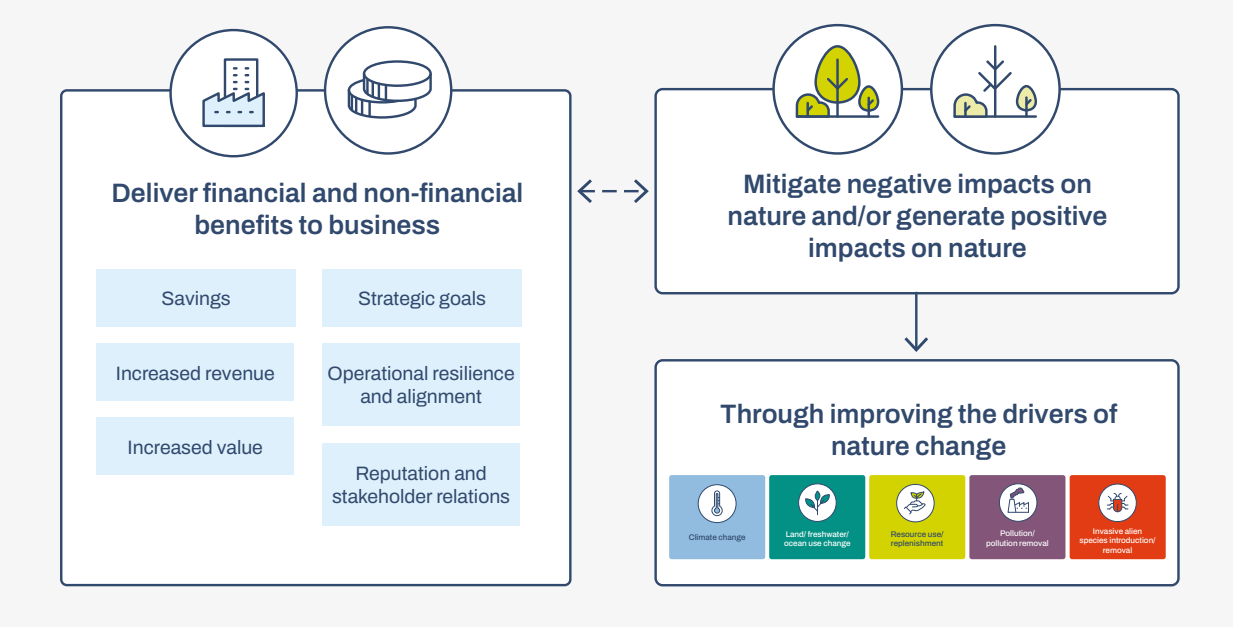
Financial benefits can be related to one or more of:

- Savings – for example, from resource efficiency, reduced risks or improved financing terms;
- Increased revenue – for example, from access to new markets or new product lines; and
- Increased value – for example, from stronger brand or future-proofing.

Non-financial benefits can be:

- Strategic – for example, meeting corporate targets or positioning in market;
- Reputational – for example, improved stakeholder relationships; and/or
- Operational – for example, improved resilience against acute stresses.

Figure 46. Business and nature outcomes from nature-related opportunities.



The TNFD recommends that business actions that can be taken to avoid or minimise negative impacts on nature should be prioritised, following mitigation hierarchy principles and the SBTN AR3T framework (see Prepare phase).[113]

In some cases, the set of actions or interventions undertaken by an organisation may both reduce negative impacts on nature and contribute to positive impacts on nature. Organisations should identify and describe to investors and other stakeholders, including through the use of negative impact metrics and positive impact metrics, whether an opportunity they seek to pursue or are currently implementing avoids or mitigates negative impacts, generates positive impacts, or does both so as not to obscure the distinction.

Organisations looking to associate their pursuit of nature-related opportunities should do so consistent with the definition published by the Nature Positive Initiative (NPI) – see Box 30.[114]

113 SBTN (2023c) Overview Step 4: Act.

114 NPI (2023) The Definition of Nature Positive.

Box 30: The definition of nature positive

Nature positive is a global societal goal defined as 'halt and reverse nature loss by 2030 on a 2020 baseline and achieve full recovery by 2050'. To put this more simply, it means ensuring more nature in the world in 2030 than in 2020 and continued recovery after that. The nature positive goal is designed to drive society to deliver a measurable absolute improvement in the state of nature against a defined baseline, which will in turn improve nature's ability to contribute to human wellbeing.

Individual entities, geographies and countries can and must demonstrate their sufficient contribution to a global nature-positive outcome. In operationalising nature positive, tackling drivers and the negative and positive impacts is central.

Source: NPI (2023) The Definition of Nature Positive.

Resilience

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.[115]

Identifying opportunities arising from dependencies, impacts and risks

Nature-related opportunities vary according to the region, market and industry in which an organisation operates. In A1, organisations should focus on how the opportunity connects to the identified dependencies, impacts and risks.

Nature-related opportunities can arise as an organisation seeks to:

- More sustainably manage its nature-related dependencies, creating a risk reduction and resilience benefit to the business;
- Reduce its current negative impacts on nature and avoid future negative impacts on nature;
- Increase positive impacts on nature;
- Provide new business solutions to help its customers or clients better manage their nature-related dependencies, impacts and risks; and
- Consider how it can contribute to the global policy and societal goal to halt and reverse nature loss by 2030 on a 2020 baseline i.e. contribute to nature-positive outcomes.

115 Folke, C. et al. (2016) Social-Ecological Resilience and Biosphere-Based Sustainability Science; Rockström, J. et al. (2023b) Shaping a Resilient Future in Response to COVID-19.

Additional considerations for financial institutions

Nature-related opportunities may be identified through financing, investment, lending, underwriting, advisory and stewardship activities. These activities can support clients, enable the development of nature-related products and services, and help replicate or scale opportunities.

Illustrative types of nature-related opportunities

To identify nature-related opportunities in A1, organisations may find it helpful to group opportunities according to how they support business functions or decision-making processes. These groups are not exhaustive and do not replace other ways of categorising opportunities, but can help connect opportunities to the teams responsible for identifying, evaluating and pursuing them.

Grouping opportunities by business function helps to relate opportunities to the roles of those within corporates and financial institutions who will identify, assess, seek approval for and execute them. This does not invalidate or supersede other ways of categorising nature-related opportunities, which may serve different audiences and aims. The TNFD discussion paper on nature-related opportunities provides examples and case studies for each opportunity group, demonstrating how organisations and financial institutions have identified and pursued nature-related opportunities in practice.

Figure 47: Five ways that nature-related opportunities bring value to business



Table 13 shows how each business function can give rise to different types of opportunities depending on the driver of nature change being addressed.

Table 13: Examples of nature-related opportunities by business function and driver of nature change

Business support	Driver of nature change				
	Climate change	Land/freshwater/ ocean-use change	Resource use/ replenishment	Pollution/pollution removal	Invasive alien species and others
Operational efficiency and resilience	Reduce energy use on a farm by using regenerative methods to reduce irrigation needs	Change vegetation management programme to allow natural growth in buffer zones around an active forestry area	Install water filtration technology to recirculate and reuse process water in other operations	Convert to precision fertiliser techniques to minimise pollutant run-off	Implement ballast water treatment to reduce the introduction, establishment and spread of invasive alien species into new ports
New product or service markets	Launch carbon-negative fertilisers using biochar	Offer ecological restoration or habitat-banking services for degraded land and coasts	Develop soil microbiome enhancement products that restore fertility and reduce input demand	Use phytoremediation to remove hydrocarbon and salt pollutants from soil	Develop environmental DNA and other early-detection services to identify invasive alien species and relevant pathways before establishment and spread
Supply chain resilience	Source dairy or beef only from verified producers using methane-suppressing feed additives and rotational grazing	Integrate sourcing criteria that reward suppliers restoring degraded pasture or buffer zones within production landscapes	Prioritise suppliers using precision irrigation and soil-moisture systems to secure water efficiency	Run joint capacity-building programmes with local cooperatives to improve waste management and reduce agrochemical run-off	Collaborate with coastal communities to monitor invasive alien species and establish early-warning systems, helping to protect fisheries and aquaculture inputs and reduce supply-chain disruption

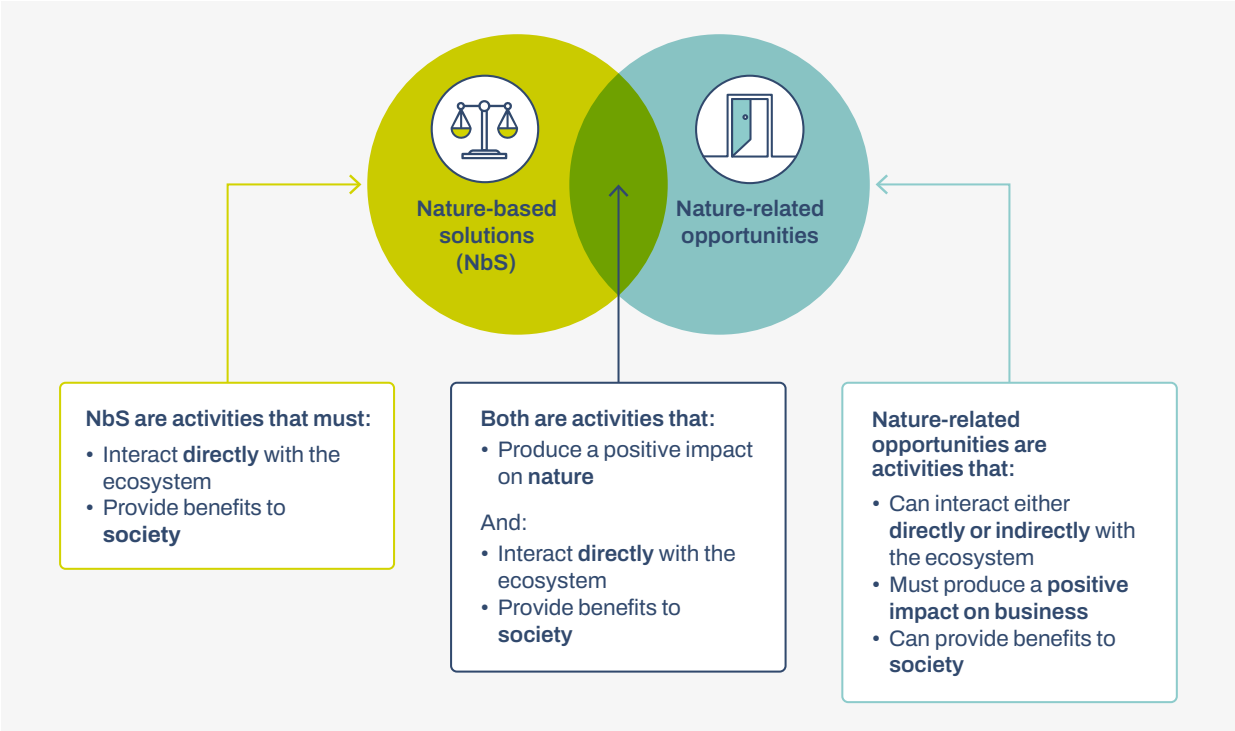
Business support	Driver of nature change				
	Climate change	Land/freshwater/ ocean-use change	Resource use/ replenishment	Pollution/pollution removal	Invasive alien species and others
Business model innovation	Use a distributed workforce model to reduce energy related to commuting	Adopt cooperative land-sharing ventures where multiple producers jointly manage habitat corridors and share returns from certified nature-positive production	Use a lighting-as-a-service model that retains ownership of fixtures and materials, reducing raw material demand and waste generation	Deploy a deposit-return and remanufacturing system in which producers retain ownership of packaging, retrieve it for reprocessing and earn income from recovered materials	Use machine learning models to predict invasive alien species outbreaks to allow proactive, preventative measures
Financial innovation	Structure sustainability-linked loans with KPIs tied to corporate decarbonisation milestones	Create green credit lines for verified deforestation-free or regenerative agriculture supply chains	Attract private equity in the circular economy supporting recycling technology companies	Attract venture capital for companies developing new technologies to remediate sites	Obtain ecological restoration insurance and performance bonds underwriting invasive alien species monitoring and control as part of restoration project delivery

Nature-related opportunities and Nature-based Solutions

Many organisations have already begun considering Nature-based solutions (NbS) as part of their response to climate change. NbS are defined by the IUCN as 'actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems that address societal, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits'.[116]

The literature on NbS contains guidance and examples that are applicable to nature-related opportunities, where NbS can be implemented by corporates or financial institutions either directly or through investment. Discussions of NbS focus primarily on environmental and social outcomes, and often do not address outcomes for a corporate or financial institution explicitly, although it is implicitly acknowledged that addressing nature loss helps to improve resilience and mitigate nature-related risks. Consistent with the TNFD's definition, NbS can be an important type of nature-related opportunity where it produces positive outcomes for both the organisation and nature. However, not all NbS are nature-related opportunities, and not all nature-related opportunities are NbS, as illustrated in Figure 48 and example table below.

Figure 48: Connections between nature-based solutions and nature-related opportunities



116 IUCN (2020) The IUCN Global Standard for Nature-based Solutions.

NbS	Both	Nature-related opportunity
A company funds ecosystem restoration that improves biodiversity and community resilience, but no positive outcome for the company is identified.[117]	A company restores a wetland that improves habitat and water quality while reducing its water treatment costs.[118]	A company increases the use of recycled materials in its products, reducing demand for virgin resource extraction and associated pressures on nature while improving material supply resilience.[119] A company converts nylon waste into regenerated nylon, reducing demand for virgin raw materials and associated pressures on nature while generating revenue from the recycled material.[120]

Box 31: Insurance solutions to support resilience in fishing value chains

Organisations in the fishing value chain working towards understanding and managing their nature-related dependencies, impacts and risks can identify opportunities to improve their business resilience. In the fishing sector, these opportunities may include financial instruments and insurance solutions that respond to physical risks linked to climate pattern changes, ocean warming, fish stock movement and disruption to ecosystem assets that support fish availability.

One example is the potential use of climate parametric insurance. In Chilean waters, the climate phenomena of El Niño and La Niña are major predictors of fish location. Understanding their pattern and future scenarios, associated with ocean temperature or upwelling, has been strategic for fish and seafood company Nutrisco. It has made it possible to assess the potential implementation of climate parametric insurance with British insurance broker Howden to explore what parameters and thresholds could trigger a payout, and what value could be covered. This information could also help the company with investment decisions, including where future processing capacity should be located as fish stocks and resource availability shift. While parametric insurance emerged as a clear opportunity in Nutrisco's analysis, translating it into practice has proven difficult for two reasons: (i) defining which parameter to insure and building a robust, auditable mechanism to measure it; and (ii) securing a counterparty willing to underwrite the cover, which is not currently available in the Chilean market and may require engagement with the international (re)insurance market.

117 Cartier Philanthropy for People and for Nature (2026) Nature and biodiversity programmes.

118 Dow (n.d.) Seadrift Constructed Wetlands: An Engineered Natural Technology Project.

119 Apple (2025) Environmental Progress Report.

120 BloombergNEF (2024) Aquafil's Regenerated Nylon Fashions a Revenue Opportunity.

Insurance can also provide an opportunity to manage nature-related risks linked to ecosystem assets. Howden is exploring insurance options to cover ecosystems that are key to small-scale fishing in the Philippines, such as mangroves, coral reefs and seagrass beds. These ecosystems are critical for the survival of fish, particularly for marine fish species, where 25% depend on coral reefs. The fishing industry in the area is exposed to the physical risk of fish stock decline because of disruptions to these ecosystem assets, caused, for example, by certain fishing techniques or extreme weather events.

Together, these examples illustrate two ways in which insurance-related opportunities may be identified in the fishing sector: through analysis of climate-related physical risks and fish stock movement, and through analysis of dependencies on ecosystem assets that support fish survival.

Business outcomes	Nature outcomes
Climate parametric insurance linked to fish stock movement • **Operational resilience:** The company can better manage exposure to changes in fish location linked to climate patterns, ocean temperature and upwelling. • **Reduced risk exposure:** Insurance coverage can be designed around defined parameters, thresholds and associated value covered. • **Strategic decision making:** Information on fish stock movement can support decisions on future processing capacity and location. Insurance for ecosystem assets supporting small-scale fisheries • **Operational resilience:** Fishing organisations can better manage physical risks linked to the disruption of ecosystem assets that support fish survival. • **Financial innovation:** Insurance routes can be developed for Marine Protected Areas, coral bleaching, storm impacts on coral reefs and seagrass, and typhoon impacts on mangroves.	Climate parametric insurance linked to fish stock movement • **Mitigation of negative impacts on nature:** By using information on climate patterns, ocean temperature, upwelling and fish stock movement, the company may be better able to avoid decisions that increase pressure on vulnerable fish stocks or ocean ecosystems. • **Improving ecosystem service understanding and management:** Helps connect business planning to the ocean conditions that support fish availability, reinforcing the importance of maintaining ecosystem service supply. Insurance for ecosystem assets supporting small-scale fisheries • **Mitigation of negative impacts:** Support the protection and management of ecosystem assets exposed to disruption.

For organisations applying the Assess phase, these examples show how findings from dependency and risk analysis can help to identify opportunities. They illustrate how nature-related assessment can inform the design of financial instruments, the definition of relevant thresholds and business decisions linked to resilience. They also show how potential effects on an organisation's prospects can be considered alongside the ecosystem assets and services that underpin business activity.

Sources: Howden (2023) Howden launches Climate Parametrics global practice to de-risk the low carbon, resilient transition and protect biodiversity; CISL and Howden (2024) Nature-related financial opportunity use case: The role of mangroves, coral reefs and seagrasses in supporting and protecting near-shore fisheries in Bolinao, the Philippines; TNFD (2026a) Applying TNFD nature-related metrics in the fishing sector.

Box 32: Indigenous Peoples and Local Communities and identification of nature-related opportunities

Nature-related opportunities may also be identified where stewardship, traditional knowledge and community-based enterprise models support ecosystem management and create value for Indigenous Peoples and Local Communities. Indigenous Peoples and Local Communities actively contribute to sustaining ecosystems through knowledge systems, governance and land-use practices.[121] This includes the creation of diverse cultural landscapes and seascapes, the domestication and conservation of agrobiodiversity, and practices that enhance resilience and productivity at a landscape or seascape scale.[122]

Evidence shows that biodiversity in lands managed by Indigenous Peoples and Local Communities tends to decline more slowly than elsewhere.[123] When stewardship aligns with market demand, opportunities can arise for community-based bioeconomies and value chain partnerships that connect cultural practices, ecosystem services and commercial activity. Examples include the Brazil nut, domesticated and cultivated in Amazonian forest landscapes for millennia,[124] which underpins a significant regional and international trade, and the açaí berry, where Indigenous and riverine management systems underpin an expanding global value chain.[125]

121 IPBES (2019a) Summary for Policymakers Global Assessment Report on Biodiversity and Ecosystem Services.

122 UNESCO (2025) People-Centred Conservation in Budj Bim Cultural Landscape; Jago et al. (2024) Agrobiodiversity conservation enables sustainable and resilient food systems; Schatte et al. (2025) Assessing holistic agroecological resilience of landscapes; MacQueen D. (2024) Agrobiodiversity — the way to save Earth's skin.

123 Garnett, S. T., et al. (2018) A spatial overview of the global importance of Indigenous lands for conservation.

124 Levis, C., et al. (2017) Persistent effects of pre-Columbian plant domestication on Amazonian forest composition.

125 UNDP (2024) How Açaí berries and agroforestry are boosting food security and income in Brazil.

Box 33: Positive impacts and nature-related opportunities related to an Indigenous community-led enterprise in Mexico – Puethé 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 Mexico. The aim was to socialise, analyse and reflect on the TNFD framework, and carry out internal assessments of nature-related risks and opportunities within the enterprises.[126]

One of the Indigenous enterprises was Puethé Products and Services (Puethé), a venture established to tackle the issue of indiscriminate looting of cacti within the Indigenous territory. The enterprise operates 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; and
- 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 sustainable way. Natural inputs include seeds, plants, soil, substrates and the use of water for irrigation, with the venture highly dependent on weather, water resources, 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

126 TNFD and CIELO MEX (2024). TNFD, LEAP and Indigenous Enterprises: Impacts and Opportunities.

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

Source: CIELO MEX (2024) TNFD, LEAP and Indigenous Enterprises: Impacts and Opportunities.

Key dataset and tool functionalities for A1:

Support the development of causal chains showing how:

- Dependencies on environmental assets and ecosystem services;
- Impacts on nature;
- External factors and trends; and
- Changes in the state of nature may give rise to physical, transition or systemic nature-related risks. Specifically:
  - Suggest the potential physical (acute/chronic) or transition (policy/market/technology/reputational/liability) hazards;
  - Provide an estimate of the company's potential vulnerability and exposure to any hazard identified;
  - Identify the potential physical, transition and systemic risks stemming from the hazards, exposures and vulnerabilities identified;
  - Move from location-specific to corporate-level assessments to determine the relevance at an enterprise or portfolio level, using a bottom-up assessment to move from local operational metrics (e.g. a facility's water withdrawal exceeding the sustainable recharge rate of its local watershed) to enterprise-level risks (e.g. reduced production volumes or higher operating costs resulting from water stress across multiple facilities);

- Define climate/nature synergies, trade-offs and interconnections;
- Identify nature-related opportunities that create positive outcomes for both the organisation and nature. These could include business outcomes such as resource efficiency, resilience, new markets or access to finance, and nature outcomes through the mitigation of negative impacts or generation of positive impacts on nature; and
- Identify cascading and compounding risks where nature loss amplifies climate risks or vice versa.

Resource types with illustrative examples:

- Risk frameworks e.g. TNFD Risk and Opportunity Registers, NGFS Nature-Related Conceptual Framework.
- **Hazard and spatial models** e.g. WRI Aqueduct flood/drought risk layers, WWF Water Risk Filter, IBAT, Global Nature Watch predictive risk maps.
- **Policy trackers and regulatory intelligence tools** e.g. National Biodiversity Strategies and Action Plans (NBSAPs), protected area designations, biodiversity-related legislation and targets.
- **Certification scheme assurance and traceability mechanisms** can support risk assessment, depending on the processes followed, see Boxes 43 and 50 in Prepare.

6.5. A2: Adjustment of existing risk and opportunity management

A2: Adjustment of existing risk and opportunity management	*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 tolerance criteria) be adapted?*

In A2, the LEAP assessment team should identify the specific 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 other teams and departments within the organisation, especially within the risk management function, as organisations should identify functions and departments responsible for those risk processes and elements. 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 Prepare phase of the LEAP assessment.

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 in the organisation and then identify the various functions involved in risk management and opportunity activities that support strategic planning.

The TNFD-GRI case studies: Identifying risks and opportunities to organizations arising from dependencies and impacts on nature also provide examples of how companies integrate nature-related information into centralised enterprise risk management (ERM) systems.

6.5.1 Nature-related risks

Many organisations have ERM structures and processes in place to identify, assess, manage, monitor and communicate risks. Given this, the TNFD LEAP guidance on risk assessment is closely linked to the COSO's ERM framework, especially the '**Performance' component**, which focuses on:[127]

- The identification of risks that may have an effect on the achievement of strategy and business objectives (equivalent to A1 of the Assess phase of LEAP);
- Their assessment and prioritisation by severity (equivalent to A3 of LEAP); and
- Implementing risk responses (equivalent to P1 of LEAP).

Two other components of the COSO framework are also particularly relevant for the Assess phase:

- **'Review and revision':** In A2, organisations should adapt their approaches to integrate nature-related risks and opportunities, and refine this over time following potential new iterations of the LEAP approach; and
- **'Information, communication and reporting':** In A4, organisations should assess the materiality of the information on risks that could reasonably be expected to affect an organisation's prospect for the purpose of disclosure.

Some of the key elements of risk management that may need to be adjusted to integrate nature-related risks include:

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

127 COSO and WBCSD (2018) Enterprise Risk Management–Applying Enterprise Risk Management to Environmental, Social and Governance-Related Risks.

Additional considerations for financial institutions

Financial institutions and especially banks can adopt a similar approach to what the Basel Committee on Banking Supervision (BCBS) foresees for climate-related risks, and what the European Central Bank (ECB) includes in its good practices for climate and nature risk management, including:[128]

- Deciding 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;
- Defining the tasks and responsibilities of the risk management function for identifying, assessing, measuring, monitoring and reporting nature-related risks. For financial institutions, embedding nature-related considerations into existing risk management processes may require adjustments to roles and responsibilities across the three lines of defence;
- Seeking to ensure that internal reporting systems are capable of monitoring nature-related risks and producing timely information to ensure effective board and senior management decision making;
- Ensuring that credit, market, liquidity, operational and other risk management systems and processes consider nature-related risks. As an example, establish effective processes to control or mitigate the potential risk of losses on – and increased volatility of – the organisation's portfolio, or the calibration of liquidity buffers; and
- Assessing current stewardship policies, engagement or client due diligence processes applied to portfolio companies/activities in relation to nature-related dependencies, impacts, risks and opportunities.

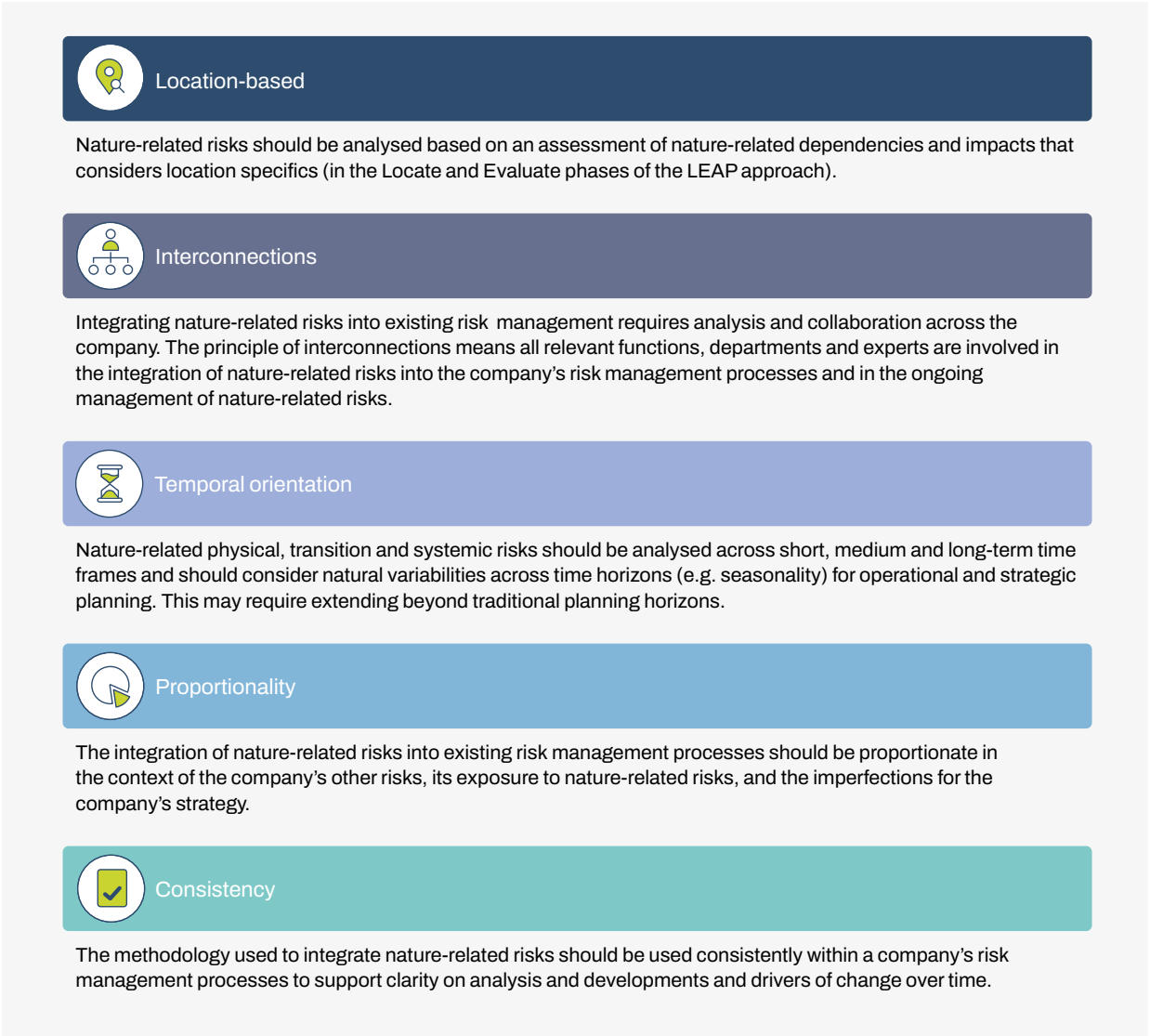
128 BCBS (2022) Principles for the effective management and supervision of climate-related financial risks; ECB (2026) Good practices for climate and nature risk management – Observations from the ECB's five-year climate and nature risk programme (2020-25) – see also Box 33.

Key principles for integrating nature-related risks into existing risk management frameworks

The TNFD recommends that nature-related risks 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.

The TNFD has adopted five principles for integrating nature-related risks into existing risk management frameworks as shown in Figure 49.

Figure 49: The TNFD's principles for integrating nature-related risks into risk management frameworks



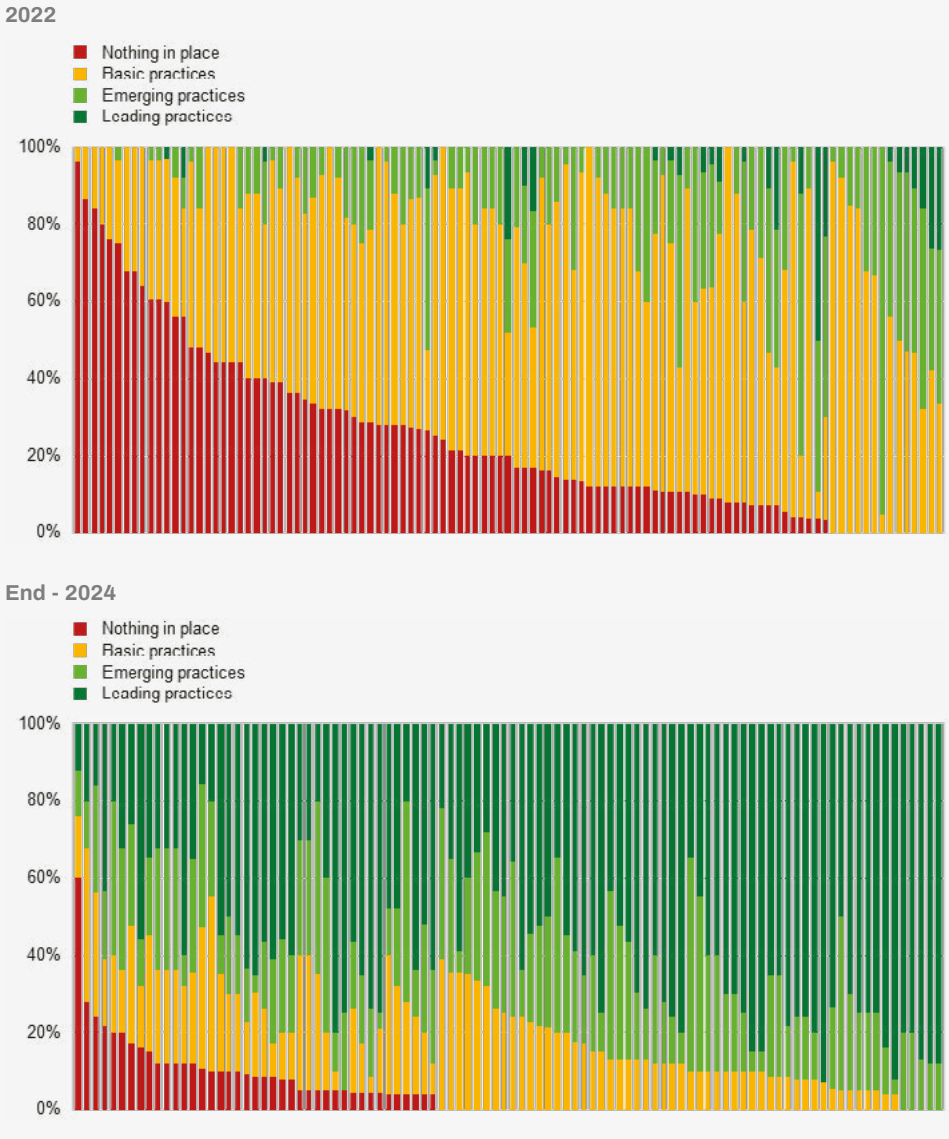
Box 34: Advancements in regulatory and supervisory guidance on nature-related risks in Europe

The ECB established a set of supervisory expectations on climate and nature risk management as part of its guide on climate-related and environmental risks for banks. In May 2026, it updated its compendium of good practices among banks under its supervision to help them close gaps in their risk management frameworks and address vulnerabilities in the evolving risk environment.

In 2025, the European Banking Authority (EBA) published guidelines on the management of ESG risks (including nature-related risks), which set requirements for the internal processes and risk management arrangements that institutions should have in place starting from January 2026. In 2023, the European Insurance and Occupational Pensions Authority (EIOPA) published a staff paper examining the transmission channels through which nature degradation may affect insurers and outlines potential future supervisory guidance.

Informed by these guidelines, financial institutions globally can consider using the LEAP assessment approach to inform their internal efforts to strengthen integrated climate and nature risk assessments and stress test capabilities, aligned with regulatory expectations and emerging industry practice. This includes identifying and mapping drivers of nature-related risks (see A1) and their transmission channels, measuring their effects (see A3) and reflecting this mapping in the institution's risk processes (see A2).

Figure 50: Bank's alignment with ECB supervisory expectations on climate- and nature-related risks



Sources: ECB – Banking Supervision (2020) Guide on climate-related and environmental risks: Supervisory expectations relating to risk management and disclosure; ECB – Banking Supervision (2026) Good Practices for Climate and Nature Risk Management: Observations from the ECB's Five-Year Climate and Nature Risk Programme (2020-25); EBA (2025) Final report on Guidelines on the management of ESG risks; EIOPA (2023) Staff Paper on Nature-related Risks and Impacts for Insurance.

Table 14 provides examples of nature-related risks for each of these common categories.

Table 14: 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. A 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 an impact on production. Costs increase on raw materials due to sustainable forestry practice requirements.
Strategic	Competitive landscape Changing consumer sentiment	Transition risk (market)	Consumer preferences shift toward products that are produced from recycled, regenerative, renewable, biodegradable, ethically, responsibly sourced organic materials.

Integrating nature-related risks into existing processes involves determining whether such risks will be treated as:

- Stand-alone risks;
- Cross-cutting drivers of existing risks; 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 into its risk taxonomy and its core processes.

Considering contributions and exposure to 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 whether physical and transition risks are linked to larger scale ecosystem instability, how these could materialise in the near future, and how this 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 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. For example, organisations may engage in landscape or seascape approaches to realise collective action and/or governance mechanisms at the scale needed to effectively manage systemic risks.

Updating and maintaining risk registers

Many entities maintain a risk inventory or register to list the risks that they face. 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 most relevant to their business or portfolio, referring to the TNFD templates for nature-related risk 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 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.

6.5.2 Nature-related opportunities

In A2, the LEAP assessment team should identify the processes and elements used to assess and manage opportunities and recommend adjustments based on the characteristics of the opportunities identified in A1. Implementation of these recommendations should be considered in the Prepare phase.

Identifying relevant processes

Relevant processes may include:

- Strategy and business planning;
- Innovation and research and development;
- Capital allocation and investment appraisal;
- Product and service development;

- Procurement and supply chain management;
- Operations and asset management; and
- Lending, underwriting, investment, client assessment, portfolio management and stewardship.

The organisation should identify the process that would normally assess, approve or govern the opportunity. More than one process may be relevant, particularly where an opportunity involves several business functions, value chain actors or locations.

Some organisations may assess opportunities through existing strategy, innovation, procurement or capital allocation processes, while others may use product development, client assessment or portfolio management processes.

Assessing process suitability

The LEAP assessment team could consider whether the relevant process:

- Uses the information and knowledge needed to assess expected outcomes for the organisation and nature;
- Involves the relevant functions and decision makers;
- Includes suitable expertise and participation;
- Addresses the relevant business model, value chain and location context; and
- Identifies significant evidence gaps, assumptions and uncertainty.

Where historical information is limited, relevant comparisons, external tools, expert input, certification or pilots may support further assessment. These are not required in every case and should be proportionate to the nature and potential significance of the opportunity.[129]

129 GRI and TNFD (2025) Identifying risks and opportunities to organizations arising from dependencies and impacts on nature.

Additional considerations for financial institutions

Financial institutions should review the processes used to identify, assess and approve nature-related financial products and client opportunities. These may include product governance, credit assessment, underwriting, investment due diligence, client engagement, portfolio construction and stewardship. Financial institutions should consider whether eligibility criteria, nature-related key performance indicators, data, responsibilities and approval processes are suitable for the opportunity being assessed.

Box 35: Integrating nature-related risks and opportunities into enterprise risk management

Swire Properties, a Hong Kong-based real estate developer and manager, has integrated nature-related risks and opportunities directly into its ERM framework. Using the TNFD LEAP approach, the company identified 11 different nature-related risks and opportunities relevant to its direct operations and supply chain. These span both physical risks and transition risks arising from regulatory, market demand and technological shifts, including potential cost increases for sourcing construction materials (such as concrete, steel and timber) due to evolving nature-related regulations and standards.

Nature-related opportunities have also been considered in the assessment. Market trends indicate growing demand for nature-inclusive green buildings that provide biophilic design, access to nature and green open spaces. These offer potential rental premiums from improved commercial tenant occupation and satisfaction, strengthening the business case for integrating nature into building design and development.

Within Swire Properties' ERM process, risk, finance, procurement, sustainability and other relevant teams collaboratively conduct a multi-dimensional risk assessment to identify, assess, monitor and manage nature-related transition and physical risks. This integrated approach aligns with the same process applied to other risk types. Each identified risk is evaluated and scored across six dimensions – covering financial, operational, legal and strategic considerations – representing the potential effect of the risks on the company. These effects are further quantified, with each score corresponding to a monetary range, enabling consistency and comparability with other risk types.

The assessment also considers the company's ability to mitigate and control the identified risks, distinguishing between risks that can be mitigated internally and those representing externalities with limited control. Mitigation measures and adaptation capacity are central to determining the degree of vulnerability for the management of the risks. For example, risks related to the sourcing of sustainable construction materials are

assessed, estimating the potential effects of these risks on the company under different regulatory or market conditions.

Swire Properties applies this approach at both asset and corporate levels when following the LEAP approach. Asset-level assessments focus on localised physical risks, such as water availability and exposure to floods, and soil and sediment retention services (connecting with climate adaptation), with results feeding into the company's corporate risk register. Corporate-level assessments, by contrast, mainly focus on transition risks, such as changes in regulations that may impact new development projects when sourcing construction materials.

Swire Properties recognises that these risks are likely to become more significant over time. Continuous monitoring and iterative assessment are therefore embedded in the company's risk management process, ensuring readiness as market and regulatory contexts evolve. Importantly, Swire Properties views risks and opportunities as two sides of the same coin: effective management and mitigation of nature-related risks can directly create new business opportunities to future-proof the business in a rapidly evolving real estate market. The company's Sustainable Development 2050 Strategy integrates nature and biodiversity considerations into core operations and business decisions to build resilience.

In the company's nature transition plan, it has committed to proactively adopt nature-based solutions, and design for nature-positive outcomes and management practices in its operations. It is collaborating with value chain partners to achieve no net loss of biodiversity and, wherever possible, deliver a biodiversity net gain by minimising land use conversion, sustainably using natural resources, and enhancing urban biodiversity and water resource management.

Source: Swire Properties (2025)

Key dataset and tool functionalities for A2:

- Map identified nature-related risks and opportunities onto the organisation's existing risk processes (e.g. risk taxonomy, risk inventory, risk register and risk appetite framework).
- Embed nature-related risk parameters into established architectures (e.g. following COSO ERM, ISO 31000).
- Trace how environmental degradation, or policy, market, technology, reputational or liability shifts, may transmit into traditional enterprise or prudential risk categories for financial institutions (credit, market and operational).
- Help identify which functions need to be involved, including risk, finance, sustainability, procurement, operations, legal, compliance, strategy and internal audit.

- Enable mapping to traditional risk categories, including credit risk, market risk, liquidity risk, operational risk, strategic risk, reputational risk and legal or liability risk, where relevant.

Resource types with illustrative examples:

- **Risk-specific guidelines:** COSO and WBCSD Guidance on Applying ERM to ESG-Related Risks, ISO 31000 Risk Management, TCFD Guidance on Risk Management Integration and Disclosure.
- **Toolkits:** Financial sector stewardship guidance, three lines of defence mapping, control libraries, internal audit templates, risk appetite framework.

6.6. A3: Risk and opportunity assessment and prioritisation

A3: Risk and opportunity assessment and prioritisation	*Which risks and opportunities could reasonably be expected to affect our prospects and should be prioritised?*

Measurement and prioritisation are fundamental to the management of risks and opportunities. In A3, organisations should prioritise from the longlist of risks and opportunities identified in the previous components based on their potential effects on the organisation.

6.6.1 Nature-related risks

Many organisations use a traditional likelihood-and-impact (or magnitude) approach to gauge the severity of their risks and then assess the severity of risks relative to their risk appetite and risk tolerance criteria. The concepts of magnitude and likelihood are consistent with standard risk management practices (ISO, COSO) and aligned with the ESRS and other market guidance on risk assessment.[130, 131] Additionally, IFRS S1 and IFRS S2 require disclosures about an organisation's processes and related policies the organisation uses to identify, assess, prioritise and monitor sustainability-related risks, which includes how the entity assesses the nature, likelihood and magnitude of the effects of those risks.

According to COSO, some organisations are expanding their risk severity criteria to improve risk management of ESG-related risks and expanding these traditional prioritisation criteria to also include others such as vulnerability and speed of onset.

130 Such as OECD (2018) Due Diligence Guidance for Responsible Business Conduct.

131 The TNFD refers to the COSO's 'impact' criteria as 'magnitude' to avoid confusion with the directionality of the term for impacts on nature.

The TNFD recommends using the same prioritisation criteria, with two additional criteria that relate to:

- The severity of impacts on nature; and
- The severity of implications for society from those nature impacts.[132]

As with the efforts to identify risks and embed them in risk management processes, the efforts to prioritise risks should take into account the geographic location of dependencies and impacts.[133]

The TNFD-GRI case studies: Identifying risks and opportunities to organizations arising from dependencies and impacts on nature show different examples of how companies prioritise nature-related risks and opportunities by taking into consideration some of the criteria above (e.g. vulnerability).

Figure 51: Criteria for prioritising nature-related risks

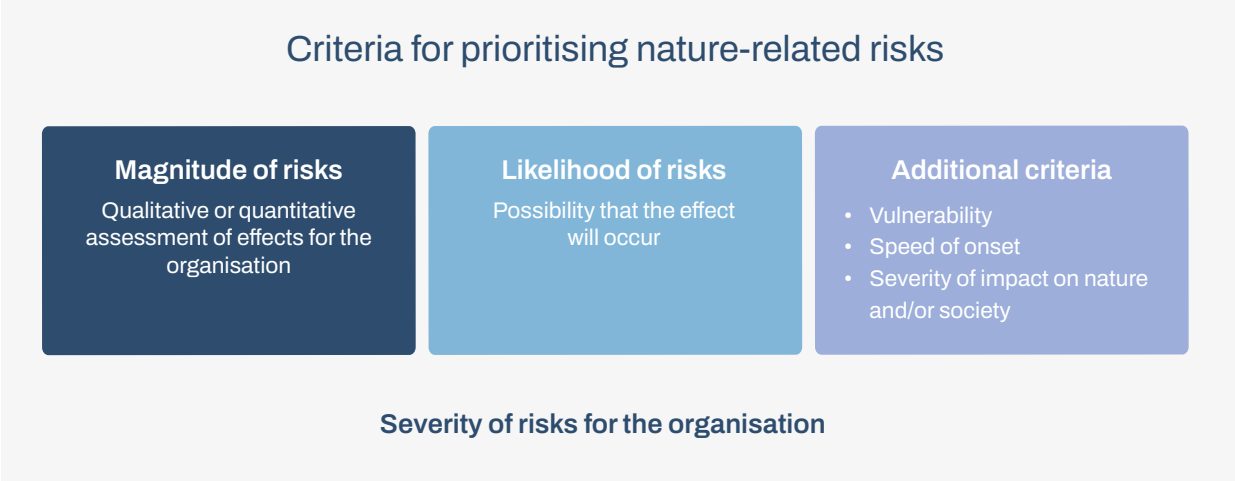


Table 15 provides an overview of the TNFD's criteria for prioritising nature-related risks and opportunities.

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

133 NGFS (2024) Nature-related Financial Risks: A conceptual framework to guide action by Central Banks and Supervisors; OECD (2023a) A supervisory framework for assessing nature-related financial risks: identifying and navigating biodiversity risks.

Table 15: TNFD prioritisation criteria for nature-related risks

Prioritisation criteria	Description
Magnitude	The significance of the risk based on the effects for the organisation. The magnitude of the effects of a risk can be assessed in both qualitative or quantitative terms through assessment methods such as scenario analysis.
Likelihood	The possibility that a given event will occur. The severity of a risk is higher if its outcome (effect) is likely to occur.
Additional COSO 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. The concept of vulnerability includes the organisation's ability or inability to adapt, mitigate or control the risk. It is dependent on risk awareness, management along the value chain, operational and managerial resilience, value chain and/or product diversification, or market or sector influence.
Speed of onset	The time that elapses between the occurrence of an event and the point at which the organisation first feels its effects. It can be expressed using the relevant time frame e.g. in the long term, medium term or short term.
Additional TNFD prioritisation criteria	**Description**
Severity of impact on nature	The scale, scope and irremediable character of the negative impact on nature. This may be informed by the prioritisation aspects recommended in L4, such as prioritising locations with the highest sensitivity and/or that meet multiple sensitive location criteria.
Severity of impact to society	The scale, scope and irremediable character of the negative impact on society. See Annex 3 on valuation of nature-related dependencies and impacts, drawing from the Natural Capital Protocol, for more details on how this can be estimated.

