Sustainable1

Nature & Biodiversity Risk Portfolio Assessment

Supporting TNFD Recommended Disclosures

S&P Global

Nature & Biodiversity Risk

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SCOPE OF ANALYSIS

COVERAGE

	Domestic Equity	Foreign Equity
Total Nature Risk coverage	98%	96%
- of which is Tier 1 coverage	16%	4%
- of which is Tier 2 coverage	82%	92%
Holding Date		31 March 2023
Analysis Date		13 July 2023

TIER 1 & TIER 2 COVERAGE

The Nature Risk Profile methodology uses input data with different levels of spatial detail, structured around two core 'tiers'.

- **TIER1**: Is a *top-down* approach, used when asset-level data is not readily available, that estimates company-level impacts and dependencies using sector averages and regional-level spatial risk factors. Methods to estimate the likely locations of activities within countries can be used to refine the sectoral approach, for example by using spatial breakdowns of GDP production within countries in order to weight average impacts and spatial risk factors.
- **TIER2**: Is a *bottom-up* approach that uses spatially resolved asset-level data to generate risk and impact factors specific to the geolocation of the asset. This approach provides the most accurate picture, and is in-line with the TNFD's focus on understanding location-specific nature-related risks and impacts.

Nature & Biodiversity Risk
Introduction

INTRODUCTION TO NATURE-RELATED RISKS

Nature risk is a rapidly emerging issue of global concern. The degradation of ecosystems has far-reaching implications, affecting not only the health of our planet but also the stability of our economies and societies. The World Economic Forum's Global Risks Report 2023 has highlighted this growing concern, placing nature and biodiversity as the fourth most pressing long-term issue, closely following climate change (See Figure 1 below). In the short-term (2 years), 5 out of the top 10 issues are environmentally related. This number grows to 6 out of 10 over the long-term (10 years).

Figure 1: World Economic Forum Global Risks Perception Survey (WEF, 2023)

Rank	Short-term (2 years)		Long-term (10 years)	
1	Societal	Cost of living crisis	Environmental	Failure to mitigate climate change
2	Environmental	Natural disaster & extreme weather events	Environmental	Failure of climate change adaption
3	Geopolitical	Geoeconomic confrontation	Environmental	Natural disasters and extreme weather events
4	Environmental	Failure to mitigate climate change	**Environmental**	**Biodiversity loss and ecosystem collapse**
5	Societal	Erosion of social cohesion & societal polarization	Societal	Large-scale involuntary migration
6	Environmental	Large-scale environmental damage incidents	Environmental	Natural resource crises
7	Environmental	Failure of climate change adaption	Societal	Erosion of social cohesion and societal polarization
8	Technological	Widespread cybercrime and cyber insecurity	Technological	Widespread cybercrime and cyber insecurity
9	Environmental	Natural resource crises	Geopolitical	Geoeconomic confrontation
10	Societal	Large-scale involuntary migration	Environmental	Large-scale environmental damage incidents

Beyond the explicit risk posed by biodiversity and ecosystem loss, there are other issues that are intrinsically linked to the environment, such as climate change and natural resource use. The interconnectedness of these risks underlies the systemic nature of the challenge.

WHAT IS BEING DONE? - TNFD AND THE LEAP FRAMEWORK

The Taskforce on Nature-related Financial Disclosures (TNFD) is a global, market-led, science-based and government supported initiative to develop a risk management and disclosure framework that allows market participants to identify, assess and respond to nature-related issues. The TNFD is bringing much-needed clarity on how organizations can start to incorporate nature-related risks and opportunities into their strategic planning, risks management and asset allocation decisions.

The final framework is due for publication in September 2023 and will aim to align with existing (TCFD, GRI) and emerging (ISSB) frameworks used by market participants for disclosing environmental risks and impacts. It will also aim to provide adaptability with respect to approaches used to assess the materiality of the risks and impacts identified, according to the preferences of regulatory requirements for report providers and consumers across various organization types and jurisdictions.

During the consultation for the TNFD framework, a key ask from participants was the provision of a simple 'how to' guide for beginning the process of identifying and assessing nature-related issues. The response was the development of the LEAP approach, with the following four key phases:

1. **Locate** your interface with nature
2. **Evaluate** your dependencies and impacts
3. **Assess** your risks and opportunities
4. **Prepare** to respond to nature-related risks and opportunities and report

The approach serves as voluntary guidance to facilitate internal risk and opportunity assessments, and should be approached iteratively rather than as a linear process with a step-by-step application from start to finish. Please refer to Figure 2 below, which offers additional detailed information on the four key phases of the LEAP approach, as outlined in version 0.4 of the Beta framework published by the TNFD. The primary objective of the Nature & Biodiversity Risk Portfolio Assessment report is to provide support for disclosures pertaining to the Locate and Evaluate stages, as highlighted in red. In this report, sections relevant to specific LEAP steps are indicated on the right side of section headers, employing the 'L[ocate]1' through to 'E[valuate]4' flags.

Figure 2: Summary of LEAP Framework proposed by the TNFD (TNFD, 2023)

Nature & Biodiversity Risk
Introduction

INTRODUCTION TO S&P GLOBAL'S NATURE RISK & BIODIVERSITY DATASET

The Nature & Biodiversity Risk dataset covers over 17,000 companies and over 1.6 million assets and provides a number of new nature-related risk metrics including a dependency score and ecosystem footprint measure enabling greater understanding of a company or asset's dependency and impact on nature. The dataset applies the Nature Risk Profile, a new methodology for analyzing companies' impacts and dependencies on nature, launched by S&P Global Sustainable1 (hereafter, 'Sustainable1') and the UN Environment Programme (UNEP) in January 2023. The dataset has been designed to help companies and financial institutions align with the recommendations of the TNFD.

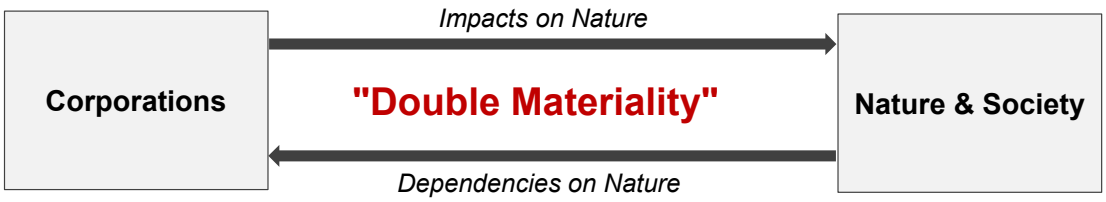
The Nature Risk Profile methodology rests on two core building blocks for profiling nature-related risks, these being impacts and dependencies on nature. In the analysis presented below, these components are broken down and explained in detail. Portfolio and sector level metrics allow users to compare overall performance against a reference benchmark, while company rankings highlight those investees driving the impact and dependency performance.

The development of the Nature Risk Profile methodology has benefited from the input of multiple experts within the conservation community, the finance sector and businesses. While this first version of the methodology enables action on nature by businesses and financial institutions, we also recognize that it will need to evolve in the future. We have identified key priorities for future development which are described in the report's appendix. We will continuously review these to account for developments in the field, particularly those of the TNFD as well as the post-2020 global biodiversity framework of the Convention on Biological Diversity.

DEFINITION OF KEY CONCEPTS

From the outset, it is important to establish standardized terminology for understanding our relationship with nature. At the asset, company and portfolio level, our nature-related risks are best understood through the lens of **Impacts**, **Dependencies** and **Double Materiality** (see Figure 3 below).

Figure 3: Impacts, Dependencies and Double Materiality



IMPACTS ON NATURE

These impacts refer to the ways in which a company's activities and operations may have positive or negative impacts on natural resources or ecosystem services. Companies that have significant impacts on nature may be more susceptible to regulatory and/or reputational risks.

Examples include contribution to local or global pollution, habitat destruction, and climate change.

DEPENDENCIES ON NATURE

These dependencies refer to the ways in which a company depends on natural resources and ecosystem services to operate. Companies that rely on these may be more vulnerable to risks associated with nature's availability and quality.

Examples include access to water, access to land and raw materials, protection from extreme weather, or a stable climate in which to operate.