Additional considerations for financial institutions

The magnitude of nature-related risks at a portfolio or sub-portfolio level may be assessed using qualitative information, quantitative proxies and/or sensitivity metrics. This may combine a bottom-up assessment, based on the client and asset-level analysis undertaken in the Evaluate phase, and aggregating results to a portfolio or sub-portfolio level; with a top-down assessment of sectoral, portfolio-wide or macroeconomic effects based on the potential exposures identified in the Locate phase, using assessment methods such as scenario analysis.

Methods for assessing the severity of nature-related risks

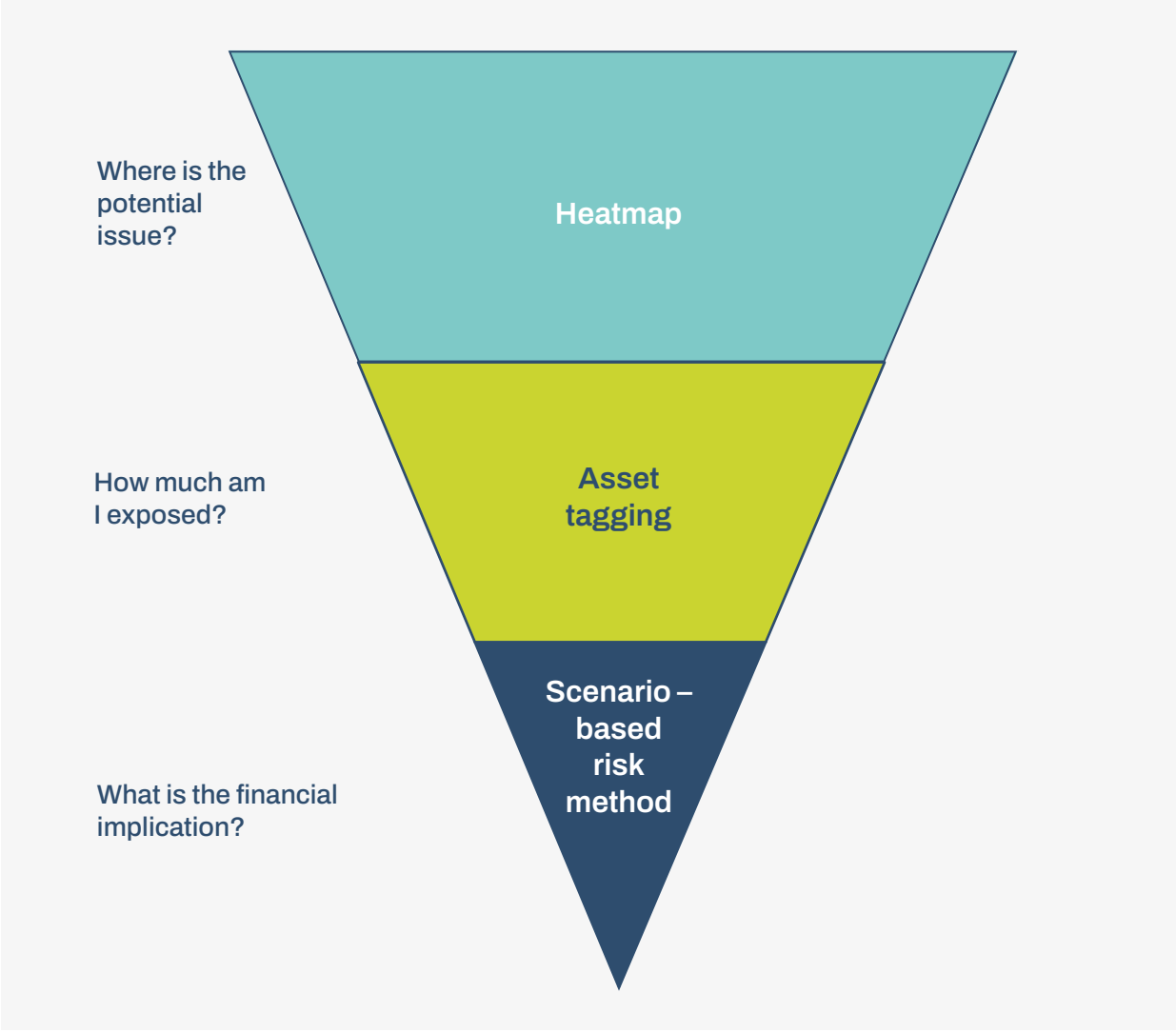
Throughout LEAP, the LEAP assessment team can consider using a number of assessment methods to help it understand the severity of the nature-related risks originating from the organisation's dependencies and impacts. These assessment methods can help the organisation identify potential exposure to nature-related issues by linking assets to sectors and locations and then translating the exposure into financial implications for the organisation. These methods include:

- **Heatmapping**, which can help screen and prioritise across the organisation's activities or portfolio, for example, by using sector averages, as undertaken in the Locate phase;
- **Asset tagging**, which can help to identify potential moderate or high dependencies and impacts on nature using company, asset or location-specific information, as undertaken in the Evaluate phase; and
- **Scenario-based risk assessment**, which can help to assess the magnitude of the effects of nature-related risks by considering their potential effects (expressed in a qualitative or quantitative way) under a range of plausible futures in the Assess phase. For more information on the TNFD approach to scenario analysis, see the TNFD scenario analysis guidance.

These methods build on each other and can be deployed in sequence when applying the LEAP approach iteratively. They can be qualitative or quantitative. If an organisation chooses to conduct scenario-based risk assessment to assess severity of its nature-related risks, it should select an approach that is commensurate with its circumstances, considering its exposure to nature-related risks and the skills, capabilities and resources available. A more quantitative or technically sophisticated approach to scenario analysis may be appropriate where exposure is greater, while qualitative information, including scenario narratives, can also provide a reasonable and supportable basis for assessment. The TNFD discussion paper on conducting advanced scenario analysis can support organisations in developing such more advanced approaches. Organisations can select and progressively refine assessment methods as they develop organisational skills and capabilities, moving from qualitative or proxy-based assessments towards more granular and quantitative approaches where this provides decision-useful information.

Organisations are encouraged to make use of and build on capabilities, tools and processes developed for climate-related risk assessment, including scenario analysis, where these provide a useful foundation for assessing nature-related risks. These approaches may need to be adapted to reflect the distinct characteristics of nature-related risks, but they can provide a solid foundation on which organisations can progressively build their capabilities for assessing nature-related risks.

Figure 52: Methods for locating and assessing nature-related risks to the organisation



Box 36: Emerging approaches for quantifying nature-related risks: NVaR

New quantitative approaches are emerging that move beyond dependency and exposure screening. Nature Value-at-Risk (NVaR), originally developed for macroeconomic and financial scenario analysis, combines information on ecosystem-service hazards, economic exposure and vulnerability to translate biophysical shocks into estimates of economic and financial value at risk.

Originally developed through work with the NGFS Nature Taskforce and subsequently applied to the UK economy and to the euro area with the European Central Bank, the NVaR family of methodologies have been applied at company- and portfolio-level in collaboration with Norges Bank Investment Management and considered as part of Barclays and LSE Earth Capital Nexus' recently announced partnership.

Corporate NVaR links ecosystem-service shocks to a company's asset locations, operations and upstream supply chains, producing estimates of the proportion of company production or revenues potentially at risk under specified scenarios. These quantitative risk estimates can be combined with information on companies' preparedness and resilience to assess resilience to nature-related shocks and stress.

Sources: Ranger, N. et al. (2023) The Green Scorpion: The Macro-Criticality of Nature for Finance: Foundations for scenario-based analysis of complex and cascading physical nature-related financial risks; Ranger, N. et al. (2024) Assessing the Materiality of Nature-Related Financial Risks for the UK; Ceglar, A. et al. (2025) Nature at Risk: Implications for the Euro Area Economy and Financial Stability; Johannes-Gold, J., Ranger, N. and Eikeset, A.M. (2026) A new framework for stress-testing investment portfolios against nature-related shocks; Spacey Martín, R. and Ranger, N. (2026) Corporate Resilience Alignment Benchmark (C-RAB): Methodology document

Effects of nature-related risks on the organisation's prospects

The assessment of nature-related risks helps the organisation understand the implications such risks may have on its cash flows, access to finance and cost of capital over the short, medium and long term (effects on prospects). This can be in the form of quantitative or qualitative information.

This assessment can also be helpful to determine the effects of nature-related risks on financial position, financial performance and cashflow (financial effects).

Table 16: Examples of nature-related risks and their potential effects on prospects

Risk type	Category of hazard	Potential effects on prospects
Physical risk	**Acute** • Degradation of nature and loss of natural protection (e.g. caused by vegetation clearance for initial clearing for mining sites) exacerbating the severity of damage 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) caused by leaks or accidental discharges (e.g. oil) by the organisation or other stakeholders in the same area that contaminates air, soil and water bodies. • 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). • 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 of hazard	Potential effects on prospects
	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 or stakeholders in specific areas.	• Increased operating costs due to scarcity of key natural inputs (e.g. water, biological resources). • Reduced revenues or productivity resulting from declining ecosystem condition and natural capital availability. • Capital expenditure required for adaptation measures or securing alternative sources of key inputs. • Asset impairment or reduced useful life of assets dependent on degraded ecosystems. • Supply chain disruption and increased procurement costs due to long-term declines in ecosystem services. • Potential relocation of operations or sourcing activities where ecosystem degradation reduces operational viability.
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.

Risk type	Category of hazard	Potential effects on prospects
	Market • Shifting customer values or preferences to products (e.g. foods, textiles) with lower impacts on nature. • Volatility or increased cost of materials.	• Reduced demand for products and services – supply disruption. • Increased production costs. • Loss of market access. • Increased raw material costs.
	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. • 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.

Adapted from: CDSB (2021) Application guidance for biodiversity-related disclosures and TNFD (2021) Nature in scope.

Understanding transmission channels for nature-related risks

Depending on the method and information available, organisations can trace the causal chain from changes in nature and ecosystem services, through hazards, exposure and vulnerability, to operational or economic effects and, ultimately, effects on financial position, financial performance and cash flows.

The financial implications of nature-related risks on the organisation may manifest through changes to its revenue streams, cost base and potentially cost of capital. The concept of **transmission channels** can help organisations to understand these effects of nature-related risks and opportunities. Transmission channels for nature-related risks are pathways through which sources of nature-related risks (represented by nature-related hazards, exposure and vulnerability via the dependency and impact pathway) translate into physical and transition risks that can affect the economy at micro, sectoral/regional/value chain and macro levels.[134] These effects can propagate through the economy via businesses and their supply chains and/or the financial system.

The transmission channel framework should be considered in conjunction with the dependency and impact pathway (see Section 2 and A1), which helps organisations understand how dependencies and impacts on nature can give rise to such sources of nature-related risks, the effects of which are explained within the transmission channel framework.

Figure 53 shows these linkages, from the sources of nature-related risks for businesses exemplified in the dependency and impact pathway to the materialisation of effects on prospects via business level or economy-wide channels, reflecting the complete nature-related risk causal chain from driver of nature degradation to financial outcomes.

Additional considerations for financial institutions

For a financial institution these effects could happen, for example, through changes in counterparties' credit risk ratings, the repricing of insurance coverage, or via changes in assets valuations.

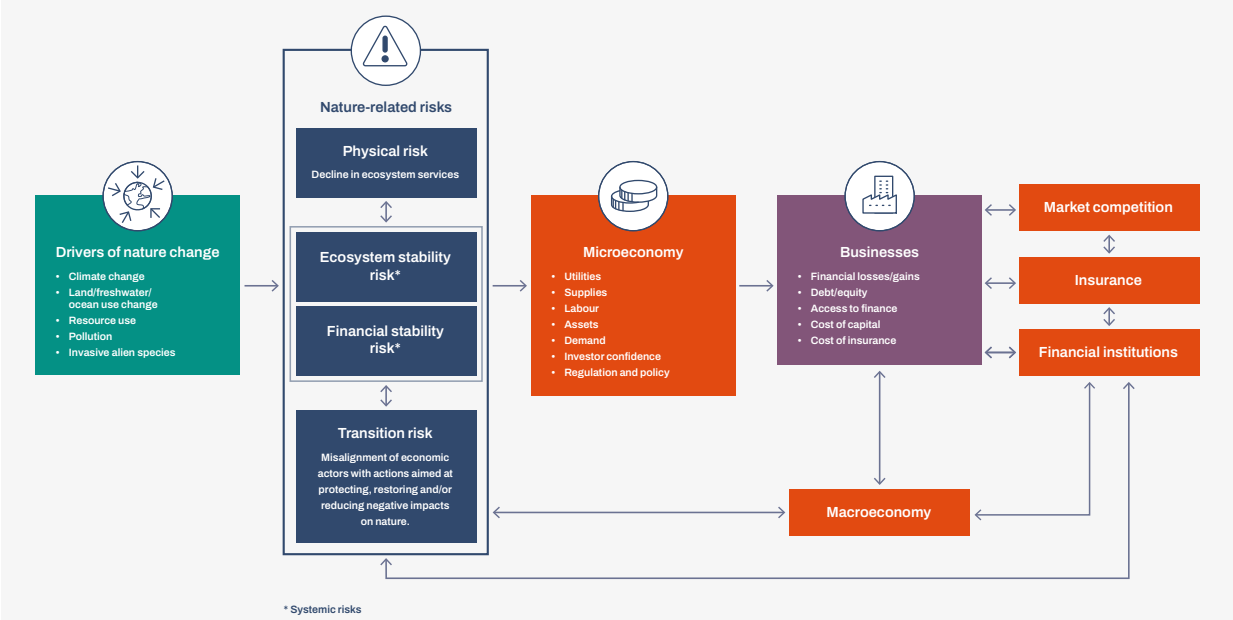
Examples of how prudential risk categories for financial institutions can be affected by potential nature-related factors are provided by NGFS in its conceptual framework and reported in Table 17 below.[135] As with climate, financial institutions should monitor how nature-related risks evolve to identify any additional channels for transmitting these risks to traditional prudential risk categories.[136]

134 Adapted from NGFS.

135 NGFS (2024) Nature-related Financial Risks: A conceptual framework to guide action by Central Banks and Supervisors.

136 BCBS (2022) Principles for the effective management and supervision of climate-related financial risks.

Figure 53: Sources and transmission channels framework of nature-related risks to business



Box 37: Evidence review on the financial effects of nature-related risks

The evidence review on the financial effects of nature-related risks (University of Oxford Environmental Change Institute as part of the Resilient Planet Finance Lab, TNFD and Global Canopy, 2025) synthesises evidence on how nature-related risks can lead to effects for corporates and financial institutions.

Drawing on more than 600 evidence entries from academic literature, company reports, case studies and other sources, it examines the causal chains through which dependencies and impacts on nature may affect an organisation's financial performance, financial position, cash flows, access to capital and cost of capital.

Organisations can use the review and its accompanying evidence database to:

- Identify potentially relevant nature-related hazards and transmission channels;
- Understand the types of financial effects that have been observed or estimated across sectors and geographies;
- Connect evidence across different parts of the causal chain, from drivers of nature change and nature-related hazards to effects on businesses; and
- Inform the selection of indicators, assumptions and scenarios for assessing the magnitude of nature-related risks.

Sources: University of Oxford et al (2025) Evidence Review on the Financial Effects of Nature-Related Risks and accompanying Nature-related Financial Risks Database.

Table 17: Description of potential effects of nature-related risks for financial institutions

Financial risk category	Description of potential effects 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 or reputational 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: TCFD (2017) Recommendations of the Task Force on Climate-related Financial Disclosures; FSB (2022) FSB Supervisory and Regulatory Approaches to Climate-related Risks Final report; NGFS (2024) Nature-related Financial Risks: A conceptual framework to guide action by Central Banks and Supervisors and OECD (2023a) A supervisory framework for assessing nature-related financial risks: identifying and navigating biodiversity risks.

Box 38: Risk assessment for a utility company

Kyūshū Electric Power Co., Inc. (Kyuden) is a utility company based in Japan that focuses primarily on generating coal, liquefied natural gas, nuclear, solar, wind and biomass power. In 2024, it published an assessment of its nature-related risks as part of its TNFD reporting.

After conducting a general impact and dependency evaluation based on ENCORE for each of its power generation sectors, it created a heatmap adjusting for local impact and dependency variation at its power generating sites. It also identified which sites were in priority locations for biodiversity.

It then designed two qualitative scenarios:

- A **Status Quo scenario**, which only featured a modest increase in policy measures related to land and water use, supply chains and nature conservation and restoration by 2050, therefore leading to modest transition risks but raised natural hazard levels.
- A **Nature Positive Transition** scenario which saw a greater increase in such measures, in line with the Kunming-Montreal Global Biodiversity Framework's vision of a "world in harmony with nature" realised by 2050, increasing transition risks but mitigating the incidence of natural hazards.

For each power generating sector, it identified physical and transition risks (42 in total) linked to its highest dependencies and impacts. Physical risks were split into acute and chronic categories, and transition risks into regulatory and reputational ones, highlighting each according to whether it was more likely to arise as a result of the 'Status Quo' scenario, 'Nature Positive Transition' scenario or both.

For instance, for **wind power**, Kyuden identified the following risks:

Sector	Risk class	Risk type	Risk overview
Wind power generation	Physical	Acute	Damage to turbines due to floods
		Chronic	Reduction in power generation due to changing wind patterns
	Transition	Regulatory	Obligation of forest regeneration onshore

The top two risks arose because of both scenarios, while the bottom one was a result of the Nature Positive Transition scenario.

Financial impacts

Kyuden then assessed the type of financial impacts these risks could have on the company and estimated their costs by assigning them to three possible levels: Level 1 (less than 1 billion yen), Level 2 (1 billion to 10 billion yen) and Level 3 (over 10 billion yen). In the **wind power** example above, the exercise yielded:

Risk class	Risk overview	Financial impact	Cost
Physical	Damage to turbines due to floods	Deterioration of financial balance due to restoration costs and reduced power generation	Less than 1 billion yen (Level 1)
	Reduction in power generation due to changing wind patterns	Deterioration of financial balance due to reduced power generation	Less than 1 billion yen (Level 1)
Transition	Obligation of forest regeneration onshore	Forest regeneration costs	Less than 1 billion yen (Level 1)

For **nuclear power**, higher risks and cost levels were identified, particularly in terms of physical risk. Interestingly, Kyuden's physical risks had little to do with reliance on water for reactor cooling as its power plant is located by the sea and uses seawater for cooling. Those risks were instead related to uranium mining, as follows:

Risk class	Risk overview	Financial impact	Cost
Physical	Landslides and subsidence due to land conversion and fire from uranium mining	Deterioration of financial balance due	Between 1 billion to 10 billion yen (Level 2)
	Depletion of aquifers due to excessive water use in mining, leading to operational disruptions		
Transition	Mandatory due diligence on nature impacts	Investigation and disclosure costs	Less than 1 billion yen (Level 1)

Source: Kyuden Group (2024) TNFD Report 2024.

Box 39: Financial institutions' assessment of nature-related risks

E.SUN

E.SUN Financial Holding Company (E.SUN) used the TNFD LEAP approach to assess dependencies and impacts on nature and identify nature-related risks and opportunities across its value chain. Building on this work, E.SUN undertook a dedicated scenario analysis to assess the potential financial impacts of nature-related risk shocks on selected domestic corporate credit, bond and equity portfolios held by E.SUN Bank and E.SUN Securities.

E.SUN built on its most severe long-term climate scenario, the Passive Transition scenario, which assumes a delayed transition and failure to limit global temperature rise to below 2°C by the end of the century. It incorporated two categories of nature-related risk:

- **Water resource risk:** water scarcity caused by drought and water-management risk arising from government intervention in water governance.
- **Systemic risk:** chain reactions triggered by severe degradation of species or ecosystem services, resulting in a loss of balance within the system that cannot be restored to its original state.

The analysis of systemic risk considered extreme heat and potential strengthening of nature-related regulation, including increased environmental penalties.

E.SUN established two nature-related scenarios:

- A **Passive Response** scenario: companies respond passively to external water pricing and operational water scarcity and undertake only minimal adaptation measures;
- **No Action** scenario: companies do not implement substantive adaptation measures despite known water supply gaps.

The scenarios also considered systemic risks arising from severe ecosystem service degradation and tighter nature-related penalties.

Measuring nature-related risks

E.SUN assessed the financial impact of nature-related risks by considering industry sector, operating location and customers' use of natural resources. The analysis drew on the IPCC Sixth Assessment Report, local Water Usage Fee Collection Regulations and penalty records from 2019 to 2024 relating to companies' use or discharge of natural resources.

The analysis estimated the effects of nature-related risk shocks on customer revenues and translated these effects into expected portfolio losses. Results were presented for 2030 and 2050 as percentages of E.SUN FHC's 2024 baseline net worth and pre-tax income. The nature-related analysis had a narrower geographical and portfolio scope than the climate analysis, focusing on domestic corporate credit, domestic bonds and equity investments.

Expected losses for corporate loans were equivalent to:

- 1.76% of E.SUN FHC's 2024 baseline net worth under the 2030 Passive Response scenario; and
- 2.40% of E.SUN FHC's 2024 baseline net worth under the 2050 No Action scenario.

For E.SUN Securities, the corresponding expected loss was 0.02% under both scenarios. The increase in expected losses attributable to nature-related risks remained below NT$600 million across industry sections and scenarios.

Under the long-term systemic-risk analysis, agriculture, forestry, fishing and animal husbandry; mining and quarrying; and electricity and gas supply showed a more pronounced increase in expected losses. E.SUN attributed this to these sectors' relatively high dependency on natural capital and the greater environmental impact of their activities.

Water-related risks

E.SUN assessed three water-related transmission channels, using the revenue impact ratio as the final indicator of risk transmission:

Water-related risk	Measurement approach	Reported financial impact
Water-use fees	Additional operating costs arising from government-imposed water-use fees.	N/A
Water scarcity (work stoppages)	Revenue losses or supply-chain disruptions caused by work stoppages resulting from water shortages.	For financing exposures, the maximum revenue impact ratio was approximately 3.76%, with the impact increasing over the longer term to 2050.
Water-supply gaps	Revenue losses associated with widening gaps between water demand and available supply.	Financing exposures were most significantly affected by this channel, with the highest revenue impact ratio reaching approximately 7.24%.

For investment exposures, manufacturing was the sector most affected by water scarcity and water management risks. Its combined revenue impact ratios were approximately 13.15% in 2030 and 13.51% in 2050, primarily driven by water-supply-gap risk. For other industry sections, work stoppages caused by water scarcity were the dominant risk factor, with overall impact ratios remaining below 5.3%.

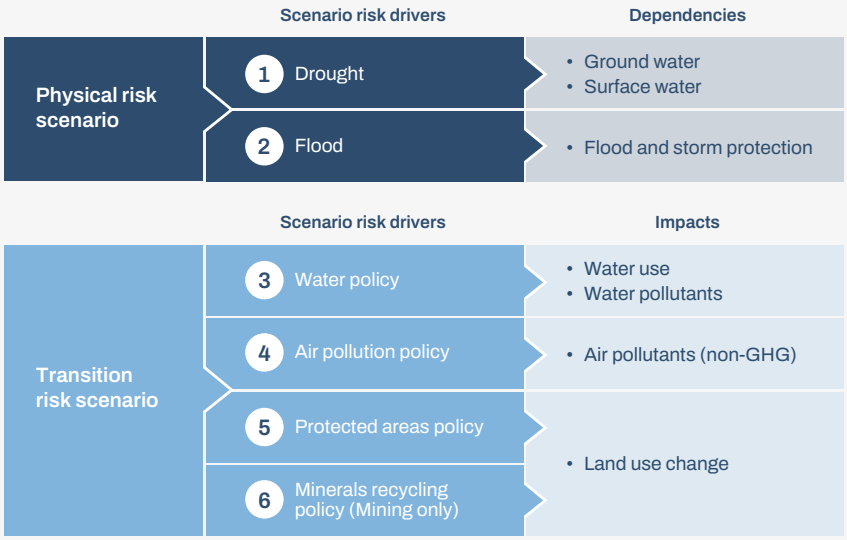
Overall, E.SUN's analysis identified water supply gaps as the most significant source of water-related risk for financing exposures.

Barclays

Barclays applied the TNFD LEAP approach to clients in the Barclays Mining and Barclays European Power portfolios. As part of the Assess phase, Barclays built on its analysis of a sample of approximately 30 mining and 40 European power portfolio companies, looking at the impacts and dependencies of those companies identified during the Evaluate phase to explore the related potential financial risks and opportunities for these companies and for Barclays. For instance, physical risks such as drought and water stress emerged as key nature-related risk drivers for both the European Power and Mining sectors, given their reliance on surface water and ground water availability, as well as water flow maintenance as an ecosystem service.

Figure 54 below illustrates the connection between the nature-related impacts and dependencies identified in the Evaluate phase and the risk drivers analysed in the Assess phase, which were used for the scenario narratives. The physical risk-related drivers mainly stem from key dependencies, while the transition risk-related drivers stem from key impacts on nature.

Figure 54: Scenario risk drivers stemming from nature-related impacts and dependencies



Barclays developed its own physical and transition stress scenario for the Assess phase. This leveraged and expanded on the international supply chain scenario in the report Assessing the Materiality of Nature-Related Financial Risks for the UK, published by the Green Finance Institute, University of Oxford and University of Reading, which was used in Barclays' 2024 Nature Exploratory Stress Test (NEST).

In the absence of publicly available scenarios, Barclays' scenario narratives relied on literature reviews and a broad-based application of estimates to calibrate nature-related shocks. Some of the existing content of the NEST was leveraged for these nature-specific narratives where there was overlap, such as content related to droughts, floods, water and air pollution policies.

To link nature-related physical and transition risks to financial performance, Barclays identified the key transmission channels through which each scenario driver could result in financial impacts at the asset level. Once the scenario-driven impacts were quantified for individual assets through various transmission channels, the model then aggregated costs and revenues up to the company level across all company assets in scope. The stressed company-level financials projected across the five-year horizon were then used to assess the potential impact on credit risk rating under the scenario.

- The stress scenario resulted in a potential earnings impact across both Mining and European Power companies assessed. In the Mining sample portfolio, cumulative earnings before interest, taxes, depreciation and amortisation (EBITDA) declined by around a quarter, primarily due to transition risks, which were partially offset by rising demand for certain critical minerals linked to climate transition
- The European Power sample portfolio experienced an approximately 10% decline in EBITDA, predominantly driven by physical risks.

Despite these impacts, overall creditworthiness remained broadly stable, underpinned by strong geographical diversification and credit quality of assessed companies.

Source: E.SUN (2025). Climate and Nature Report 2024; Barclays (2025) Navigating Nature Risk: Applying the TNFD's LEAP framework.

Valuation

When measuring nature-related risks, organisations may find it helpful to use valuation techniques, as described in Annex 3. These techniques can include measures of value expressed in financial terms. 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 also help assess how a risk or opportunity could affect an organisation's prospects.

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**, used to identify the potential scale of costs and/or benefits, expressed through qualitative, non-numerical terms (e.g. a high increase in health impacts from emitted pollutants or a low decrease in recreation visits);
- **Quantitative valuation**, used to provide numerical data as indicators for costs and/or benefits (e.g. a 20% increase of health impacts from emitted pollutants or a 0.5% decrease in the number of people benefitting from recreation visits); and
- **Monetary valuation**, which 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 to estimate value meaningfully and correctly interpret results. If the LEAP assessment team undertakes a valuation exercise, it is 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 (primarily Step 7) and has been co-developed with the Capital Coalition. Further guidance can also be found on the Capitals Coalition website.

6.6.2 Nature-related opportunities

In A3, organisations should measure and prioritise the opportunities identified in A1. The assessment should be proportionate to the information available.

Measuring expected outcomes

Organisations should assess the expected outcome for the organisation and the expected outcome for nature separately. The assessment could consider the magnitude and likelihood of each outcome, along with additional nature-related opportunities criteria, including the organisation's ability to adapt, and the scale and the scope of positive impacts on nature. Qualitative information may be appropriate where quantitative information is not available.[137]

The organisation should consider the location, ecosystem condition, scale and duration of the expected nature outcome.[138] The expected outcome for nature should not be assessed through its financial value to the organisation.

137 EC (2023) Commission Delegated Regulation (EU) 2023/2772 as regards sustainability reporting standards (ESRS), Annex II: Definitions.

138 IPBES (2024) Summary for Policymakers of the Transformative Change Assessment.

Feasibility, evidence and uncertainty

Organisations could consider whether the opportunity is feasible, taking account of significant uncertainty. Relevant factors may include:

- Expected demand and market conditions;
- Technical requirements and operational readiness;
- Access to inputs, infrastructure, knowledge and skills;
- Access to finance and the expected cost profile;
- Regulatory, policy and contractual conditions;
- Conditions in the relevant location or value chain; and
- The strength and limitations of evidence supporting the expected outcomes.

These factors are illustrative. Organisations should not treat them as a mandatory checklist or assign standard weights without an appropriate basis.[139]

Connections, maturity and scaling

Where relevant, organisations should consider potential synergies, trade-offs and unintended consequences across their business model and value chain. The depth of assessment should be proportionate to the potential significance of these connections.[140]

The maturity or scalability of an opportunity may affect the evidence available and the appropriate next decision. Lower technical maturity or readiness should not automatically result in lower priority. It may instead indicate that further evidence, appraisal or piloting is needed.[141]

Some organisations may use pilots, partnerships or external expertise to strengthen the evidence supporting an opportunity before wider implementation or scaling.

Effects of nature-related opportunities on the organisation's prospects

The assessment of nature-related opportunities helps the organisation understand the implications such opportunities may have on its cash flows, access to finance and cost of capital over the short, medium and long term (effects on prospects). This can be in the form of quantitative or qualitative information. This assessment can also be helpful to determine the effects of nature-related opportunities on financial position, financial performance and cash flow (financial effects).

139 WEF (2026) 50 Investible Opportunities for a New Nature Economy; Global Canopy and Cornell Atkinson (2026) The Little Book of Nature Business.

140 IPBES (2024) Nexus Assessment; IPBES (2024) Summary for Policymakers of the Transformative Change Assessment.

141 WEF (2026) 50 Investible Opportunities for a New Nature Economy; Global Canopy and Cornell Atkinson (2026) The Little Book of Nature Business.

Table 18 provides examples of potential effects generated by nature-related opportunities on an organisation's prospects.

Table 18: Illustrative effects of nature-related opportunities

Opportunity area (not comprehensive)	Examples of nature-related opportunities	Potential effects
Operational efficiency and resilience • Changes to processes, site management or resource use practices that reduce dependencies or impacts on nature within the existing business model	• Water-efficient processes • Circular waste systems • Ecosystem-based site management • Wastewater byproducts converted into useful inputs • Changes to site management that reduce maintenance and resource needs	• 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 • Reduced capital costs or avoided capital expenditure, where process or site management changes reduce future adaptation or infrastructure needs • Improved continuity of operations
New product or service markets • Development, adaptation or scaling of products and services that help customers or clients reduce negative impacts on nature or generate positive impacts	• Bio-based materials • Nature-related monitoring technologies • Products that reduce pollution or resource use • Services that help clients manage nature-related issues	• 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 • Increased revenues through access to new and emerging markets • Improved ability to attract investment or financing for product development, commercialisation or scaling

Opportunity area (not comprehensive)	Examples of nature-related opportunities	Potential effects
Supply chain resilience • Working with suppliers, producers or local partners to improve the reliability, quality or sustainability of inputs	• Supplier capacity building • Regenerative or conservation-linked sourcing models • Traceability approaches • Certification or collaboration to manage nature-related pressures affecting key inputs	• Increased revenues through access to new and emerging markets • Access to public sector incentives • Increased diversification of financial assets
Business model innovation • Changes to how an organisation creates, captures or communicates value from nature-related activities	• Ecosystem services business models • Circular economy models • Restoration models • Community-based enterprise models • Value chain partnerships	• New revenue or value pathways • Improved ability to secure external financing or partnerships where the business case links nature outcomes to business value • Increased resilience due to business diversification
Financial innovation • Accessing, adapting or developing financial products and services that support nature-related outcomes	• Sustainability-linked loans • Blue or green bonds • Biodiversity-focused funds • Insurance products • Performance bonds • Nature-related indices • Stewardship activities	• Increased access to funds and loans • Access to capital for high-risk projects • Improved financing terms, where nature-related outcomes strengthen the financing case • Increased diversification of financial assets • Increased revenues through access to new and emerging markets • Increased fee, interest, underwriting or investment income for financial institutions • Development of new strategic business lines • Access to new clients, markets or investable opportunities

6.6.3 Metrics for identifying and assessing nature-related risks and opportunities

Assessment metrics can be used by organisations within an integrated internal process for identification and assessment of nature-related issues, such as the LEAP approach.

The LEAP assessment team is recommended to use the TNFD's assessment metrics for risks and opportunities to assess the effects of the risks and opportunities on the organisation's prospects (see the TNFD's assessment metrics in Annex 1 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 that the severity of nature-related risks and opportunities is measured through the use of:

- **Exposure metrics** based on nature-related dependencies and impacts (refer to the Evaluate phase of LEAP). These can help organisations understand the potential sources of nature-related risks; and
- **Magnitude metrics** used to assess the effects to the organisation's prospects of nature-related risks and opportunities (their magnitude). Magnitude metrics should be quantified as far as possible.

Tables 19 and 20 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 19: Illustrative examples of risk indicators

Type	Hazard	Example	Exposure indicators (dependencies and impacts)	Magnitude indicators (risks)
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	Hazard	Example	Exposure indicators (dependencies and impacts)	Magnitude indicators (risks)
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	Hazard	Example	Exposure indicators (dependencies and impacts)	Magnitude indicators (risks)
		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	Hazard	Example	Exposure indicators (dependencies and impacts)	Magnitude indicators (risks)
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	Hazard	Example	Exposure indicators (dependencies and impacts)	Magnitude indicators (risks)
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 20: Illustrative examples of opportunities indicators

Type of opportunity	Business and nature outcomes	Exposure indicators (dependencies and impacts)	Magnitude indicators (opportunity)
Operational efficiency and resilience: An organisation implements water-efficient processes or recirculation systems to reduce water use in operations located in areas of water scarcity.	**Business outcome:** Reduced operating costs and improved continuity of operations. **Nature outcome:** Reduced pressure on water resources through lower water withdrawal or consumption.	• Volume of water withdrawn or consumed in areas of water scarcity. • Percentage reduction in water withdrawal or consumption. • Number or value of sites where water-efficient processes are implemented. • Water stress or water scarcity level in areas of operation.	• Reduction in operation and compliance costs. • Reduction in water abstraction, treatment or discharge costs. • Reduced capital costs or avoided capital expenditure, where process changes reduce future adaptation or infrastructure needs. • Improved cash flows through lower input, maintenance or treatment costs.
New product or service markets: An organisation develops or scales products or services that reduce pollution, resource use or other negative impacts on nature for customers or clients.	**Business outcome:** New revenue streams, market access and product differentiation. **Nature outcome:** Reduced negative impacts on nature or increased positive impacts enabled through customer or client use.	• Revenue linked to products or services with demonstrable lower impacts on nature. • Number of customers or clients using the product or service. • Reduction in relevant impact drivers enabled by the product or service, such as pollution, waste or resource use. • Markets or customer segments where the product or service is offered.	• New revenue streams. • Increased revenues through access to new and emerging markets. • Increased value from differentiated products or services. • Better competitive position to reflect shifting consumer preferences. • Improved ability to attract investment or financing for product development, commercialisation or scaling.

Type of opportunity	Business and nature outcomes	Exposure indicators (dependencies and impacts)	Magnitude indicators (opportunity)
Supply chain resilience: An organisation works with suppliers or producers to improve the reliability, quality or sustainability of inputs through capacity building, traceability, certification or regenerative sourcing.	**Business outcome:** Improved reliability, quality or continuity of inputs. **Nature outcome:** Reduced pressures on nature in upstream value chains through improved management of impacts linked to sourced inputs.	• Number or proportion of suppliers covered by capacity-building, traceability, certification or regenerative sourcing programmes. • Volume or value of inputs sourced through verified or improved practices. • Nature-related pressures affecting the input, such as water stress, land degradation, pollution or invasive alien species.	• Reduced exposure to raw material and natural resource price volatility. • Reduced reliance on natural resources and increased resilience to potential shortages. • Reduced costs associated with supply chain disruption, input substitution or production delays. • Reduced revenue losses linked to interruption or deterioration of supply chains. • Improved access to markets or customers requiring traceability, certification or verified sourcing practices.
Business model innovation: An organisation develops a circular economy, restoration, ecosystem services or community-based enterprise model that creates new value from nature-related activities.	**Business outcome:** New revenue or value pathways and improved resilience through diversification. **Nature outcome:** Improved ecosystem condition, reduced waste or resource use, or increased value attributed to restoration, regeneration or ecosystem services.	• Revenue, assets or business units linked to the new or adapted business model. • Area restored, conserved or managed through the model, where relevant. • Quantity of materials reused, recycled or substituted through circular models. • Number of communities, partners or customers participating in the model.	• New revenue streams or value pathways. • Increased revenues through access to new and emerging markets. • Increased resilience due to business diversification. • Increased value from ecosystem services, traceability, restoration, regenerative practices or circular economy models. • Improved ability to secure external financing or partnerships where the business case links nature outcomes to business value.

Type of opportunity	Business and nature outcomes	Exposure indicators (dependencies and impacts)	Magnitude indicators (opportunity)
Financial innovation: A financial institution develops or adapts products and services that support nature-related outcomes, such as sustainability-linked loans, blue or green bonds, biodiversity-focused funds, insurance products, performance bonds, nature-related indices or stewardship activities.	**Business outcome:** New strategic business lines, client support and additional fee, interest, underwriting or investment income. **Nature outcome:** Increased financing, investment, underwriting or advisory support for activities that mitigate negative impacts or generate positive impacts on nature.	• Value of financing, investment, underwriting or advisory activity linked to nature-related outcomes. • Number or value of clients, transactions, funds or products with nature-related KPIs or use-of-proceeds criteria. • Value of assets under management or exposure linked to nature-related products or services. • Nature-related outcomes or KPIs associated with the financial product or service.	• Increased access to funds and loans for clients or projects. • Improved financing terms, where nature-related outcomes strengthen the financing case. • Increased fee, interest, underwriting or investment income for financial institutions. • Development of new strategic business lines. • Access to new clients, markets or investable opportunities. • Increased ability to replicate or scale nature-related opportunities through financing, investment, underwriting or advisory activities.

Type of opportunity	Business and nature outcomes	Exposure indicators (dependencies and impacts)	Magnitude indicators (opportunity)
Reputation and stakeholder relationships: An organisation undertakes credible nature-related actions and engagement that strengthen trust with communities, customers, investors, regulators or other stakeholders.	**Business outcome:** Stronger trust, legitimacy, licence to operate and market confidence. **Nature outcome:** Improved governance, stewardship or accountability for nature-related actions, especially where affected stakeholders are involved.	• Number or value of locations, projects, clients or business activities where stakeholder concerns are material to operations or financing decisions. • Number of complaints, disputes, delays or remediation actions linked to nature-related issues. • Evidence of engagement with affected stakeholders, including Indigenous Peoples and Local Communities where relevant. • Disclosure, assurance or governance indicators supporting the credibility of nature-related actions.	• Increased brand value. • Reduced revenue losses associated with loss of social licence to operate or stakeholder opposition. • Reduced costs associated with delays, disputes, complaints or remediation linked to stakeholder concerns. • Improved access to finance or investment, where credible nature-related action strengthens investor or lender confidence. • Increased market value or customer loyalty, where reputational benefits translate into demand, pricing power or market access.

Organisations should refer to the TNFD's suggested set of assessment metrics (Annex 1). Organisations can also refer to the guidance on assessment of state of nature (Annex 2) for measuring nature outcomes. Where the location is not known, potential exposure can be surmised through the use of estimates, models or generic sector impacts.

Aggregated (corporate- or portfolio-level) metrics

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

- Corporate level; and/or
- Portfolio level.

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

Illustrative risk and opportunity aggregated metrics

The following aggregated metrics can be used to measure nature-related risks and opportunities:

- Risks:
  - 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; and
  - Value of write-offs and early retirements of assets due to nature-related risks.
- Opportunities:
  - 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.[142]

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

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

142 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.

Box 40: Interpreting aggregated risk metrics through exposure and vulnerability

Aggregated risk metrics, such as the value of assets, liabilities, revenues or expenses exposed or vulnerable to nature-related risks, provide an indication of where nature-related risks may be concentrated across an organisation's operations, value chains or portfolios.

However, exposure alone does not determine the severity of risk. Organisations should also consider vulnerability when interpreting aggregated metrics, which reflects the propensity or predisposition to be adversely affected by a risk and involves the organisation's capacity to cope and adapt. As a result, two organisations with similar concentrations of exposure may face different levels of risk.

In practice, vulnerability may be influenced by factors such as existing risk management measures, diversification, supplier concentration, substitutability of ecosystem services or natural inputs, adaptation actions and other characteristics of the organisation's operations, value chains or portfolios.

The nature of vulnerabilities may vary considerably depending on an organisation's business activities and assets. Scenario analysis may provide further insights into exposure to nature-related risks and the resulting vulnerabilities. Organisations should therefore apply judgement when aggregating and interpreting metrics, including determining the appropriate level of detail, so that material information is not obscured and the resulting information remains decision-useful.

Aggregated metrics are therefore likely to be most decision-useful when accompanied by information explaining the key sources of vulnerability and how these influence the interpretation of reported exposures. This may be particularly relevant where significant concentrations of exposure occur in specific sectors, geographies, ecosystem services, counterparties or portfolio activities.

Key dataset and tool functionalities for A3:

- Measure or estimate the magnitude of the effects of nature-related risks and opportunities (qualitatively or quantitatively).
- Estimate the effects of nature-related risks and opportunities on:
  - Cash flows;
  - Access to finance; and
  - Cost of capital.

- Identify the risks and opportunities that could reasonably be expected to affect the organisation's prospects.
- For opportunities, link the effects to the expected business outcome and related mitigation of negative impacts on nature or generation of positive impacts on nature.
- Measure or estimate the likelihood of the risk/opportunity.
- Support prioritisation of risks and opportunities by combining the estimated magnitude and likelihood with other TNFD prioritisation criteria (speed of onset, severity (or scale and scope) of impact on nature and impact to society).
- Apply qualitative, quantitative and monetary valuation approaches to estimate business and societal consequences arising from changes in ecosystem condition and ecosystem service provision.
- Undertake forward-looking scenario analysis to assess organisational and/or portfolio/asset-level resilience under plausible nature-related physical, transition and systemic risk pathways.
- Support comparison of alternative management responses and identify priority risks and opportunities for decision making.
- Produce aggregated assessment metrics (e.g. proportion of total assets vulnerable to identified nature-related physical or transition risks/aligned with identified nature-related opportunities).

Resource types with illustrative examples:

- **Assessment methods**: scenario-based risk assessment.
  - **Scenario-based approaches**: TNFD scenario analysis guidance, NGFS recommendations on nature-related financial risk scenarios, Nature value-at-risk (NVaR), bespoke/internal scenario approaches, climate-nature scenario tools.
- **Valuation methodologies** (if applicable): TNFD LEAP Guidance Annex 3 – Valuation of dependencies and impacts, Natural Capital Protocol valuation guidance, Governance for Valuation guidance, UN SEEA Ecosystem Accounting valuation approaches, Global Value Factor Database (GVFD), further guidance and methodologies from the Impact Value Standards Board (IVSB).
- **Spatially explicit models:** InVEST, GLOBIO.

6.7. A4: Assessment of material information on risks and opportunities

A4: Assessment of material information on risks and opportunities	*What information about risks and opportunities should be disclosed?*

The TNFD disclosure recommendations can enable the disclosure of decision-useful information on nature-related dependencies, impacts, risks and opportunities from organisations to investors and other capital providers (the primary users of sustainability reporting). The Assess phase of the LEAP approach is designed to provide an 'on-ramp' to the use of IFRS Sustainability Disclosure Standards for the purpose of disclosing sustainability-related financial information. Organisations interested in using LEAP for this purpose should refer to the IFRS Foundation website.

A4 helps the LEAP assessment team be prepared to determine the information about the nature-related risks and opportunities assessed and prioritised in A3 for disclosure, and refers organisations to apply the definition of 'material information' in IFRS S1 for disclosing material information about nature-related risks and opportunities that could reasonably be expected to affect prospects. Additionally, A4 refers organisations to apply any other materiality definitions specified by any relevant jurisdictional requirements.

The IFRS materiality definition considers that information is material if omitting, misstating or obscuring that information could reasonably be expected to influence decisions made by existing and potential investors, lenders and other creditors on the basis of the organisation's general purpose financial reports.[143]

Aligned with the ISSB, the determination of materiality should reflect the organisation's specific facts and circumstances, and organisations should not rely on prescribed thresholds to determine material information about the nature-related risks and opportunities.

6.7.1 Materiality assessment with different materiality lenses

When identifying material information for disclosure, organisations that need or choose to use a **financial materiality lens** should:[144]

- Complete components E1-E3 of the Evaluate phase before moving to the Assess phase, as the identification of dependencies and impacts on nature provides the basis for the identification and assessment of nature-related risks and opportunities;
- Complete components A1-A3 of the Assess phase to identify risks and opportunities that could reasonably be expected to affect an organisation's prospects; and

143 ISSB (2024) Sustainability-related risks and opportunities and the disclosure of material information.

144 The following steps are suggested actions for organisations when following the LEAP approach to identify and assess nature-related issues with the ultimate objective of disclosure of material information, but are not mandated or required to be followed for compliance with the IFRS Sustainability Disclosure Standards. An organisation would need to comply with all the requirements in those standards, including the identification of material information to disclose (following paragraphs 72 and 73 of IFRS S1).

- Complete component A4 to consider the information on these nature-related risks and opportunities for disclosure, including information on dependencies and impacts that give rise to nature-related risks and opportunities that could reasonably be expected to affect the organisation's prospects. This should be consistent with the requirement for the disclosure of material information about nature-related risks and opportunities under the definition of material information in IFRS S1 or other jurisdictional requirement.

As an example, a utility company using the LEAP approach to disclose using a financial materiality lens will use components E1-E3 of the Evaluate phase to identify and evaluate its dependencies and impacts on nature. This could include dependencies on water supply and water-flow regulation for electricity generation and cooling, alongside impacts arising from water withdrawal, land use and infrastructure. In the Assess phase, when identifying the material information on risks and opportunities that could reasonably be expected to affect its prospects, the organisation will consider information that is useful to primary users of general purpose financial reports about the underlying dependencies and impacts on nature that have given rise to these risks and opportunities, such as information on the company's reliance on water, the locations and activities exposed to water stress, and how changes in water-related ecosystem services have led to disruption in operations or increased costs.

Organisations choosing or required to use a **double materiality lens** should complete all steps of the Evaluate phase to identify material information for disclosure on impacts on nature based on impact materiality. The Assess phase should be used to identify material information on nature-related risks and opportunities, including the information on dependencies and impacts that give rise to risks and opportunities based on financial materiality.

Key dataset and tool functionalities for A4:

- Apply principles and requirements consistent with IFRS S1 to identify the nature-related risks and opportunities that could reasonably be expected to affect the organisation's prospects.
- Apply principles and requirements consistent with IFRS S1 to identify material information about nature-related risks and opportunities for disclosure.

Resource types with illustrative examples:

- **Disclosure standards** ISSB IFRS S1 General Requirements, double materiality approach according to ESRS 1 and ESRS 2 and other jurisdictional standards as applicable.
- **Disclosure guidance:** ISSB's educational material on sustainability-related risks and opportunities and the disclosure of material information.

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 have identified its nature-related risks and opportunities that could reasonably be expected to affect its prospects, which can support disclosure of information consistent with the ISSB's IFRS Sustainability Disclosure Standards and other jurisdictional requirements where relevant.

The following specific outputs can inform disclosures aligned with the TNFD's recommendations:

- A longlist of nature-related risks and opportunities for the organisation stemming from dependencies and impacts on nature. The output of this can support reporting on TNFD recommended disclosures (Metrics and Targets A);
- A matrix of risks consistent with the enterprise or portfolio risk management framework of the organisation (e.g. significance by sector, business line, location and value chain);
- A shortlist of nature-related risks and opportunities that could reasonably be expected to affect the organisation's prospects. 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 on how these processes and elements can be adapted and improved 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

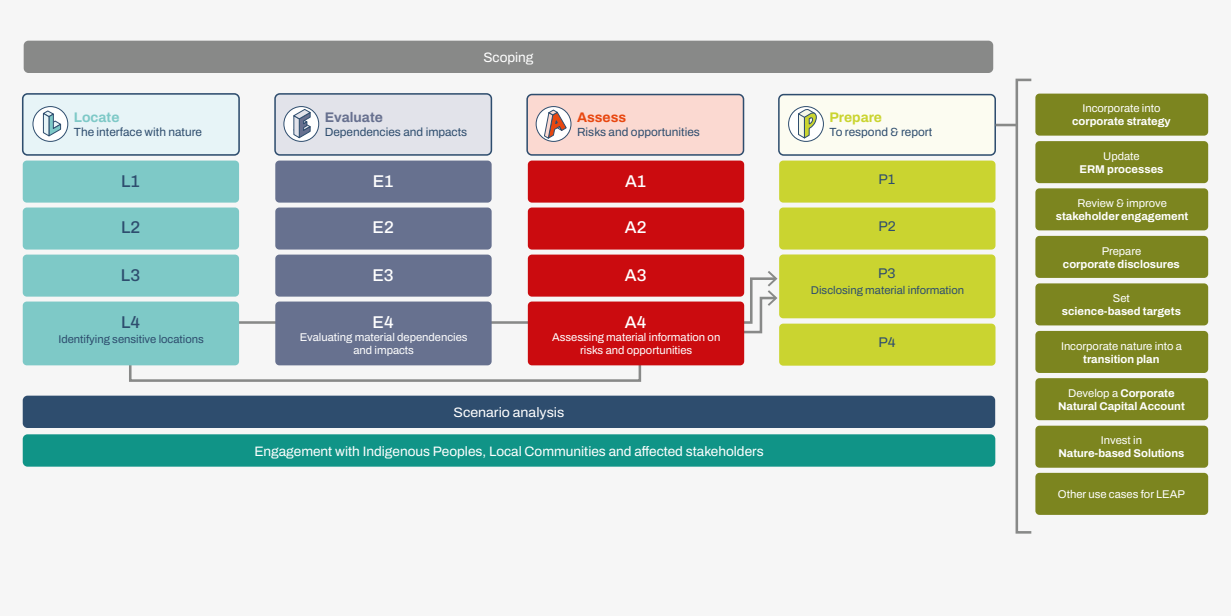
- Suggested metrics for nature-related risks and opportunities (Annex 1: Assess – Risk and opportunity metrics);
- Guidance on valuation of dependencies and impacts on nature, prepared with the Capitals Coalition and based on the Natural Capital Protocol (Annex 3);
- TNFD discussion paper on nature-related opportunities;
- TNFD guidance on scenario analysis;
- TNFD discussion paper on conducting advanced scenario analysis;
- University of Oxford's Resilient Planet Finance Lab, TNFD and Global Canopy Evidence Review on the Financial Effects of Nature-Related Risks and accompanying Nature-related Financial Risks Database; and
- Nature-related risk and opportunity registers.

7. Preparing to respond and report

The Prepare phase helps organisations to translate their assessment of nature-related issues from the Locate, Evaluate and Assess phases of LEAP into decisions and actions. Supporting the preparation of corporate reporting disclosures for investors and others users of mainstream financial and sustainability reporting is the primary use case for which LEAP was developed. However, market feedback from early use of the LEAP approach has highlighted a broad range of other decisions and actions for which corporate and financial institutions have used LEAP:

- Strategy – revising or setting a corporate or investment strategy incorporating nature-related considerations;
- Governance – enhancements to corporate governance arrangements to ensure appropriate oversight of nature-related issues;
- Risk management – mainstreaming nature-related considerations into Enterprise Risk Management and Portfolio Risk Management processes;
- Resource allocation decisions – including the capital expenditure decisions of companies and the capital allocation decisions of asset owners and managers;
- Transition planning – incorporating nature-related considerations into a transition plan;
- Target setting and performance measurement – for example, supporting the use of SBTN target-setting methods, where applicable;
- Engagement activities – including with Indigenous Peoples, Local Communities and affected stakeholders;
- Investor stewardship – for example, the incorporation of nature-related considerations into stewardship guidance issued by asset owners and the investor relations dialogue between companies and asset managers; and
- Corporate natural capital accounting – where a company wishes to prepare a corporate natural capital account.

Figure 55: Use cases for a LEAP assessment



The guidance outlined below offers general insights of value across these use cases, but with a particular focus in P3 and P4 on the preparation of disclosures.

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 those nature-related issues – dependencies, impacts, risks and opportunities – for the organisation deemed to satisfy financial materiality and/or impact materiality.

The project team will then be able to use this assessment to inform a discussion with internal stakeholders about how the organisation should respond to the issues identified. This includes what material nature-related information the organisation should disclose to investors and other primary users as part of its general purpose financial reports.

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 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 – including disclosure-related decisions and those related to transition plans and target setting. It does not focus on what the specific responses – including disclosures, transition plans and targets – should be.

Objective

To decide how the organisation should respond, and the specific decisions and actions it should take, to the nature-related issues identified in the LEAP approach.

Desired outputs

- Agreement on how the organisation will respond to the nature-related issues identified in the LEAP approach i.e. the specific decisions and actions it plans to take (from those listed above and potentially others); and
- A discussion within the organisation about its governance and risk management processes to oversee the implementation and follow-up of those decisions and actions in light of its nature-related assessment.

Practical tips

- Review and revisit previous phases of the LEAP approach, if necessary, to ensure you have a fully informed response.
- For **corporate reporting**: Your organisation will need to decide what nature-related issues to disclose, in line with your approach to materiality and informed by the TNFD recommended disclosures. Your organisation will also need to decide on the form and presentation of those disclosures, in line with regulatory requirements and relevant voluntary disclosure standards, such as those provided by the ISSB and GRI.
- For **target setting**: The TNFD recommends that corporates take action towards science-based targets, and to measure their progress and performance against them.[145] To do so, the TNFD recommends using Science Based Targets Network (SBTN) guidance, where applicable. The greatest applicability for SBTN methods is for sectors where impacts on nature are typically more direct and significant, including primary production, manufacturing, construction, wholesale and retail, and related activities.
- For **transition planning**: The TNFD recommends drawing on the TNFD guidance on nature in transition plans.

145 SBTN (2023e) Resources.

- For **engagement**: The TNFD recommends drawing on the TNFD guidance on engagement with Indigenous Peoples, Local Communities and affected stakeholders to inform actions to expand or enhance engagement activities.
- For incorporating nature in **corporate strategy**: The TNFD recommends consideration of the Nature Strategy Handbook produced by Business for Nature.

7.3. Guiding questions

The following high-level questions should guide an organisation's analysis in the Prepare phase:

P1: Governance, strategy and resource allocation plans – What governance, strategy, risk management and resource allocation decisions should be made as a result of this analysis?

P2: Target setting, transition planning and performance management – How will we set targets and define and measure progress, including through incorporation of nature-related considerations in our transition plan?

P3: Reporting – What will we disclose in line with the TNFD recommended disclosures and relevant international voluntary standards and/or jurisdictional requirements?

P4: Presentation – Where and how do we present our nature-related disclosures? Should we consider accompanying our mainstream sustainability reporting with a corporate natural capital account?

7.4. P1: Governance, strategy and resource allocation plans

P1: Governance, strategy and resource allocation plans	*What governance, strategy, risk management 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 its senior sponsor, should present its assessment to senior management teams from across the organisation and discuss the implications for organisational governance, 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 governance, strategy, business model and value chain(s):** What are the implications of our assessment of nature-related

dependencies, impacts, risks and opportunities for the organisation's corporate or business unit governance, strategy, business model and value chain(s)? What should the organisation's strategy in relation to nature-related issues be? How is this shaped by different plausible future scenarios facing the organisation? Is the strategy, business model and value chain(s) resilient in the face of the trends and uncertainties, and risks and opportunities identified?

- **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? Do the board and senior management have sufficient visibility of potential exposure to environmental crime?
- **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? Is there clear accountability for integrating environmental crime signals into sourcing, onboarding, due diligence and monitoring, and a defined escalation path for crime-related intelligence triggers?[146]
- **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? Could the organisation's nature-related dependencies, impacts or risks affect investor confidence or its access to, or cost of, capital?

146 For further guidance on environmental crime-related uncertainty, governance, escalation and disclosure considerations, including relevant legal and regulatory considerations, refer to the TNFD guidance on environmental crime.

In identifying possible governance, strategy, risk management and resource allocation decisions, organisations should also 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 contributions to nature-positive outcomes in the locations, and across the sectors and value chains, in which we are active? What risk, if any, do we face of 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 or high impacts, dependencies, risks and opportunities? What potential responses and solutions have we identified through this engagement?
- **Priorities for action:** What are we looking to achieve through addressing our nature-related issues? How and where can we be most effective in achieving these results? How should we sequence our responses to achieve our goals?
- **Wider engagement, collaboration and landscape/seascape approaches:** What are the assumptions and external factors relevant to the identified responses and resource allocations? How and where can we achieve synergies with other efforts, including for climate? Which business and supplier relations are most important for delivering our responses? How do we avoid impact leakage?[147] Where are we missing capabilities or influence and could benefit from engagement with others, such as through landscape or seascape approaches?



Additional considerations for financial institutions

Financial institutions should consider resource allocation and governance for 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.

147 The unintended negative consequences that occur when efforts to manage or protect nature in one area lead to adverse effects in another area, potentially increasing nature-related risks.

These teams, and the processes they are responsible for, should be readied to integrate the nature-related issues identified. This 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.

Box 41: Managing risks and impacts through landscape and seascape approaches

Many risks associated with nature loss, in particular ecosystem stability systemic risks, cannot be addressed by individual organisations acting alone or working in silos. Further, siloed approaches to nature management can result in negative outcomes overall. For example, some efforts to manage individual operational impacts on nature through efficiency gains can drive increased cumulative resource use by stakeholders, thereby increasing nature-related risks.

When different organisations and stakeholders manage dependencies and impacts on nature in the same ecosystem, management is more effective if supported by strong coordination among stakeholders. Coordinated collective action by multiple stakeholders, through landscape and seascape approaches, can often be an effective way to manage nature-related dependencies, impacts, risks and opportunities. Such action can address risks and create opportunities at a landscape or seascape scale.

Following an assessment of dependencies, impacts, risks and opportunities, organisations may explore whether credible landscape or seascape initiatives exist that may inform and support their response. The Landscape and Jurisdictional Initiatives Map includes a selection of existing landscape initiatives. Organisations can use this and similar resources to identify existing initiatives or multi-stakeholder platforms in locations relevant to their operations and value chains.

Landscape and seascape approaches may involve representation from Indigenous Peoples, Local Communities and affected stakeholders and aim to address nature-related issues of shared interest. Since these approaches recognise the interconnections between people and nature, they are well-suited to participatory processes and governance structures that empower marginalised groups.

Landscape initiatives are on-the-ground collaborative programmes to set common goals, take collective action, reconcile different interests and monitor progress towards improving social, environmental and economic outcomes at a landscape or seascape scale. The credibility and potential effectiveness of present landscape and seascape initiatives can be assessed using ISEAL's Core Criteria for Mature Landscape Initiatives.

Box 42: Example collaborative approaches in the ocean realm at the seascape level

Organisations can draw on established multinational, regional and national marine frameworks when developing and monitoring coordinated seascape responses. Good Environmental Status (GES) under the EU Marine Strategy Framework Directive, the OSPAR Convention and relevant national or regional marine strategies can provide shared environmental objectives and reference points that help stakeholders establish common goals and align their actions. For example, the OSPAR Convention's Coordinated Environmental Monitoring Programme (CEMP) provides comparable data from across the OSPAR Maritime Area for use in coordinated assessments.[148] This evidence can support collective monitoring of progress towards shared goals and inform the adaptation of responses where needed.

Box 43: Using certification schemes to support nature-related assessments using the LEAP approach

Certification schemes and other sustainability systems[149] may provide information that can support an organisation when conducting nature-related assessments using the LEAP approach and preparing TNFD-aligned disclosures. Depending on their scope and design, these systems may provide location and traceability information, risk assessments, performance requirements, monitoring data and assurance. They may also support engagement and improvement across value chains.

Information collected through the LEAP approach may also help an organisation identify and compile evidence relevant to the requirements of a certification scheme. However, additional information, actions and independent assessment may be required to achieve certification.

148 OSPAR Coordinated Environmental Monitoring Programme.

149 According to ISEAL, sustainability systems are market-based tools designed to address the most pressing social and environmental challenges of our time. They define responsible practices, assess the implementation of these practices, and measure and communicate results. Sustainability systems are used in most sectors worldwide to improve social and environmental performance. The term 'sustainability systems' refers to a range of organisations and approaches that have common elements: they define sustainability performance levels or improvement pathways; they measure, monitor, or verify performance or progress; and they allow for claims and communications. ISEAL (2026) What is a sustainability system?

Certification schemes should be treated as inputs to, rather than substitutes for, an organisation's assessment of its nature-related dependencies, impacts, risks and opportunities and its TNFD-aligned disclosures. Certification against a standard does not, on its own, demonstrate that all information needed to apply the LEAP approach or prepare TNFD-aligned disclosures has been collected or made publicly available.

When considering how information from a certification scheme might be relevant in the context of a nature-related assessment using the LEAP approach, an organisation should assess:

- **Relevance:** Whether the scheme's scope and standard cover the activities, locations and nature-related issues relevant to the organisation;
- **Data availability and suitability:** Whether relevant information, such as location data, risk data and performance data are publicly available or held in auditable but non-public documentation;
- **Traceability:** Whether the chain-of-custody model is sufficiently granular and location-specific, including, for example, the production unit, collection point, supply shed or jurisdiction, and what conclusions it supports about the origin and sustainability attributes of products or materials;
- **Credibility:** Whether the scheme's standard-setting, assurance, monitoring and governance processes reflect internationally recognised good practice for credible certification schemes and other sustainability systems, including, where relevant, the ISEAL Code of Good Practice for Sustainability Systems and the ISEAL Credibility Principles;
- **Independent assessment:** Whether a competent and independent third party has assessed conformity with the relevant scheme requirement; and
- **Limitations:** Any differences in scope, definitions, methodologies, thresholds or reporting boundaries between the certification scheme and the organisation's application of the LEAP approach and/or its TNFD-aligned disclosures.

Where certification scheme information is relevant and suitable, an organisation could consider its use alongside other internal, supplier, scientific and geospatial information to inform strategy, resource allocation, target setting, performance management and disclosure.

Prioritising governance, risk management, strategy and resource allocation decisions

Once it has identified its possible response options, an organisation should decide what governance, risk management, strategy and resource allocation responses it will implement to address its nature-related issues. This may include immediate decision making and transition planning or other longer-term plans, strategies and capital allocation decisions.

Many organisations will not be able to address all identified material nature-related issues at the same time and will have to prioritise where to focus their efforts initially. To inform this, organisations may draw on the considerations mentioned above and prioritisation factors in previous phases of LEAP such as:

- **Strategic and financial relevance:** The significance of nature-related risks and opportunities and alignment with the organisation's wider strategy;
- **Resilience assessment:** The resilience of the organisation's strategy and business model to uncertainties arising from nature-related risks, including the capacity to adjust or adapt its strategy and business model to these uncertainties, taking into consideration different scenarios;
- **Importance for nature and people:** The significance of the organisation's impacts, the ecological sensitivity of its locations, and the implications for Indigenous Peoples, Local Communities and affected stakeholders; and
- **Feasibility and efficacy:** The organisation's ability to deliver the intended outcomes, taking account of cost, capacity, influence, possible synergies, available solutions and opportunities to work with others.

Organisations may also consider the prioritisation factors mentioned in L4 and the integrated priority ranking proposed by SBTN in its Step 2 methods.[150]

Organisations are encouraged to consider these governance, risk management, strategy and resource allocation decisions within the context of transition plans. These provide a coherent structure for organisations to manage their nature-related dependencies, impacts, risks and opportunities, and communicate their climate mitigation and adaptation efforts, and thereby to respond and contribute to the transition implied by the Kunming-Montreal Global Biodiversity Framework and the Paris Agreement. For further guidance, see the TNFD's guidance on nature in transition plans and related use cases.

150 SBTN's Step 2 integrated priority ranking approach requires location-specific information on impact drivers (referred to as pressures by SBTN), corresponding pressure-sensitive state-of-nature indicators, biodiversity significance and dependencies. This information may already have been gathered through the Locate and Evaluate phases of LEAP or may require supplementary assessment.

Box 44: Grouping sourcing regions as part of a transition plan to define priorities in a commodity supply chain

JDE Peet's is a Dutch multinational coffee and tea company headquartered in Amsterdam. JDE Peet's transition plan sets out its nature-related goals, targets, strategies and actions, and illustrates how an organisation can group locations with similar ecological, operational and socioeconomic characteristics to define nature-related priorities and implementation pathways at a regional level.

JDE Peet's developed a structured approach to defining actionable nature-related priorities that could guide implementation, engagement and target setting across its global sourcing footprint. Its transition plan sets out the company's strategy for advancing regenerative agriculture and deforestation-free commodities, with a particular focus on its coffee supply chains.

Given the scale of its global coffee production, which is estimated at 12.5 million farms, and its sourcing footprint (approximately 8% of global supply), JDE Peet's is likely directly connected to at least 1 million farmers each year. JDE Peet's leveraged its existing classification of 'farming archetypes' to define and operationalise plan priorities. These archetypes group sourcing regions based on shared socioeconomic and environmental characteristics. They include:

1. **Brazil and Vietnam** – characterised by high yields, high mechanisation, including irrigation, and high input;
2. **East Africa and Indonesia** – characterised by low yields, shade-grown and rain-fed coffee, low mechanisation and low input; and
3. **Latin America** – characterised by medium yields, shade-grown and rain-fed coffee, wet milling and low to medium input.

This method aligns with the recommendations outlined in the TNFD's guidance on nature in transition plans on grouping locations only when they share relevant natural and operational aspects. In doing so, JDE Peet's was able to translate its complex global sourcing footprint into a manageable set of priorities for nature-related action.

A central focus across archetypes is achieving regenerative agriculture (RegenAg) aimed at reducing synthetic inputs, restoring soil health and improving resilience and livelihoods. However, each archetype faces specific physical and transition risks, supply chain controls and farmer support availability, which require tailored mitigation, implementation and engagement approaches.

By leveraging its archetype approach to define priorities, JDE Peet's was able to develop a scalable, yet precise approach to manage its nature-related financial risks. It also laid the groundwork for embedding transition planning into JDE Peet's responsible sourcing strategy.

Source: JDE Peet's (2026) Grounded in Nature: Nature Transition Plan.

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 to 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 56: SBTN AR3T framework



Examples of **corporate responses** to nature-related issues, and their connection to mitigation hierarchy principles, are outlined in Table 21.

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 21: Examples of business responses to nature-related issues, categorised by mitigation hierarchy component

Mitigation hierarchy component	Illustrative responses
Avoid	Use 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, for example, to reduce water use or reduce nonpoint source pollution when consuming your products.
	Develop and apply methods that measure farm output beyond yield per area to include nutritional value and wider benefits to society of a healthy landscape.

Source: SBTN (2023d) 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. Reviews should also consider whether pursued nature-related opportunities are delivering the expected organisational and nature outcomes, and whether they should be adapted, scaled or discontinued. 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, transition planning and performance management

P2: Target setting, transition planning and performance management	*How will we set targets and define and measure progress, including through incorporation of nature-related considerations in our transition plan?*

Organisations should consider setting targets, including in the context of a transition plan. Through such targets and transition plans, organisations can specify how they will respond and contribute to the transition implied by the Kunming-Montreal GBF, and how they will manage the synergies and trade-offs associated with other transition objectives, including those related to global policy priorities such as net zero, consistent with the Paris Agreement.

TNFD recommended disclosure Strategy B recommends that organisations disclose the effect of nature-related issues on the organisation's business model, value chain, strategy and financial planning, as well as any transition plans or analysis in place. TNFD recommended disclosure Metrics and Targets C recommends that organisations describe the targets and goals used by the organisation to manage nature-related issues and its performance against these.

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, and risks and opportunities.

Table 22 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 22: 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 risks arising from its water use, which could include 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.

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 (%).

The same assessment outputs may also inform nature-related opportunities. For example, where an organisation identifies a dependency on water in an area experiencing water stress, actions such as improving water efficiency, water reuse or water recycling may support both risk management and opportunity identification, depending on the expected outcomes for the organisation and for nature.

7.5.2 Setting effective targets

As well as defining 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 recommended disclosure Metrics and Targets C). The TNFD strongly recommends that organisations set targets that align with the goals and targets of the Kunming-Montreal GBF, 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 (see Box 45).

Box 45: 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: SBTN (2020) Initial Guidance for Business; see also Andersen et al. (2020) Defining 'science-based targets'.

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:

- What to target?
- How to measure it?
- The target value and trajectory; and
- The monitoring, reporting and reviewing process.

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 (see Figure 57), in line with the plans, policies, actions and response metrics in place at different levels of the organisation.

Organisations may consider three categories of targets[151]:

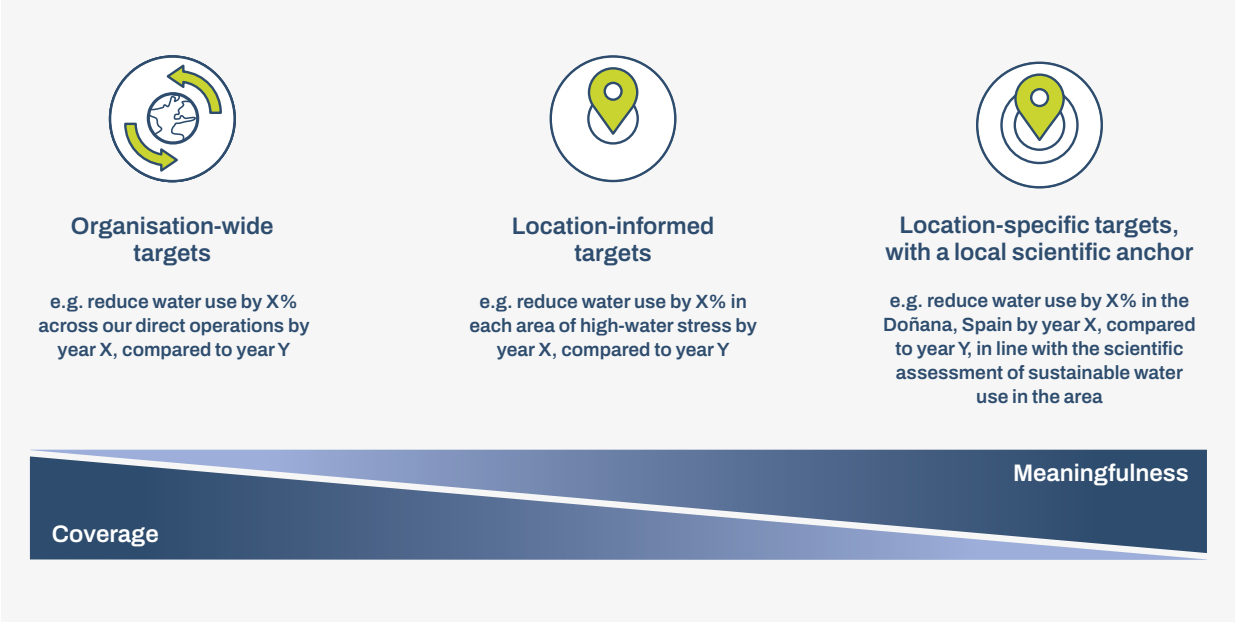
- **Dependency and impact targets:** These cover impact drivers, changes to the state of nature and changes to ecosystem services, and are used to monitor and drive progress for the dependency and/or impact (e.g. the amount of forest converted) and manage related risks and opportunities;
- **Governance, business and operational targets:** These are response targets used to monitor and drive implementation and progress across governance, engagement, business and operational activities (e.g. the percentage of certified products); and
- **Financial targets:** These are response targets used to monitor and drive the financial delivery of plans (e.g. annual capital expenditure allocated to restoring and regenerating ecosystems).

For targets in each of these categories, organisations should also consider the degree of aggregation across locations for which targets are set. In line with General Requirement 3 of the TNFD recommendations, dependency and impact targets should be location-specific, where possible. Targets should only be aggregated where the locations have shared characteristics, both in terms of the type and condition of nature in those locations, and the dependencies, impacts, risks and opportunities associated with them. Organisations may consider organisation-wide, location-informed and location-specific targets (see Figure 57).[152] Aggregated organisation-wide impact driver targets should only be considered as complementary to location-specific or location-informed targets, with information disaggregated to the location level.

151 Similarly, in SBTN methods, targets cover different aspects, such as impact drivers (e.g. No Conversion of Natural Ecosystems Target) or business and operational aspects (e.g. SBTN's Enabling Targets focused on supplier engagement and traceability improvements).

152 Similarly, in SBTN methods, distinct levels of aggregation are applied per target type, including targets set at a company-wide level (e.g. the No Conversion of Natural Ecosystems Target), location-specific targets (e.g. the Freshwater Quantity Target) and targets referring to a particular landscape (e.g. the Landscape Engagement Target).

Figure 57: Impact driver targets



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 been 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 or whole organisation) and geography (e.g. land held or managed by the organisation, surrounding ecosystems or 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 where applicable. As noted above, the greatest applicability for SBTN methods is for sectors where impacts on nature are typically more direct and significant, including primary production, manufacturing, construction, wholesale and retail, and related activities.

SBTN offers comprehensive and accelerated pathways, allowing an organisation to begin with a more focused scope and to expand its target coverage over time. 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 credibility of targets not based on the SBTN methods may be enhanced if they are linked to external anchor points. These are desired levels for activities, impact drivers, the state of nature or ecosystem services based on external established sources for specific geographic and temporal scales. These include global goals under conventions, scientific reference conditions for the state of nature and ecosystem services in a relevant location, stakeholder agreements (e.g. collective commitments as part of landscape and seascape approaches), national and regional policy objectives, and industry benchmarks.

The TNFD strongly encourages organisations to anchor nature-related targets, where possible, to global targets and goals under conventions such as the Kunming-Montreal GBF, the Paris Agreement, the High Seas Treaty and the Glasgow Leaders' Declaration on Forests and Land Use, to goals such as those related to planetary boundaries and safe and just earth system boundaries, and the UN Sustainable Development Goals (SDGs).[153] Some 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

153 CBD (2022b) Monitoring framework for the Kunming–Montreal Global Biodiversity Framework; UNFCCC (2015) Paris Agreement; UN (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; UN (2015b) Transforming our world: the 2030 Agenda for Sustainable Development.

businesses on which areas to set targets. Annex 5 illustrates some of the ways that the GBF targets might be translated into targets 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 the design, reporting and consequential outcomes of targets are credible and legitimate. Organisations may also set collective commitments, and associated targets, with others as part of landscape and seascape approaches. 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.

Box 46: 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, for example, for the state of nature, to ensure that an ecosystem is managed so that the services it provides are sustained; and
- **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 the quantification of impact drivers, ecosystem services and changes to the state of nature are set out in E3 and E4, and Annexes 2 and 4.

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[154] by 2025 could include the concentration of mercury and brominated flame retardants in the water body;[155]
- **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 change 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 23 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.

154 For example, as defined by the EC (2000) Water Framework Directive 2000/60/EC.

155 WISE Freshwater(2025) Surface water chemical status.

Table 23: 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.[156] 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,[157] 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.

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

157 CBD (2022c) Target 16; SDG 12 Hub Target 12.3.

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[158] 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 targets, where possible;
  - **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**, which should be set for any long-term targets at appropriate intervals, such as every five years, to start to drive action. These interim targets should be checkpoints between now and the target end date, when an organisation assesses its progress and makes any necessary adjustments to its plans and target.
- **Based on the best available science:**
  - The level and timing of interim and final targets should be 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).

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;

158 UN (2015a) Paris Agreement.

- **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. Organisations may adjust targets if their strategy or goals change or if they outpace or underperform previously set targets.

Box 47: Setting science-based nature targets for land in the apparel sector

H&M Group is a global fashion and design company, with over 4,000 stores in more than 80 markets and online sales in over 60 markets. The company has adopted validated science-based targets for land using SBTN methods, focused on land-related pressures in its upstream value chain and priority raw materials including cotton and wool. H&M Group is now using TNFD guidance to help connect those outputs with transition planning, strategic decision making and reporting processes.

H&M Group's nature assessment and prioritisation work began through SBTN. Building on existing work on materials, water, chemicals, deforestation and biodiversity, H&M Group assessed and prioritised its nature-related impacts using SBTN's foundational assessment and prioritisation steps (Steps 1 and 2). This helped to confirm priority landscapes and raw materials and identify where further action was needed.

It also showed that existing initiatives were aligned with these priorities. Two landscape initiatives developed within H&M Group's partnership with WWF – focused on cotton in Central India and wool in South Africa – were subsequently validated as part of H&M Group's land targets under SBTN's Step 3.

H&M Group translated this assessment into three core land targets defined by SBTN:

- **No Conversion of Natural Ecosystems targets:** H&M has set a target for upstream impacts, with low exposure to conversion of natural ecosystems in its direct operations. **Supporting action:** Strengthening sourcing requirements, traceability and risk management approaches for relevant raw materials.
- **Land Footprint Reduction target:** H&M Group has committed to reduce its absolute agricultural land footprint from upstream impacts by 3.85% by 2030 from a 2019 base year. **Supporting action:** Increasing the use of recycled materials and implementing other measures that reduce demand for agricultural land.

- **Landscape Engagement target:** H&M Group is engaged in the REEVA project in Central India and the Regenerative Wool Project in the Eastern Cape Drakensberg Grasslands of South Africa, with a commitment to contribute to improvements in ecological and social conditions by 2030. **Supporting action:** Supporting landscape-level initiatives and long-term partnerships in priority sourcing regions.

Sources: SBTN (2026c) H&M Group: Bringing existing nature action into one science-based strategy; SBTN (2026d) H&M Group adopts science-based targets for land; H&M Group (2026b) H&M Group adopts science-based targets for land, following the Science Based Targets Network framework (SBTN); SBTN (2026) Target Tracker.

Box 48: A food and beverage company sets science-based targets for the ocean realm

Orkla Foods, a consumer goods company operating mainly in the Nordics, Baltics and Central Europe, used TNFD's LEAP approach to assess and prioritise nature-related dependencies, impacts, risks and opportunities across its business, helping to identify seafood as an area for focused action. It then applied SBTN's Step 3 Ocean guidance to develop science-based targets for seafood sourcing in its upstream value chain.

The company first used the LEAP guidance to identify key raw materials and sourcing areas, both agricultural and marine, to understand its dependencies on nature and the financial risks and opportunities. This helped to build the internal business case for target setting. With thousands of suppliers and hundreds of raw-material categories, Orkla used LEAP to prioritise a manageable scope based on materiality, considering factors such as sourcing volumes, strategic importance, environmental impacts and business risks. This work was performed in collaboration with the BIOPATH research programme.

Orkla additionally participated in SBTN's ocean pilot to set seafood targets, following SBTN's accelerated pathways. After completing a high-level sector screening (Step 1a) in which the whole Orkla Foods portfolio company was screened for materiality based on eight pressure categories, Orkla focused its value chain assessment (Step 1b and Step 2) and subsequent target-setting steps on a more limited scope. The organisation selected Orkla Foods Sverige as the business unit, the ocean realm as the area, and the upstream value chain as the focus, which is where Orkla identified the most impacts and risks. The resulting scope covered approximately 20 seafood species across several sourcing areas per species, creating a more manageable basis for target development and internal approval.

Orkla then combined sourcing information with external data, including information from the Marine Stewardship Council (MSC), to examine issues such as stock status, fishing-gear impacts on ecosystems and bycatch. The process highlighted the importance of seafood traceability, regularly updated sourcing records and clear documentation to support the SBTN validation process.

The example illustrates how organisations can utilise the findings of a LEAP assessment and a science-based target setting method. An organisation can prioritise the parts of the value chain where dependencies, impacts, risks and opportunities are most material, establish the business case, identify the data needed, and use the SBTN target-setting methodology to translate those findings into targets and action.

Sources: SBTN (2026a) Scaling Science-Based Targets for Nature (Orkla's SBTN Journey); SBTN (2026b) Target tracker.

Box 49: An investor sets TNFD-aligned nature expectations for portfolio companies

Norges Bank Investment Management (NBIM), the asset management unit responsible for managing the Norwegian Government Pension Fund Global, has holdings in approximately 7,200 companies worldwide. NBIM has established nature expectations for portfolio companies whose activities or value chains depend on or impact land, freshwater or ocean ecosystems. NBIM considers that the degradation of these ecosystems can affect companies' long-term value.

These expectations inform NBIM's investment analysis, risk management and engagement with portfolio companies, including company dialogue, shareholder proposals and voting. In specific cases, companies that do not respond to engagement may be assessed against NBIM's criteria for risk-based divestment.

NBIM states that companies should align their disclosures on financially material nature-related issues with international frameworks and standards, such as the TNFD and ISSB/SASB. Its core expectations address governance, assessment and reporting, targets, action plans and stakeholder engagement, supplemented by detailed expectations for land, freshwater and ocean ecosystems.

For target setting, NBIM identifies TNFD core metrics, alongside ISSB/SASB metrics, as a potential starting point. It expects companies to set targets addressing material nature-related dependencies and impacts, using internationally recognised frameworks and metrics. Targets should be measurable and time-bound, with clearly defined objectives, scope, baselines, interim milestones and quantitative measures. Companies should implement action plans and report annually on performance against their targets.

Source: NBIM (2026) Nature Expectations.

7.5.3 Nature in transition plans

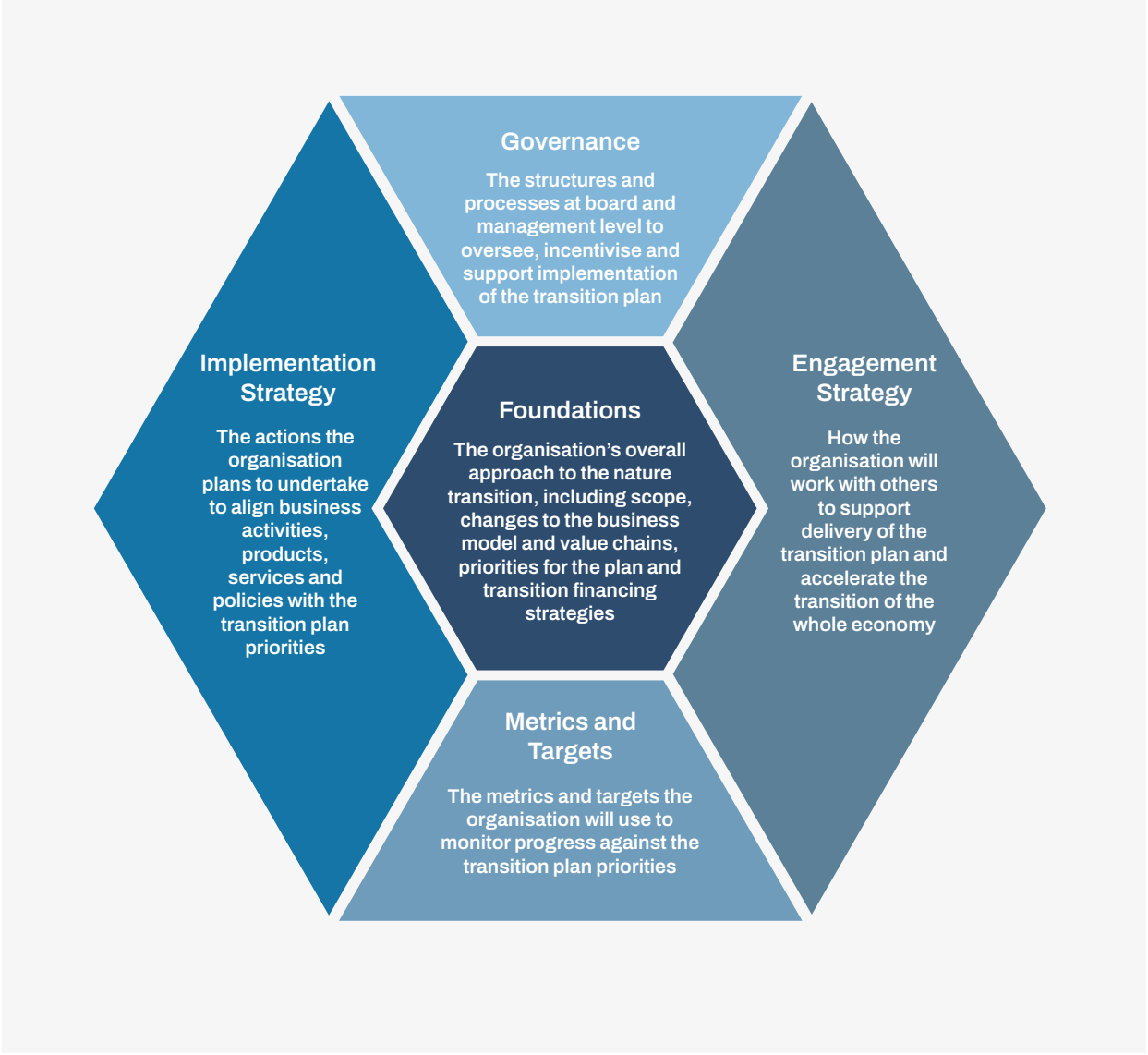
Transition plans provide a way to translate an organisation's assessment of nature-related issues and its targets into forward-looking strategy, actions, resource allocation and accountability. The TNFD defines a transition plan as an aspect of an organisation's overall business strategy that sets out its goals, targets, actions, accountability mechanisms and intended resources to respond and contribute to societal goals and other economic transformations. Nature in transition planning refers to responding and contributing to the transition implied by the Kunming-Montreal Global Biodiversity Framework (GBF), where biodiversity loss is halted and reversed by 2030 and biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people by 2050. This includes managing the synergies and trade-offs associated with other objectives of its proposed transition, including global policy priorities such as net zero, consistent with the Paris Agreement.

A LEAP assessment provides an important foundation for nature in transition planning by identifying the organisation's nature-related dependencies, impacts, risks and opportunities and their associated locations. Building on this assessment, organisations can determine priorities for the plan and the actions needed to deliver them. The TNFD guidance on nature in transition plans emphasises actions that drive change for nature and the real economy, applying the mitigation hierarchy to avoid and reduce negative impacts, protect, conserve, regenerate and restore nature, and address underlying drivers of nature loss. Transition plans should be timebound and science based, respect human rights, and identify and manage synergies and trade-offs with other objectives, including climate.

The guidance is structured around the same five themes recommended by GFANZ for climate in transition plans: Foundations, Implementation Strategy, Engagement Strategy, Metrics and Targets and Governance, as shown in Figure 58, underpinned by the principles of Ambition, Action and Accountability. For financial institutions, this includes defining transition financing strategies and using financing, engagement and stewardship with clients and portfolio companies as levers to support change in the real economy.

Organisations may integrate nature into an existing transition plan or develop a standalone nature-focused plan. Where possible, the Taskforce recommends an integrated approach to transition planning for nature, climate and other goals. Organisations can initially prioritise the nature-related issues and locations requiring the most urgent action, while being clear about the scope of the plan, and expand its coverage, precision and depth over time. The TNFD guidance on nature in transition plans provides detailed guidance for developing, implementing and disclosing these plans.

Figure 58: Themes for nature in transition plans



7.6. P3: Reporting

P3: Reporting	*What will we disclose in line with the TNFD recommended disclosures and relevant international voluntary standards and/or jurisdictional requirements?*

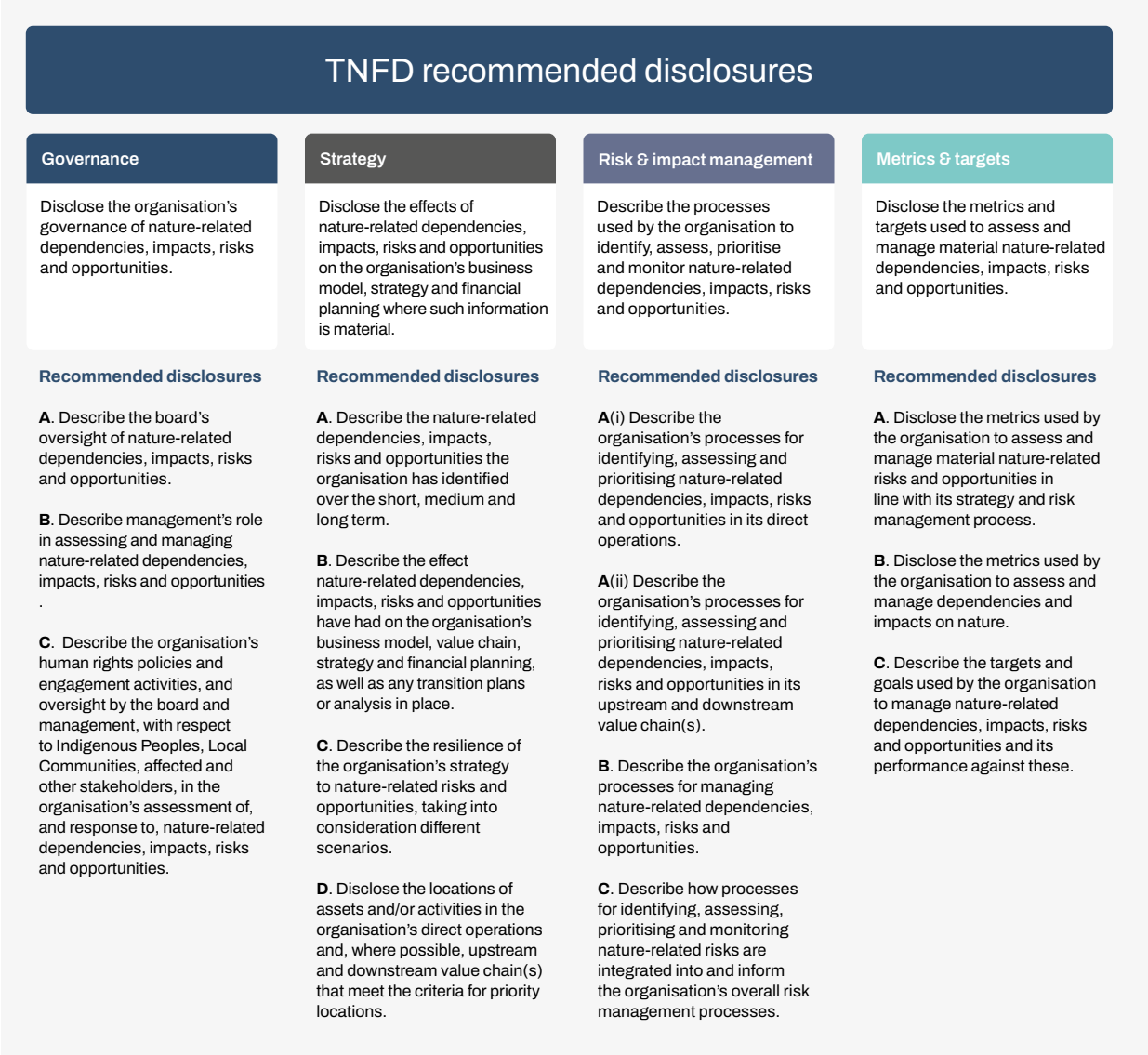
The development of a set of recommended disclosures for nature-related issues is built on the premise that transparency of information through disclosures facilitates better risk and capital allocation decisions by corporates, investors and lenders.

The TNFD recommended disclosures are designed principally to provide decision-useful information to investors and other primary users of general purpose financial reports. They can:

- 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 59 below.