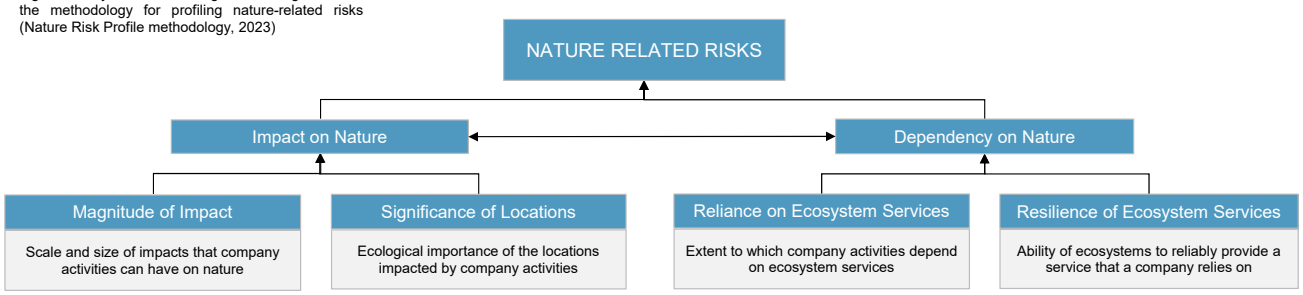
DOUBLE MATERIALITY

This concept emphasizes the importance of considering both the impact of a company on the environment (inside-out) and the impact of environmental changes on the company (outside-in). It recognizes that a company's financial viability and environmental/social sustainability are interconnected. When inside-out impacts exceed certain thresholds at the aggregate level, they can impair the natural systems on which a company depends, leading to an increace of outside-in impacts that can create business continuity risks.

APPROACH SUMMARY

The concepts introduced above form the core pillars of the Sustainable1 approach to assessing nature and biodiversity risks. In order to better understand performance against each pillar, an additional two concepts on each side are introduced, those being **Magnitude** and **Significance** in relation to impacts, and **Reliance on** and **Resilience of** in relation to dependencies (see Figure 4 below).

Figure 4: Key element forming the building blocks of the methodology for profiling nature-related risks (Nature Risk Profile methodology, 2023)



Nature & Biodiversity Risk
Executive Summary & Headline Results

EXECUTIVE SUMMARY AND HEADLINE RESULTS

Presented below are some of the key metrics describing the nature-related impact and dependency performance of each portfolio. They are presented across the three core themes of this assessment's appoach to biodiversity risks, these being; i) **Reputational and Regulatory Risks**, i.e. risks arising from asset located in biodiverse areas, ii) **Impact Risks**, i.e. risks arising from the level of impacts on nature observed at the sites occupied, and iii) **Dependency Risks**, i.e. risks arising from the degree of dependency investee companies have on the services provided by nature. For more information on any of these core themes please see the associated sections within the report, or the glossary for a description of terms.

REPUTATIONAL AND REGULATORY RISKS

In December 2022 at COP15, governments across the world adopted the Kunming-Montreal Global Biodiversity Framework. The agreement aims at halting and reversing the unprecedented loss of nature observed globally, and includes the '30 by 30' initiative in which governments will work to designate 30% of our land and seas as protected areas by 2030.

The analysis presented within this report allows investors to begin the process of identifying those companies whose assets overlap with existing Protected Areas (PAs) determined by local and national governing bodies, as well as locations that have been identified as Key Biodiversity Areas (KBAs) by the international scientific community. Asset overlap with either area type presents a significant exposure to both regulatory and reputational risks. Depending on the legal status of these areas companies may face increasing compliance or operational costs for their assets, while also experiencing increasing pressures through public stakeholders holding them accountable.

Domestic Equity	Foreign Equity	
67% VOH Share	83% VOH Share	• This is the Value of Holding (VOH) exposure to companies with assets located in either a PA or a KBA. • The higher the percentage, the higher the financial exposure of the portfolio to companies operating - to a greater or lesser degree - in either legally protected or ecologically important areas.
8% KBA Overlap	6% KBA Overlap	• This is the share of the asset-level **Land-Use Footprint** (i.e. Tier2 companies) that is overlapping with KBAs. • The higher the percentage, the higher the likely dependency investees have on operating in ecologically important areas.
15% PA Overlap	8% PA Overlap	• This is the share of the asset-level **Land-Use Footprint** (i.e. Tier2 companies) that is overlapping with PAs. • The higher the percentage, the higher the likely dependency investees have on operating in ecologically protected areas.

IMPACT RISKS

Impacts on nature, as defined by the TNFD, represent the changes in the state of nature which may result in changes to the capacity of nature to provide social and economic functions. Businesses may negatively impact nature through pressures known as 'Impact Drivers'. By looking first at the hectares of land used for the direct operations of investees, followed second by their 'ecosystem footprint', we are able to identify exposure to companies who's assets or operations are situated in the most degraded, and most ecologically significant locations.