Figure 59: TNFD recommended disclosures



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 ISSB, which is providing a global reporting baseline for corporate sustainability reporting, and GRI, which provides impact-focused disclosure standards for those organisations that need or want to disclose their impacts on the environment and society. Organisations should also refer to any other applicable jurisdictional requirement where relevant.

Consistent with the ISSB's IFRS S1 General Requirements for Disclosure of Sustainability-related Financial Information,[159] 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, potentially in transition plans including targets. 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 of IFRS S1, in relation to:

- Fair presentation;
- Reporting entity; and
- Connected information.

In addition to the General Requirements and other provisions of IFRS S1, 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 TNFD General Requirements to enable consistency in the information disclosed. The General Requirements apply across the four pillars of the TNFD recommended disclosures: Governance, Strategy, Risk and Impact Management, and Metrics and Targets. They describe:

- The application of materiality;
- The scope of disclosures;
- The location of nature-related issues;
- Integration with other sustainability-related disclosures;
- The time horizons considered; and
- 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.

159 ISSB (2023a) IFRS S1 General Requirements for Disclosure of Sustainability-related Financial Information.

Box 50: Using certification schemes to support TNFD-aligned disclosures

When considering how evidence required by a certification scheme might support TNFD-aligned disclosures, an organisation should assess and identify:

Whether the scope of the scheme and its requirements is relevant:

- The extent of alignment between certification scheme requirements and relevant TNFD disclosure indicators and metrics;
- Whether the relevant data is sufficiently granular, current and location specific for the relevant TNFD indicator or metric, noting the geographic level represented, such as production unit, collection point, supply shed or jurisdiction; and
- The scheme and standard's version, jurisdiction, recognition status, assurance approach and chain-of-custody model;

The extent to which the relevant data is publicly available:

- Whether publicly available evidence is required for certification, such as certificates, lists of certified enterprises or production units, public summaries or reports; and
- Whether auditable but non-public documentation is included, such as supplier declarations, audit reports and transaction-level chain-of-custody records;

Whether the scheme and its resulting data are credible:

- Whether its monitoring, assurance and data management processes reflect internationally recognised good practice for credible sustainability systems, including, where relevant, the ISEAL Code of Good Practice for Sustainability Systems and the ISEAL Credibility Principles;
- Whether the scheme is recognised under applicable regulatory frameworks in jurisdictions relevant to the organisation's activities or value chains; and
- Any additional information needed to report against the relevant TNFD disclosure indicators or metrics, including any limitations affecting the use or interpretation of certification evidence.

Interoperability mappings that take the above points into consideration can show where credible certification evidence supports TNFD-aligned disclosures and where additional information or explanation is needed. Such interoperability mappings do not constitute endorsement by the TNFD of a certification scheme, its standard, its certificate holders, its conformity assessment bodies or any claims made under the scheme.

A mapping should distinguish clearly between scheme requirements, auditable but non-public evidence and publicly available evidence that an organisation can reference

in its TNFD-aligned disclosures. The TNFD additional sector guidance for fishing provides one example, mapping the Marine Stewardship Council (MSC) Fisheries Standard v2.01 and associated publicly available certification reports against relevant TNFD disclosures and metrics. The approach and level of information available will differ between certification schemes.

Organisations should also refer to component L3 of this guidance for information on traceability. Further information on the use of secondary data and proxies can be found in the TNFD guidance on value chains.

7.7. P4: Presentation

P4: Presentation	*Where and how do we present our nature-related risk disclosures? Should we consider accompanying our mainstream sustainability reporting with a corporate natural capital account?*

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 or as outlined in jurisdictional requirements with which the report preparer must comply.[160]

Information recommended for disclosure by the TNFD may be included in reports produced under other standards with which the TNFD has a high level of alignment. For this reason, organisations may present TNFD-aligned disclosures within existing sustainability reports, annual reports or other general purpose financial reports, ideally at the same time and covering the same reporting period as the related financial statements. Where nature-related information in alignment with the TNFD recommendations is disclosed in reports aligned with other standards or frameworks, cross-reference tables can help users locate relevant information and understand how disclosures connect. The TNFD supports this approach, where appropriate, provided there is no loss of quality in the disclosures made. Cross-reference tables can be attached to an organisation's reporting to show the alignment of sustainability disclosures, including data points, with the TNFD recommendations and metrics.[161]

160 ISSB (2023) IFRS S1 General Requirements for Disclosure of Sustainability-related Financial Information.

161 See TNFD (2024) The TNFD supports use of cross-reference tables for corporate reporting. Information on the TNFD alignment with other standards or frameworks can be found on the TNFD website: https://tnfd.global/standards-alignment/.

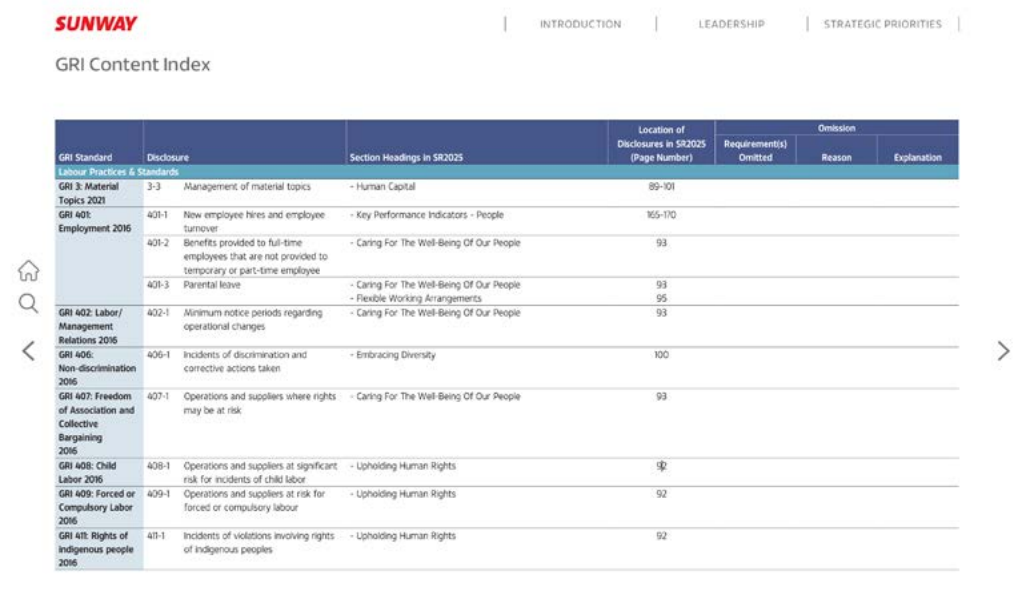
Box 51: Presenting TNFD-aligned disclosures through cross-reference tables

Sunway Berhad, part of Sunway Group, is a Malaysian conglomerate with business divisions including real estate, construction, healthcare, retail, hospitality, education and related sectors. Its Sustainability Report 2025 provides an example of how an organisation can use reporting indexes to connect nature-related information across different sustainability reporting frameworks.

The TNFD supports the use of cross-reference tables, where appropriate, to help simplify and streamline the presentation of TNFD-aligned disclosures in existing corporate reporting. These tables can reduce duplication and make information easier for report users to find, provided there is no loss of quality in the disclosures made.

In its GRI Content Index, Sunway refers users to its TNFD Report for selected biodiversity-related disclosures, including in the section on GRI 3: Material Topics 2021 on the protection of biodiversity and ecology, and in its GRI 304: Biodiversity 2016 disclosures on operational sites in protected or high biodiversity value areas, significant impacts on biodiversity, and habitats protected or restored.

Figure 60: Sunway's GRI content index



SUNWAY | INTRODUCTION | LEADERSHIP | STRATEGIC PRIORITIES |

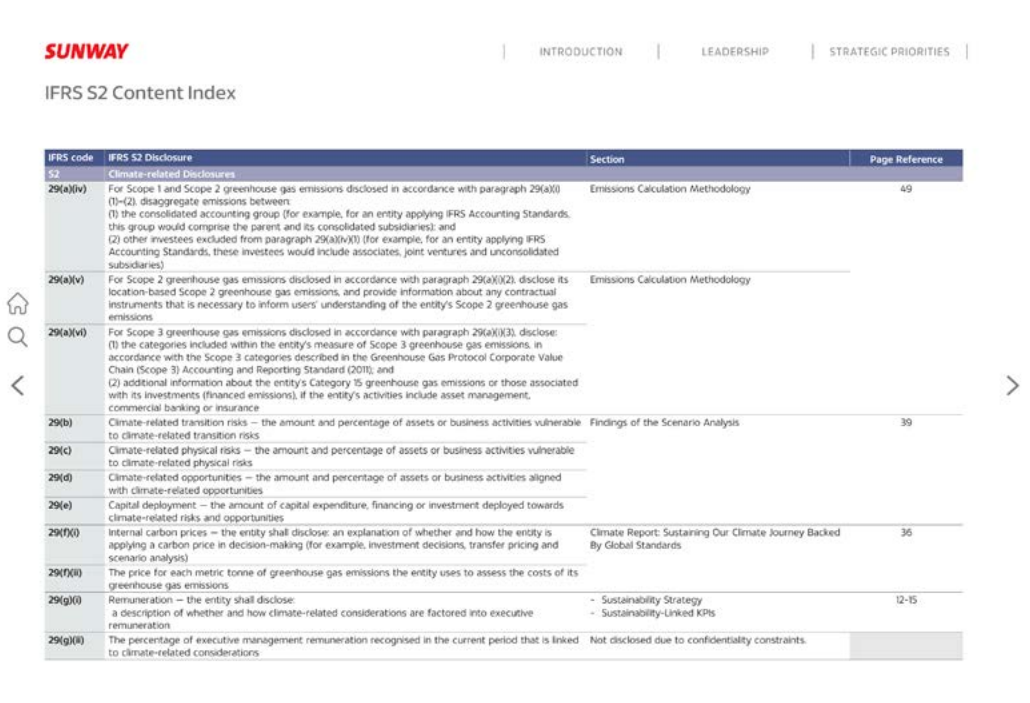
GRI Content Index

GRI Standard	Disclosure		Section Headings in SR2025	Location of Disclosures in SR2025 (Page Number)	Omission		
					Requirement(s) Omitted	Reason	Explanation
Labour Practices & Standards							
GRI 3: Material Topics 2021	3-3	Management of material topics	- Human Capital	89-101			
GRI 401: Employment 2016	401-1	New employee hires and employee turnover	- Key Performance Indicators - People	165-170			
	401-2	Benefits provided to full-time employees that are not provided to temporary or part-time employee	- Caring For The Well-Being Of Our People	93			
	401-3	Parental leave	- Caring For The Well-Being Of Our People - Flexible Working Arrangements	93 95			
GRI 402: Labor/ Management Relations 2016	402-1	Minimum notice periods regarding operational changes	- Caring For The Well-Being Of Our People	93			
GRI 406: Non-discrimination 2016	406-1	Incidents of discrimination and corrective actions taken	- Embracing Diversity	100			
GRI 407: Freedom of Association and Collective Bargaining 2016	407-1	Operations and suppliers where rights may be at risk	- Caring For The Well-Being Of Our People	93			
GRI 408: Child Labor 2016	408-1	Operations and suppliers at significant risk for incidents of child labor	- Upholding Human Rights	92			
GRI 409: Forced or Compulsory Labor 2016	409-1	Operations and suppliers at risk for forced or compulsory labour	- Upholding Human Rights	92			
GRI 411: Rights of Indigenous people 2016	411-1	Incidents of violations involving rights of indigenous peoples	- Upholding Human Rights	92			

Source: Sunway (2025). Advancing equitable growth. Sustainability report 2025

Sunway also uses its SASB Content Index to refer users to its TNFD Report for selected ecological and biodiversity impact metrics. These include references related to lodging facilities located in or near protected conservation areas or endangered species habitat, environmental management policies and practices to preserve ecosystem services, and biodiversity impacts in construction materials.

Figure 61: Sunway's SASB content index



SUNWAY | INTRODUCTION | LEADERSHIP | STRATEGIC PRIORITIES |

IFRS S2 Content Index

IFRS code	IFRS S2 Disclosure	Section	Page Reference
S2	Climate-related Disclosures		
29(a)(iv)	For Scope 1 and Scope 2 greenhouse gas emissions disclosed in accordance with paragraph 29(a)(i) (1)–(2), disaggregate emissions between: (1) the consolidated accounting group (for example, for an entity applying IFRS Accounting Standards, this group would comprise the parent and its consolidated subsidiaries); and (2) other investees excluded from paragraph 29(a)(iv)(1) (for example, for an entity applying IFRS Accounting Standards, these investees would include associates, joint ventures and unconsolidated subsidiaries)	Emissions Calculation Methodology	49
29(a)(v)	For Scope 2 greenhouse gas emissions disclosed in accordance with paragraph 29(a)(i)(2), disclose its location-based Scope 2 greenhouse gas emissions, and provide information about any contractual instruments that is necessary to inform users' understanding of the entity's Scope 2 greenhouse gas emissions	Emissions Calculation Methodology	
29(a)(vi)	For Scope 3 greenhouse gas emissions disclosed in accordance with paragraph 29(a)(i)(3), disclose: (1) the categories included within the entity's measure of Scope 3 greenhouse gas emissions, in accordance with the Scope 3 categories described in the Greenhouse Gas Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard (2011); and (2) additional information about the entity's Category 15 greenhouse gas emissions or those associated with its investments (financed emissions), if the entity's activities include asset management, commercial banking or insurance		
29(b)	Climate-related transition risks – the amount and percentage of assets or business activities vulnerable to climate-related transition risks	Findings of the Scenario Analysis	39
29(c)	Climate-related physical risks – the amount and percentage of assets or business activities vulnerable to climate-related physical risks		
29(d)	Climate-related opportunities – the amount and percentage of assets or business activities aligned with climate-related opportunities		
29(e)	Capital deployment – the amount of capital expenditure, financing or investment deployed towards climate-related risks and opportunities		
29(f)(i)	Internal carbon prices – the entity shall disclose: an explanation of whether and how the entity is applying a carbon price in decision-making (for example, investment decisions, transfer pricing and scenario analysis)	Climate Report: Sustaining Our Climate Journey Backed By Global Standards	36
29(f)(ii)	The price for each metric tonne of greenhouse gas emissions the entity uses to assess the costs of its greenhouse gas emissions		
29(g)(i)	Remuneration – the entity shall disclose: a description of whether and how climate-related considerations are factored into executive remuneration	- Sustainability Strategy - Sustainability-Linked KPIs	12-15
29(g)(ii)	The percentage of executive management remuneration recognised in the current period that is linked to climate-related considerations	Not disclosed due to confidentiality constraints.	

Source: Sunway (2025). Advancing equitable growth. Sustainability report 2025

This approach illustrates how cross-reference tables can help organisations to present TNFD-aligned information alongside disclosures prepared under other sustainability reporting standards. Correspondence mappings with GRI and other standards bodies can help organisations to streamline their nature-related reporting.

Source: Sunway Berhad (2025) Sustainability Report 2025.

7.7.1 Corporate natural capital accounting

Corporate natural capital accounting can complement TNFD-aligned disclosures. Natural capital accounts organise information on an organisation's relationship with nature using accounting rules. For example, a natural capital account can capture: the stocks of natural capital it owns, manages or stewards; changes in the extent and condition of those stocks; and the flows of ecosystem services and other benefits they provide to the organisation and to society.

Natural capital accounting has been pioneered in national accounting through the UN System of Environmental-Economic Accounting (UN SEEA), which is a UN-approved statistical standard, and is a central reference throughout TNFD's guidance and recommendations. UN SEEA comprises a Central Framework (covering accounts on stocks and flow of environmental assets such as water and minerals, adopted as a UN statistical standard in

2012)[162] and an Ecosystem Accounting Framework (covering ecosystem extent, condition, service flows (physical and monetary) and monetary ecosystem asset accounts, adopted as a UN statistical standard in 2021).[163] By 2025, 98 countries had implemented the SEEA, including 71 that publish at least one account regularly.[164] Governments are also embedding the information gained from natural capital accounts in policy, for example through natural capital advisory bodies,[165] or legislation on their use in areas such as natural resource, infrastructure and land use planning.[166] This includes Gross Ecosystem Product (GEP) which measures the monetary value of ecosystem services, modeled after and complementary to Gross Domestic Product (GDP), used to measure the value of ecosystem services. It has been developed and piloted from city to national scales in China, adopted nationally in Bhutan,[167] and increasingly used elsewhere.[168] It has been officially adopted by the United Nations Statistical Commission as part of the UN-SEEA system of ecosystem accounting.

Natural capital accounting is increasingly applied by corporates, as well as governments. Standards now exist to support implementation, notably ISO 14054:2025 Natural capital accounting for organizations — Principles, requirements and guidance. Other guidance includes CSIRO's Natural Capital Handbook that provides a practical guide to corporate natural capital accounting.[169] For example, corporates that directly depend on or steward ecosystems have produced natural capital accounts using the principles of UN SEEA Ecosystem Accounting (e.g. in the forestry and mining sectors). Practical examples include:

- Forico's natural capital reporting presents the value generated by its forestry estate across environmental, social and economic dimensions;[170]
- BHP has produced a preliminary baseline account developed with reference to recognised natural capital accounting approaches;[171] and
- Holcim has applied SEEA-aligned accounts to quarry restoration, measuring ecosystem services in physical and monetary terms so that the social and economic benefits of alternative restoration scenarios can be compared.[172]

162 UN et al (2014) System of Environmental-Economic Accounting – Central Framework.

163 UN et al (2021) System of Environmental-Economic Accounting – Ecosystem accounting.

164 UN et al (2025) 2025 Global Assessment of Environmental-Economic Accounting.

165 UK Government (2020) Natural Capital Committee; Government of Chile (2023) President Gabriel Boric launches Natural Capital Committee to promote the sustainable development of Chile.

166 Natural Capital Alliance (2026) People, Planet, Prosperity: Mainstreaming Nature in Policy & Investment Decisions (Global); Republic of the Philippines, Department of Energy (2024) Republic Act No. 11995.

167 Natural Capital Alliance (2026) Bhutan becomes first country to adopt 'gross ecosystem product' at national level.

168 Natural Capital Alliance (2026) Gross Ecosystem Product (GEP): An Overview.

169 CSIRO (2023) Natural Capital Handbook.

170 Forico (2025) Natural Capital Report.

171 BHP (2026) Advancing the valuation of nature: BHP's first operated asset natural capital baseline and accounting approach.

172 Lammerant, J. (2021b) Business and Natural Capital Accounting Case Study: Quarry restoration by Holcim, Spain.

Further examples also highlight how natural capital accounting approaches are being operationalised by corporates.[173] Biophysical accounts, as well as accounts presenting monetary valuation, can be useful inputs to corporate decision making, as demonstrated by The Biodiversity Disclosure Project (BDP).[174] Annex 3 gives further information on valuation of dependencies and impacts.

Organisations that depend on ecosystems through their upstream value chains can also present information in accounting formats. For example, Natura's Integrated Profit & Loss (iP&L) approach measures and monetises positive and negative impacts across natural, social and human capital throughout its value chain, presenting their value to society in an integrated profit-and-loss format.[175]

These examples show how accounts can complement disclosure by creating consistent, decision-useful information: making value to the business and society more visible, tracking changes over time, testing management or restoration options, informing strategy and capital allocation, and communicating trade-offs to stakeholders. A common accounting structure can also improve the organisation, comparability and accountability of nature-related information and help connect national datasets, internal management and TNFD-aligned risk assessment and disclosure.[176]

In turn, both national and corporate natural capital accounts data and information can be applied to evaluate and assess nature-related business dependencies, impacts, risks and opportunities in alignment with the components of the TNFD LEAP approach as shown in Figure 62.[177]

173 ISFC and Capitals Coalition (2025) Forestry Natural Capital Project: Measuring the Contribution of Forestry – Part 1 Progress Report: Context and Scoping (COP30 supplement report).

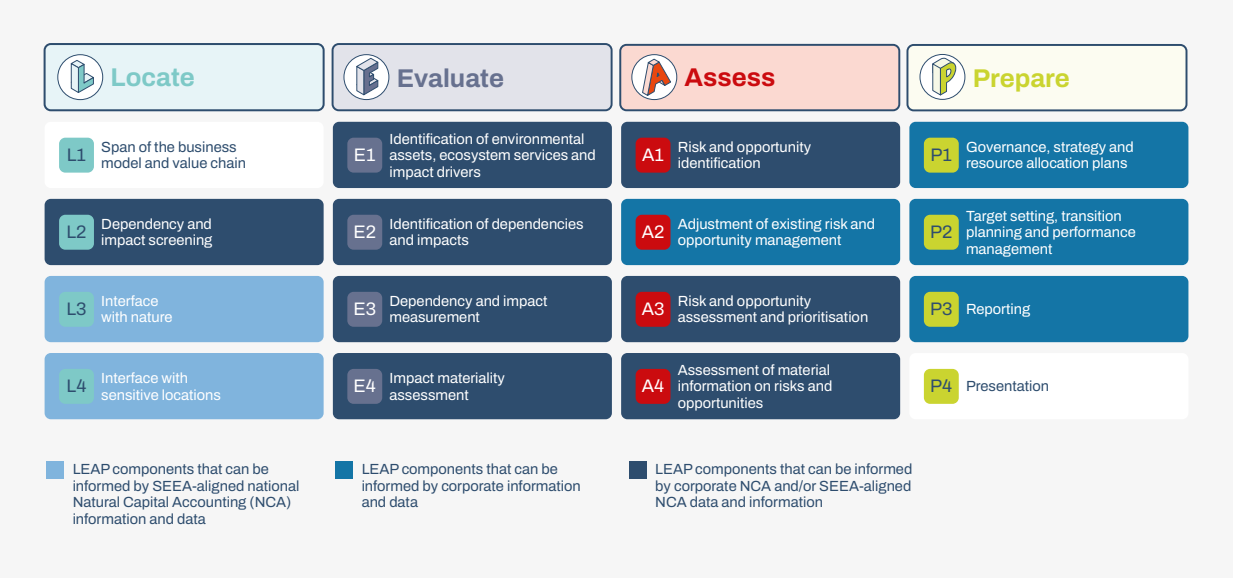
174 Houdet, J and Teren, G. (2022) Quality Biodiversity Footprint Assessments in Practice: Why Organisational Biodiversity Accounting Matters. A Position Paper of the Biodiversity Disclosure Project (BDP).

175 Natura (2026) IP&L Natura 2025; Capitals Coalition (2025) Accounting for Value: Emerging Approaches of Integrated Profit & Loss and Impact Statements; VBA (2025) Value Balancing Alliance 5th Pilot Study.

176 Ingram, J. C. et al (2024) Leveraging natural capital accounting to support businesses with nature-related risk assessments and disclosures; McKenzie, E. et al (2025) Science and technical priorities for private sector action to address biodiversity loss.

177 Ingram J.C. et al. (2024) Leveraging natural capital accounting to support businesses with nature-related risk assessments and disclosures.

Figure 62: Potential for national and corporate natural capital accounting data and information to be applied in a LEAP assessment



Source: Ingram J.C. et al. (2024) Leveraging natural capital accounting to support businesses with nature-related risk assessments and disclosures.

7.8. Desired outputs from the Prepare phase

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, your organisation should be able to use its LEAP assessment to inform and make decisions and take actions regarding your identified nature-related issues, including what information to disclose to the primary users of general purpose financial reports.

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;
- ISSB's IFRS S1 General Requirements for Disclosure of Sustainability-related Financial Information; and
- Certification scheme process data (see Boxes 43 and 50).

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 is 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.

Evaluate – Dependency and impact metrics

Table 24: 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 25: Impact driver assessment metrics

Driver of nature change	Impact driver	Indicator	Metric	Disclosure inclusion
Climate change	Greenhouse gas emissions	GHG emissions	Refer to ISSB's IFRS 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;[178] 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;[179] and • Type of business activity.	Core

178 When disclosing on ecosystem types, refer to the IUCN Global Ecosystem Typology.

179 When disclosing on ecosystem types, refer to the IUCN Global Ecosystem Typology.

Driver of nature change	Impact driver	Indicator	Metric	Disclosure inclusion
Land/ freshwater/ ocean-use change	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
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.[180] 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

180 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	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
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

Driver of nature change	Impact driver	Indicator	Metric	Disclosure inclusion
Pollution/ pollution removal	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
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.[181] For plastic packaging, percentage of plastics that is: • Reusable; • Compostable; • Technically recyclable; and • Recyclable in practice and at scale.	Core

181 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	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
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

Driver of nature change	Impact driver	Indicator	Metric	Disclosure inclusion
Resource use and replenishment	Water use	Water withdrawal and consumption from areas of water scarcity	Water withdrawal and consumption[182] (m^3) from areas of water scarcity, including identification of water source.[183]	Core
	Water use	Total water consumption and withdrawal	Total volume of water withdrawal and consumption (m^3).[184]	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
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

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

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

184 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	Other resource use	Quantity of high-impact natural commodities sourced from land/ocean/ freshwater	Quantity of high-impact natural commodities[185] (tonnes) sourced from land/ocean/freshwater, split into types, including proportion of total natural commodities. Quantity of high-impact natural commodities[186] (tonnes) sourced under a sustainable management plan or certification programme, including proportion of total high-impact 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
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

185 Organisations should refer to the SBTN High Impact Commodity List. Organisations should also consider relevant commodities involving species listed as Vulnerable, Endangered or Critically Endangered on the IUCN Red List of Threatened Species or listed in Appendices I, II or III to Cites.

186 Organisations should refer to the SBTN High Impact Commodity List. Organisations should also consider relevant commodities involving species listed as Vulnerable, Endangered or Critically Endangered on the IUCN Red List of Threatened Species or listed in Appendices I, II or III to Cites.

Driver of nature change	Impact driver	Indicator	Metric	Disclosure inclusion
Invasive species and other	Biological alterations	Measures against the introduction, establishment and spread of invasive alien species (IAS)[187]	Proportion of activities with high IAS-related impact potential operated under appropriate measures to reduce the probability of introduction, establishment and spread of IAS.	Core
	Biological alterations	Number/extent of established IAS and/or newly introduced IAS	Number/extent of established IAS and/or newly introduced IAS in areas owned, operated, used or, where possible, financed in priority areas (absolute, presence/absence, extent covered (km^2)).	Additional

187 Due to the measurement of levels of invasive species for organisations being a developing area, the core indicator and metric focuses on whether an appropriate management response is in place for the organisation. The additional indicator and metric on IAS measure the level of invasive species within an area.

Table 26: State of nature assessment metrics

Indicator	Metric			Disclosure inclusion
	Site level change	*Landscape/seascape level change (context)*	*Location sensitivity*	
Ecosystem extent	Area, losses and gains in extent of natural ecosystems (including semi-natural) by type (km^2, %).		Location sensitivity screening values reflecting aspects of ecosystem extent and condition.	Core
Ecosystem condition	Area, losses and gains for each condition class (km^2, %), by ecosystem type, considering elements of structure, function and composition.	Change in condition of ecosystems within the landscape/seascape, considering elements of structure, function and composition. Values and change in structural and functional connectivity between natural ecosystems.		Core
Species extinction risk	Species extinction risk measurement showing the contributions of the site to global extinction risk.	Species extinction risk measurement showing the contribution of the landscape/seascape to global extinction risk.	Location sensitivity screening values reflecting species extinction risk.	Core
Species population size	Number and proportion of priority species with estimated populations that are 1) declining, 2) slowing in decline, 3) stable and 4) increasing.			Additional

Table 27: 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
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 28: 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 and maintenance and cultural) impacted, measurement of the change in the availability and quality of the ecosystem services.	Additional
	N/A		For ecosystem services (provisioning, regulating and maintenance and cultural) depended on, measurement of 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 km² (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 km² (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. PM10; PM2.5).	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

Assess – Risk and opportunity metrics

Table 29: 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 30: TNFD global risk and opportunity assessment metrics

Risk/ opportunity	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).[188]	Core
	Physical	Value of assets, liabilities, revenue and expenses that are assessed as vulnerable to nature-related physical risks (total and proportion of total).[188]	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

188 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 and Locate phases and connected to exposure to nature-related dependencies and impacts, while 'vulnerability' is determined in the Assess phase, considering the organisation's capacity to cope and adapt reflecting the propensity or predisposition to be adversely affected by the risk.

Risk/ opportunity	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/ opportunity	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/ opportunity	Category	Metric	Disclosure inclusion
Risk	Transition – Technology	Expenditure on R&D for new and alternative technologies related to mitigation of and adaptation to 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/ opportunity	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
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

Prepare – Response metrics

Table 31: 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 32: 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 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 issues.	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 (km^2)), split into ecosystem/biome type and by: • 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: State of nature assessment in the TNFD framework

Introduction

State of nature information is an important component for organisations undertaking assessments of their nature-related issues using the LEAP approach. It informs evaluation of dependencies and impacts on nature, which provides the basis for assessing nature-related risks and opportunities.

This guidance annex:

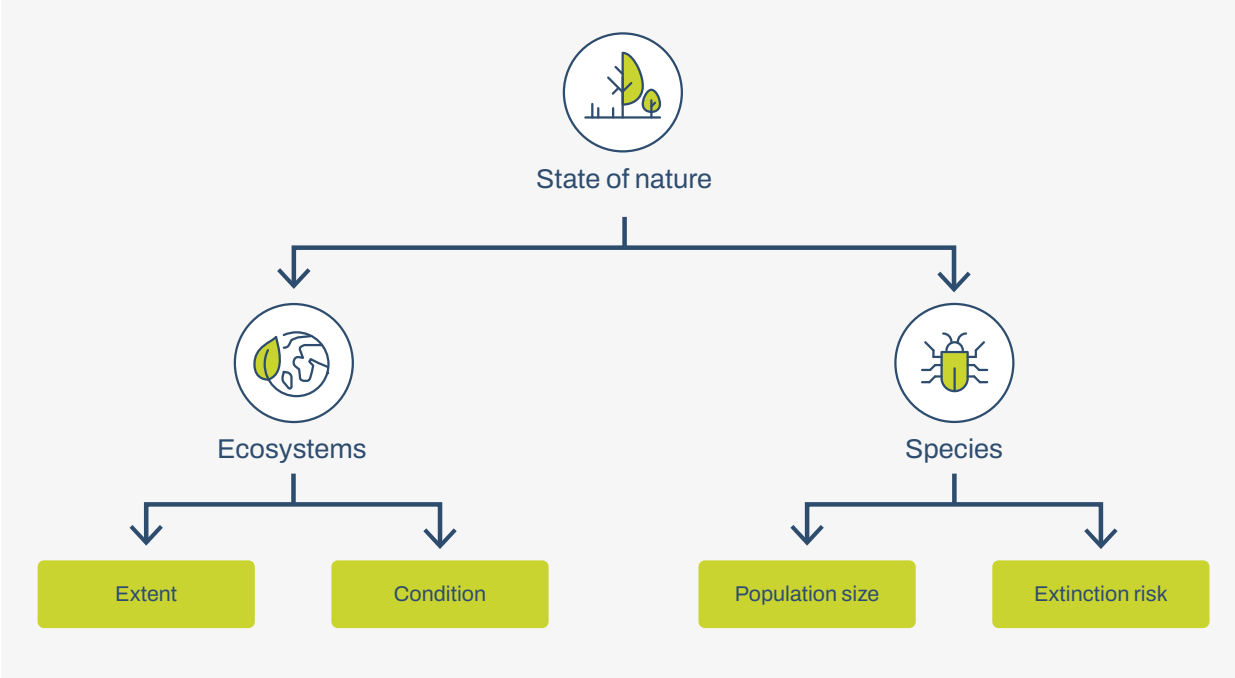
1. Provides further information on the state of nature in the context of assessing organisations' nature-related issues using the LEAP approach, for example, in the Evaluate phase; and
2. Guides organisations with their disclosures on the state of nature when reporting their material dependencies and impacts (Strategy A and Metrics and Targets B in the TNFD recommended disclosures).

Changes to the state of nature can include both positive and negative changes. Following the dependency and impact pathway approach outlined in the Evaluate phase, it is important for organisations to understand and reference changes to the state of nature in assessment locations with high and moderate dependencies and impacts, and as the basis for disclosure of their material nature-related issues and disclosure of state of nature metrics in material locations.

As illustrated in Figure 63, assessing changes to the state of nature requires assessment in locations where the organisation has a dependency and/or impact on nature of:

- Changes to ecosystem extent and condition; and
- Changes to species population size and extinction risk.

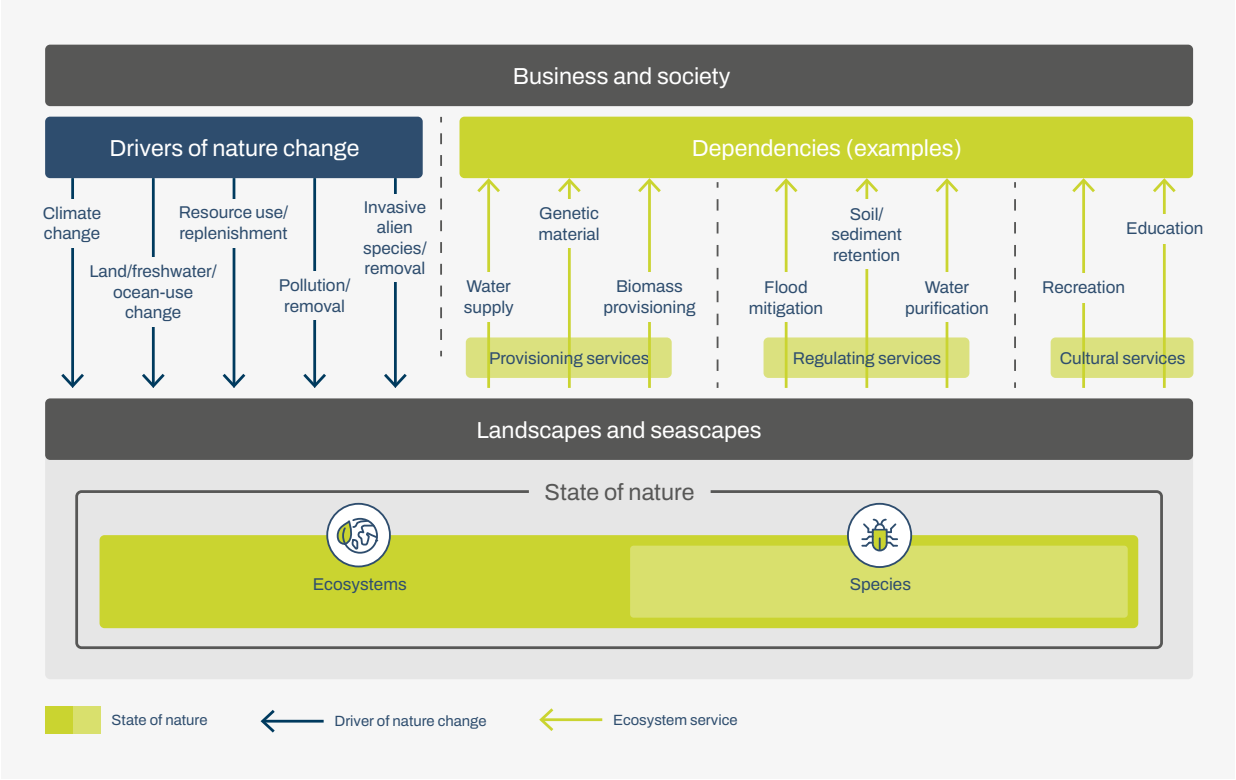
Figure 63: Components of state of nature



The state of nature can determine the capacity of ecosystems to supply ecosystem services on which an organisation depends: it is a function of their extent and condition, including the abundance of species that play key functional roles.

The state of nature can also be impacted by human activity: all five drivers of nature change can cause changes to ecosystems and species. As well as impacts driven by legal activities, ecosystem degradation and species loss can be impacted by environmental crime, including illegal deforestation and land conversion, illegal mining, illegal fishing, wildlife trafficking, illegal waste and pollution practices.

Figure 64: The state of nature can be impacted by human activity, and underpins the supply of ecosystem services that business and society depend on



Assessment and disclosure metrics

Table 33 provides TNFD metrics for the state of nature, including assessment metrics set out in Annex 1 of this LEAP guidance, and disclosure metrics in Annexes 1 and 2 of the TNFD recommendations. The TNFD's approach to assessment and disclosure metrics for the state of nature incorporates the state of nature metric descriptors developed by the Nature Positive Initiative (NPI), in which the TNFD participates as a member organisation.

Information on state of nature to inform assessments of nature-related issues can come from different sources, including:

- Established scientific assessments, from which insights on significance, state and trends in nature can be drawn;
- Public or third-party datasets, for example, sourced from data platforms or providers, where data can then be applied by organisations undertaking a LEAP assessment; and
- Direct measurement may be required for some contexts and use cases, where elements of the state of nature require at high spatial or temporal resolution or data on variables that are highly tailored to local context. These may be measurements your organisation collects directly or collects through consultants or other service providers.

Guidance is provided below on key concepts and considerations for assessing ecosystem extent and condition, species extinction risk related metrics and species populations in the context of assessments of nature-related issues.

Table 33: State of nature and ecosystem service metrics

Indicator	Metric	Disclosure metric (core/ additional & metric number)
Ecosystem extent	Area, losses and gains in extent of natural ecosystems (including semi-natural) by type (km^2, %)	Core (C5.0)
Ecosystem condition	**Site-level:** Area, losses and gains for each condition class (km^2, %), by ecosystem type, considering elements of structure, function and composition. **Landscape/seascape-level:** Change in condition of ecosystems within the landscape/seascape, considering elements of structure, function and composition. Values and change in structural and functional connectivity between natural ecosystems.	Core (C5.1)
Species extinction risk	Species extinction risk measurement showing the contribution of the location to global extinction risk.	Core (C5.2)
Species population size	Number and proportion of priority species with estimated populations that are 1) declining, 2) slowing in decline, 3) stable and 4) increasing.	Additional (A5.0)
Ecosystem services the organisation has an impact on	See guidance on measuring changes in ecosystem services in Section 5.5.5: Ecosystem service provision and Section 5.6, E3: Dependency and impact measurement.	Additional (A6.0)
Ecosystem services the organisation depends on	See guidance on measuring changes in ecosystem services in Section 5.5.5: Ecosystem service provision and Section 5.6. E3: Dependency and impact measurement.	Additional (A6.1)

Metrics on land/freshwater/ocean-use change are closely related to the state of nature metric on ecosystem extent (Table 34).

Table 34: Related impact driver metrics

Driver of nature change	Indicator	Metric	Disclosure metric (core/ additional & metric number)
Land/ freshwater/ ocean-use change	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 (C1.0)
	Extent of land/ freshwater/ ocean-use change	Extent of land/freshwater/ocean ecosystem use change (km^2) by: • Type of ecosystem;[189] 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;[190] and • Type of business activity.	Core (C1.1)

State of nature measurement guidance for assessments

For further guidance on how to measure state of nature metrics, organisations can refer to NPI's (2026b) Initial Measurement Guidance: State of Nature Metrics. Additional guidance on the state of nature in the context of a nature-related assessment includes UN SEEA Ecosystem Accounting and outputs from the Align Project.[191]

189 When disclosing on ecosystem types, refer to IUCN (2026) Global Ecosystem Typology.

190 When disclosing on ecosystem types, refer to IUCN (2026) Global Ecosystem Typology.

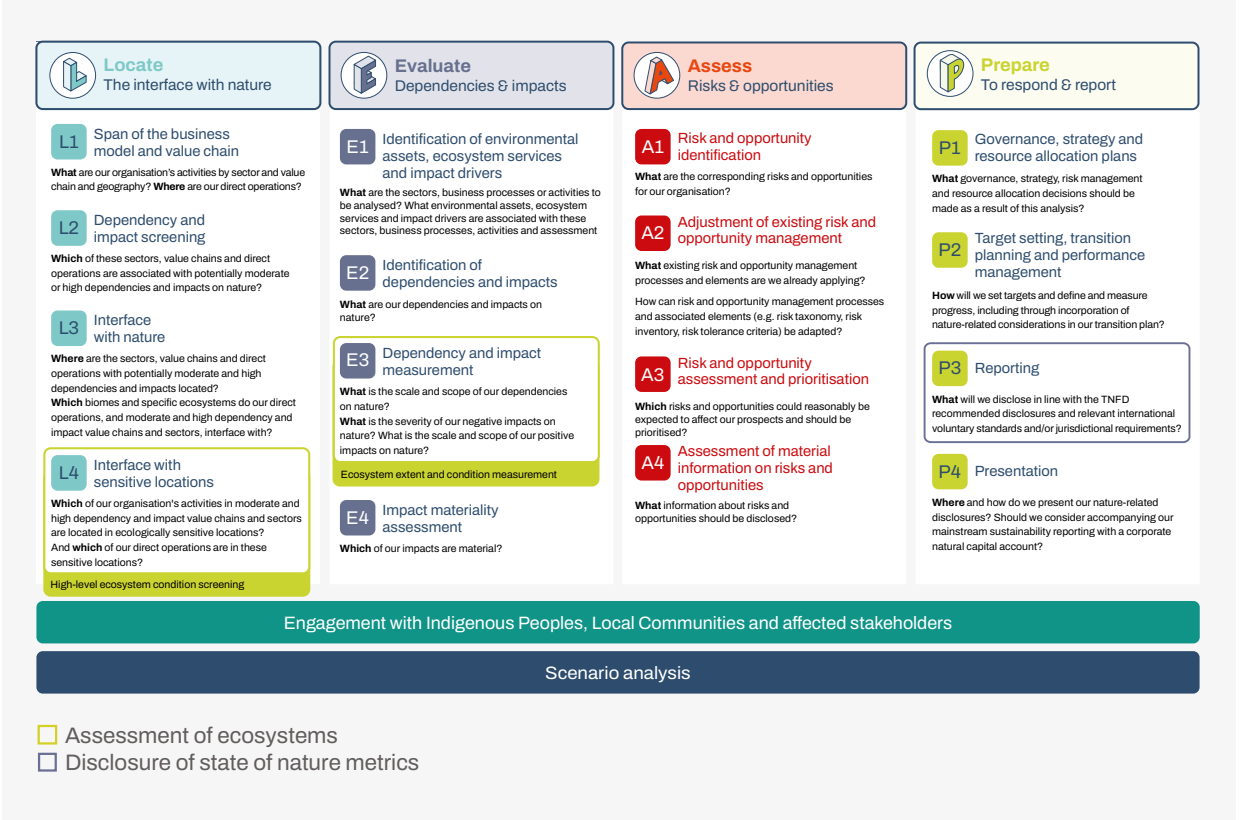
191 UN et al. (2024) System of Environmental-Economic Accounting – Ecosystem Accounting (SEEA EA); UNEP-WCMC et al. (2022) Recommendations for a standard on corporate biodiversity measurement and valuation, Aligning accounting approaches for nature.

Assessing ecosystem extent and condition

What is involved for a LEAP assessment: Assessing ecosystem extent and condition is part of the Locate and Evaluate phases of LEAP. Insights from your consideration of ecosystem extent and condition will support your assessment of dependencies and impacts in the Evaluate phase of LEAP and inform your assessment of risks and opportunities in the Assess phase of LEAP.

To complete your LEAP assessment in support of potential TNFD-aligned disclosures (specifically Strategy A and Metrics and Targets B), you will need to provide best-available measurements of the extent of different ecosystem types and ecosystem condition in material locations. To support TNFD-aligned disclosure for Strategy D, you will need to assess ecosystem condition and integrity to identify sensitive locations in your direct operations and, where possible, in upstream and downstream value chains.

Figure 65: Ecosystem assessment, and preparation for disclosure, within the LEAP approach



Introduction

An ecosystem is a dynamic complex of plant, animal and microorganism communities and the non-living environment, interacting as a functional unit.[192] Ecosystems comprise discrete groups of different organisms and their interactions with their physical environment. Ecosystems can be differentiated from one another by their physical composition and structure (i.e. the vegetation types and species present) and by the function of ecological processes. Ecosystems are highly diverse, ranging in the land realm, for example, from tropical rainforests to grasslands and croplands, and in the ocean realm, from coral reefs to tidal flats. 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.[193, 194]

Negative impacts on ecosystem extent and condition can reduce the ability of the ecosystem to supply ecosystem services that the organisation and others depend on in the same or a different connected location, and be a key source of nature-related risk to the organisation. Positive impacts on ecosystem extent and condition are important for risk mitigation and can generate nature-related opportunities for the organisation.

Ecosystem extent refers to the area coverage of a distinct ecosystem type within a defined area.[195] Ecosystem condition refers to the 'quality' of these ecosystems compared to a reference state. Indices of ecosystem condition are usually standardised on a numerical scale to be between 0 ('highly degraded') and 1 (the 'reference state') or grouped into qualitative 'condition classes' ranging from 'very high' to 'very low'. Together, ecosystem extent and condition describe the state of nature at the ecosystem level.

Ecosystem condition can reflect the capacity of an ecosystem to supply ecosystem services on an ongoing basis.[196] It therefore provides complementary information to ecosystem extent. For example, two sites may contain the same measured extent of a forest ecosystem. However, on one site the forest is in very good condition and on the other site the forest is in very poor condition. They therefore differ in their biodiversity and the capacity of those locations to provide the ecosystem services required by business, society and nature itself. When an ecosystem's resilience is compromised, businesses face potential physical and transition risks. For example, if an ecosystem can no longer deliver the ecosystem service of biological control, it will become vulnerable to invasion by invasive alien species.[197] If the decline in ecosystem condition crosses a tipping point, this can also be the source of systemic risks to business and society.

192 CBD (1992a) Convention on Biological Diversity, Article 2, Use of Terms; IPBES (2019b) Global Assessment Report on Biodiversity and Ecosystem Services.

193 Keith, D. A. et al. (2013) Scientific foundations for an IUCN Red List of Ecosystems.

194 Nicholson, E. et al. (2021) Scientific foundations for an ecosystem goal, milestones and indicators for the post-2020 global biodiversity framework.

195 UN et al. (2024) System of Environmental-Economic Accounting—Ecosystem Accounting (SEEA EA).

196 UNEP-WCMC et al (2023) Measuring ecosystem condition – a primer for business.

197 See Annex 4 on invasive alien species.

This section introduces key concepts for assessment of ecosystems.

Key concepts for ecosystem-related assessment

Ecosystem types

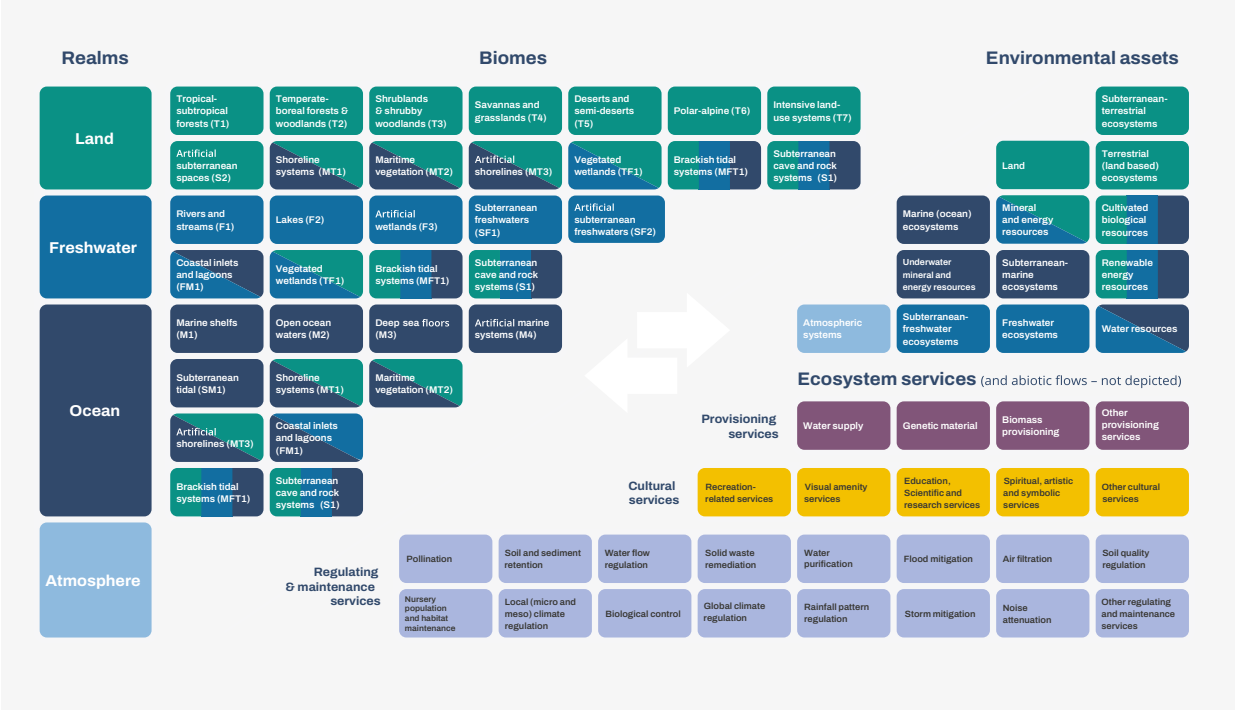
Ecosystems can be differentiated from one another by their physical composition (i.e. the vegetation types and species present) and by ecological processes. They can be categorised into different ecosystem 'types'. Ecosystem types are distinguished by a degree of uniqueness in composition, structure, and ecological processes and function.

The **IUCN Global Ecosystem Typology (GET)**[198] 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. 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.[199] 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.

198 Keith, D. A. et al. (eds.) (2020) IUCN Global Ecosystem Typology 2.0: descriptive profiles for biomes and ecosystem functional groups; Keith, D. A. et al. (2022) A function-based typology for Earth's ecosystems.

199 Keith, D. A. et al. (eds.) (2020) IUCN Global Ecosystem Typology 2.0: descriptive profiles for biomes and ecosystem functional groups; Keith, D. A. et al. (2022) A function-based typology for Earth's ecosystems.

Figure 66: Realms, biomes, environmental assets and ecosystem services



There is an important distinction between natural/semi-natural and anthropogenic ecosystem types. Many goals and targets related to biodiversity focus on maintaining and increasing the area of natural ecosystems.

Natural/semi-natural ecosystem types: Ecosystem types predominantly influenced by natural ecological processes are characterised by a stable ecological state maintaining ecosystem integrity and ecosystem condition ranges within their natural variability. 'Semi-natural ecosystems' are natural ecosystems that have retained most of their processes and biodiversity, but may be modified by human activity in composition, balance or function relative to the natural state. In some cases, semi-natural ecosystems are distinct ecosystem types, and include certain pasture and meadow ecosystems that are maintained through human management, but retain native and/or other valuable biodiversity.[200] Examples of natural and semi-natural ecosystems include those in the following biomes: primary and old growth forests (GET biomes T1 and T2); natural grasslands and savannahs (GET biome T4); natural lakes (GET biome F2) and wetlands (GET biome TF1).

Anthropogenic ecosystem types: In contrast to natural and semi-natural ecosystems, anthropogenic ecosystems are created and maintained through human interventions, i.e. human interventions are the primary determinant of the composition, structure and functioning of the ecosystem. An anthropogenic ecosystem type has typically replaced a pre-existing or antecedent natural ecosystem type, which is no longer recognisably present

200 UN et al. (2026) Compilation Guidelines for GBF Indicator A.2. Advanced draft prepared for CBD SBSTTA-28.

(although small patches/fragments and some native species may persist). Examples include urban green spaces and croplands (GET biome T4); artificial waterbodies (GET biome F3) and anthropogenic ocean systems (GET biome M4).

Ecosystem extent and ecosystem conversion

The extent of an ecosystem can be reduced:

- Through conversion to other ecosystem types (e.g. from primary forest to cropland); or
- When there is complete degradation so that it is no longer the same ecosystem type (e.g. loss of coral reef extent due to bleaching).

The extent of an ecosystem can also be increased through restoration of previously converted ecosystem types.

Ecosystem condition

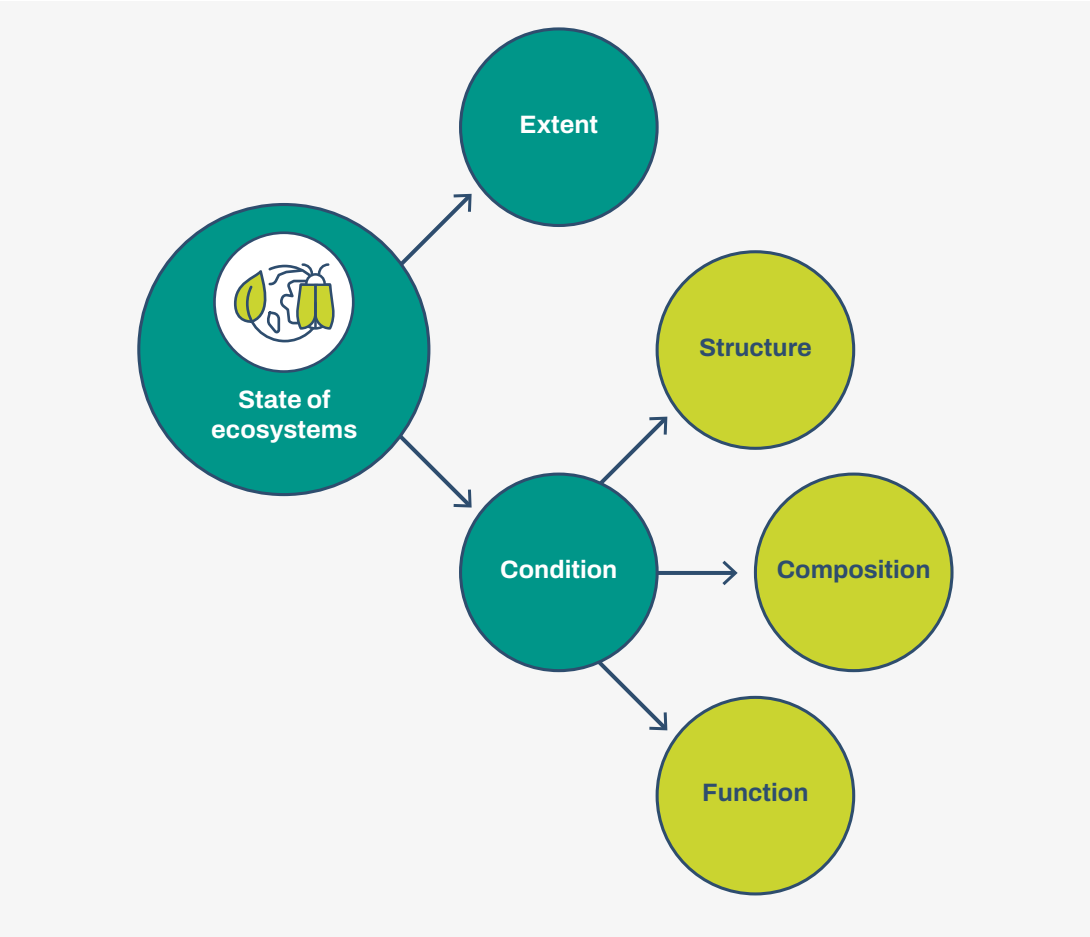
Ecosystem condition is the quality of an ecosystem that can be measured by its abiotic and biotic characteristics. It is a useful and important way of assessing the state of nature at a location, as condition underpins the ecological integrity of the ecosystem and supports its capacity to supply ecosystem services.

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, may be relatively simple to assess, measuring ecosystem extent alone gives an incomplete picture that does not account for changes in the quality of ecosystems at different stages of degradation or restoration.

Ecosystem condition components

The UN SEEA ecosystem accounting framework is the globally accepted statistical standard for ecosystem accounting. It defines six classes of measurable biotic and abiotic characteristics of ecosystems. The three core biotic components of ecosystem condition are: structure, composition and function.[201] Assessments of condition should cover characteristics across these core biotic components (Figure 67).

Figure 67: Ecosystem measurement – ecosystem condition and its biotic components in relation to state of nature



Source: UN et al. (2024) System of Environmental-Economic Accounting—Ecosystem Accounting (SEEA EA).

201 UN et al. (2024) System of Environmental-Economic Accounting—Ecosystem Accounting (SEEA EA).

Table 35: The UN SEEA ecosystem condition typology (ECT)

ECT groups and classes
Group A: Abiotic ecosystem characteristics
Class A1. Physical state characteristics: physical descriptors of the abiotic components of the ecosystem (e.g. soil structure, water availability)
Class A2. Chemical state characteristics: chemical composition of abiotic ecosystem compartments (e.g. soil nutrient levels, water quality, air pollutant concentrations)
Group B: Biotic ecosystem characteristics
Class B1. Compositional state characteristics: composition/diversity of ecological communities at a given location and time (e.g. presence/abundance of key species, diversity of relevant species groups)
Class B2. Structural state characteristics: aggregate properties (e.g. mass, density) of the whole ecosystem or its main biotic components (e.g. total biomass, canopy coverage, annual maximum normalised difference vegetation Index (NDVI))
Class B3. Functional state characteristics: summary statistics (e.g. frequency, intensity) on the biological, chemical and physical interactions between the main ecosystem compartments (e.g. primary productivity, community age, disturbance frequency)
Group C: Landscape-level characteristics
Class C1. Landscape and seascape characteristics: metrics describing mosaics of ecosystem types at coarse (landscapes, seascape) spatial scales (e.g. landscape diversity, connectivity, fragmentation)

Source: UN et al. (2024) System of Environmental-Economic Accounting—Ecosystem Accounting (SEEA EA)

Ecosystem integrity

Ecosystem integrity is a similar concept to **ecosystem condition**. It refers specifically to the degree to which an ecosystem's structure, composition and function resemble the characteristics of its natural range of variation.[202] Ecosystem integrity can be considered at a range of scales, whereas ecosystem condition refers to the condition of a defined spatial area of an ecosystem type. For example, ecosystem integrity can be assessed at broad spatial scales, giving an overview of an area containing multiple different ecosystem types. This is why two criteria for screening sensitive locations in the Locate phase of LEAP relate to ecosystem integrity (high integrity locations and areas of rapid decline in integrity).

202 UNEP-WCMC et al (2023) Measuring ecosystem condition – a primer for business.

Ecosystem connectivity

Ecosystem connectivity is a landscape/seascape-level ecosystem condition characteristic (Table 35). It can be defined as the degree to which the landscape/seascape facilitates the movement of organisms (such as animals and plant reproductive structures (e.g. pollen and spores)) and other environmentally important resources, such as nutrients and moisture, between similar habitats. It is an important aspect of ecosystem condition because maintaining connectivity supports viable populations of species and the flow of ecosystem services such as pollination and biological pest control. Connectivity is hampered by fragmentation, for example, linear infrastructure such as roads and rail lines, and deforestation for agricultural land use.[203, 204]

Connectivity assessments consider how fragmented the landscape is and apply metrics that consider the size, distance between and configuration of habitat patches. Connectivity assessments may also need to consider informal or illegal access routes, extraction tracks or transport corridors that fragment landscapes.

The figure below gives an example of ecosystem fragmentation and loss, driven by development of linear infrastructure in the landscape (in this case, roads reducing connectivity in Siberian boreal forest).[205]

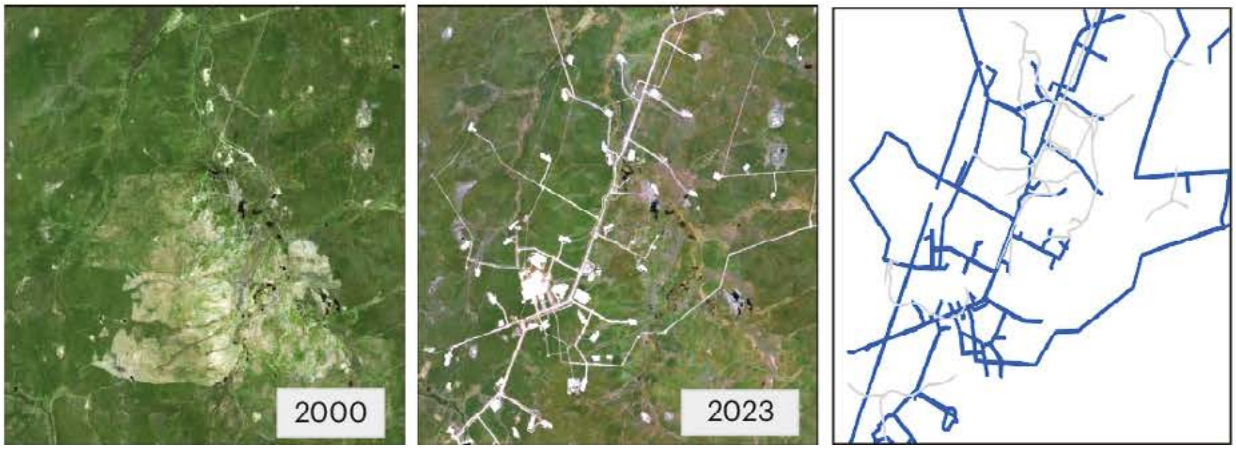
203 IPBES (n.d.) Glossary: Habitat connectivity.

204 For more information on the impact of linear infrastructure on ecosystem fragmentation, refer to the TNFD's additional sector guidance – Engineering, construction and real estate.

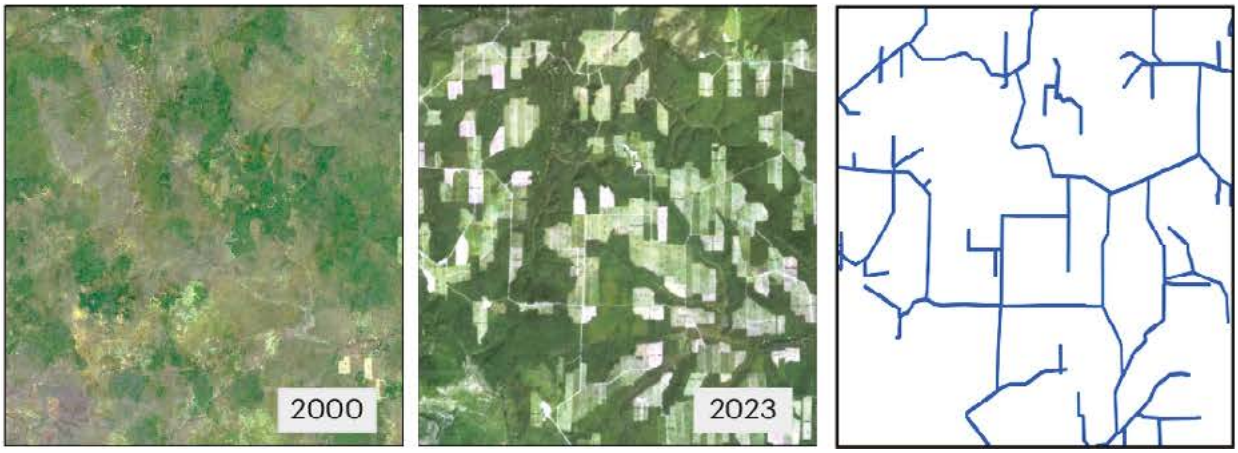
205 Zhang, Z. J., et al. (2026) Fourfold increase in fragmentation from road expansion in Siberian intact forests since 2000.

Figure 68: Satellite-observed road expansion leading to ecosystem fragmentation in Eastern Siberia from 2000 to 2023

A. Examples of road expansion for oil and gas exploration in the Sakha Republic (Siberia).



B. Examples of road expansion for clear-cut logging in Irkutsk Oblast (Siberia).



Source: Zhang, Z. J., et al. (2026) Fourfold increase in fragmentation from road expansion in Siberian intact forests since 2000.

Ecosystem threat status

Ecosystem threat status can be used to contextualise local changes in ecosystem extent and condition. For example, changes in the extent and condition of an ecosystem type that is listed as endangered could be seen as more significant than changes in the extent and condition of ecosystem types listed as of least concern (i.e. assessed as being at low risk of ecosystem collapse).

At both national and global levels, ecosystem types are assessed for their overall threat status (the risk of collapse of that ecosystem type) under the IUCN Red List of Ecosystems.[206] Ecosystem collapse can be defined as the 'transformation of identity, a loss of key defining biotic or abiotic features, and a replacement by a different ecosystem type or anthropogenic environments'.[207] Red List of Ecosystems assessments collate and analyse standardised knowledge and data about ecosystems and apply quantitative criteria to estimate the relative risk of ecosystem collapse. The criteria assign ecosystem types to ordinal risk categories that denote their threat status (e.g. endangered or vulnerable).

Assessment of ecosystem extent and condition

Ecosystem extent can be assessed using tools that can calculate area statistics from spatial data layers that depict the distribution of different ecosystem types. For guidance on how ecosystem types can be mapped and their extent calculated, see NPI's Initial Measurement Guidance: State of Nature Metrics.

When assessing ecosystem condition as part of their LEAP assessment, organisations may draw on scientific assessments of – or when feasible and appropriate themselves collect or source data on – direct ecosystem characteristics, such as canopy height and soil pH, indirect proxies, such as water stress and habitat fragmentation, or a combination of both. Structure or composition indicators may also be used as easier-to-measure proxies for ecosystem function. Structural connectivity, for example, could be used as a proxy for dispersal or the presence of certain species could be used as a proxy for natural disturbance processes.

Measures of impact drivers such as the level of pollutants or invasive alien species are also used as proxy measures for ecosystem condition where the relationship between the impact drivers and ecosystem condition are well understood.

As organisations undertaking LEAP assessments seek to understand ecosystem condition, a number of considerations are important to bear in mind. Organisations should seek to understand the underlying indicators used in any ecosystem condition data and/or analysis used to support their LEAP assessment. This includes how the composition, structure and function elements of ecosystem condition are included, and whether these are direct measures or inferred from models.

Inferred or modelled relationships between impact drivers and the state of nature produce condition estimates over large spatial scales. For example, the GLOBIO model extrapolates condition estimates globally based on studies of how particular impact drivers affect a condition measure (Mean Species Abundance) locally.[208] For organisations undertaking a

206 Nicholson, E. et al. (2023) Beyond the headline: roles of the Red List of Ecosystems in implementing the Kunming-Montreal Global Biodiversity Framework.

207 IUCN (2024) Guidelines for the application of IUCN Red List of Ecosystems Categories and Criteria : version 2.0.

208 Schipper, A. M. et al. (2020) Projecting terrestrial biodiversity intactness with GLOBIO 4.

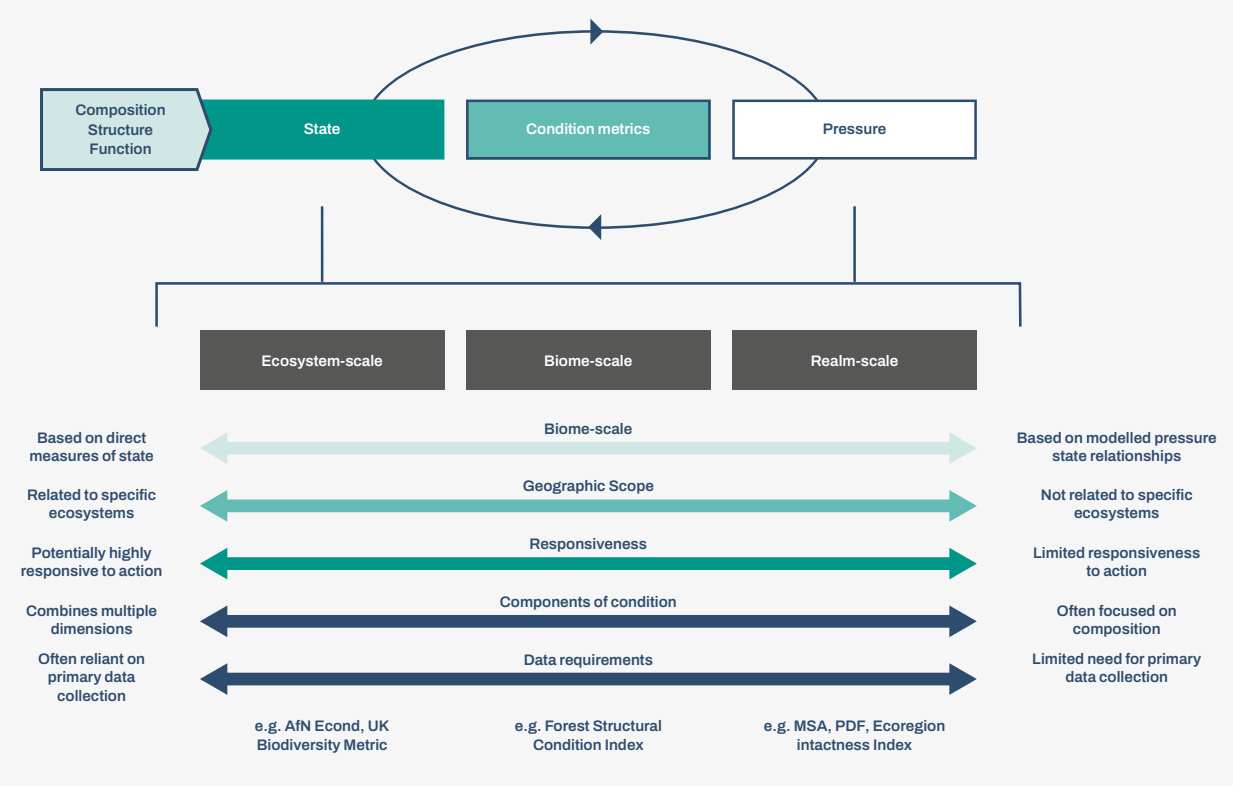
LEAP assessment, there are trade-offs to consider when using these approaches between their utility in assessing condition at scale, and their lower accuracy and precision than direct measurement of condition variables. A LEAP assessment team should be particularly cautious if a small number of observed data points are used as the basis for inferring ecosystem condition over very large areas.

Life Cycle Analysis (LCA) and other footprinting tools often use these impact driver-state models to infer how impact drivers associated with a company's activity translate to reductions in ecosystem condition. These tools and approaches have particular utility in identifying potential impact 'hotspots' within value chains in the Locate and Evaluate phase, but do not themselves measure the condition of different ecosystems in different locations, which is also a focus of the Evaluate phase (E3). Further guidance on the use of footprinting tools can be found in the TNFD discussion paper on biodiversity footprinting approaches.[209]

It is important for a LEAP assessment team to consider the level of specificity required to generate meaningful insights about ecosystem condition as part of the overall evaluation of dependencies and impacts in specific locations. Different ecosystem condition datasets and measurement methodologies provide measures of condition at different levels of specificity. For example, methods providing measures of the condition of individual ecosystem types are often based on the measurement of direct state variables that are specific to particular ecosystems. In contrast, metrics applicable to an entire realm (Level 1 in the GET) are not usually specific to individual ecosystems and rely less on primary data collection and more heavily on models.

209 TNFD (2024c) Discussion paper on biodiversity footprinting approaches for financial institutions.

Figure 69: The broad characteristics of different ecosystem condition datasets and measurement methods at the ecosystem, biome and realm scale of specificity



Identification of relevant condition variables when undertaking direct measurement

For an organisation commissioning scientists to undertake, or itself undertaking, direct data collection at locations of interest to its LEAP assessment, it is important to consider the selection of relevant characteristics of structure, composition and function for that biome/ecosystem type. This could include identifying characteristics that have a particularly important role in delivering ecosystem services. For example:

- In forest ecosystems, tree species richness has been shown to correlate to enhanced carbon sequestration, carbon storage, water supply, water regulation and soil conservation at the watershed level;[210] and
- In mangrove ecosystems, vegetation height and density influence their frontal surface area and ability to absorb energy from waves.[211] These structural characteristics therefore influence the ecosystem service of storm surge attenuation.

210 Zhang, J. et al. (2026) Ecological multifunctionality of watersheds increases with tree species richness.

211 Van Hespen, R. et al. (2023) Mangrove forests as a nature-based solution for coastal flood protection: Biophysical and ecological considerations.

It could also involve identifying biophysical features that are particularly relevant for the integrity and functioning of that specific ecosystem type. For example:

- **Coolibah-Black Box woodland ecosystems in Australia** depend critically upon the water table. Ecosystem condition metrics based only on species composition might not detect abiotic ecosystem components which could be central to dependencies;
- **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 the probability of ecosystem collapse 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.

The Red List of Ecosystems standard provides a framework for selecting relevant condition indicators for a given ecosystem type.[212] Referring to methodologies underpinning published ecosystem threat status assessments can be a useful source of information, as well as the underlying datasets for measuring the condition of specific ecosystem types.

Consideration of a reference condition

The condition of an ecosystem is measured in terms of the difference between its current condition and its reference condition. A reference condition is the condition against which past, present and future ecosystem condition (or other aspects of the state of nature) is compared in order to measure relative change over time.[213] In other words, it is the state against which characteristics of an ecosystem are compared to in order to assess the condition of the ecosystem at a point in time.

This is different from a baseline, which is the starting point or benchmark against which changes in the state of nature can be compared in relation to the organisation's activities.

A LEAP assessment team will need to consider the reference condition used as part of the analysis of ecosystem condition and the dependencies and impacts of the organisation in that context. The selection of reference conditions can affect the outcome of ecosystem condition assessments.

A particularly important consideration is the selection of reference conditions for anthropogenic ecosystems. Comparing anthropogenic ecosystems using a contemporary

212 Coverage of the Red List of Ecosystems is not yet universal. Nicholson, E. et al. (2023) Beyond the headline: roles of the Red List of Ecosystems in implementing the Kunming-Montreal Global Biodiversity Framework.

213 UN et al. (2024) System of Environmental-Economic Accounting—Ecosystem Accounting (SEEA EA).

or least-disturbed approach to reference conditions would likely still be comparing to an anthropogenic reference (e.g. cropland being compared to 'best attainable' cropland). This may be useful when considering aspects of sustainable land management and ecosystem services. However, using a historical reference condition may mean it is compared to a natural ecosystem reference condition. This would result in the current anthropogenic system being assessed as much lower condition. This may be most appropriate when assessing a comparable 'biodiversity footprint', when it is important to capture the full extent of biodiversity loss reflected in the current system. For more information, see UN SEEA Ecosystem Accounting (Appendix A5.2, including table A5.2.1).[214]

In either case, reference conditions should ideally 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.

For measurement guidance on ecosystem extent and condition, organisations can refer to NPI's Initial Measurement Guidance: State of Nature Metrics. Resources to support application of state of nature metrics in the ocean are available through Accelerating Critical Transformations (ACT) for the Ocean.

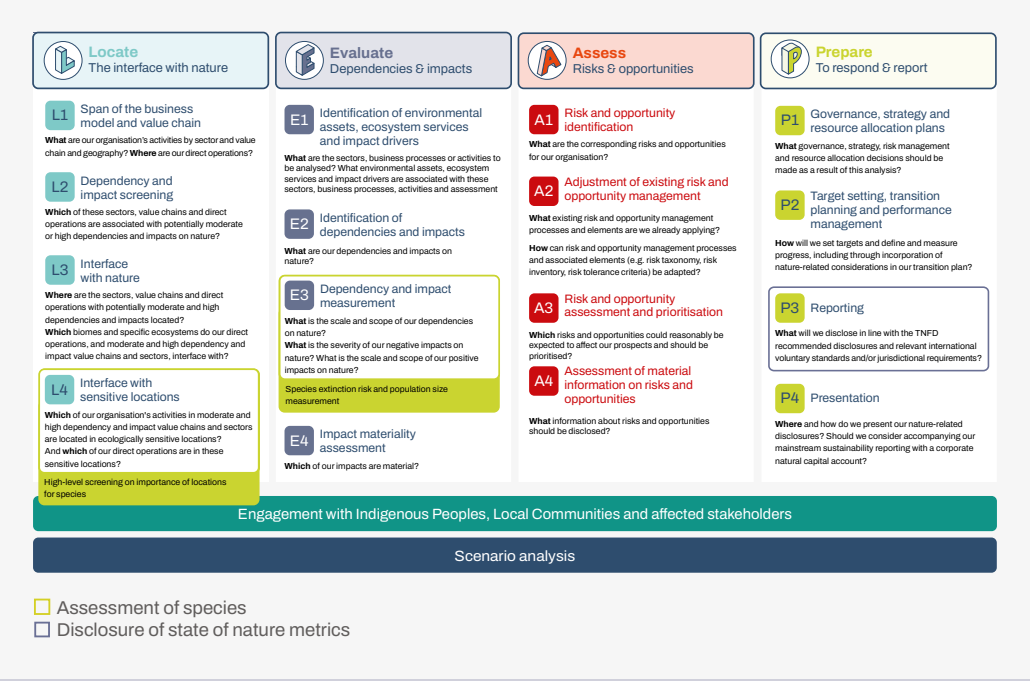
Assessing species extinction risk and species population related metrics

What is involved for a LEAP assessment: Understanding your organisation's potential contribution to species extinction risk, based on both the location of activities and the impact drivers associated with them, is part of the Locate and Evaluate phases of LEAP. Insights from your consideration of species extinction risk and species populations in assessment locations can support your assessment of material dependencies and impacts in the Evaluate phase of LEAP, and of risks and opportunities that could reasonably be expected to affect the organisation's prospects in the Assess phase of LEAP.

To complete your LEAP assessment to support TNFD-aligned disclosures (specifically Strategy A and Metrics and Targets B), you will need to reference species extinction risk metrics for material locations. To support TNFD-aligned disclosure for Strategy D, you will need to assess species extinction risk to identify sensitive locations in direct operations and, where possible, in upstream and downstream value chains.

214 UN et al. (2024) System of Environmental-Economic Accounting—Ecosystem Accounting (SEEA EA).

Figure 70: Assessment of species, and preparation for disclosure, within the LEAP approach.



Introduction

A species is the basic taxonomic rank used to classify different organisms.

This section outlines key concepts for assessing species, including species extinction risk related metrics.

Understanding 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 of 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[215] and current trends signal an imminent 'sixth mass extinction'.[216, 217]

Global extinction of a species is irreversible. However, global extinctions are typically preceded by local extinction of species from sites, regions or countries.

In the Kunming-Montreal Global Biodiversity Framework, 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.'

The extinction risk of any given species is assessed by scientists based on aspects of their range, population trends and threats, and a threat status is applied to that species. Therefore, it is not the threat status of species that is assessed directly as a measure of an organisation's dependencies, impacts, risks and opportunities. Instead, species extinction risk related metrics (Table 36) are used to reflect:

- The significance of locations in terms of their contribution to overall stocks of species; and
- The influence that impact drivers such as land use change (both negative and positive) at these locations may have on species persistence. Species extinction risk metric values for a location will be influenced by impacts happening elsewhere in species' ranges (for example, for migratory birds), even if all conditions in that location have stayed the same.

Understanding range size and species habitat area

Species habitat area refers to the total area of suitable habitat available to a species, across its geographic range. This is typically smaller than the range size of a species as it excludes areas that cannot presently function as habitat. For some species, total species habitat area may be large and widely geographically distributed. For others, however, the total species habitat area may be much smaller and geographically restricted. Therefore, some locations may hold portions of the habitat areas of many species (i.e. supporting a high number of species) and some locations may hold high proportions of an individual species' total habitat area (i.e. supporting endemic species).

215 Díaz, S. et al. (2019) Pervasive human-driven decline of life on Earth points to the need for transformative change.

216 Barnosky, A. D. et al. (2011) Has the Earth's sixth mass extinction already arrived?

217 Curnick, D.J. et al. (2022) SmallSats: a new technological frontier in ecology and conservation?

Locations with high proportions of species habitat area have elevated significance in terms of species persistence and potential extinction risk. Changes in area of habitat (e.g. through land-use change) can reflect an organisation's impacts on species extinction risk.[218, 219]

Understanding how scientists assess species threat weighting

The IUCN Red List is the global standard for providing expert-led global threat assessments for species. 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'. Many species extinction risk metrics weight habitat area measurement by species threat status.

For a LEAP assessment team assessing location sensitivity as part of the Locate phase, this means that locations supporting a high richness of threatened species are weighted higher than those supporting a high richness of non-threatened or common species.

While habitat loss is a main driver of extinction risk, species in specific locations may face additional threats such as nutrient pollution or direct exploitation (for example, poaching as part of illegal wildlife trafficking). When species extinction risk metrics incorporate threat weightings, this can help to identify these other specific threats that are impacting the species in specific locations. Actions that your organisation may be able to take at those locations to reduce these impacts and threats can contribute to a reduction in species extinction risk.

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

219 UN et al. (2024) System of Environmental-Economic Accounting—Ecosystem Accounting (SEEA EA).

Table 36: Example species extinction risk related methods and datasets.

Species Threat Abatement and Restoration (STAR)	Uses IUCN Red List data and estimates a location's potential to contribute to a reduction in global species extinction risk by abating relevant threats. Available for commercial use through IBAT.[220]
Land-cover change Impacts on Future Extinctions (LIFE)	Provides quantitative estimates of the marginal changes in the expected number of extinctions (both increases and decreases) caused by converting remaining natural vegetation to agriculture and restoring farmland to natural habitat.[221]
SAVE Species	An area-normalised measure of the global priority to reduce specific pressures on species to help prevent extinction, considering both Global Vulnerability – the concentration of globally at-risk species – and Local Vulnerability – a measure of the critical need to reduce specific local threats to prevent species extirpation. The metric can be disaggregated by individual species and pressure and aggregated across spatial scales. Available for commercial use through Map of Life Solutions.
Potentially Disappeared Fraction (PDF) and Global Extinction Probability (GEP)	PDF is a measure of local extinction used in LCA methodologies, 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.

Understanding species population size

In some contexts, it can be useful to understand changes in the local population size of specific priority species in order to measure an organisation's contribution to species persistence more directly.

In addition to threatened species, local species population size measurements of more common species can also be useful in assessing the state of nature. For example, measuring:

- Species underpinning the supply of ecosystem services on which the organisation depends, such as pollinators (as part of dependency measurement in E3);
- Indicator species of ecosystem condition; and
- Species that hold particular value to Indigenous Peoples, Local Communities and other stakeholders.

220 IUCN (2025) IUCN RHINO (Rapid High-Integrity Nature-positive Outcomes) approach, Technical Source Document 2.0.

221 Eyres et al. (2025) LIFE: A metric for mapping the impact of land-cover change on global extinctions.

State of nature assessment at different spatial scales

The state of nature and changes to the state of nature can be assessed at different spatial scales and should reflect the scale at which dependencies and impacts occur. Measuring at different spatial scales provides different, but complementary information on an organisation's nature-related dependencies, impacts, risks and opportunities. It is important for a LEAP assessment team to understand the data and analysis needed at different spatial scales to inform your assessment and decisions based on your LEAP assessment (including what is material and needs to be disclosed).

- **Site level** refers to the direct spatial boundaries of an area in an organisation's direct operations or value chain, such as a farm, ranch, mine site, infrastructure development, factory, office, fishery operation or shipping route. Measurements at site level can reflect the state of nature that may be most directly influenced by an operation's activities.
- **Landscape/seascape level** refers to defined geographic areas with common ecological and socioeconomic characteristics. They may be delineated based on watersheds, ecological factors, jurisdictional boundaries, company sourcing areas, areas of influence[222] or in other ways. Measurements at landscape/seascape level can reflect how the wider state of nature is both influenced by, and influences, activities. Many nature-related issues emerge at these wider landscape/seascape scales, and landscape/seascapes can often be a relevant scale for both action and understanding state of nature outcomes. Connectivity is a particularly important consideration for landscape/seascape-level assessment. Another way that landscape/seascape scales can be defined is through understanding relevant servicesheds. A serviceshed is defined as an area that supports ecosystem service production for a specific beneficiary that has physical and institutional access to the service. Servicesheds are characterised by three components: 1) ecosystem service supply; 2) institutions with formal or informal legal access; and 3) physical access.[223] For example, the serviceshed for crop pollination is the area around farm fields of interest within the flight range of native pollinators. For water supply services, the serviceshed is the catchment area that delivers water to a population or beneficiary of interest that has legal and physical access to the source.

222 See the Locate chapter for information on area of influence.

223 Tallis, H., et al. (2015) Mitigation for one & all: An integrated framework for mitigation of development impacts on biodiversity and ecosystem services; Tallis, H., and Polasky, S. (2009) Mapping and valuing ecosystem services as an approach for conservation and natural- resource management.

Box 52: Examples of decisions on the spatial scale of state of nature metrics

A site-based extractives company assesses state of nature metrics within its site boundaries and area of influence. It uses these measurements to evaluate progress towards site-level management objectives. To provide wider context for these site level changes, it assesses changes in the state of nature at the landscape level. This reveals that the site has a particularly important role in maintaining ecosystem connectivity at the landscape level.

A food manufacturing company assesses changes in forest cover within key cocoa sourcing landscapes. Landscape-level changes are relevant to the organisation's nature-related issues, as deforestation-linked land degradation may impact cocoa output. The company uses this information to contextualise assessment of its sourcing strategy and engage in landscape and jurisdictional approaches to improve the state of nature, while managing related risks and opportunities to the company.

A shipping company assesses where its routes cross ecologically sensitive locations and how its activities could be contributing to changes in the state of nature at these locations (e.g. through animal collisions). It uses this information to contextualise disclosures on its nature-related impacts and risks, and its route-planning strategy.

Guidance on state of nature in the context of disclosure

Building on the guidance above about how to incorporate state of nature analysis into a LEAP assessment, this section outlines considerations when incorporating state of nature information into disclosures that are aligned to the TNFD's recommended disclosures.

State of nature disclosures are outputs from two components of LEAP:

- Assessments of the organisation's interface with sensitive locations in L4; and
- Measurement of changes in state of nature in E3.

The state of nature outputs produced in both these components of a LEAP assessment can be sources of information for disclosures following the TNFD's recommended disclosure Metrics and Targets B, as well as for global nature-related disclosure standards such as the ISSB IFRS Standards or the GRI Biodiversity: 101 Standard, and for relevant jurisdictional standards such as the European Sustainability Reporting Standards (ESRS).

Following the general disclosure principle of materiality, state of nature metrics should be disclosed only for those locations deemed material as a result of a LEAP assessment. Under the TNFD recommendations, state of nature metrics are disclosed following Metrics and Targets B.

- The TNFD recommends disclosing specific state of nature metrics, including:
  - Core global metrics on a comply or explain basis:

  - Ecosystem extent (C5.0);
  - Ecosystem condition (C5.1); and
  - Species extinction risk (C5.2).
- Additional global metrics on species population size (A5.0); and
- Additional metrics on ecosystem services that an organisation has an impact or depends on (A6.0 and A6.1).

For full details of the TNFD recommendations for disclosure of state of nature metrics, please refer to the TNFD recommendations, particularly Metrics and Targets B and general requirement 3 on the location of nature-related issues.

Assessment of state of nature metrics in L4 of the Locate phase and E3 of the Evaluate phase in a LEAP assessment can also help to identify sensitive locations in an organisation's direct operations and, where possible, its upstream and downstream value chains. This can inform reporting aligned with the TNFD's recommended disclosure Strategy D.

State of nature measurement guidance for disclosure

In drawing on LEAP assessments when preparing disclosures on state of nature metrics, it may be useful to refer to the Nature Positive Initiative's Initial Measurement Guidance: State of Nature Metrics, including the measurement specification tables. These give guidelines for measuring state of nature metrics at different levels of granularity, from a preparatory level through to higher granularity levels. The measurement specifications suggest characteristics of the underlying data, including thematic coverage, spatial resolution and the degree of ground-truthing, as well as reporting outputs that reflect different levels of granularity.

Use of footprinting tools and LCA methods in disclosures

As outlined above, many footprinting tools and LCA methods model the potential impacts of activities and associated impact drivers, such as land-use change, on state of nature variables. While these methods can be used by organisations to assess and evaluate the potential impacts of value chains and identify impact hotspots using heat mapping, they are not methods for measuring a baseline and changes in the state of specific ecosystems at specific locations.

The TNFD recommends disclosing specific state of nature metrics (see Annexes 1 and 2 of the TNFD recommendations) over outputs from model-based footprinting tools or modelled impacts from LCAs. Organisations that wish to report outputs from footprinting and LCA tools can do so, but these should not be a substitute for the use of the TNFD's recommended disclosure metrics on the state of nature in specific locations.

Scale of measurement

State of nature metrics can be disclosed following the TNFD's recommended disclosure Metrics and Targets B at different geographic scales, including site or landscape/seascape scale or larger geographic scales (where the organisation discloses location sensitivity values), depending on what scale of information is proportionate for report preparers and decision useful for report users in relation to the nature-related issues. Decisions on the appropriate scale/s for disclosure can be informed by considerations of data availability, proportionality for different aspects of the value chain for report preparers, and the scale at which relevant nature-related issues manifest.

For example, a company with direct operations that have site-based dependencies and impacts that result in material risks and opportunities that could reasonably be expected to affect the organisation's prospects may disclose both site-level change and landscape-level change for context, reflecting decision-useful information for report users, data availability, proportionality and the spatial scale of its dependencies and impacts. However, for its key upstream supply chain locations, the company uses landscape/seascape level change for disclosure because of limitations in data availability and the fact that its nature-related issues manifest at the sourcing-region level.

Location sensitivity analysis (L4) supporting disclosures

The TNFD's location sensitivity criteria, outlined in L4 of the Locate phase, support Strategy D and Metrics and Targets B disclosures. For most organisations, these metrics are typically sourced from globally available datasets (see Table 6 in L4 for the TNFD's suggested list of example reference datasets to identify sensitive locations).

These state of nature datasets are used to provide a 'snapshot' screening of the significance and integrity of nature at different locations to help identify priority locations and support Strategy D disclosures. By inferring potential changes in the state of nature at a specific location, they also provide context to measures of impact drivers and dependencies in the Evaluate phase. They can therefore be disclosed under Metrics and Targets B for material nature-related impacts and dependencies.

However, as location sensitivity is often determined with global data layers, which have low spatial resolution and only show a snapshot of ecosystem condition or integrity, or species extinction risk at a specific time (rather than change against a baseline), these screening values are unlikely to be sufficient for measuring site or landscape/seascape-level change in relation to measuring impacts and dependencies when using the state of nature disclosure metrics. Nevertheless, in iterative cycles of LEAP assessments, the state of nature metrics calculated in the Evaluate phase or for disclosures can be input back into the screening analysis in L4 to validate or enhance its robustness and support change detection over time.

Box 53: Hypothetical disclosure of state of nature metrics from location sensitivity analysis (L4)

A food and beverage company with global value chains has identified five sourcing regions as priority locations, from which it sources commodities from multiple farms. Given identified dependencies on water supply, water purification and water flow regulation, the company uses water basins to define relevant measurement boundaries in its context.

The company has integrated spatial analysis of the state of nature into its supply chain strategy using screening datasets,and discloses the TNFD recommended disclosure metrics on ecosystem condition and species extinction risk screening values using these analyses. It discloses the screening values for ecosystem condition and species extinction risk, alongside descriptors from its location sensitivity assessment (e.g. very high/very low/medium). The company has used water stress analysis in its determination of location sensitivity, which found that Location 1 had very high water stress.

The company is working towards being able to measure and disclose changes in ecosystem extent and condition metrics in the landscape (as landscape context) against a baseline to provide a more granular disclosure of emerging dependencies and impacts on nature, and associated risks and opportunities to the company.

Key information gained:

- Location 1 likely has elevated dependency-driven risk. This is because the low ecosystem integrity of the landscape means it likely has reduced capacity for regulating water supply. Separately, analysis of water stress criteria identifies that the landscape is water stressed.
- Location 1 also has high significance for global species extinction risk, meaning that impact drivers in this location likely have large negative impacts on species persistence.

Use of information:

- The report preparing company uses ecosystem integrity and species extinction risk disclosure to contextualise disclosure of its risk management strategy (Risk and Impact Management B).
- Report users, the company's investors, use the location sensitivity disclosures to refine their engagement with the company, focusing on its management of supply chain impacts and dependencies in the highest priority locations.