Domestic Equity	Foreign Equity	
142,921 hectares	88,728 hectares	• This is the **Land-Use Footprint** of each portfolio, representing the area used in the direct operations of investees.
12,530 hectare eq.	9,306 hectare eq.	• This is the **Ecosystem Footprint** of each portfolio, representing the equivalent extent of fully degraded, globally significant ecosystems impacted.
8.8%	10.5%	• This is the **Ecosystem Impact Ratio**, representing the ratio of the Ecosystem Footprint to the Land-Use Footprint. • The higher the ratio, the higher the level of ecosystem degradation and global significance of the areas occupied.

DEPENDENCY RISKS

Dependencies on nature, as defined by the TNFD, refer to those aspects of ecosystem services that an organization relies on to function. Business dependencies on nature will hinge on the interaction between the level of *reliance* on ecosystem services and the ability of the ecosystems within which a business operates to *sustain* a continued flow of those services to that business. 85% of the world's largest companies (with reference to S&P Global 1200 index data as of 31st March 2023) were found to have a significant dependency on nature across their direct operations.

Identifying which companies are highly dependent on nature, and understanding the type of dependency with reference to specific ecosystem services allows investors to better understand their dependency-related risks, and engage with investees accordingly.

Domestic Equity	Foreign Equity	
0.65 High	0.66 High	• This is each portfolio's weighted-average 'Dependency' score, indicating a 'High' dependency on nature across both portfolios. • Across the 21 ecosystem services assessed, the leading dependencies in both portfolios were on Mass stabilisation and erosion control, Flood and storm protection, and Bio-remediation.
81%	87%	• This is the investment-weighted exposure to the companies with a 'Significant' dependency on ecosystem services. • 'Significant' in this assessment includes company's whose dependency score is in the High (0.6-0.8) and Very High (0.8-1) range.

Nature & Biodiversity Risk
Reputational & Regulatory Risks

UNDERSTANDING REPUTATIONAL AND REGULATORY RISKS
L[ocate]3 - Priority Location Identification

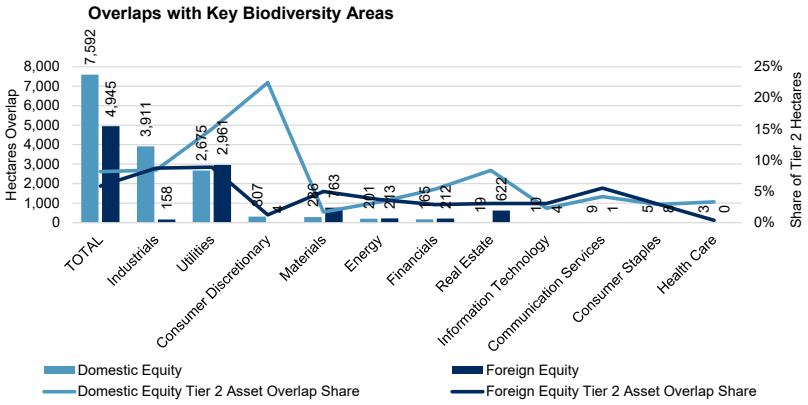
Asset level data can be assessed for significance by overlaying them with area-based data layers defining areas of high significance. In contrast to the continuous 'significance index' approach described above, these provide additional binary contextual flags as to the significance of the location of the assets and the associated asset-level impacts. It is recommended that these additional asset level flags are included as best practice.

Although many different area-based designations exist which reflect a range of regulatory and reputational risks at a range of scales, two global standard datasets are recommended as detailed below. In the future, these can be complemented with other relevant datasets that become available.

REPUTATIONAL RISK - OVERLAPS WITH KEY BIODIVERSITY AREAS
L[ocate]3 - Priority Location Identification

Key Biodiversity Areas (KBAs) are sites contributing significantly to the global persistence of biodiversity, and are identified at the national, sub-national or regional level by local stakeholders based on standardised scientific criteria and thresholds. Operating within KBAs poses a series of potential transition risks for businesses.