Table 37: Example state of nature related location sensitivity at water basin scale

Priority location	Ecosystem condition at water basin scale (average ecosystem integrity)	Species extinction risk (e.g. STAR values) at water basin scale
Location 1	Very low (0.2)	Top 10 percentile of global values
Location 2	Very high (0.9)	Lowest 10 percentile of global values
Location 3	Medium (0.45)	Top 30 percentile of global values

Dependency and impact measurement (E3) supporting disclosures

Measurement of both dependencies and impacts on nature generates state of nature metrics as part of dependency and impact pathway analysis (see E3 for full guidance on this). When measuring change in the state of nature as part of these pathways, metrics would reflect change against a baseline at site, landscape/seascape or other relevant geographic scales.[224]

In drawing on these metrics for disclosure aligned with the TNFD recommendations, it is relevant to consider:

- Reporting information at the scale/s that best reflect the identified material nature-related dependencies, impacts, risks and opportunities (see phases E4 and A4 of the LEAP assessment and the TNFD recommended disclosures Metrics and Targets B and Strategy A);
- Reporting nature-related information at the level of aggregation and disaggregation that meets the TNFD general requirement 3 (see General Requirement 3 in Section 3.2 of the TNFD recommendations);
- Applying best available data, including proxy and modelled data where this is appropriate (e.g. for location sensitivity disclosure), and working towards higher granularity over time (see Box 5 in the TNFD recommendations);

224 On baselines for measuring changes in the state of nature at site and landscape/seascape levels, NPI's measurement guidance advises:
- Organisations to use a baseline year of 2020 in the context of NPI's focus on the definition of Nature Positive, and to align with the goals and targets of the Kunming-Montreal GBF.
- If the data needed for a particular metric is not available then a later baseline year can be used.
- In situations where a significant impact on nature occurred just before 2020 (e.g. a new mine site began operations in 2019 or 2020 saw a significant wildfire event), companies should use a pre-impact baseline to ensure credibility.
- Organisations should give a rationale for baseline selection.

- Stating whether locations with material dependencies and impacts (for which dependency and impact metrics would be reported, under recommended disclosure Metrics and Targets B), are in an organisation's direct operations, or upstream or downstream in the value chain. (Note that the TNFD's recommended disclosure Strategy D recommends that organisations disclose priority locations in their direct operations, and, where possible, in upstream and downstream value chain(s)); and
- Reporting metrics against a clear and transparent baseline where possible (see the TNFD's recommended disclosure Metrics and Targets B).

Box 54: Hypothetical disclosure of change in state of nature (E3)

An extractives company has identified 12 sites that have potentially high dependencies and impacts. For each site, it first maps and lists the different ecosystem types present (both natural/semi-natural and anthropogenic).

From this basemap, the company then calculates the extent (area coverage) of the different ecosystem types. It discloses the changes in extent of the different natural/semi natural ecosystems for material nature-related issues.

The extent measurements of the different ecosystem types then form the basis for disclosing on changes in ecosystem condition. The company measures changes in the area of the different ecosystem types that fall under different condition classes.[225]

Key information gained

- Site 1 has had a negative impact on total forest extent and forest condition because of the expansion of industrial land. There has been no change in the baseline extent and condition of grassland ecosystems.
- Habitat loss is a large driver of extinction risk for the species present at the location, meaning these impacts also have a large impact on species persistence.

Use of information

The report preparing company uses the disclosure as part of the supporting evidence for its reporting that site-level targets of no net loss for grassland ecosystems have been met.

Report users, the company's investors, use the disclosures to assess the level of transition risk associated with the company's operations, focusing on risks associated with the reduction in forest extent and condition with a large impact on species persistence.

225 Disclosure of changes in ecosystem condition at site and landscape levels can cover condition of both natural/semi-natural and anthropogenic ecosystem types.

Table 38: Example measurements to support disclosure metrics of changes in ecosystem extent and condition at site level[226]

Site 1 – Ecosystem extent and condition				
Ecosystem functional group	**Metric**	**Area in baseline year x (ha)**	**Area in reporting year y (ha)**	**Accompanying notes on changes**
Deciduous temperate forest	Ecosystem extent	100	50	Converted to mining land use in year xxx.
	Condition class – high	80	0	
	Condition class – medium	10	20	
	Condition class – low	10	30	
Temperate subhumid grassland	Ecosystem extent	80	80	No change in grassland extent.
	Condition class-high	80	80	

226 Note: this table is an illustrative example of how measurements may be organised and presented in relation to disclosure, and does not reflect a prescriptive approach to disclosing state of nature metrics.

Annex 3: Valuation of dependencies and impacts

Introduction

This annex provides an overview of relevant guidance for organisations in the Natural Capital Protocol on valuation of dependencies and impacts on nature. There are signposts to the Natural Capital Protocol[227] 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 organisations 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 an organisation's dependencies and impacts on nature can help it to assess the relative significance of risks and opportunities to determine how it could affect an organisation's prospects.

Table 39 shows the elements of the LEAP approach where valuation is relevant.

Table 39: 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.

227 Capitals Coalition (2016) Natural Capital Protocol.

TNFD LEAP approach component	Relevance of valuation
A3: Risk and opportunity measurement and prioritisationt	Valuation can help determine the severity of nature-related risks and opportunities and prioritise them. Valuation of impacts on society can be used to help identify and prioritise risks and opportunities that result directly from impacts on society 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 guidance, methods and standards exist, the TNFD integrates these instead of developing new approaches. For the valuation of dependencies and impacts, the TNFD recommends that organisations use the Natural Capital Protocol and its guidance on valuation techniques.

When organisations 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 organisations undertake valuation when applying the TNFD's LEAP approach, they are encouraged to follow five steps:

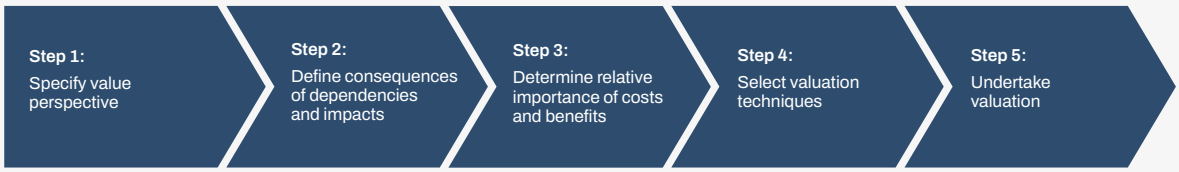
Step 1	Specify the value perspective (i.e. to business or society). Be as specific as possible. This will affect the valuation method used and the final valuation.
Step 2	Define the consequences of dependencies and impacts on nature (for business and/or society), completed in the Evaluate phase of the 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 A3 component of the LEAP approach: Risk and opportunity materiality assessment.

Table 40 provides a summary of the key features (including objectives, outputs and data requirements) of each step of valuation.

Table 40: 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 in nature • Value factors[228]

Figure 71: Five steps for valuation



228 Value factors translate measurements of impact drivers or the flow of ecosystem services and disservices that come from natural capital into qualitative, quantitative or monetary values. Developed based on empirical assessments and studies, these factors allow organisations to understand how they create, preserve or erode value across all the capitals – natural, human, produced and social capital – providing context for strategic decision making.

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 to better understand each perspective.

An example of starting from the business value perspective is focusing on the financial implications to the 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 41 provides additional advice on the selection of an appropriate value perspective.

Table 41: 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 organisation and thus the value at risk. • Assess organisation exposure to risks arising from its impacts and/or dependencies. • Minimise organisation expenses or liabilities and maximise organisation revenues/receivables. • Communicate to shareholders, budget control staff, management and creditors.
Societal value	• Understand the significance of the organisation's 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, particularly the organisation's future impacts on society, enables all potential business values to be considered.

Source: Adapted from Accounting for Sustainability (2015) Essential Guide to Natural and Social Capital Accounting.

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 an organisation provides information to assess the severity 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 profitability. They can include less tangible impacts that may affect financial performance, such as reputational damage (or benefits), delays in permitting, or the relative ease or difficulty of recruiting or retaining employees. Impacts on the business may relate to the cost of production inputs (e.g. the purchase costs of water and timber), and the cost and/or benefit of outputs (e.g. an 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. the 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 reduce the amount of water 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 (from 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 or 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 increase 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 it may have far greater societal impact in five or 10 years as a result of population increase, climate change and other pressures on resources. 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 the TNFD guidance on scenario analysis to help with this.

c) Consequences of dependencies on nature (for business)

Potential costs and benefits for the organisation 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'.

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, reducing the benefits they provide, such as flood protection. This may lead to increased flood risks or a need to spend money replacing the flood protection services that these ecosystems once provided.

Extraction of natural resources may also lead to impacts on society as others depend on those resources and other ecosystem services may be affected.

The consequences of the organisation's dependencies for the business can provide useful information to assess the severity 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 LEAP 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 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, an organisation may need to consider the extent of its 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.

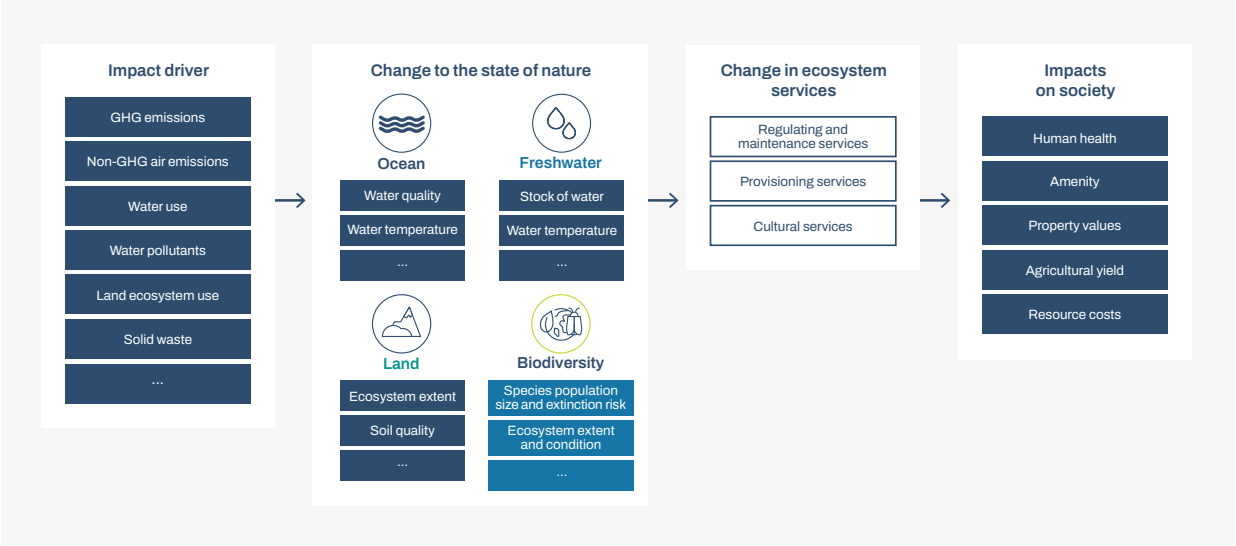
Box 55: Assessing value to society through impact drivers and impact pathways

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. The Impact Value Standards Board (IVSB) is developing a common and comprehensive Impact Valuation Methodology for value creation, including standardised pathways and value factors for environmental, human and social impacts.[229] When assessing the 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 and included in IVSB's Global Value Factor Database (GVFD) include greenhouse gas (GHG) emissions, air pollution, water consumption, water pollution, land use and conversion, and waste.

229 The Impact Value Standards Board (IVSB) is hosted by the Capitals Coalition and serves as an independent governing body dedicated to building international consensus and establishing a global common baseline for impact valuation. IVSB's core foundation is building on the legacy of the International Foundation of Valuing Impacts. The EU-funded Transparent project has developed impact pathways as part of the Transparent methodology and guidance. Transparent Project (2023) Standardized Natural Capital Management Accounting: A methodology promoting the integration of nature in business decision making.

Figure 72 shows the impact pathways that have been described within the Transparent methodology and guidance. Other relevant impact drivers should also be considered.

Figure 72: The Transparent methodology



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.[230] 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.[231] 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 42 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.

Table 42: 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 or 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.

230 TEEB (2010) The Economics of Ecosystems and Biodiversity: Ecological Economics Foundations.

231 TEEB (2011) The Economics of Ecosystems and Biodiversity in National and International Policy Making.

Technique	Description
Quantitative valuation	
Structured surveys*	Structured surveys or questionnaires can be used to elicit quantitative values, such as one-to-one surveys that employ 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 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. The scoring and weighting is effectively the valuation technique. Also considered an analytical tool to bring together an assessment of different parameters.
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).

Technique		Description
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).
Stated preference	Contingent valuation	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	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.

Technique	Description
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 WBCSD et al. (2011) Guide to Corporate Ecosystem Valuation; WBCSD (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 56: Value transfer

A primary valuation based on detailed information specific to the study site will produce the most accurate results. However, it is often 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.[232] 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.

232 Liu, S. et al. (2012) Environmental Benefit Transfers of Ecosystem Service Valuation.

Various factors will influence which valuation techniques are best for an 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).

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 57: 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 contributing to the standardisation of natural, social and human capital valuation and accounting.

Some useful materials on valuation approaches and data available on the Capitals Coalition website include:

- Global Value Factors Database (GVFD) – This is a centralised resource for environmental and social value factors spanning 218 countries and over 150 impacts, built from all environmental and social topic methodologies at every stage in their due process. It is maintained by the Impact Value Standards Board (IVSB), which is developing a common and comprehensive Impact Valuation Methodology for value creation, including standardised pathways and value factors for environmental, human and social impacts. The impact drivers commonly assessed and included in the Global Value Factors Database (GVFD) are greenhouse gas (GHG) emissions, air pollution, water consumption, water pollution, land use and conversion, and waste. IVSB's webpage also includes a non-exhaustive list of other providers of publicly available value factors; and.
- Governance for Valuation – This resource was developed to increase transparency and consistency in valuation. It provides technical guidance needed on a common structure to build confidence in valuation and ascertain if provided capitals information is suitable for the intended use, given the current state of the market.

Annex 4: Information on invasive alien species (IAS) in the TNFD framework

Introduction

Invasive alien species (IAS) are one of the five drivers of nature change identified by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). Through their activities and value chains, organisations can create or amplify the pathways through which species are transported, introduced and spread. IAS-related changes to the state of nature can affect ecosystem services on which the organisation or wider society depend.

IAS-related dependencies and impacts on nature can be a potential source of nature-related risks for corporates and financial institutions. Conversely, IAS removal can give rise to potential nature-related opportunities. IAS are therefore an important consideration in an organisation's assessment of nature-related issues using the LEAP approach when considering an impact materiality and/or financial materiality lens.

This annex:

1. Provides further information on IAS in the context of assessing organisations' nature-related issues using the LEAP approach, including the rationale for IAS assessment, the financial and economic relevance of IAS, biological invasion pathways and how IAS can affect the state of nature, ecosystem services, and resulting risks and opportunities; and
2. Guides organisations on the assessment and disclosure of IAS-related information, including application of the TNFD's recommended IAS metrics, worked examples and supporting resources.

This guidance has been developed by the TNFD to support organisations with IAS-related assessments using the LEAP approach and with disclosure aligned with the TNFD's core global disclosure metric on IAS. It was developed:

- With support from TNFD knowledge partners, IUCN and Fauna & Flora, which lead the Invasive Alien Species Collaborative Initiative;
- With insights from 10 corporates and financial institutions that have pilot tested the TNFD core global disclosure IAS metric; and
- Informed by consultation workshops with academic IAS experts, including authors of the IPBES IAS assessment.

The financial materiality and economic costs of IAS

In 2019, the global economic costs of invasive alien species were estimated to have reached around USD 423 billion a year, highlighting the economic consequences of biological invasions worldwide.[233] Recent evidence from the InvaCost database, a comprehensive global compilation of invasion-related economic costs, estimates that biological invasions generated at least USD 1.7 trillion in reported costs globally between 1970 and 2019. Reported costs have increased substantially over time, with analyses suggesting a roughly four-fold increase per decade. Available estimates are also considered conservative, as many impacts remain undocumented or unquantified, particularly in developing economies and for less-studied taxa.[234]

While the consequences for economies and societies can be significant, the consequences for an individual business can be dramatic, depending on the spread vector of the IAS and the availability of proven response options to mitigate that risk. In 2025, the University of Oxford, TNFD and Global Canopy published an evidence paper on the financial effects of nature-related risks and a database of over 600 examples.[235] Examples of the effects of physical risks related to alien and native invasive species include:

- Citrus greening, spread by the invasive Asian citrus psyllid, has devastated orange groves in Florida, cutting production by around 90% and causing tens of billions of US dollars in losses. Citrus growing companies have also faced credit rating downgrades as a result;[236]
- Sudden oak death in California, driven by IAS, caused damage worth over USD 200 million to local forestry operations;
- An outbreak of the invasive tomato leaf miner, *Tuta absoluta*, caused severe damage to tomato production in Kano State, Nigeria, in 2016, with losses to growers estimated at more than USD 1.5 million in a single growing season;[237]
- Large swarms of the invasive nomad jellyfish, *Rhopilema nomadica*, have caused sudden disruption to coastal power infrastructure in Israel by blocking seawater intake pipes. In summer 2001, Israel Electric removed tonnes of jellyfish from intake pipes at its two largest power plants at an estimated cost of USD 50,000;[238]
- The invasive golden mussel, *Limnoperna fortunei*, fouls turbines, cooling systems and pipelines at hydroelectric plants in Brazil, resulting in additional maintenance and

233 IPBES (2023) Thematic Assessment Report on Invasive Alien Species and their Control.

234 Diagne, C., et al (2021) High and rising economic costs of biological invasions worldwide.

235 University of Oxford et al (2025) Evidence review on the financial effects of nature-related risks; Alvarez, J., et al (2025) Nature-related financial risks database (June 2025).

236 USDA NASS (2024) Florida Citrus Statistics 2022-2023.

237 Sanda, N. B., et al (2018) Biological Invasion of Tomato Leaf Miner, *Tuta absoluta* (Meyrick) in Nigeria: Problems and Management Strategies Optimization: A Review.

238 Galil B.S. and Zenetos A (2002) A sea change – exotics in the eastern Mediterranean Sea.

cleaning costs and associated revenue losses. Annual losses to the Brazilian electricity sector have been estimated at approximately USD 77 million;[239] and

- Flammable invasive grasses contributed to the rapid spread of the August 2023 Maui wildfire by creating dense, dry fuel around Lahaina, alongside drought, strong winds and other factors. Moody's RMS estimated total economic losses of USD 4 billion to USD 6 billion, including property damage, contents and business interruption across residential, commercial, industrial and infrastructure assets.[240]

These examples illustrate that IAS-related financial effects may arise from rapid outbreaks or accumulations, such as pest outbreaks and jellyfish swarms, and from species that establish and expand over time but contribute to sudden operational disruption or acute financial losses.

Other examples of the effects of transition risks related to IAS include fines for violating ballast water discharge regulations and difficulty in maintaining a licence to operate due to IAS introduction, establishment or spread.[241]

The economic burden of biological invasions is expected to continue increasing in the absence of effective management interventions. Recent analyses highlight that delays in prevention, early detection, rapid response and control can result in substantially higher long-term costs, reinforcing the value of proactive approaches to IAS management.[242]

IAS management may also create opportunities for new products, services and business models that contribute to prevention, control or removal. Examples include monitoring and early detection technologies (such as eDNA), specialist eradication services, restoration activities and financial solutions that support effective IAS management.

For **financial institutions**, these effects may translate into nature-related risks through exposure to sectors, regions and assets affected by IAS. Understanding how clients and investees identify and manage IAS-related impacts and dependencies may therefore support broader assessments of portfolio exposure to nature-related risks and opportunities.

Understanding IAS pathways to impact

IAS typically spread through a process described by scientists as biological invasion: the human-mediated movement of species outside their natural range, followed by their introduction, establishment and spread in new environments.[243]

239 CTG Brasil (2025) Study advances toward sustainable solution to golden mussel infestation at hydroelectric plants; Valor Economico (2025) Power plants deploy GMOs to combat Asian pest.

240 NAISMA (2023) The tragedy in Lahaina: How invasive grasses and shrubs are fueling the wildfire crisis in Hawai'i; Moody's RMS (2023) Moody's RMS estimates USD 4 to 6 billion in economic losses from Hawaii wildfires; Insurance for Good (2026) Invasive Species & Wildfire Risk.

241 Alvarez, J., et al (2025) Nature-related financial risks database (June 2025).

242 Cuthbert, R. N., Diagne, C., et al (2022) Managing biological invasions: the cost of inaction.

243 IPBES (2023) Thematic Assessment Report on Invasive Alien Species and their Control.

This process comprises four stages:

- **Transport** – movement of species beyond barriers that define its natural range through human activity;
- **Introduction** – arrival in a new location outside its native range;
- **Establishment** – development of a viable, self-sustaining population; and
- **Spread** – dispersal or movement in a new range.

Pathways of introduction

IPBES identifies **introduction pathways** as the primary mechanism linking human activities to biological invasions, defined as the ways in which species are moved between locations through human activity.

The CBD defines a pathway-based approach for assessing the relationship between human activities and biological invasion,[244] including:

- Release in nature;
- Escape from confinement;
- Transport – contaminant;
- Transport – stowaway;
- Corridors; and
- Unaided spread.

These pathways reflect both intentional and unintentional introductions, including through trade, transport systems and infrastructure.

Pathways of establishment and spread

While pathways are most visible at the introduction stage, evidence from IPBES assessments shows that human activities continue to influence:

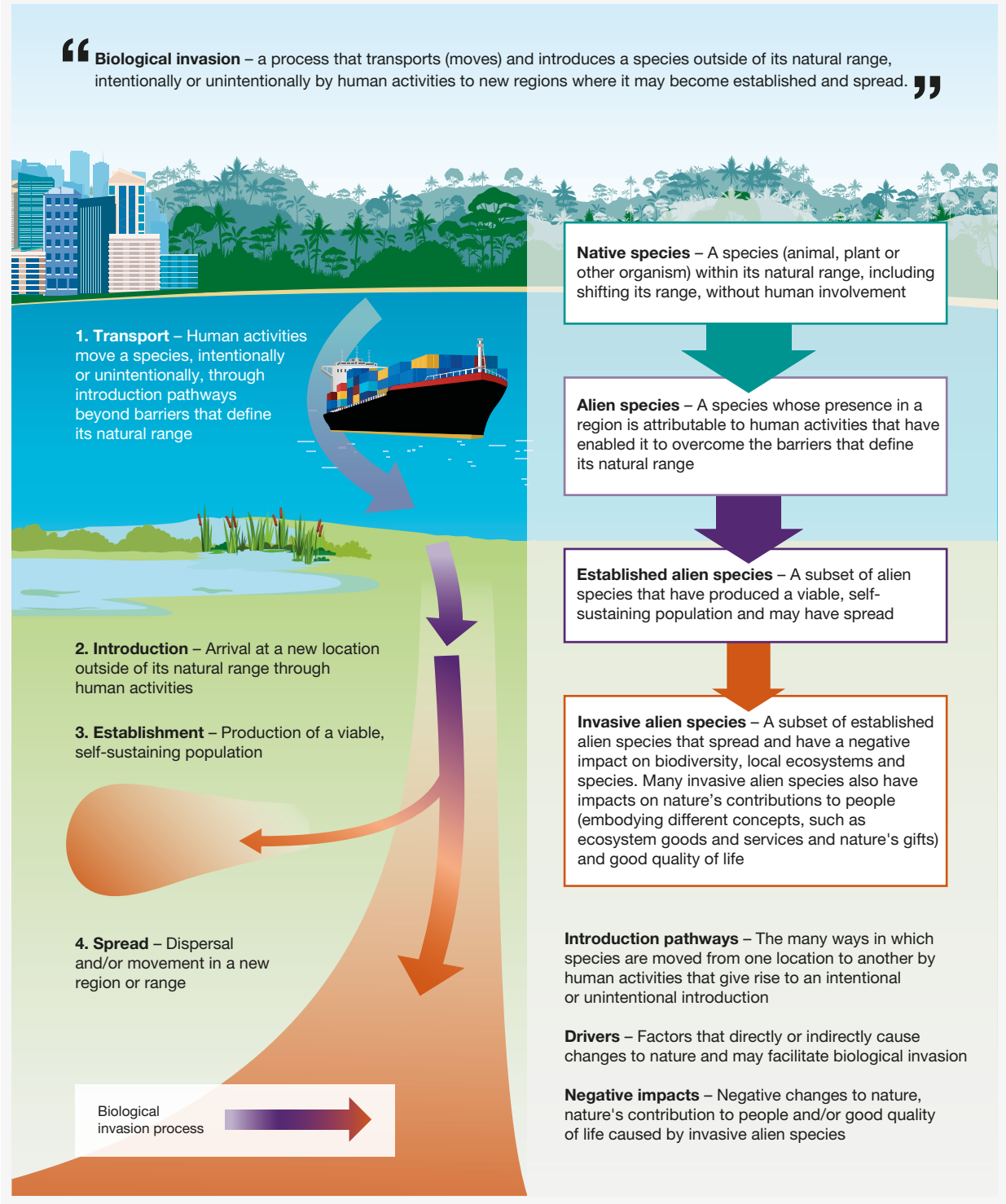
- **Establishment of IAS**, through repeated introductions and environmental disturbance; and
- **Spread of IAS**, through infrastructure, connectivity and secondary movements.

Human activities, including trade and transport, are major drivers of all stages of invasion, often acting in combination with other drivers such as land-use change and anthropogenic climate change.[245] In practice, a single activity may contribute to multiple stages of the invasion process. For example, a construction company moving soil-contaminated machinery between sites may introduce seeds or organisms into a new location, and continued movement of equipment across sites can contribute to their establishment and spread across the wider landscape.

244 CBD (2014) SBSTTA/18/9/Add.1 Pathways of introduction of invasive species, their prioritization and management. The TNFD's core global disclosure metric on IAS uses this pathway-based framework.

245 IPBES (2023) Thematic Assessment Report on Invasive Alien Species and their Control.

Figure 73: Stages in the biological invasion process.



Source: IPBES (2023) Thematic Assessment Report on Invasive Alien Species and their Control

IAS can affect the state of nature through a range of pathways, including predation, competition, disease transmission, genetic introgression,[246] habitat alteration and displacement of native species. The relevance and severity of these impacts will depend on the IAS itself, the pathway of introduction or spread and the characteristics of the receiving environment.

Dependencies and impacts related to IAS can lead to nature-related risks through:

- Changes to the state of nature itself, caused by business impact drivers or external factors and trends.
  - For example, the introduction and establishment of invasive silver carp in freshwater systems can outcompete native juvenile fish, reducing native fish populations and worsening water quality;
- Changes to the flow of ecosystem services associated with the changes to the state of nature.
  - For example, the spread of invasive alien plants in agricultural landscapes can displace native flowering plants and reduce habitat for wild pollinators, lowering pollination services for nearby crops and affecting the productivity of organisations and value chains that depend on the pollinator-supported production; and
- Impacts to society and related risks to business resulting from business impacts on nature.
  - For example, invasive water hyacinth, spread through horticultural trade, can block waterways and reduce access to clean water for drinking and irrigation, creating impacts on the livelihoods of communities. This can result in stakeholder concerns, operational disruption and transition risks, including liability and reputational risk for organisations operating in affected areas.

IAS introduction can be relevant where an organisation's activities, assets or business relationships increase the likelihood of introduction, establishment or spread of IAS, or where an organisation depends on ecosystem services that are disrupted by IAS. These impacts may affect, for example, agricultural production, forestry, fisheries, water resources, infrastructure, tourism and human health, creating both direct costs and broader nature-related risks for corporates and financial institutions.[247]

IPBES identifies **pathway management** as central for preventing invasion, establishment and spread, and as the most effective and cost-efficient strategy of mitigating future impacts from IAS.

246 Genetic introgression is the transfer of genes from one gene pool to another.

247 IPBES (2023) Thematic Assessment Report on Invasive Alien Species and their Control.

TNFD's recommended IAS metrics

Consistent with the IPBES conceptualisation of biological invasions, the TNFD's recommended IAS metrics focus on **human-driven pathways** of IAS introduction, establishment and spread and reflect a pathway management approach, with measurement based on:

- Identification of relevant pathways linked to activities;
- Prioritisation of pathways or activities with high IAS-related impact potential; and
- Evaluation of measures implemented to manage those pathways.

'Activities with high IAS-related impact potential' are defined by the TNFD as activities with high probability of causing introduction, establishment and/or spread of IAS.

This approach provides a feasible, practical and decision-useful basis for assessment and disclosure related to IAS.

The recommended IAS-related disclosure metrics (see TNFD recommendations Annexes 1 and 2) as outlined in Table 43 are as follows:

- The core global disclosure metric on IAS is a response metric (C4.0). It measures action an organisation can take to reduce the probability of introducing, establishing or spreading IAS;
- The additional global disclosure metric on IAS is a combined state of nature and impact driver metric that can be used to provide further complementary information on IAS outcomes and impacts (A4.0); and
- TNFD sector guidance provides further sector-specific disclosure metrics on IAS.

Together, these metrics are intended to support practical, decision-useful assessment and disclosure of material information on IAS and their potential resulting risks and opportunities to companies and investors.

Table 43: TNFD IAS metrics

Driver of nature change	Impact driver	Indicator	Metric	Disclosure metric type and number
Invasive species and other	Biological alterations	Measures against the introduction, establishment and spread of IAS	Proportion of activities with high IAS-related impact potential operated under appropriate measures to reduce the probability of introduction, establishment and spread of IAS.	Core (C4.0)
		Number/extent of established IAS and/or newly introduced IAS	Number/extent of established IAS and/or newly introduced IAS in areas owned, operated, used or (where possible) financed in priority areas (absolute, presence/absence, extent covered (km^2)).	Additional (A4.0)

This scope includes:

- Intentional and unintentional pathways of introduction, meaning the human-mediated movement of alien species beyond the geographic barriers defining their natural range into a new location; and
- Intentional and unintentional pathways of spread, meaning the human-mediated movement of established alien species that facilitates their further spread within the receiving location.

Whether a species is alien or invasive alien is location-specific and should be determined in relation to its natural past or present distribution and dispersal. Depending on the geographic scale of the assessment, the relevant receiving location may be a site, catchment, island, ecosystem, landscape or wider region. A species may therefore be native in one part of a country or region but alien in another location where it has been introduced beyond its natural range through human activity. Where an alien species becomes established and spreads with negative impacts on nature, it may be considered an invasive alien species in that receiving location.[248]

248 IPBES (2023) Thematic Assessment Report on Invasive Alien Species and their Control, Chapter 1.

Out of scope:

Species that have expanded their range into new areas in response to a changing climate, or other changes in nature, are out of scope for IAS-related assessment and can be considered as impacts of climate change or another impact driver. They should be distinguished from alien species introduced outside their natural range through human-mediated movement.

For example, populations and ranges of native deer and other large mammals have expanded in parts of Japan, with impacts on ecosystems and sectors, including forestry and agriculture.[249] These species should not be in scope for IAS-related assessment because their populations are increasing and their ranges are changing due to other impact drivers, such as climate change, or they are causing impacts on nature or people within their natural range.

Climate change can exacerbate the impacts of IAS. Climate change allows for the establishment and spread of many alien species and can create the conditions for them to become invasive. Indeed, climate change can reduce the resilience of an ecosystem to invasions; and once established, invasive alien species can further reduce the resilience of their new area to the effects of climate change.[250]

IAS assessment in the LEAP approach

This section explains IAS in the context of the LEAP approach, including guidance on identifying **activities with high IAS-related impact potential** and determining **appropriate measures**, which can inform measurement of the TNFD core global disclosure metric on IAS.

Identifying activities with high IAS-related impact potential

'Activities with high IAS-related impact potential' are defined by the TNFD as activities with high probability of causing introduction, establishment and/or spread of IAS.

Organisations should identify which activities present a higher potential to contribute to the introduction, establishment or spread of IAS that may lead to negative impacts on nature and/or financial risks to the organisation, which therefore should be prioritised for management actions. This includes, where feasible, identifying IAS that may be introduced through these pathways, and are able to establish and spread within locations and surrounding environments.

This prioritisation should reflect the stages of the biological invasion process and the potential ecological impacts of the species to determine the overall risk to the organisation and to inform the selection and scope of appropriate measures. The level of detail included in any

249 Oka, T. et al (2025) The range of large terrestrial mammals has expanded into human-dominated landscapes in depopulated Japan over the past 40 years; Ministry of the Environment, Government of Japan. (2015). Enforcement of the Act for Partial Revision of the Wildlife Protection and Hunting Management Law.

250 IPBES (2023) Thematic Assessment Report on Invasive Alien Species and their Control.

assessment should be proportionate to its intended use, focusing on the information needed to support those actions.

For example:

- A company that frequently transports materials, equipment or biological inputs between sites may initially conduct a high-level screening of transport and introduction pathways to prioritise preventive measures;
- Where these movements are central to operations, occur at high volumes or frequency, or are associated with sensitive locations, more detailed assessment may be required to inform targeted biosecurity and operational controls; and
- Where species are already established or spreading, more detailed analysis may be needed to support eradication or control actions.

The factors illustrated in this example are reflected in the considerations below.

Pathway-based assessment

When assessing how their activities relate to pathways of introduction and spread, organisations may want to gain further information on potential IAS-related impacts by asking targeted questions to their site operations and/or procurement teams. Example guiding questions include:[251]

- What alien species are present on our sites? How and when did they get here (pathways of introduction)? What are their known and potential future impacts?
- Which alien species and pathways of introduction and spread should we be most concerned about at this site?
- What alien species might arrive in the near future? How could they arrive (pathways of introduction)? What might their impacts be? What can we do to prevent invasive alien species from being introduced, establishing or spreading?

Some pathways may be relevant to particular sectors, including pathways not fully captured by the CBD's classification system. For example, complex pathways such as Raw Water Transfers (RWT) are major IAS invasion routes for water utilities.[252] The TNFD's sector guidance provides sector-specific IAS considerations and disclosure metrics.

Assessing activities with high IAS-related impact potential throughout the LEAP approach

The LEAP approach provides a structured basis for identifying and prioritising activities with IAS-related impact, considering both potential impacts on nature, dependencies on nature affected by IAS, and risks and opportunities for the organisation. Organisations can use the

251 CBD and IUCN (2024) Invasive Alien Species Toolkit for Target 6 of the Kunming-Montreal Global Biodiversity Framework. Expert support may be necessary to answer these questions.

252 Waine, Robertson, and Pattison (2024) Understanding and classifying the raw water transfer invasion pathway.

resources in Section 5 of this annex to get started (e.g. the IUCN Global Invasive Species Database (GISD)).

An organisation can identify activities with high IAS-related impact potential through the considerations outlined in Table 44.

Table 44: Considerations of activities with high IAS-related impact potential throughout the LEAP approach

IAS consideration	Component and phase of LEAP
Consider the potential of business activities or value chains to contribute to the intentional or unintentional introduction, establishment and spread of IAS.	L2-3, Locate
Consider the sensitivity of locations associated with relevant IAS-related activities and pathways.	L4, Locate
Assess the likelihood of IAS introduction, establishment and spread, including the volume and frequency of movement and the potential impacts on nature.	E1-3, Evaluate
Consider how the organisation's IAS-related dependencies and impacts may give rise to risks and opportunities for the organisation.	A1-3, Assess
Inform the prioritisation of activities with high IAS-related impact potential and/or high risk to the organisation and the selection of appropriate targets and measures.	P1-2, Prepare

Key considerations may include the following:

IAS impact potential of activities (L2 and L3):
Building on an assessment of how their activities interface with nature in L2 and L3, an organisation should consider the potential of its activities and value chains to drive IAS-related impacts.

For example:

- A logistics company operating a distribution hub may identify international container movements, dunnage (materials used to secure and protect cargo during transport) and reusable packaging as activities with IAS-related impact potential, where goods arrive from regions with known wood-boring insects or other contaminant species;
- A horticulture retailer may identify the import and sale of ornamental plants as an activity with IAS-related impact potential, where alien species could escape cultivation or carry pests and pathogens into surrounding habitats; and

- A cruise operator may identify passenger landings and equipment transfers between islands as activities with IAS-related impact potential, where footwear, luggage, food waste or recreational equipment could move propagules between sensitive locations.

Ecological sensitivity of locations (L4):
Drawing on the identification of sensitive locations in L4, organisations should consider whether the activity with high IAS-related impact potential occurs in, adjacent to or otherwise connected to a location that meets one or more of the TNFD's sensitive location criteria (see L4).

Location sensitivity may increase the potential impacts of IAS introduction, establishment or spread on nature and therefore influence whether an activity should be prioritised for further assessment and/or implementation of IAS management measures. Considerations could include impacts on threatened species and genetic diversity. Modelling tools may also help organisations to understand the distribution of IAS and their interface with sensitive locations.[253]

For example:

- A mining company may classify vehicle and machinery movement as having higher impact potential where a site is adjacent to a protected area or to a freshwater system supporting native species of conservation concern;
- A forestry and paper company may classify the transfer of planting material as having higher impact potential where plantation operations are located near conservation corridors or habitats with high biodiversity value; and
- A salmon aquaculture company may classify fish escapes as having high IAS-related impact potential where farms are located near rivers or coastal systems supporting threatened wild salmonid populations or genetically distinct local stocks. Escaped farmed salmon may compete or interbreed with wild populations, potentially reducing local genetic diversity and adaptive capacity, as well as increasing disease or parasite pressures in sensitive ecosystems.

Severity of environmental impacts (E1-3):
Activities that may lead to the introduction, establishment or spread of IAS that are likely to have harmful impacts upon biodiversity and ecosystems should be classed as having high IAS-related impact potential. The assessment of impact drivers and impact pathways in E1 (informed by analysis in L2, L3 and L4), and their resulting impacts on nature in E2 and E3, can help inform this judgement. Organisations can also consider how their dependencies interact with IAS, for example, IAS may impact the supply of ecosystem services on which the organisation depends.

253 Jetz, W. et al (2019) Essential biodiversity variables for mapping and monitoring species populations; McGeoch, M. and Jetz, W. (2019) Measure and Reduce the Harm Caused by Biological Invasions.

In E2 and E3, organisations can consider the scale and severity of the resulting impacts on nature in the relevant locations, including changes in ecosystem condition, species populations and ecosystem service supply. Potential socioeconomic impacts, including on human health, resulting from IAS's impact on nature, could also be considered. Existing tools and classifications, such as IUCN's Environmental Impact Classification for Alien Taxa (EICAT),[254] may help inform the identification of IAS associated with more harmful environmental impacts.

For example:

- A food and agriculture company may treat the introduction of a non-native pasture species as having high IAS-related impact potential where there is evidence that it can outcompete native vegetation and alter habitat structure;
- A construction materials company may treat the use of imported seed mixes for quarry rehabilitation as a high IAS-related impact potential where candidate species are known to be associated with severe environmental impacts in similar ecosystems; and
- A seafood company sourcing shellfish may treat the invasion of hitchhiker species that come with the live shellfish, such as Japanese Oyster Drill, as having high IAS-related impact potential as they prey on other shellfish species and will impact the supply of shellfish species on which the company depends.

Volume of movement (E1-3):
A key characteristic that may increase the likelihood of IAS introduction, establishment or spread is the volume and frequency of movements associated with an activity (termed 'propagule pressure'). As part of E1-3, organisations can consider how the type, volume and frequency of movement affect the intensity of the pathway and the potential impacts on nature.

In E2 and E3, the volume and frequency of these movements can be used to assess the intensity of the pathway and the potential scale of the resulting impacts on nature. Higher volumes and more frequent movements can mean a greater number of individuals or amount of biological material are introduced, raising the likelihood that IAS establish in new areas. These pathways may operate across multiple stages of the invasion process, particularly where movements are repeated across locations.

For example:

- A forestry company may classify repeated movement of harvesting equipment, timber, bark and soil between forest blocks as a high IAS-related impact potential, as frequent transfers can introduce IAS and facilitate their establishment across sites;
- An extractives company may classify the transfer of drilling rigs, heavy vehicles, aggregate and rehabilitation materials between sites as having high IAS-related impact potential where frequent movement creates repeated opportunities for introduction and establishment at new locations; and

254 IUCN (2020) EICAT Standard; IUCN (n.d.) EICAT assessments.

- A construction company may classify the repeated import of high volumes of aggregate and soil from outside the country for large construction projects as a high IAS-related impact potential activity as this may introduce IAS into new environments.

Severity of business risks (A1-A3):
The IAS-related impacts/potential impacts on nature identified and measured in the Evaluate phase may give rise to nature-related risks for the organisation. IAS may also affect the availability or quality of ecosystem services on which the organisation depends, creating or increasing risks to its operations and value chains. In A1 to A3, organisations can identify the relevant sources of risk and assess their likelihood, magnitude and other criteria in the context of the organisation's activities, locations and value chains.

As outlined in the introduction to this annex, potential effects on an organisation from IAS-related impacts may include operational disruption, increased costs, supply chain effects, legal and compliance exposure or other financially relevant effects. This requires understanding which IAS are associated with the pathways of introduction and their potential risks for the organisation.

For example:

- A forestry company may consider the movement of nursery stock between sites to be associated with high IAS-related impact potential, giving rise to potential risks that can reasonably be expected to affect the prospects of the company, where an IAS introduction could lead to quarantine restrictions, higher management costs and delays to planting operations; and
- A tourism operator that regularly moves tourists and equipment between ecologically sensitive locations may create opportunities for the spread of IAS from one site to another, which could reduce the attractiveness of the locations, and create reputational risks for the organisation due to concerns from regulators and visitors.

IAS introduced by one company may also affect the operations of another company and/or sector.

For example:

- A cargo ship's ballast water may introduce zebra mussels to an area, which could subsequently lead to potential risks for water treatment and power plants operating in that area.

In applying the considerations above, an organisation may draw on existing risk assessment processes and supporting resources to structure its analysis and document assumptions and limitations. These resources may be particularly relevant in the Evaluate phase to inform the organisation's assessment of pathways and activities, the likelihood of introduction, establishment and spread, and the potential environmental impacts. They may also help it to assess the effects of potential risks originating from IAS on the organisation in the Assess phase.

How an organisation can identify potential actions to respond to IAS

'Appropriate measures' in the context of IAS management are measures in place to reduce the likelihood of the introduction, establishment and spread of IAS through activities with high IAS-related impact potential. Organisations should consider identifying and committing to measures or actions to reduce high IAS-related impact potential and manage related risks in the Prepare phase of LEAP. Those actions may inform the organisation's business strategy and be included in its TNFD-aligned disclosures, science-based targets and/or transition plan.

The TNFD defines 'appropriate measures' in this context as measures with:[255]

i. Alignment (proportionate) to the level of likely impact and risk presented by the relevant pathway/organisational activity;
ii. Evidence of effectiveness against relevant IAS introduction pathways; and
iii. Mechanisms for implementation consistency, such as enforcement and Monitoring, Reporting and Verification (MRV).

Alignment with the risk profile (P1):
When considering alignment, organisations can assess whether measures are proportionate to the likelihood of potential introduction, establishment and spread associated with relevant pathways, the impact potential of relevant species, the sensitivity of relevant areas (analysed in the Locate and Evaluate phases), and the potential resulting risks to the organisation (analysed in the Assess phase). In practice, measures are more likely to be appropriate where they address the pathway through which introduction, establishment or spread is most likely to occur, and where the response is proportionate.[256]

For example:

- A forestry company operating near native forest remnants may conclude that basic contractor signage is not an appropriate measure for machinery transfers between plantation blocks, because the likelihood of introduction, establishment and spread of IAS and ecological sensitivity are high. In that context, a more appropriate measure may include mandatory cleaning, inspection before entry and restrictions on moving equipment during wet periods when soil and propagules are more likely to be transported; and
- An extractives company working close to a protected freshwater catchment may conclude that a generic vehicle hygiene policy is not sufficient for imported aggregate

255 This definition builds on sources including IPBES (2023) Thematic Assessment Report on Invasive Alien Species and their Control and CBD and IUCN (2024) Invasive Alien Species Toolkit for Target 6 of the Kunming-Montreal Global Biodiversity Framework.

256 Robertson, P. A. et al (2021) Risk Management Assessment Improves the Cost-Effectiveness of Invasive Species Prioritisation; U.S. FWS (2022) Invasive Species Biosecurity Protocols; NSW Department of Primary Industries and Regional Development (2025) Biosecurity and land access considerations for explorers, miners and landholders.

and heavy equipment movements. In that setting, a more appropriate measure may include designated washdown points, controlled entry procedures and site-specific restrictions for higher risk materials and vectors.

Evidence of effectiveness (Prepare):
Credible evidence of the effectiveness of measures may include documented reductions in IAS introduction, establishment or spread where the measure has been implemented, verified through continuous monitoring. However, the absence of direct outcome evidence does not necessarily indicate that a measure is ineffective. Relevant credible evidence may also include inspection records, treatment logs, implementation checks, alignment with recognised standards, and other compliance-based evidence that a measure is likely to reduce impact and risk. Organisations can also respond to the results of continuous monitoring with an adaptive management approach. The existence of a policy, contractual requirement or operating procedure alone does not demonstrate that a measure has been implemented or is effective. Similarly, cleaning logs or other operational records should not, on their own, be treated as sufficient evidence of effectiveness, for example, where they are incomplete, cannot be attributed to the relevant activity, or are not subject to proportionate checks or verification.

For example:

- A forestry and paper company may treat machinery cleaning between forest blocks as an appropriate measure where it is supported by a documented protocol, contractor sign-off records and periodic inspection results showing that cleaning is completed before each transfer;
- A tourism operator managing coastal properties may treat screening of new landscaping species as an appropriate measure where the species selection process is documented, higher impact taxa are excluded using published impact evidence, and follow-up monitoring shows that planted species are not escaping into adjacent habitats; and
- A water utility may treat IAS removal from intake screens, reservoirs or canals as an appropriate measure where removal protocols, disposal records, equipment-cleaning checks and follow-up monitoring demonstrate that the activity reduces biofouling or blockage risks without facilitating further spread of IAS.

Implementation consistency (Prepare):
Implementation consistency considers whether measures are consistently applied and whether there are mechanisms to verify compliance. Measures are more likely to be appropriate where they are embedded in routine practice, supported by clear responsibilities and training, and backed by verification rather than ad hoc implementation.[257] Evidence of implementation consistency may include attributable operational records, inspections, audits, supervisory checks or automated compliance records. Technology-supported

257 U.S. FWS (2022) Invasive Species Biosecurity Protocols; NSW Department of Primary Industries and Regional Development (2025) Biosecurity and land access considerations for explorers, miners and landholders.

approaches can strengthen traceability and verification. Verification should be proportionate to the IAS-related impact potential of the pathway or activity.

For example:

- A construction materials company may determine that a protocol for imported rehabilitation materials is only appropriate if it is applied across all sites and contractors in the same way, with clear entry requirements, inspection records and a process for rejecting non-compliant materials before use; and
- An aquaculture company may determine that equipment disinfection between production locations is only appropriate if the same procedure is followed consistently across staff and contractors, supported by training, supervision and documented checks before equipment is redeployed.

Where activities with high IAS-related impact potential are delivered by contractors, suppliers, joint ventures or through leased assets, organisations should include these activities within the scope of assessment where they form part of the organisation's operations, value chain or relevant business relationships. Measures implemented through these arrangements may be considered appropriate where responsibilities and requirements are clearly documented, applied consistently and supported by verification mechanisms, such as contractual requirements, inspection records, implementation checks, audit findings or equivalent evidence.

These considerations can be applied together, throughout the relevant phases and components of an organisation's LEAP assessment. In practice, appropriate measures may involve a combination of controls, particularly where pathways are recurrent or complex.

The following additional considerations are also important:

- Where direct outcome monitoring is limited, confidence may instead be supported by pathway-specific design, evidence-informed selection of measures, and documented implementation and compliance; and
- Where IAS are already established, appropriate measures may include evaluation and prioritisation of species and pathways, area-based management planning, containment, eradication or control, depending on feasibility, expected effectiveness and potential unintended consequences. Appropriate management will not necessarily require removal of all IAS present in an area.

Consideration of unintended consequences

When designing appropriate measures, unintended consequences should also be considered. A measure against IAS may also have significant impact on non-target species. This could include considerations of welfare for target and non-target species.[258] For example, when designing vehicle disinfection measures, an organisation may consider whether washdown water or disinfectants could harm nearby streams or soils if not properly contained. In this context, an appropriate measure may include using designated washdown areas, selecting suitable disinfectants, containing and treating wastewater, and avoiding discharge to sensitive habitats so that the measure reduces IAS spread without creating additional ecosystem impacts.

The mitigation of unintended consequences may give rise to nature-related opportunities. These may include the development or adoption of more selective control methods, lower impact technologies, and improved containment and treatment systems. Such approaches may enhance the effectiveness of IAS management, reduce additional pressures on nature, and lower potential costs and liabilities for the organisation.

Box 58: Insights from pilot testing: application of IAS considerations in the renewable energy sector

Pilot testing with a renewable energy operator provided practical insights into how organisations can identify and implement appropriate measures for managing IAS.

The pilot indicated that these measures are strengthened when LEAP guidance is followed and complemented by business-specific inputs. The LEAP guidance helped the energy operator to identify relevant IAS pathways. These were translated into practical measures through targeted questions and engagement across business functions.

In this pilot, the company applied measures across relevant biological invasion pathways, reflecting both regulatory requirements and operational priorities. Measures addressed both introduction and spread and were shaped by regulatory processes, including environmental impact assessments, permitting and customs checks. Key types of measures identified in the pilot included:

- Controls to prevent the introduction of IAS through import-related pathways (e.g. components, machinery, landscaping materials and clothing);
- Measures to manage the spread of IAS already present at sites, including site-level operational practices; and
- Procurement-related controls addressing IAS impact potentials associated with imports and supply chains.

258 Smith, K.G. et al (2022) A manual for the management of vertebrate invasive alien species of Union concern, incorporating animal welfare.

This pilot further highlights the importance of applying measures across functions within organisations, including development, operations and procurement, and of engagement to identify existing controls and gaps. The company identified procurement-related pathways as a particularly important component of IAS management.

Overall, the findings illustrate that effective IAS management requires measures that address both the prevention of IAS introduction and the management of IAS spread, including control of already established species. The pilot supports a risk-based approach to selecting and implementing measures, which enables organisations to prioritise measures against activities with high IAS-related impact potential and apply proportionate, decision-useful and cost-effective controls.

Referencing regulatory requirements to identify appropriate measures

Determining whether measures are appropriate ultimately requires consideration of the specific pathways, activities and locations associated with IAS-related impact potential. In practice, organisations may start by assessing whether applicable regulatory and biosecurity requirements are being met, before considering whether additional measures are needed to address pathways with higher IAS-related impact potential.

As such, regulatory requirements may provide a useful baseline when determining whether measures are appropriate. In many jurisdictions, legislation, permit conditions, quarantine requirements, biosecurity regulations and species management obligations establish minimum expectations for preventing or reducing the introduction, establishment and spread of IAS. For example, the EU IAS Regulation requires member states to take action on pathways of introduction, take measures for early detection and eradication where possible, and manage species already widespread in their territory.[259] For some pathways with a particularly high probability of causing IAS introduction, establishment or spread, there are international mandatory requirements to manage IAS. For example, the International Maritime Organisation (IMO)'s Ballast Water Management Convention has established a mandatory Code for Approval of Ballast Water Management Systems, adopted by all parties to the convention.[260]

Compliance with these requirements may provide a useful baseline for IAS management. However, compliance alone may not be sufficient where the level of pathway risk, the sensitivity of the location, the potential impact of relevant IAS or the evidence of implementation indicates that additional measures are needed.

259 European Parliament and the Council of the European Union (2014) Regulation (EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species.

260 IMO (2017) Ballast Water Management (BWM) Convention and Guidelines.

Box 59: Landscape-level collaboration for managing IAS

In many cases, IAS-related potential impacts are not confined to a single site or organisation, but are shared across landscapes or seascapes, where multiple actors contribute, or are exposed, to common pathways of introduction, establishment and spread. Collaborative approaches may be particularly relevant where these pathways operate across catchments, river systems, transport corridors or other connected landscapes, and where site-level measures alone are unlikely to manage the impact and resulting risk effectively.

As a result, effective management of IAS often requires coordinated action beyond the boundaries of organisational control. Individual measures implemented at a site level may reduce IAS-related impact potential locally but are unlikely to be fully effective where pathways remain open in the surrounding landscape.

Collaborative, multi-stakeholder approaches can therefore represent an important component of 'appropriate measures', particularly for activities associated with high-risk pathways. These may involve coordination between companies, governments, local communities and other stakeholders to manage shared impacts and risks, for example through:

- Joint identification and prioritisation of pathways with IAS-related impact potential across a landscape or supply chain;
- Alignment of biosecurity protocols and operational practices (e.g. for transport, equipment movement or materials);
- Shared monitoring, data collection and early detection systems;
- Coordinated responses or control actions, particularly where species are already established or spreading; and
- Engagement with relevant authorities to support consistency with regulatory requirements and landscape-level management plans.

Such approaches can improve effectiveness by addressing IAS-related potential impacts at the scale at which they occur, rather than at the level of individual operations. They may also enable more efficient use of resources, particularly where risks and responsibilities are distributed across multiple actors.

While the level of collaboration required will vary depending on the context, organisations may consider participation in, or the initiation of, multi-stakeholder IAS management initiatives as part of a proportionate response to high-risk activities.

The IAS Collaborative Initiative's State of Business Knowledge and Action on IAS survey of 90 businesses found that nearly half of those who responded to the survey already work with others to tackle IAS, and almost 90% want to engage in further collaborations.[261]

261 IAS Collaborative Initiative (2026) Growing Momentum: Tackling invasive alien species together.

Disclosing high IAS-related impact potential and its corresponding risks and opportunities to the organisation

IAS in the TNFD disclosure metrics architecture

The TNFD uses the five main drivers of nature change, including IAS, to structure its metrics architecture. For disclosure metrics, the TNFD applies a three-tier approach:

- Core global metrics to support the comparison of performance across sectors;
- Core sector metrics to support the comparison of performance within sectors; and
- Additional metrics recommended where relevant to reflect an organisation's material nature-related issues.

Using assessment outputs to report on the TNFD core global disclosure metric on IAS

Table 45: TNFD IAS core global disclosure metric

Driver of nature change	Impact driver	Indicator	Metric	Metric number
Invasive species and other	Biological alterations	Measures against the introduction, establishment and spread of invasive alien species (IAS)	Proportion of activities with high IAS-related impact potential operated under appropriate measures to reduce the probability of introduction, establishment and spread of IAS.	Core (C4.0)

When calculating the IAS core global disclosure metric, the organisations can use the following equation for the proportion calculated:

Proportion of activities with high IAS-related impact potential operated under appropriate measures to reduce the probability of introduction, establishment and spread of IAS =

Number of activities with high IAS-related impact potential operated under appropriate measures ÷ Total number of activities with high IAS-related impact potential

The core global disclosure metric on IAS is a response metric, focused on actions taken. Rather than attempting to directly measure observed IAS outcomes in terms of species presence or populations, it assesses whether organisations are managing the activities and

pathways most likely to contribute to the introduction, establishment and spread of IAS. This makes it different from other TNFD impact driver metrics, which quantify direct impact drivers. This approach responds to concerns raised during consultation and pilot testing about the feasibility of species and population measurement, consistent with the TNFD's principle of proportionality for metrics.

The core global disclosure metric focuses on actions that an organisation can directly control, by identifying the proportion of activities with high IAS-related potential impacts that are operated under appropriate measures. This provides a practical indicator of impact and risk management and corporate response. Leased areas, vehicles or other relevant items (e.g. construction equipment) should be considered in scope for measuring and reporting this metric.

Using assessment outputs to report on the TNFD additional global disclosure metric on IAS

The TNFD has an additional disclosure indicator and metric on the number or extent of established IAS and/or newly introduced IAS.

Table 46: TNFD IAS additional disclosure metric

Driver of nature change	Impact driver	Indicator	Metric	Metric number
Invasive species and other	Biological alterations	Number/extent of established IAS and/or newly introduced IAS	Number/extent of established IAS and/or newly introduced IAS in areas owned, operated, used or (where possible) financed in priority areas (absolute, presence/absence, extent covered (km^2)).	Additional (A4.0)

This metric helps capture information on IAS establishment, and newly observed introductions where organisations are able to identify and report them, including in absolute terms, as presence or absence, and/or by extent covered. This additional metric complements GBF Target 6's headline indicator on the rate of IAS establishment.[262]

Together, the two disclosure metrics serve different but complementary purposes: the core metric indicates whether pathway-related potential impacts are being actively managed, while the additional metric can provide contextual information on established and newly introduced taxa in areas owned, operated, used or, where possible, financed. It can also help to validate the effectiveness of measures against IAS, where relevant information is available.

262 CBD (2024) Metadata factsheet on Target 6: headline indicator.

When reporting the number or extent of established IAS and/or newly introduced IAS, organisations should, where relevant and available, describe the survey, monitoring or detection effort underpinning the information reported. This may include the scope, frequency or method of monitoring, as well as key assumptions, limitations or data gaps that may affect interpretation.

Considerations for IAS disclosure by financial institutions

TNFD guidance for financial institutions outlines expectations for disclosure by financial institutions.[263]

Financial institutions may have limited direct control over activities that create pathways for the introduction, establishment and spread of IAS. However, financial institutions can use portfolio company disclosures of the IAS core global metric to support their understanding of their exposure at a portfolio level, and to inform engagement with clients and investees, including through stewardship, due diligence and risk management processes.

Financial institutions can use this metric, when reported by their investees and clients, to support practical engagement, including meaningful conversations with portfolio companies on how they prioritise and manage IAS-related potential impacts and risks. This can complement existing approaches that already factor IAS considerations into investment, credit, ratings or insurance decision making. In practice, use cases may include:

- **Portfolio screening and prioritisation:** Using the metric to identify sectors, geographies or activities where IAS-related impacts on nature and risks to the organisation are more likely to be material, and to prioritise engagement accordingly;
- **Engagement and stewardship:** Using the metric to ask comparable questions of portfolio companies, for example, how activities with high IAS-related impact potential have been identified, what measures are in place, and how implementation quality and consistency are monitored; and
- **Strengthening discussion of feasibility and improvement over time:** Using the metric to support practical discussions with companies on improving coverage and implementation, particularly where outcome measurement is challenging and proxy indicators are used.

263 The TNFD recommends two core sector disclosure metrics to support financial institutions' disclosure of their exposure to sectors with material nature-related dependencies and impacts and exposure to sensitive locations.

Box 60: Illustrative examples of IAS-related information in financial institution use cases

Different types of financial institution can use information disclosed by investees and clients on the IAS core global disclosure metric for their use cases. Table 47 provides illustrative examples of how this IAS-related information could be used by financial institutions, recognising that application will depend on business model, asset class, location, portfolio characteristics and data availability.

Table 47: Illustrative examples of financial institution use of IAS-related information from the core global disclosure metric

Financial institution type	Illustrative use
Asset owners and asset managers	Compare how investee companies identify and manage activities linked to IAS introduction, establishment and spread. For example, asset managers could use the proportion of activities with high IAS-related impact potential covered by appropriate measures to prioritise engagement with companies in sectors where low coverage may indicate unmanaged IAS-related potential impacts. The metric could also support stewardship discussions on strengthening biosecurity controls, improving implementation consistency and tracking progress over time.
Banks and lenders	Use as part of sector, client and transaction due diligence, particularly where financed activities involve movement of vessels, equipment, soil, commodities, biological materials or packaging between locations. For example, a lender financing a port, mine, plantation or infrastructure project could use the metric to assess whether activities with high IAS-related impact potential have been identified, whether appropriate measures are in place, and whether gaps in coverage create potential physical or transition risks to the organisation.

Financial institution type	Illustrative use
Insurers	Inform underwriting, risk selection and portfolio risk monitoring where IAS could contribute to physical or transition risks (e.g. supply chain disruption or compliance costs). For example, insurers could consider whether clients that have activities with high IAS-related potential impacts in sensitive locations have appropriate prevention, monitoring and response measures in place. Low metric coverage may signal increased claims potential.
Ratings agencies	Use as input to analysis of nature-related risk management quality, particularly for issuers exposed to IAS-sensitive sectors and/or locations. For example, ratings analysts could consider whether a company has identified material activities with high IAS-related potential impacts and what proportion are managed through appropriate measures when assessing exposure to operational disruption, regulatory costs, supply chain impacts or reputational risk.

Worked examples: Reporting the IAS core global disclosure metric and use of those disclosures by financial institutions

The following hypothetical examples illustrate how report preparers from real economy sectors could disclose the IAS core global metric under the TNFD recommended disclosure Metrics and Targets B, in line with the TNFD recommendations.

Example 1. Forestry, pulp and paper

This example illustrates how a forestry and paper company could use the outputs of its LEAP assessment to disclose the proportion of activities with high IAS-related impact potential operated under appropriate measures across two priority locations.

In the Locate phase, the company identified a plantation landscape and nursery operations in Pará state, Brazil, and a pulp and paper mill and logistics corridor in Tacuarembó, Uruguay, as priority locations for further assessment. In the Evaluate phase, it assessed pathways associated with the movement of planting material, machinery, soil, wood products, packaging and other biological material, and considered their potential impacts on nature. In the Assess phase, the company considered how these impacts could give rise to operational, regulatory and supply chain risks. In the Prepare phase, it assessed whether the activities identified as having high IAS-related impact potential were operated under appropriate measures.

Priority material location 1, Plantation landscape and nursery operations (Pará state, Brazil)

Table 48: Activity with high IAS-related impact potential and appropriate measures explanation

Activity with high IAS-related impact potential	Operated under appropriate measures	Explanation
Movement of planting material and nursery stock between sites (CBD pathway: Escape – agriculture/horticulture)	Yes	High volumes of biological material moved between sites create repeated opportunities for the introduction and establishment of IAS (for example, if the species is new to the receiving area or already present and with invasive potential).. Planting material is sourced through approved suppliers, checked against site restrictions and subject to inspection before transfer.
Movement of machinery and equipment between forest sites (CBD pathway: Transport – contaminant/stowaway)	Yes	Frequent cross-site movements can transfer soil, seeds or organisms, facilitating both introduction and spread. Machinery is cleaned and inspected before transfer, with implementation recorded through operational checklists.
Transport of logs and biomass between forest areas and mill (CBD pathway: Transport – contaminant)	Yes	Regular transport flows may unintentionally move biological material between locations. Transport routes and handling procedures are subject to controls to reduce transfer risks.
Soil movement during site preparation and road building (CBD pathway: Transport – contaminant)	No	Movement of soil between locations can introduce and establish IAS through propagules. Controls are not yet consistently implemented across contractors and no verification process is in place.

Activities assessed but not classified as having high IAS-related impact potential:

- Routine administrative and office operations with no material movement of biological material; and
- Maintenance of fixed infrastructure (e.g. buildings and storage facilities) where activities do not involve transfer of soil, organic matter or living organisms.

Proportion 1: 75% of activities with high IAS-related impact potential operated under appropriate measures.

This example shows how the company used the outputs of the Evaluate and Assess phases to identify four activities with high IAS-related potential impacts on nature and potential risks to the organisation, and assessed in the Prepare phase whether each activity was operated under appropriate measures. Several pathway controls are established, but one activity remains outside appropriate management because controls are not consistently implemented across contractors and no verification process is in place.

Priority material location 2, Pulp and paper mill and logistics corridor (Tacuarembó, Uruguay)

Table 49: Activity with high IAS-related impact potential and appropriate measures explanation

Activity with high IAS-related impact potential	Operated under appropriate measures	Explanation
Import of raw materials, including wood products and packaging (CBD pathway: Transport – contaminant)	Yes	International sourcing introduces contamination pathways, particularly through untreated materials and packaging. Receipt and inspection controls are in place.
Storage and handling of wood packaging and pallets (CBD pathway: Transport – stowaway)	No	Storage conditions may allow IAS to persist and spread within sites. Inspection and segregation procedures are not consistently implemented.
Transport of bark, residues or mulch off site (CBD pathway: Transport – contaminant)	Yes	Movement of organic material may facilitate both introduction and spread between locations. Handling procedures and contractor controls are in place.
Landscaping or revegetation using external plant material (CBD pathway: Escape – horticulture)	No	Use of non-native material may lead to introduction and establishment if not screened. A consistent species-selection protocol is not yet applied.

Activities assessed but not classified as having high IAS-related impact potential:

- Handling of processed pulp and finished paper products with no viable biological material; and
- Transport of sealed, non-organic inputs (e.g. chemicals in closed containers) where no pathway for IAS introduction or spread is present.

Proportion 2: 50% of activities with high IAS-related impact potential operated under appropriate measures.

This second example shows how the same assessment approach was applied at another priority location, distinguishing between activities operated under appropriate measures and those where gaps remain in species screening or operational implementation.

Example 2. Aquaculture

This example illustrates how an aquaculture company could use the outputs of its LEAP assessment to disclose the proportion of activities with high IAS-related impact potential operated under appropriate measures at a priority location.

In the Locate phase, the company identified marine finfish farming and associated service activities in coastal British Columbia, Canada, as a priority location. In the Evaluate phase, it assessed pathways associated with the farming and movement of live fish, potential escapes from production facilities and the transfer of organisms or biological material between locations. In the Assess phase, the company considered how these impacts could give rise to operational, regulatory and reputational risks. In the Prepare phase, it assessed whether the activities identified as having high IAS-related impact potential were operated under appropriate measures.

Priority material location: marine finfish farming and associated service activities (coastal British Columbia, Canada)

Table 50: Activity with high IAS-related impact potential and appropriate measures explanation

Activity with high IAS-related impact potential	Operated under appropriate measures	Explanation
Farming of a non-native finfish species in open marine pens (CBD pathway: Escape from confinement – aquaculture)	Yes	Escape of farmed fish could introduce non-native individuals into the surrounding marine environment. Potential impacts depend on the ability of the species or strain to survive, establish or interact with wild populations. Site-specific containment procedures are in place, supported by routine net inspections, documented maintenance and monitoring of escape incidents.

Activity with high IAS-related impact potential	Operated under appropriate measures	Explanation
Transfer of live fish from hatchery or juvenile facilities to marine grow-out sites (CBD pathway: Escape from confinement – aquaculture)	Yes	The movement of live fish creates opportunities for escape during loading, transport and stocking. Documented containment and handling procedures are applied to each transfer. Responsibilities extend to relevant transport contractors, and transfer events and suspected releases are recorded and reviewed.
Movement of vessels, nets and other equipment between production locations (CBD pathway: Transport – contaminant or stowaway)	No	Equipment and service vessels may transfer organisms or biological material between production locations and receiving environments. A general cleaning policy is in place, but cleaning and inspection are not consistently recorded across contractors, and no verification process is applied. The activity is therefore not considered to be operated under appropriate measures.
Screening and selection of species or strains before introduction to a new production location (CBD pathway: Escape from confinement – aquaculture)	Yes	Farming a species or strain outside its native range may create a pathway for introduction if individuals escape or are released. Proposed species and strains are screened against applicable regulatory requirements and available information on alien status, establishment potential and potential impacts on native populations. The assessment and approval are documented before stocking.

Activities assessed but not classified as having high IAS-related impact potential:

- Processing and storage of harvested fish in closed facilities where live fish are not handled and no viable biological material is released into the receiving environment;
- Routine administrative activities that do not involve the breeding, housing, movement or management of live aquatic organisms; and
- Transport of sealed, processed products where no viable organisms or contaminated water are present.

Total number of activities identified as having high IAS-related impact potential: 4

Number of activities operated under appropriate measures: 3

Proportion of activities with high IAS-related impact potential operated under appropriate measures: 75%

This example shows how the company used the outputs of the Evaluate and Assess phases to identify four activities with high IAS-related impact potential and assessed in the Prepare phase whether each activity was operated under appropriate measures. Although a general cleaning policy applied to the movement of vessels and equipment, the activity was not included in the numerator because implementation was not consistently evidenced or verified.

The company also discloses information on escape incidents and escaped individuals[264] under the TNFD core sector disclosure metric for the aquaculture sector (A.C4.0): *Total number and percentage of escapes per species, including type of escape events (minor, major, catastrophic failure) by type of ecosystem affected (marine, freshwater, terrestrial), including in cases of extreme weather.*

The organisation describes the monitoring or detection methods underpinning the disclosure, including the locations monitored, monitoring frequency, methods used and relevant assumptions or limitations.

Example 3. Financial Institution, commercial bank

This example illustrates how a commercial bank could use portfolio screening and information collected from borrowers to assess how clients in a priority lending portfolio identify and manage activities with high IAS-related impact potential.

In applying LEAP, the bank identified agricultural lending connected with protected areas as a priority portfolio segment, assessed IAS pathways associated with financed soybean and cattle activities, considered the resulting credit, regulatory and reputational risks, and engaged selected borrowers to assess whether activities with high IAS-related impact potential were operated under appropriate measures.

The bank used applicable phytosanitary, veterinary and animal health requirements as an initial source of information. It did not assume that regulatory compliance alone demonstrated that appropriate measures were in place. It also considered whether the measures were pathway specific, proportionate to the level of potential impact and risk, supported by evidence of effectiveness and implemented consistently.

Priority portfolio segment: agricultural lending associated with soybean production and cattle ranching in areas connected with protected areas in South Africa

264 Whether escaped individuals constitute IAS depends on the alien status of the species or strain and their capacity to establish and spread in the receiving environment.

Table 51: Activity with high IAS-related impact potential and appropriate measures explanation

Activity with high IAS-related impact potential identified through borrower assessment	Operated under appropriate measures	Explanation
Sourcing and movement of soybean seeds and other planting material between production locations (CBD pathway: Transport – seed contaminant)	Yes	Seeds and planting material may carry alien weeds, pests or pathogens into new production locations and surrounding habitats. The borrower uses authorised suppliers, maintains phytosanitary documentation and applies documented receipt and inspection procedures. Procurement and inspection records are reviewed as part of the bank's client due diligence.
Movement of agricultural machinery, soil and other inputs between soybean production locations (CBD pathway: Transport – contaminant or stowaway)	No	Machinery, soil and agricultural inputs may transfer seeds, organisms or other biological material between locations. A general cleaning requirement is in place, but the borrower does not consistently maintain attributable cleaning and inspection records for machinery operated by contractors. The bank therefore does not consider implementation sufficiently evidenced or verified.
Movement of cattle between production locations and to sale or slaughter facilities CBD pathway: (Transport – contaminant on animals or parasites on animals)	Yes	Livestock movement may contribute to the transfer of parasites, pathogens, seeds or other biological material between locations. The borrower applies documented animal health and movement procedures, supported by veterinary records and inspections before transfer. Responsibilities for transport providers are included in contractual requirements.

Activity with high IAS-related impact potential identified through borrower assessment	Operated under appropriate measures	Explanation
Introduction and management of non-native pasture species in cattle production (CBD pathway: Escape from confinement – agriculture)	No	Non-native pasture species may establish and spread into surrounding natural habitats if their potential impacts and suitability for the receiving environment are not assessed. The borrower complies with general agricultural requirements, but does not have a documented process for screening pasture species against alien status, establishment potential or potential impacts on protected areas.

Activities assessed but not classified as having high IAS-related impact potential:

- Routine administrative activities that do not involve the movement or management of seeds, soil, livestock or other biological material;
- Financing of closed storage and processing activities where no viable biological material is released into the receiving environment; and
- Transport of sealed, processed agricultural products where no viable organisms, untreated soil or contaminated water are present.

Total number of borrower activities identified as having high IAS-related impact potential: 4

Number of borrower activities operated under appropriate measures: 2

Proportion of assessed activities with high IAS-related impact potential operated under appropriate measures: 50%

The result covers four activities identified through the assessment of selected borrowers in the priority agricultural lending portfolio. It does not represent the proportion of the bank's total portfolio or portfolio exposure.

This example shows how the bank combined portfolio screening with information collected through client engagement and due diligence. Existing regulatory requirements provided a useful baseline, but were not treated automatically as evidence that an activity was operated under appropriate measures. Activities were included in the numerator only where the bank obtained information indicating that pathway-specific measures were proportionate to the potential impacts and risks, implemented consistently and supported by appropriate records or verification.

The assessment identified gaps associated with contractor controls for machinery movements and the screening of non-native pasture species. The bank used these results to prioritise engagement with the relevant borrowers, request improvements in pathway-specific controls, and consider incorporating IAS-related questions into future credit assessment and portfolio monitoring.

The bank also documented limitations in the assessment. These included differences in the availability and quality of borrower information, reliance on regulatory compliance information where company-level monitoring was unavailable and incomplete coverage of the wider agricultural lending portfolio.

Resources to support IAS assessment

Organisations may draw on established frameworks, operational data, public datasets, regulatory information, local ecological expertise and expert-reviewed tools to structure their assessment of IAS using the LEAP approach. These sources can support the identification and prioritisation of relevant locations, pathways and activities with high IAS-related impact potential without requiring direct field assessment in all cases.

Relevant information may include:

- Operational records, such as records of equipment movements, transfers, cleaning, inspections and IAS-related incidents;
- Applicable regulatory requirements and associated records, including biosecurity, quarantine, permitting and environmental impact assessment requirements;
- Public datasets and monitoring information from government authorities, research institutions and other recognised sources;
- Location-based information, including data on sensitive locations and the ecosystems associated with relevant activities;
- Pathway-based information, including the type, volume and frequency of movements and the potential IAS associated with relevant pathways; and
- Local ecological expertise on relevant species, establishment potential, environmental impacts and management options.

The sources and level of assessment used should be appropriate to the organisation's circumstances and the intended use of the assessment. Organisations should document the sources and methods used, together with relevant assumptions, uncertainties, limitations and data gaps.

Table 52 summarises a non-exhaustive list of examples of established resources spanning frameworks, standards, tools, databases and evidence sources that may support this work, depending on context and data availability.

Table 52: Illustrative IAS assessment resources

Type	What it supports	Hypothetical examples	Resource
Guidance toolkit	Structured approach covering pathway analysis, prioritisation, risk assessment and management planning	A company uses the toolkit as the main structure for its IAS assessment, first mapping introduction pathways linked to nursery stock and harvesting equipment, then using the same framework to prioritise activities with high IAS-related impact potential and document management actions in a consistent way.	CBD and IUCN (2024) Invasive Alien Species Toolkit for Target 6 of the GBF
Guidance	Identification and understanding of different pathways of introduction	A company uses the document to help assess whether its activities and operations are relevant to known pathways of introduction and spread.	IUCN (2018) Guidance for interpretation of CBD categories of pathways of introduction
Peer reviewed framework	A checklist style set of minimum standards for IAS impact and risk assessments	A mining company uses the framework as a quality check on a draft internal impact and risk assessment, reviewing whether the assessment is sufficiently evidence based, transparent, peer reviewable and clear about uncertainty before finalising it.	Roy, Rabitsch, Scalera, et al (2018) Developing a framework of minimum standards for the risk assessment of alien species

Type	What it supports	Hypothetical examples	Resource
Risk analysis framework	Structured questions on likelihood, impacts and management options	A company uses RAAT to work through a structured set of questions on whether repeated movement of planting material and machinery is likely to lead to introduction or spread, what the likely impacts could be, and which management option is most defensible.	Kumschick, Wilson and Foxcroft (2020) Risk Analysis for Alien Taxa (RAAT)
Rapid screening approach	Rapid evaluation of a species' potential invasiveness	A company uses ERSS as a first screen when a contractor proposes a non-native species for landscaping, using the summary to decide whether the species should be ruled out immediately or sent for deeper review.	USFWS (continuously updated) Ecological Risk Screening Summaries (ERSS)
International standard	Regulation of wood packaging material	A logistics company uses ISPM 15 to ensure that any wood packaging material (e.g. pallets or crates) align with international standards so that they do not spread wood-borne IAS.	International Plant Protection Convention (IPPC) (2021) ISPM 15: Regulation of wood packaging material in international trade
International guidance	Import risk analysis for disease risks associated with animals and animal products	A company importing live aquatic animals uses the WOAH guidance to structure an import risk analysis, separating hazard identification, risk assessment and management so that decisions are documented in a transparent way.	World Organisation for Animal Health (WOAH) (2010) Import risk analysis for animals and animal products

Type	What it supports	Hypothetical examples	Resource
Impact classification tool	Classifying severity of environmental impacts caused by alien taxa	A company considering species for quarry restoration uses IUCN EICAT to check whether candidate non-native species are associated with minor, moderate or more severe environmental impacts elsewhere, and uses that information to rule out higher impact options.	IUCN (2020) Environmental Impact Classification for Alien Taxa (EICAT)
Database	Species profiles and invasive species information, including EICAT-related content	A port operator uses GISD to pull together a profile of a species already detected near one of its sites, reviewing known pathways, impacts and management information to inform how that species should be prioritised internally.	IUCN (2015) Global Invasive Species Database (GISD)
Impact classification tool	Standardised classification of socio-economic impacts on human well being	A resort operator uses SEICAT to understand whether a species affecting beaches or coastal access is linked to reduced recreation, health concerns or disruption to local livelihoods.	Bacher et al (2018) Socio-economic impact classification of alien taxa (SEICAT)
Evidence base and database	Economic cost evidence for biological invasions	A producer uses InvaCost to identify published cost evidence for invasive pests affecting similar crops or regions, and then uses those figures as contextual evidence when prioritising prevention and surveillance spending.	Diagne, Leroy, Gozlan et al (2020) InvaCost, a public database of the economic costs of biological invasions worldwide.

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 is 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 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 number of introduced or established invasive alien species at site Y.
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 solutions 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, credible sustainable forestry certification standards by 2030, including effective sharing of benefits with Indigenous Peoples and Local Communities.
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.

	GBF target	Target area	Illustrative target for organisations
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 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.
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.

	GBF target	Target area	Illustrative target for organisations
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.
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.

	GBF target	Target area	Illustrative target for organisations
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, 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 USD 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 USD 200 billion per year, including by: d. 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 USD 20 billion per year by 2025, and to at least USD 30 billion per year by 2030; e. 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; f. 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; g. Stimulating innovative schemes such as payment for ecosystem services, green bonds, biodiversity offsets and credits, benefit-sharing mechanisms, with environmental and social safeguards;	n/a	X% additional finance leverage effect of nature-targeted investment by 2030.

	GBF target	Target area	Illustrative target for organisations
	h. Optimising co-benefits and synergies of finance targeting the biodiversity and climate crises; i. 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 j. Enhancing the effectiveness, efficiency and transparency of resource provision and use.		
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.

	GBF target	Target area	Illustrative target for organisations
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 – Avoid, Reduce, Regenerate, Restore and Transform. SBTN's action framework for the mitigation hierarchy.

AIS – Automatic Identification System

ALIGN – Aligning Accounting Approaches for Nature

API – Application Programming Interface

AUM – Assets Under Management

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

BBNJ – Biological Diversity Beyond Areas of National Jurisdiction. Relates to agreement on the Conservation and Sustainable Use of Marine Biological Diversity of Areas beyond National Jurisdiction

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

CEF – Corporate Environmental Footprint

CEMP – Coordinated Environmental Monitoring Programme

CITES – Convention on International Trade in Endangered Species of Wild Fauna and Flora

COSO – Committee of Sponsoring Organizations of the Treadway Commission

DIRO – Dependencies, Impacts, Risks and Opportunities

DPSIR – Driving forces, Pressures, State, Impacts, Responses

EAI – Ecosystem Area Index

EBA – European Banking Authority

EBSAs – Ecologically or Biologically Significant Marine Areas

ECB – European Central Bank

ECT – Ecosystem Condition Typology

EIA – Environmental Investigation Agency

eDNA – Environmental DNA

EHI – Ecosystem Health Index

EII – Ecosystem Integrity Index

EIOPA – European Insurance and Occupational Pensions Authority

EITI – Extractive Industries Transparency Initiative

ENCORE – Exploring Natural Capital Opportunities, Risks, and Exposure

ErII – Ecoregion Intactness Index

ERM – Enterprise risk management systems

ERP – Enterprise Resource Planning

ESG – Environmental, Social, and Governance

ESRS – European Sustainability Reporting Standards

EU B@B – European Union Biodiversity & Business Platform

ETC – Ecosystem Condition Typology

FAIR – Findable, Accessible, Interoperable and Reusable

FSB – Financial Stability Board

GBF – Kunming-Montreal Global Biodiversity Framework

GBIF – Global Biodiversity Information Facility

GET – Global Ecosystem Typology

GEP – Global Extinction Probability

GHG – Greenhouse Gas

GICS – Global Industry Classification Standard

GIS – Geographic Information System

GISD – IUCN Global Invasive Species Database

GI-TOC – Global Initiative Against Transnational Organized Crime

GIUM – Global Initiative on Ungulate Migrations

GMAP – Global Map of Environmental and Social Risks in Agro-Commodity Production

GPS – Global Positioning System

GVFD – Global Value Factor Database

GRI – Global Reporting Initiative

HICL – High Impact Commodity List

IAIS – International Association of Insurance Supervisors

IAS – Invasive Alien Species

IASSB – International Auditing Assurance Standards Board

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

IIFB – International Indigenous Forum on Biodiversity

IMMA – Important Marine Mammal Areas

INVEST – Integrated Valuation of Ecosystem Services and Tradeoffs

IPA – Important Plant Area

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

IPCC – Intergovernmental Panel on Climate Change

IPLC – Indigenous Peoples and Local Communities

IRGC – International Risk Governance Council

ISFC – International Sustainable Forestry Coalition

ISIC – International Standard Industrial Classification of All Economic Activities

ISO – International Organization for Standardization

ISSA – International Standard on Sustainability Assurance

ISSB – International Sustainability Standards Board

IUCN – International Union for Conservation of Nature

IUCN RHINO – IUCN's approach to delivering Rapid High-Integrity Nature-positive Outcomes

IVSB – Impact Value Standards Board

KBA – Key Biodiversity Area

KPI – Key Performance Indicator

KYC – Know Your Customer

LCA – Life Cycle Analysis

LEAP – Locate, Evaluate, Assess, Prepare

LIFE – Land-cover Impacts on Future Extinctions

LULC – Land Use/ Land Cover

MARPOL – International Convention for the Prevention of Pollution from Ships

MPAs – Marine Protected Areas

MRIO – Multi-Regional Input-Output

MRV – Monitoring, Reporting and Verification

MSA – Mean Species Abundance

MSC – Marine Stewardship Council

NbS – Nature-based Solutions

NBSAP – National Biodiversity Strategy and Action Plan

NCFA – Natural Capital Finance Alliance

NDVI – Normalised Difference Vegetation Index

NGFS – Network for Greening the Financial System

NPI – Nature Positive Initiative

NPL – Non-Performing Loan

NVaR – Nature Value-at-Risk

OECD – Organisation for Economic Co-operation and Development

OECMs – Other Effective Area-based Conservation Measures

OSPAR – Convention for the Protection of the Marine Environment of the North-East Atlantic.

PA – Protected Area

PBAF – Partnership for Biodiversity Accounting Financials

PDF – Potentially Disappeared Fraction

PEF – Product Environmental Footprint

PESTLE – Political, Economic, Social, Technological, Legal and Environmental

PSSA – Particularly Sensitive Sea Area

QGIS – Quantum Geographic Information System

SASB – Sustainability Accounting Standards Board

SBTi – Science Based Targets initiative

SBTN – Science Based Targets Network

SDG – Sustainable Development Goal

SEEA EA – System of Environmental Economic Accounting - Ecosystem Accounting

SICS – Sustainable Industry Classification System

STAR – Species Threat Abatement and Restoration metric

STEEP – Social, Technological, Economical, Environmental and Political

TEEB – The Economics of Ecosystems and Biodiversity

TESSA - Toolkit for Ecosystem Service Site-Based Assessment

TCFD – Task Force on Climate-related Financial Disclosures

UN – United Nations

UNEP – United Nations Environment Programme

UNEP FI - United Nations Environment Programme Finance Initiative

UNEP WCMC – United Nations Environment Programme World Conservation Monitoring Centre

UNHCR – Office of the United Nations High Commissioner for Refugees

UN SEEA EA – United Nations System of Environmental-Economic Accounting Ecosystem Accounting

VME – Vulnerable Marine Ecosystems

VOC – Volatile Organic Compounds

WASH – Water, Sanitation, and Hygiene, specifically referring to the provision of water supply, drainage, toilets, and waste disposal

WDPA – World Database on Protected Areas

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

WSC – World Shipping Council

WWF – World Wide Fund for Nature

Annex 7: References

Accounting for Nature (2022) Accounting for Nature Certification Standard Version 3.1. This version informed the LEAP approach v1.1. A new version is now available – Accounting for Nature Standard Version 5.0.

Accounting for Nature (n.d.) Method catalogue.

Accounting for Sustainability (2015) Essential guide to natural and social capital accounting. An Introduction to integrating natural and social capital into accounting and decision making. A4S CFO Leadership Network.

Alcocer, I. et al. (2022) Acoustic indices as proxies for biodiversity: a meta-analysis. Biological Reviews 97, 2209–2236.

Allianz Global Corporate and Specialty (2018) Measuring and managing environmental exposure: A business sector analysis of natural capital risk.

Alvarez, J., Postel-Vinay, N., Guckenberger, M., Lee, J., Lambin, R., O'Donnell, E. and Pasqua, C (2025) Nature-related financial risks database (June 2025). Resilient Planet Finance Lab, Environmental Change Institute, University of Oxford.

Andersen et al. (2020) Defining 'science-based targets'. National Science Review 8(7), nwaa186.

Apple (2025) Environmental Progress Report.

Bacher et al (2018). Socio-economic impact classification of alien taxa (SEICAT). Methods in Ecology and Evolution 9,159–168.

Bachman, S. P. et al. (2019) Progress, challenges and opportunities for Red Listing. Biological Conservation 234, 45–55.

Banco Bolivariano (2024) Informe integrado 2024.

Banco de Bogotá (2025) Riesgos y oportunidades de la naturaleza.

Banque de France (2021) A "Silent Spring" for the financial system? Exploring biodiversity-related financial risks in France.

Barclays (2025) Navigating Nature Risk: Applying the TNFD' s LEAP Framework.

Barnosky, A. D. et al. (2011) Has the Earth's sixth mass extinction already arrived? Nature 471, 7336.

BBOP (2012) Standard on Biodiversity Offsets. Washington, D.C. Business and Biodiversity Offsets Programme.

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

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.

Berger-Tal, O. and Lahoz-Monfort, J. J. (2018) Conservation technology: the next generation. Conservation Letters 11, e12458.

Beyer, H. et al. (2019) Substantial losses in ecoregion intactness highlight urgency of globally coordinated action. Conservation Letters 13(2).

BHP (2026) Advancing the valuation of nature: BHP's first operated asset natural capital baseline and accounting approach.

Biggs, R., et al. (2018) The regime shifts database: a framework for analyzing regime shifts in social-ecological systems. Ecology and Society, 23(3).

BirdLife International (2023) The World Database of Key Biodiversity Areas. Developed by the KBA Partnership: BirdLife International, International Union for the Conservation of Nature, Amphibian Survival Alliance, Conservation International, Critical Ecosystem Partnership Fund, Global Environment Facility, Re:wild, NatureServe, Rainforest Trust, Royal Society for the Protection of Birds, Wildlife Conservation Society and World Wildlife Fund.

Blackburn, T. M., et al (2011) A proposed unified framework for biological invasions. Trends in Ecology & Evolution, 26(7), 333–339.

Blanco-Pimentel, M., et al. (2022) All-Inclusive Coral Reef Restoration: How the Tourism Sector Can Boost Restoration Efforts in the Caribbean.

BloombergNEF (2024) Aquafil's Regenerated Nylon Fashions a Revenue Opportunity. Bloomberg New Energy Finance.

BNZ (2006) Port of Tauranga: Baseline survey for non-indigenous marine species. Biosecurity New Zealand. National Institute of Water and Atmospheric Research.

Boakes, E. H., et al. (2026) Exploring the use of state of nature metrics to screen global business operations for ecological sensitivity and to select priority sites for disclosure. bioRxiv, 2026-08.

Bracy Knight, K. et al. (2020) A framework for evaluating biodiversity mitigation metrics. Ambio 49, 1232–1240.

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

Buchadas, A., et al. (2022) Uncovering major types of deforestation frontiers across the world's tropical dry woodlands. Nature Sustainability, 5(7), 619-627.

Bunge (2026) 2026 Global Sustainability Report.

Burivalova, Z. et al. (2021) "Early warning sign of forest loss in protected areas." Current Biology 31.20 (2021): 4620-4626.

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.

Business for Nature (2025) Nature Strategy Handbook.

Butchart, S. H. M. et al. (2005) Using Red List Indices to measure progress towards the 2010 target and beyond. Philosophical Transactions of the Royal Society B 360(1454), 255–268.

Butchart, S. H. M. et al. (2007) Improvements to the Red List Index. PLoS ONE 2(1).

Candriam (2026) Taskforce on Nature-related Financial Disclosures Report 2026.

Capitals Coalition (2016) Natural Capital Protocol.

Capitals Coalition (2018) Connecting finance and natural capital: A supplement to the Natural Capital Protocol.

Capitals Coalition (2025) Governance for Valuation.

Capitals Coalition (2026) Global Value Factor Database.

Capitals Coalition (n.d.a) Guides and supplements.

Capitals Coalition (n.d.b) Impact Value Standards Board. Capitals Coalition.

Capitals Coalition (n.d.c) SUSTAIN: Strengthening Understanding and Strategies of Business to Assess and Integrate Nature.

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

Carroll, S. R. et al. (2020) The CARE principles for indigenous data governance. Data science journal, 19(1), 43-43.

Carter, S. K. et al. (2019) Quantifying ecological integrity of terrestrial systems to inform management of multiple-use public lands in the United States. Environmental Management 64, 1–19.

Cartier Philanthropy for People and Nature (2026) Nature and biodiversity programmes.

CBD (1992a) Convention on Biological Diversity, Article 2, Use of Terms. Convention on Biological Diversity.

CBD (1992b) Convention on Biological Diversity. Convention on Biological Diversity.

CBD (2014) SBSTTA/18/9/Add.1 Pathways of introduction of invasive species, their prioritization and management.

CBD (2022a) Kunming-Montreal Global Biodiversity Framework. Convention on Biological Diversity.

CBD (2022b) Monitoring framework for the Kunming–Montreal Global Biodiversity Framework. Convention on Biological Diversity.

CBD (2022c) Target 16. Convention on Biological Diversity.

CBD (2023) Ecologically or Biologically Significant Marine Areas (EBSAs). Convention on Biological Diversity.

CBD (2024) Metadata factsheet on Target 6: headline indicator. Convention on Biological Diversity.

CBD and IUCN (2024) Invasive Alien Species Toolkit for Target 6 of the Kunming-Montreal Global Biodiversity Framework. Convention on Biological Diversity and the International Union for the Conservation of Nature.

CDP (2026) The CDP Water Impact Index.

CDP and Planet Tracker (2022) High and dry: How water issues are stranding assets. CDP and Planet Tracker.

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

Ceglar, A. et al. (2025) Nature at Risk: Implications for the Euro Area Economy and Financial Stability. ECB Occasional Paper Series No. 380. Frankfurt: European Central Bank.

Chaplin-Kramer, R. et al. (2023) Mapping the planet's critical natural assets. Nature Ecology and Evolution 7, 51–61.

CIELO MEX (2024) TNFD, LEAP and Indigenous Enterprises: Impacts and Opportunities. Federación Indígena Empresarial y Comunidades Locales de México.

CISL (2022) Integrating Nature: The case for action on nature-related financial risks. Cambridge, UK. University of Cambridge Institute for Sustainability Leadership.

CISL and Howden (2024) Nature-related financial opportunity use case: The role of mangroves, coral reefs and seagrasses in supporting and protecting near-shore fisheries in Bolinao, the Philippines. University of Cambridge Institute for Sustainability Leadership.

CMS (2020) The Global Initiative on Ungulate Migration. Convention on the Conservation of Migratory Species of Wild Animals.

Conservation International (2026) Trends.Earth. Conservation International, Lund University, NASA and gef.

COSO (2017) Enterprise Risk Management Framework. Committee of Sponsoring Organizations.

COSO (2020) Creating and protecting value: Understanding and implementing Enterprise Risk Management. Committee of Sponsoring Organizations.

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

CTG Brasil (2025) Study advances toward sustainable solution to golden mussel infestation at hydroelectric plants.

Curnick, D. J. et al. (2022) SmallSats: a new technological frontier in ecology and conservation? Remote Sensing in Ecology and Conservation 8, 139–150.

Cuthbert, R. N., Diagne, C., et al (2022) Managing biological invasions: the cost of inaction.

Dasgupta, P. (2021) The economics of biodiversity: The Dasgupta Review. London: HM Treasury.

De Lauriere, C. F. et al. (2023) Assessing the multidimensional complexity of biodiversity using a globally standardized approach. EcoEvoRxiv. Preprint.

De Palma, A. et al. (2021) Annual changes in the Biodiversity Intactness Index in tropical and subtropical forest biomes, 2001–2012. Scientific Reports 11, 20249.

DEFRA (2026) UK Pollutant Release and Transfer Register. Threshold List. Department of Environment Food and Rural Affairs.

Diagne, C., et al (2021) High and rising economic costs of biological invasions worldwide. Nature, 592, 571-576.

Diagne, Leroy, Gozlan et al (2020) InvaCost, a public database of the economic costs of biological invasions worldwide. Scientific Data 7(277).

Díaz, S. and Malhi, Y. (2022) Biodiversity: Concepts, Patterns, Trends and Perspectives. Annual Review of Environment and Resources 47(1), 31–63.

Díaz, S. et al. (2015) The IPBES conceptual framework – Connecting nature and people. Current Opinion in Environment and Sustainability 14, 1–16.

Díaz, S. et al. (2019) Pervasive human-driven decline of life on Earth points to the need for transformative change. Science 366 (6471).

DNB (2020) Indebted to nature – Exploring biodiversity risks for the Dutch financial sector. De Nederlandsche Bank.

DNB (n.d.) Biodiversity Working Group. De Nederlandsche Bank.

Dow (n.d.) Seadrift Constructed Wetlands: An Engineered Natural Technology Project.

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(2), 1098–1113.

Dudgeon, D. (2019) Multiple threats imperil freshwater biodiversity in the Anthropocene. Current Biology 29(19), R960–R967.

Dunnett, S., et al. (2025) An update to the global Critical Habitat screening layer. Scientific Data, 12(1), 1812.

Durán, A. P. et al. (2020) A practical approach to measuring the biodiversity impacts of land conversion. Methods in Ecology and Evolution 11(8), 910–921.

E.SUN (2025) Climate and Nature Report 2024.

EBA (2025) Final report on Guidelines on the management of ESG risks. European Banking Authority.

EC (2000) Water Framework Directive 2000/60/EC. European Commission.

EC (2021) Environmental footprint methods. European Commission.

EC (2023a) Commission delegated regulation (EU) 2023/2772 of 31 July 2023 supplementing Directive 2013/34/EU of the European Parliament and of the Council as regards sustainability reporting standard. European Commission.

EC (2023b) Draft delegated regulation – Ares(2023)4009405. European Commission.

EC (2023c) European Platform on Life Cycle Assessment (EPLCA). European Commission.

EC (2026) Commission Delegated Regulation (EU) 2026/1563 of 3 July 2026 amending Delegated Regulation (EU) 2023/2772 as regards the simplification of certain sustainability reporting standards. European Commission.

ECB – Banking Supervision (2020) Guide on climate-related and environmental risks: Supervisory expectations relating to risk management and disclosure. European Central Bank – Banking Supervision.

ECB (2007) Model risk: An overview of the issues. European Central Bank.

ECB (2026) Good practices for climate and nature risk management – Observations from the ECB's five-year climate and nature risk programme (2020-25). European Central Bank.

Ecoinvent (n.d.) ecoinvent database. ecoinvent Association.

Ecopetrol (2026) Integrated Management Report 2025.

EEA (2021) Natura 2000 viewer. European Environment Agency.

EFRAG (2025) Simplified ESRS glossary: sustainability-related opportunity. European Financial Reporting Advisory Group.

Eftec (2010) Valuing environmental impacts: Practical guidelines for the use of value transfer in policy and project appraisal.

EIOPA (2023) Staff Paper on Nature-related Risks and Impacts for Insurance. European Insurance and Occupational Pensions Authority.

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

Endangered Wildlife Trust (2020) The Biological Diversity Protocol. Biodiversity Disclosure Project, Endangered Wildlife Trust.

Eora (n.d.) Eora2 Global Supply Chain Database (MRIO). KGM & Associates Pty. Ltd.

Euring (2022) Eurasian African Bird Migration Atlas project. European Commission.

European Parliament and Council of the European Union (2000) Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.

European Parliament and Council of the European Union (2023) Regulation (EU) 2023/1115 of the European Parliament and of the Council of 31 May 2023 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.

European Parliament and the Council of the European Union (2014) Regulation (EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species.

Exiobase Consortium (2015) EXIOBASE3 dataset.

Eyres et al. (2025) LIFE: A metric for mapping the impact of land-cover change on global extinctions. Philosophical Transactions of the Royal Society B. 380 (1917): 20230327.

Folke, C. et al. (2016) Social-ecological resilience and biosphere-based sustainability science. Ecology and Society 21(3), 41.

Forico (2025) Natural Capital Report.

FSB (2020) The implications of climate change for financial stability. Financial Stability Board.

FSB (2022) FSB Supervisory and Regulatory Approaches to Climate-related Risks Final report. Financial Stability Board.

FWS (2022) Invasive Species Biosecurity Protocols. United States Fish and Wildlife Service.

Galil B.S. and Zenetos A (2002) A sea change – exotics in the eastern Mediterranean Sea.

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

GEO, CBD Secretariat and IUCN (n.d.) Global Ecosystems Atlas. Group on Earth Observations, Secretariat of the Convention on Biological Diversity and International Union for Conservation of Nature.

GIDA (2026) Care principles for indigenous data governance. Global Indigenous Data Alliance.

GI-TOC (2019) Sand mafias in India: Disorganized crime in a growing economy. Global Initiative Against Transnational Organized Crime.

Global Canopy (2023) Forest 500 – 2023: A watershed year for action on deforestation. Annual Report 2023.

Global Canopy (2025) How financial institutions use ENCORE for TNFD risk assessments.

Global Canopy and Cornell Atkinson (2026) The Little Book of Nature Business.

Global Fishing Watch (2026) Global Fishing Watch Interactive Map.

Global Nature Watch (2026) Global Nature Watch Dashboard.

GO Fair Foundation (2026) The FAIR guiding principles.

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.

Goldin, I. and Mariathasan, M. (2014) The Butterfly Defect: How globalisation creates systemic risks and what to do about it.

Gosling et al (2026) A prioritization strategy for protecting Conservation Imperatives Sites. Frontiers in Conservation Science, 7.

Government of Chile (2023) President Gabriel Boric launches Natural Capital Committee to promote the sustainable development of Chile.

Grantham, H. S. et al. (2020) Anthropogenic modification of forests means only 40% of remaining forests have high ecosystem integrity. Nature Communications 11, 5978.

GreenDelta (2005) Open Source Life Cycle Assessment software (openLCA).

Greenhouse Gas Protocol (2015) A corporate accounting and reporting standard.

GRI (2018) GRI 303 Water and Effluents. Global Reporting Initiative.

GRI (2021a) GRI 3: Material Topics 2021. Global Reporting Initiative.

GRI (2021b) GRI 1: Foundations. Global Reporting Initiative.

GRI (2021c) GRI Standards and Glossary. Global Reporting Initiative.

GRI (2024) GRI 101 Biodiversity. Global Reporting Initiative.

GRI (n.d.) Sector Program. Global Reporting Initiative.

GRI and TNFD (2025), Identifying risks and opportunities to organizations arising from dependencies and impacts on nature. Global Reporting Initiative and Taskforce on Nature-related Financial Disclosures.

Guerrero-Pineda, C. et al (2022) An investment strategy to address biodiversity loss from agricultural expansion. Nature Sustainability 5(7), 610–618.

Gullison, R. E. et al. (2015) Good practices for the collection of biodiversity baseline data.

H&M Group (2026) H&M Group adopts science-based targets for land, following the Science Based Targets Network framework (SBTN).

Halpern, B. et al. (2008) A Global Map of Human Impact on Marine Ecosystems. Science. 319(5865), 948-952.

Halpern, B. S. et al. (2015) Spatial and temporal changes in cumulative human impacts on the world's ocean. Nature communications 6, 7615.

Halpern, B. S. et al. (2019) Recent pace of change in human impact on the world's ocean. Scientific Reports 9, 11609.

Hansen, A. et al. (2019) Global humid tropics forest structural condition and forest structural integrity maps. Scientific Data 6, 232.

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

Henriques, S. et al. (2020) Accelerating the monitoring of global biodiversity: Revisiting the sampled approach to generating Red List Indices. Conservation Letters, 13(3).

Hill, S. L. L. et al. (2022) The Ecosystem Integrity Index: A novel measure of terrestrial ecosystem integrity with global coverage. bioRxiv 2022.08.21.504707.

Houdet, J and Teren, G. (2022) Quality Biodiversity Footprint Assessments in Practice: Why Organisational Biodiversity Accounting Matters. A Position Paper of the Biodiversity Disclosure Project (BDP). Endangered Wildlife Trust.

Howden (2023) Howden launches Climate Parametrics global practice to de-risk the low carbon, resilient transition and protect biodiversity.

IAASB (2024) International Standard on Sustainability Assurance 5000, General Requirements for Sustainability Assurance Engagements. International Auditing Assurance Standards Board.

IAIS (2021) Application paper on the supervision of climate-related risks in the insurance sector. International Association of Insurance Supervisors.

IAS Collaborative Initiative (2026) Growing Momentum: Tackling invasive alien species together. Fauna & Flora, IUCN and Taskforce on Nature-Related Financial Disclosures.

IBAT alliance (2021) Species Threat Abatement and Restoration (STAR) data layer. Business User Guidance. Integrated Biodiversity Assessment Tool alliance.

IBAT alliance (n.d.) Integrated Biodiversity Assessment Tool. BirdLife International, Conservation International, IUCN and UNEP-WCMC.

IBBI (2025) Integrating Nature-related Aspects in Business Responsibility & Sustainability Reporting (BRSR) Disclosures using the Taskforce on Nature-related Financial Disclosures (TNFD) Recommendations. India Business and Biodiversity Initiative.

Iberdrola (2024) Biodiversity Report.

ICCA Consortium (2023) Indigenous Peoples' and community-conserved territories and areas. Indigenous Peoples' and Community Conserved Territories and Areas Consortium.

IFC (2012) Performance Standard 6 Biodiversity Conservation and Sustainable Management of Living Natural Resources. International Finance Corporation.

IFC (2023) Biodiversity Finance Reference Guide. International Finance Corporation.

IFRS Sustainability (2024), Sustainability-related risks and opportunities and the disclosure of material information. International Financial Reporting Standards (IFRS) Sustainability.

IFRS Sustainability (2025) Disclosing information about anticipated financial effects applying ISSB Standards. International Financial Reporting Standards (IFRS) Sustainability.

IMO (2026) Ballast Water Management (BWM) Convention and Guidelines. International Maritime Organisation.

Indigenous Navigator (n.d.) Indigenous data.

ING (2024) ING's Nature Approach. ING Group.

Ingram, J. C. et al (2024) Leveraging natural capital accounting to support businesses with nature-related risk assessments and disclosures. Philosophical Transactions of the Royal Society B 379 (1903): 20220328.

Insurance for Good. (2026) Invasive Species & Wildfire Risk.

IPBES (2019a) Summary for policymakers of the global assessment report on biodiversity and ecosystem services. Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.

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

IPBES (2020) IPBES workshop on biodiversity and pandemics: Workshop report. Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.

IPBES (2022) Methodological Assessment Report on the Diverse Values and Valuation of Nature of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. IPBES secretariat, Bonn, Germany.

IPBES (2023) Thematic Assessment Report on Invasive Alien Species and their Control. Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.

IPBES (2024a) Thematic Assessment Report on the Interlinkages among Biodiversity, Water, Food and Health. Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.

IPBES (2024b) Summary for Policymakers of the Transformative Change Assessment. Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.

IPBES (2024c) Thematic Assessment Report on the Underlying Causes of Biodiversity Loss and the Determinants of Transformative Change and Options for Achieving the 2050 Vision for Biodiversity of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. IPBES secretariat, Bonn, Germany.

IPBES (2026) Methodological assessment of the impact and dependence of business on biodiversity and nature's contributions to people. Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.

IPBES (n.d.) Glossary. Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.

IPCC (2014) Climate Change 2014: Synthesis report. Intergovernmental Panel on Climate Change.

IPPC (2021) ISPM 15: Regulation of wood packaging material in international trade. International Plant Protection Convention.

IRGC (2018) Guidelines for the Governance of Systemic Risks. International Risk Governance Council.

Irwin, A. et al. (2022) Quantifying and categorising national extinction-risk footprints. Scientific Reports 12(1), 5861.

ISEAL (2021) Credibility Principles. ISEAL Alliance.

ISEAL (2023) Code of Good Practice for Sustainability Systems. ISEAL Alliance.

ISEAL (2024) Core criteria for mature landscape initiatives. ISEAL Alliance.

ISEAL (2026) What is a sustainability system? ISEAL Alliance

ISFC and Capitals Coalition (2025) Forestry Natural Capital Project: Measuring the Contribution of Forestry – Part 1 Progress Report: Context and Scoping (COP30 supplement report). International Sustainable Forestry Coalition and Capitals Coalition.

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

ISO (2025) ISO 14054:2025 Natural capital accounting for organizations — Principles, requirements and guidance. International Organization for Standardization.

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

ISSB (2023b) IFRS S2 Climate-related Disclosures. International Sustainability Standards Board.

ISSB (2024) Educational material – Sustainability-related risks and opportunities and the disclosure of material information. International Sustainability Standards Board.

IUCN (2018) Guidance for interpretation of CBD categories of pathways of introduction. International Union for the Conservation of Nature.

IUCN (2020a) The IUCN Global Standard for Nature-based Solutions. International Union for Conservation of Nature.

IUCN (2020b) IUCN EICAT Categories and Criteria. First Edition. The Environmental Impact Classification for Alien Taxa (EICAT). International Union for Conservation of Nature.

IUCN (2023) Species Threat Abatement and Restoration (STAR) metric. International Union for Conservation of Nature.

IUCN (2024) Guidelines for the application of IUCN Red List of Ecosystems Categories and Criteria: Version 2.0. International Union for Conservation of Nature.

IUCN (2025) IUCN RHINO (Rapid High-Integrity Nature-positive Outcomes) approach, Technical Source Document 2.0. International Union for Conservation of Nature.

IUCN (2026) A Global Typology for Earth's Ecosystems. International Union for Conservation of Nature.

IUCN (n.d.a) EICAT assessments. Global Invasive Species Database. International Union for Conservation of Nature.

IUCN (n.d.b) The IUCN Red List of Ecosystems. International Union for Conservation of Nature.

IUCN (n.d.c) The IUCN Red List of Threatened Species. International Union for Conservation of Nature.

IUCN Red List (2012) IUCN Red List Categories and Criteria (version 3.1) (Second edition). International Union for Conservation of Nature.

Jago et al. (2024) Agrobiodiversity conservation enables sustainable and resilient food systems. Science and Society 39(10), 877-880.

Jaureguiberry, P. et al. (2022) The direct drivers of recent global anthropogenic biodiversity loss. Science Advances 8(45), eabm9982.

JDE Peet's (2026) Grounded in Nature: Nature Transition Plan. JDE Peet's.

Jetz, W. et al (2019) Essential biodiversity variables for mapping and monitoring species populations. Nat Ecol Evol 3:539–551.

Johannes-Gold, J., Ranger, N. and Eikeset, A.M. (2026) A new framework for stress-testing investment portfolios against nature-related shocks, Grantham Research Institute / Earth Capital Nexus commentary, 31 March 2026.

JSW Steel (2025) TNFD Report 2025.

JSW Steel (2026) Biodiversity.

Jurisdictional Action Resource Hub (n.d.) Landscape and Jurisdictional Initiatives Map.

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.

Keith, D. A. et al. (2013) Scientific foundations for an IUCN Red List of Ecosystems. PLOS one 8(5), e62111.

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

Keith, D. A., et al. (2022) A function-based typology for Earth's ecosystems. Nature, 610(7932), 513-518.

Kempel, A. et al. (2020) Nationwide revisitation reveals thousands of local extinctions across the ranges of 713 threatened and rare plant species. Conservation Letters 13(6), e12749.

Kirin (2026) Environmental Report.

Kuipers, K. J. J. et al. (2019) Potential Consequences of Regional Species Loss for Global Species Richness: A Quantitative Approach for Estimating Global Extinction Probabilities. Environmental Science & Technology 53(9), 4728–4738.

Kumschick, Wilson and Foxcroft (2020). A framework to support alien species regulation: the Risk Analysis for Alien Taxa (RAAT). NeoBiota 62 213-219.

Kyuden Group (2024) TNFD Report 2024.

Lammerant, J. (2021a) Business and Natural Capital Accounting Case Study: Ambuja Cement, India. United Nations Statistics Division, Department of Economic and Social Affairs, New York.

Lammerant, J. (2021b) Business and Natural Capital Accounting Case Study: Quarry restoration by Holcim, Spain. United Nations Statistics Division, Department of Economic and Social Affairs, New York.

Land & Carbon Lab, WWF, Systemiq and SBTN (n.d.) Natural Lands Map. World Resources Institute, World Wide Fund for Nature, Systemiq and Science Based Targets Network.

LANDex (2023) Global land governance index.

LandMark (2023) Global Platform of Indigenous and Community Lands database.

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.

Ledger, S. E. H. et al. (2023) Past, present and future of the Living Planet Index. Nature. Npj Biodiversity 2(1), 12.

Leung, B. et al. (2020) Clustered versus catastrophic global vertebrate declines. Nature 588, 7837.

Levin, S. A. ed. (2009) The Princeton Guide to Ecology. Princeton, NJ: Princeton University Press.

Levis, C., et al. (2017) Persistent effects of pre-Columbian plant domestication on Amazonian forest composition. Science 355 (6328), 925-931.

Liu, C. et al. (2024) Dynamics of ecosystem services and nonlinear responses to increased anthropogenic pressure. Ambio, 53(11), 1649-1663.

Liu, S. et al. (2012) Environmental Benefit Transfers of Ecosystem Service Valuation. Ecological Economics of Estuaries and Coasts 12, 55–77.

Loss, S. R. et al. (2015) Direct Mortality of Birds from Anthropogenic Causes. Annual Review of Ecology, Evolution and Systematics 46(1), 99–120.

LPC (2024) Nature-related Disclosures. Lyttelton Port Company.

Lucas, P. and Wilting, H. (2018) Using planetary boundaries to support national implementation of environment-related sustainable development goals.

Lumbierres, M. et al. (2022) Area of Habitat maps for the world's terrestrial birds and mammals. Scientific Data 9, 1.

LVMH (2026) Universal registration document – Fiscal year ended December 31, 2025. Louis Vuitton Moët Hennessy.

MacQueen D. (2024) Agrobiodiversity — the way to save Earth's skin.

Maes, J. et al. (2016) An indicator framework for assessing ecosystem services in support of the EU Biodiversity Strategy to 2020. Ecosystem Services 17, 14–23.

Maes, J. et al. (2023) Accounting for forest condition in Europe based on an international statistical standard. Nature Communications 14, 3723.

Mair, L. et al. (2021) A metric for spatially explicit contributions to science-based species targets. Nature Ecology & Evolution 5, 836–844.

Mair, L. et al. (2023) Quantifying and mapping species threat abatement opportunities to support national target setting. Conservation Biology 37(1), e14046.

Marine Mammal Protected Areas Task Force (2023) IMMA e-Atlas.

MAS (2022) Information Papers on Environmental Risk Management. Monetary Authority of Singapore.

Mayr, E. (1949) The Species Concept: Semantics Versus Semantics. Evolution 3(4), 371–372.

McGeoch, M. and Jetz, W. (2019) Measure and Reduce the Harm Caused by Biological Invasions. One Earth, 1: 171-174.

McKenzie, E. et al (2025) Science and technical priorities for private sector action to address biodiversity loss. Philosophical Transactions of the Royal Society B 380 (1917): 20230208.

Ministry of Corporate Affairs, Government of India (2018) National Guidelines on Responsible Business Conduct.

Ministry of the Environment, Government of Japan. (2015). Enforcement of the Act for Partial Revision of the Wildlife Protection and Hunting Management Law.

Moody's (2020) Moody's Investor Service: Heat map: Sectors with $3.4 trillion in debt face heightened environmental credit risk.

Moody's Ratings (2024) Rating Action: Moody's Ratings downgrades Naked Juice's CFR to Caa1 from B3, outlook is stable. [URL not available].

Moody's Ratings (2025) Naked Juice LLC: Update to credit analysis following upgrade of CFR to Caa2. [URL not available].

Moody's RMS. (2023) Moody's RMS estimates USD 4 to 6 billion in economic losses from Hawaii wildfires.

Mowi (2026a) About us.

Mowi (2026b) TNFD report.

NAISMA (2023) The tragedy in Lahaina: How invasive grasses and shrubs are fueling the wildfire crisis in Hawai'i. North American Invasive Species Management Association.

Natura (2026) IP&L Natura 2025.

Natural Capital Alliance (2026a) Bhutan becomes first country to adopt 'gross ecosystem product' at national level.

Natural Capital Alliance (2026b) Gross Ecosystem Product (GEP): An Overview.

Natural Capital Alliance (2026c) InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs).

Natural Capital Alliance (2026d) InVEST Model: Crop Pollination.

Natural Capital Alliance (2026e) People, Planet, Prosperity: Mainstreaming Nature in Policy & Investment Decisions (Global).

Natural England (2023) Biodiversity metric: calculate the biodiversity net gain of a project or development.

NBIM (2024) Climate and Nature Disclosures 2024. Norges Bank Investment Management.

NBIM (2025) Climate and Nature Disclosures 2025. Norges Bank Investment Management.

NBIM (2026) Nature Expectations. Norges Bank Investment Management.

Newbold, T., et al. (2016) Has land use pushed terrestrial biodiversity beyond the planetary boundary? A global assessment. Science, 353(6296), 288-291.

NGFS (2019) A call for action: Climate change as a source of financial risk. Network for Greening the Financial System.

NGFS (2020) NGFS Climate Scenarios for central banks and supervisors. Network for Greening the Financial System.

NGFS (2021) Climate-related litigation: Raising awareness about a growing source of risk. Network for Greening the Financial System.

NGFS (2023) Recommendations Toward the Development of Scenarios for Assessing Nature-Related Economic and Financial Risks. Network for Greening the Financial System.

NGFS (2024) Nature-related Financial Risks: A conceptual framework to guide action by Central Banks and Supervisors. Network for Greening the Financial System.

NGFS and INSPIRE (2022) Central banking and supervision in the biosphere: An agenda for action on biodiversity loss, financial risk and system stability. Final Report of the NGFS-INSPIRE Study Group on Biodiversity and Financial Stability. Network for Greening the Financial System, International Network for Sustainable Financial Policy Insights, Research, and Exchange.

NHM (2023) The Science of PREDICTS. Natural History Museum.

NHM (n.d.) Biodiversity Intactness Index. Natural History Museum.

Nicholson, E. et al. (2021) Scientific foundations for an ecosystem goal, milestones and indicators for the post-2020 global biodiversity framework. Nature Ecology & Evolution 5, 1338–1349.

Nicholson, E. et al. (2023) Beyond the headline: roles of the Red List of Ecosystems in implementing the Kunming-Montreal Global Biodiversity Framework.

Nordic Council of Ministers (2019) Vulnerable marine ecosystems (VMEs).

Norinchukin Bank (2025) Climate and Nature Report 2025.

Noss, R. F. (1990) Indicators for Monitoring Biodiversity: A Hierarchical Approach. Conservation Biology 4(4), 355–364.

NPI (2023) The Definition of Nature Positive. Nature Positive Initiative.

NPI (2026a) Finalizing a state of nature metrics framework. Nature Positive Initiative.

NPI (2026b) Initial Measurement Guidance: State of Nature Metrics. Nature Positive Initiative.

NSW Department of Primary Industries and Regional Development (2025) Biosecurity and land access considerations for explorers, miners and landholders.

Obayashi Corporation (2024) Nature-Related Information Disclosure (Disclosure Based on TNFD recommendations).

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

OECD (2020) Biodiversity and the economic response to COVID-19: Ensuring a green and resilient recovery. Organisation for Economic Co-operation and Development.

OECD (2023a) A supervisory framework for assessing nature-related financial risks: identifying and navigating biodiversity risks. Organisation for Economic Co-operation and Development.

OECD (2023b) Assessing nature-related financial risks: Navigating the landscape of existing approaches. Organisation for Economic Co-operation and Development.

OECD (2025a) Environment at a Glance Indicators. Organisation for Economic Co-operation and Development.

OECD (2025b) Core Set of Indicators for Environmental Performance Reviews: A Synthesis Report by the Group on the State of the Environment, Environment Monographs No. 83, OECD, Paris, OCDE/GD(93)179. Organisation for Economic Co-operation and Development.

Oka, T. et al (2025) The range of large terrestrial mammals has expanded into human-dominated landscapes in depopulated Japan over the past 40 years. Communications Earth & Environment, 6(292).

OSPAR (n.d.) Coordinated Environmental Monitoring Programme.

PBAF (n.d) A biodiversity accounting standard for the financial industry. Partnership for Biodiversity Accounting Financials.

Peh, K. S.-H. et al. (2013) TESSA: A toolkit for rapid assessment of ecosystem services at sites of biodiversity conservation importance. Ecosystem Services 5, 51-57.

Phalan, B. et al. (2011) Minimising the harm to biodiversity of producing more food globally. Food Policy 36(1), S62–S71.

Power, S. et al. (2022) An overview of nature-related risks and potential policy actions for Ministries of Finance: Bending the curve of nature loss. Coalition of Finance Ministers for Climate Action.

PRé Sustainability and CREM (n.d.) Biodiversity Footprinting for Financials (BFFI). Biodiversity Metrics.

Purina (2023) Purina Europe announces its commitments towards a more regenerative future. Purina.

Purina (2024) Purina Europe launches its first Ocean Restoration Program, aiming to restore 1 500 hectares of marine habitats by 2030.

Puurtinen, M. et al. (2022) The Living Planet Index does not measure abundance. Nature 601(7894), E14–E15.

PwC (2015) Valuing corporate environmental impacts: PwC methodology document. PwC.

Pyšek, P., et al (2004). Alien plants in checklists and floras: Towards better communication between taxonomists and ecologists. TAXON, 53(1), 131–143.

Ramsar Convention on Wetlands (2022) Resolution XIV.13: The Status of Sites in the List of Wetlands of International Importance. 14th Meeting of the Conference of the Contracting Parties (COP14) to the Ramsar Convention on Wetlands.

Ranger, N. et al. (2023) The Green Scorpion: The Macro-Criticality of Nature for Finance: Foundations for scenario-based analysis of complex and cascading physical nature-related financial risks. NGFS Occasional Paper, 13 December 2023. Network for Greening the Financial System.

Ranger, N. et al. (2024) Assessing the Materiality of Nature-Related Financial Risks for the UK. London: Green Finance Institute.

Republic of the Philippines, Department of Energy (2024) Republic Act No. 11995.

Resilience Alliance and Santa Fe Institute (2004) Thresholds and alternate states in ecological and social-ecological systems. Resilience Alliance.

Resolve (2017) Global map of ecoregions.

Ritchie, H. and Roser, M. (2020) CO2 and GHG Emissions – Emissions by Sector. Our World in Data.

Robertson, P. A. et al (2021) Risk Management Assessment Improves the Cost-Effectiveness of Invasive Species Prioritisation. Biology, 10(12).

Rockström, J. et al. (2023a) Safe and just Earth system boundaries. Nature 619, 102–111.

Rockström, J. et al. (2023b) Shaping a resilient future in response to COVID-19. Nature Sustainability 6, 897–907.

Rodríguez, J. P. et al. (2015) A practical guide to the application of the IUCN Red List of Ecosystems criteria. Philosophical Transactions of the Royal Society B: Biological Sciences, 370(1662), 20140003.

Rosa, I. M. et al. (2013) Predictive modelling of contagious deforestation in the Brazilian Amazon. PLoS One, 8: e77231.

Rossberg, A. G. (2022) Quantifying Biodiversity Impact—Relations amongst local and global metrics, why they matter and how to offset impacts. Environmental Science.

Rossberg, A. G. et al. (2023) A metric for tradable biodiversity credits linked to the Living Planet Index and global species conservation. arXiv:2111.03867 [q-bio.PE].

Rosselló-Mora, R. and Amann, R. (2001) The species concept for prokaryotes. FEMS Microbiology Reviews 25(1), 39–67.

Rossini, R. et al. (2021) Koala Population and Habitat Method.

Roswell, M. et al. (2021) A conceptual guide to measuring species diversity. Oikos 130(3), 321–338.

Rowland, J. et al. (2019) Ecosystem indices to support global biodiversity conservation. Conservation Letters 13(1).

Roy, Rabitsch, Scalera, et al (2018). Developing a framework of minimum standards for the risk assessment of alien species.

Ruggiero, M. A. et al. (2015a) A Higher Level Classification of All Living Organisms. PLOS ONE 10(4), e0119248.

Ruggiero, M. A. et al. (2015b) Correction: A Higher Level Classification of All Living Organisms. PLOS ONE 10(6), e0130114.

S&P Global Ratings (2024) Naked Juice LLC Downgraded To 'CCC+' From 'B-', Outlook Negative, Debt Ratings Lowered.

Sanda, N. B., et al (2018) Biological Invasion of Tomato Leaf Miner, Tuta absoluta (Meyrick) in Nigeria: Problems and Management Strategies Optimization: A Review. Asian Journal of Agricultural and Horticultural Research. 1(4).

Sappi Southern Africa Limited (2025) Sappi Saiccor mill Alien Invasive Species Management Plan. Sappi Southern Africa Limited.

SASB (n.d.a) Materiality Finder. Sustainability Accounting Standards Board.

SASB (n.d.b) Sustainable Industry Classification System®. Sustainability Accounting Standards Board.

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

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

SBTN (2023a) High Impact Commodity List. Science Based Targets Network.

SBTN (2023b) Materiality Screening Tool. Science Based Targets Network.

SBTN (2023c) Overview Step 4: Act. Science Based Targets Network.

SBTN (2023d) Response options. Science Based Targets Network.

SBTN (2023e) Resources. Science Based Targets Network.

SBTN (2023f) SBTN Glossary of Terms. Science Based Targets Network.

SBTN (2023g) SBTN Technical Guidance Step 1 and 2. Science Based Targets Network.

SBTN (2026a) Scaling Science-Based Targets for Nature (Orkla's SBTN Journey), Science-Based Targets Network.

SBTN (2026b) Target tracker. Science Based Targets Network.

SBTN (2026c) H&M Group: Bringing existing nature action into one science-based strategy. Science Based Targets Network.

SBTN (2026d) H&M Group adopts science-based targets for land. Science Based Targets Network.

Schatte et al. (2025) Assessing holistic agroecological resilience of landscapes. Ecology & Society 30(2).

Schipper, A. M. et al. (2020) Projecting terrestrial biodiversity intactness with GLOBIO 4. Global Change Biology 26(2), 760–771.

Schneck, J. et al. (2023) Species Threat Abatement and Recovery in Cameroon and Kenya. International Union for the Conservation of Nature.

Scholes, R. J. et al. (2005) A biodiversity intactness index. Nature 434(7029), 45–49.

Schroders (2026) Nature Report.

SDG 12 Hub. Target 12.3 Food loss and Waste Sustainable Development Goal 12 Hub.

SEI and Global Canopy (2015) Trase Database. Stockholm Environment Institute, Global Canopy.

Shift Project (2026) Community Engagement, Nature and Financial Materiality: An evidence review on the financial effects of engagement with Indigenous Peoples and local communities on nature-related issues. Shift.

Simpson, G. G. (1951) The Species Concept. Evolution 5(4), 285–298.

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. Kunming-Montreal Global Biodiversity Framework.

Smith, K.G. et al (2022) A manual for the management of vertebrate invasive alien species of Union concern, incorporating animal welfare.

Space Intelligence (2023) HabitatMapper.

Spacey Martín, R. and Ranger, N. (2026) Corporate Resilience Alignment Benchmark (C-RAB): Methodology document. London: Earth Capital Nexus, Grantham Research Institute on Climate Change and the Environment, London School of Economics and Political Science.

Spatz, D. R. et al. (2017) Globally threatened vertebrates on islands with invasive species. Science Advances 3(10), e1603080.

Speaker, T. et al. (2022) A global community- sourced assessment of the state of conservation technology. Conservation Biology 36.

Steffen, W. et al. (2015) Planetary boundaries: Guiding human development on a changing planet. Science 347(6223).

Stewards of Nature et al. (2025) Water impact claims from the removal of invasive alien plants in South Africa. Stewards of Nature, Roundtable on Sustainable Biomaterials (RSB), and World Wide Fund for Nature (WWF) South Africa.

Stockholm Resilience Centre (n.d.) Regime Shifts DataBase.

Stork, N. E. (2018) How Many Species of Insects and Other Terrestrial Arthropods Are There on Earth? Annual Review of Entomology 63(1), 31–45.

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.

Sunway Berhad (2025) Sustainability Report 2025.

Swiss Re Institute (2020) Biodiversity and ecosystem services – A business case for re/insurance.

Tallis, H., and Polasky, S. (2009) Mapping and valuing ecosystem services as an approach for conservation and natural- resource management. Annals of the New York Academy of Sciences, 1162(1), 265-283.

Tallis, H., et al. (2015) Mitigation for one & all: An integrated framework for mitigation of development impacts on biodiversity and ecosystem services. Environmental Impact Assessment Review, 55, 21-34.

Taskforce on Nature Markets (2023) Making nature markets work: Shaping a global nature economy in the 21st century. NatureFinance.

TCFD (2017) Recommendations of the Task Force on Climate-related Financial Disclosures. Task Force on Climate-related Financial Disclosures.

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

TCFD (2020b) Guidance on Scenario Analysis for Non-Financial Companies. Task Force on Climate-related Financial Disclosures.

TCFD (2021) Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures. Task Force on Climate-related Financial Disclosures.

TEEB (2010) The Economics of Ecosystems and Biodiversity: Ecological Economics Foundations. Edited by P. Kumar. Earthscan, London and Washington, DC. The Economics of Ecosystems and Biodiversity.

TEEB (2011) The Economics of Ecosystems and Biodiversity in National and International Policy Making. Edited by P. ten Brink. Earthscan, London and Washington, DC. The Economics of Ecosystems and Biodiversity.

TEEB (2012) The Economics of Ecosystems and Biodiversity in Business and Enterprise. The Economics of Ecosystems and Biodiversity. Edited by J. Bishop. Earthscan, London and Washington, DC. The Economics of Ecosystems and Biodiversity.

Textile Exchange and Apparel Alliance (2026) Supply chain taxonomy. For the textile, apparel and fashion industry.

TNC (2016) Mapping Ocean Wealth Explorer. The Nature Conservancy.

TNFD (2021) Nature in scope. Taskforce on Nature-related Financial Disclosures.

TNFD (2023a) Disclosure Recommendations. Taskforce on Nature-related Financial Disclosures.

TNFD (2023b) Guidance on Biomes. Taskforce on Nature-related Financial Disclosures.

TNFD (2024a) Discussion paper on biodiversity footprinting approaches for financial institutions. Taskforce on Nature-related Financial Disclosures.

TNFD (2024b) Guidance on engagement with Indigenous Peoples, Local Communities and affected stakeholders. Taskforce on Nature-related Financial Disclosures.

TNFD (2024c) The TNFD supports use of cross-reference tables for corporate reporting. Taskforce on Nature-related Financial Disclosures.

TNFD (2024d) TNFD Nature-related risk and opportunity registers. Taskforce on Nature-related Financial Disclosures.

TNFD (2025a) Additional sector guidance. Engineering, construction and real estate. Taskforce on Nature-related Financial Disclosures. Taskforce on Nature-related Financial Disclosures.

TNFD (2025b) Discussion paper on nature-related opportunities. Taskforce on Nature-related Financial Disclosures.

TNFD (2025c) Guidance on nature in transition plans. Taskforce on Nature-related Financial Disclosures.

TNFD (2025d) Recommendations for upgrading the nature data value chain for market participants. Taskforce on Nature-related Financial Disclosures.

TNFD (2025e) TNFD Additional Guidance for Financial Institutions. Taskforce on Nature-related Financial Disclosures.

TNFD (2026a) Applying TNFD nature-related metrics in the fishing sector. Taskforce on Nature-related Financial Disclosures.

TNFD (2026b) Glossary. Taskforce on Nature-related Financial Disclosures.

TNFD (2026c) Guidance on environmental crime. Taskforce on Nature-related Financial Disclosures.

TNFD (2026d) Guidance on scenario analysis. Taskforce on Nature-related Financial Disclosures.

TNFD (n.d.a) Case study library. Taskforce on Nature-related Financial Disclosures.

TNFD (n.d.b) Standards alignment. Harmonising the nature-related information disclosed by corporates and financial institutions. Taskforce on Nature-related Financial Disclosures.

TNFD (n.d.c) Tools catalogue. Taskforce on Nature-related Financial Disclosures.

TNFD and GRI (2025) GRI & TNFD case studies: Identifying risks and opportunities to organizations arising from dependencies and impacts on nature. Taskforce on Nature-related Financial Disclosures and the Global Reporting Initiative.

Transparent Project (2023) Standardised natural capital management accounting. A methodology promoting the integration of nature into business decision making. Alliance, Capitals Coalition, WBCSD and EU Life.

UK Government (2020) Natural Capital Committee.

UN (2015a) Paris Agreement. United Nations.

UN (2015b) Transforming our world: The 2030 Agenda for Sustainable Development. United Nations.

UN (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. United Nations.

UN Biodiversity Lab (2023) UN Biodiversity Lab.

UN Climate Change Conference UK (2021) Glasgow leaders' declaration on forests and land use. United Nations.

UN Climate Change High-Level Champions (2022) Assessing the financial impact of the land-use transition on the food and agriculture sector. United Nations.

UN et al (2014) System of Environmental-Economic Accounting 2012 – Central Framework.

UN et al (2021b) System of Environmental-Economic Accounting—Ecosystem Accounting (SEEA EA), Online supplement: Ecosystem Services Reference List Crosswalk to Selected Ecosystem Services Classifications and Typologies. United Nations.

UN et al. (2021a) System of Environmental-Economic Accounting—Ecosystem Accounting. White cover publication, pre-edited text subject to official editing. United Nations.

UN et al. (2024) System of Environmental-Economic Accounting—Ecosystem Accounting (SEEA EA). United Nations, European Commission, Agriculture Organization of the United Nations (FAO), International Monetary Fund (IMF), Organisation for Economic Co-operation and Development (OECD) and World Bank.

UN et al. (2026) Compilation Guidelines for GBF Indicator A.2. Extent of Natural Ecosystems. Advanced draft prepared for CBD SBSTTA. United Nations.

UNDP (2024) How Açaí berries and agroforestry are boosting food security and income in Brazil. United Nations Development Programme.

UNEP et al. (2020) Beyond 'Business as Usual': Biodiversity targets and finance. Managing biodiversity risks across business sectors. United Nations Environment Programme, United Nations Environment Programme Finance Initiative, Global Canopy.

UNEP FI (2022a) Prioritising nature-related disclosures. Considerations for high-risk sectors. United Nations Environment Programme Finance Initiative.

UNEP FI (2022b) State of finance for nature. Time to act: Doubling investment by 2025 and eliminating nature-negative finance flows. United Nations Environment Programme Finance Initiative.

UNEP FI and UNEP-WCMC (2021) Biodiversity Target-setting: Guidance for banks (Version 1: June 2021), Principles for Responsible Banking. United Nations Environment Programme Finance Initiative, United Nations Environment Programme-World Conservation Monitoring Centre.

UNEP-WCMC (2023) Ocean+ Habitats database. United Nations Environment Programme-World Conservation Monitoring Centre.

UNEP-WCMC (2024) Ocean+ Ocean data viewer. Now archived. United Nations Environment Programme-World Conservation Monitoring Centre.

UNEP-WCMC (n.d.) Ecosystem Integrity Index. United Nations Environment Programme World Conservation Monitoring Centre.

UNEP-WCMC and Finance for Biodiversity Initiative (2022) The Climate Nature Nexus. An investor guide to expanding from climate to nature data. United Nations Environment Programme-World Conservation Monitoring Centre, Finance for Biodiversity Initiative.

UNEP-WCMC and IUCN (2023) The World Database on Protected Areas (WDPA). United Nations Environment Programme-World Conservation Monitoring Centre, International Union for Conservation of Nature.

UNEP-WCMC et al (2023) Measuring ecosystem condition – a primer for business. Aligning accounting approaches for nature.

UNEP-WCMC et al. (2022) Recommendations for a standard on corporate biodiversity measurement and valuation, Aligning accounting approaches for nature. United Nations Environment Programme-World Conservation Monitoring Centre, Capitals Coalition, Arcadis, International Finance Corporation (ICF), World Conservation Monitoring Centre Europe.

UNESCO (2025) Ngootyoong Gunditj, Ngootyoong Mara: People-Centred Conservation in Budj Bim Cultural Landscape. United Nations Educational, Scientific and Cultural Organization.

UNESCO World Heritage Convention (2023) World Heritage Interactive Map. United Nations Educational, Scientific and Cultural Organization.

University of Cambridge Institute for Sustainability Leadership (2022) Integrating climate and nature: the rationale for financial institutions. Cambridge, UK. University of Cambridge Institute for Sustainability Leadership.

University of Oxford, TNFD and Global Canopy (2025) Evidence review on the financial effects of nature-related risks. Taskforce on Nature-related Financial Disclosures, University of Oxford and Global Canopy.

USDA NASS (2024) Florida Citrus Statistics 2022-2023. Florida Department of Agriculture and Consumer Services. Department of Agriculture, National Agricultural Statistics Service.

USFWS (continuously updated). Ecological Risk Screening Summaries. US Fish and Wildlife Service.

Valor Economico (2025) Power plants deploy GMOs to combat Asian pest.

Van Hespen, R. et al. (2023) Mangrove forests as a nature-based solution for coastal flood protection: Biophysical and ecological considerations. Water Science and Engineering, 16(1), 1-13.

VBA (2025) Value Balancing Alliance 5th Pilot Study. Value Balancing Alliance.

Venter, O. et al. (2016) Sixteen years of change in the global terrestrial human footprint and implications for biodiversity conservation. Nature Communications 7, 12558.

Verones, F. et al. (2022) Global extinction probabilities of terrestrial, freshwater and marine species groups for use in Life Cycle Assessment. Ecological Indicators 142, 109204.

Waine, Robertson, and Pattison (2024) Understanding and classifying the raw water transfer invasion pathway. Biological Invasions 26, 4035-4049.

Waldren, A. et al. (2020) Protecting 30% of the planet for nature: Costs, benefits and economic implications.

Wallenius Wilhelmsen (2025) Enhancing maritime biodiversity considerations: a marine transportation company applying the LEAP approach.

Wang, J. et al. (2016) Prediction and estimation of effective population size. Heredity 117, 193–206.

WBCSD (2013) Business Guide to Water Valuation: An introduction to concepts and techniques. World Business Council for Sustainable Development.

WBCSD et al. (2011) Guide to Corporate Ecosystem Valuation. World Business Council for Sustainable Development, ERM, International Union for Conservation of Nature, PwC.

WEF (2020) Nature Risk Rising: Why the crisis engulfing nature matters for business and the economy. World Economic Forum.

WEF (2022) Location matters: Using spatial intelligence for business action on nature and climate. World Economic Forum.

WEF (2026) 50 Investible Opportunities for a New Nature Economy. World Economic Forum.

WEF Global Future Council on Nature-based Solutions (2022) Scaling investments in nature: The next critical frontier for private sector leadership. World Economic Forum.

White, T. B. et al. (2021) Using technology to improve the management of development impacts on biodiversity. Business Strategy and the Environment 30(8), 3502–3516.

Wilkinson, M., Dumontier, M., Aalbersberg, I. et al. (2016). The FAIR Guiding Principles for scientific data management and stewardship. Scientific Data, 3, 160018.

WISE Freshwater. Surface water chemical status.

WOAH (2010). Handbook on import risk analysis for animals and animal products. World Organisation for Animal Health.

World Bank (2021) The Economic Case for Nature: A global earth-economy model to assess development policy pathways.

World Bank (2023) Biodiversity and finance: A preliminary assessment of physical risks for the banking sector in emerging markets.

World Benchmarking Alliance (2022) The methodology for the 2022 nature benchmark methodology. World Benchmarking Alliance. A new version is now available: The Methodology for the 2026 Nature Benchmark.

WRI and WBCSD (2022) Greenhouse Gas Protocol Land Sector and Removals Guidance (Draft for Pilot Testing and Review, September 2022). World Resources Institute, World Business Council for Sustainable Development. A new version is now available: Greenhouse Gas Protocol Land Sector and Removals Guidance Version 1.0: Agriculture and CO2 removal technologies (2026).

WRI Aqueduct (2023) Water Risk Atlas. World Resources Institute.

WRI Resource Watch (2023) Resource data dashboards. World Resources Institute.

WWF (2022) A Biodiversity Guide for Business. World Wide Fund for Nature.

WWF (2026a) Biodiversity Risk Filter. World Wide Fund for Nature.

WWF (2026b) Water Risk Filter. World Wide Fund for Nature.

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

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. Gland, Switzerland. World Wide Fund for Nature, United Nations Environment Programme-World Conservation Monitoring Centre, GEF Small Grants Programme, ICCA-Global Support Initiative, LandMark Global Platform of Indigenous and Community Lands, The Nature Conservancy, Conservation International, Wildlife Conservation Society, UNDP Equator Prize, Conservation Matters LLC, International Union for Conservation of Nature.

Zhang, J., et al. (2026a). Ecological multifunctionality of watersheds increases with tree species richness. Nature Communications 17 (8034).

Zhang, J., et al. (2026b) Fourfold increase in fragmentation from road expansion in Siberian intact forests since 2000. Nature Ecology & Evolution, 1-13.

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