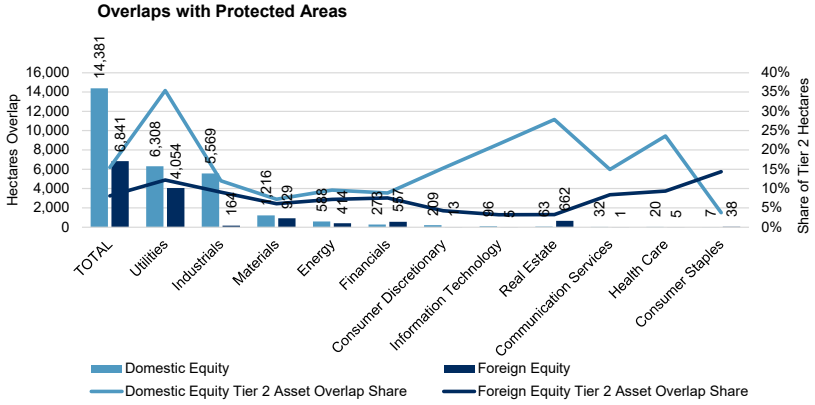
The right-hand chart provides the apportioned area in hectares overlapping at the individual sector as well as overall level for each portfolio. This is supplemented with the line indicating the percent share of the Tier2 Land Use Footprint. A higher percentage indicates a potentially higher sector-level dependency on assets overlapping the KBAs and consequentially a higher exposure to reputational risks in the future.



REGULATORY RISKS - OVERLAPS WITH PROTECTED AREAS
L[ocate]3 - Priority Location Identification

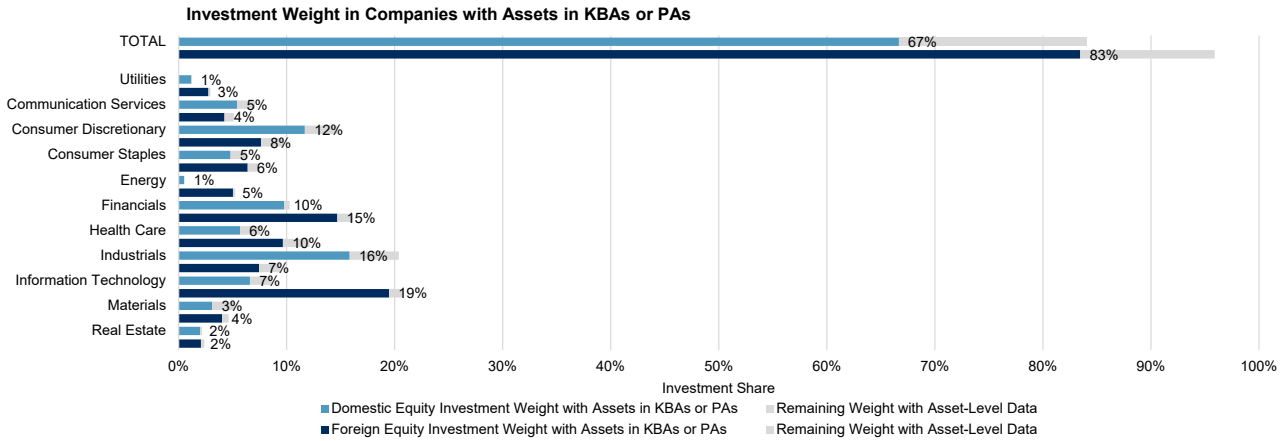
Protected Areas (PA) are clearly defined geographical spaces, recognized, dedicated and managed through legal or other effective means to achieve the long-term conservation of nature with associated ecosystem services and cultural values. PAs are the cornerstones of in-situ conservation.

The right-hand chart provides the apportioned area in hectares overlapping at the individual sector as well as overall level for each portfolio. This is supplemented with the line indicating the percent share of the Tier2 Land Use Footprint. A higher percentage indicates a potentially higher sector-level dependency on assets overlapping the PAs and consequentially a higher exposure to policy risks in the future.



EXPOSURE TO COMPANIES WITH KBA OR PA OVERLAPS
L[ocate]3 - Priority Location Identification

KBA (Key Biodiversity Area) and PA (Protected Area) grid-point flags are not mutually exclusive, meaning that summing the overlapping areas would result in double counting. An alternative exposure view can be obtained by considering the investment weighted exposure to companies that have assets overlapping with either a KBA or a PA. The chart below shows this combined exposure, with the grey 'remaining weight' bar representing the investment weight in companies assessed using the Tier2 approach, with no assets overlapping with environmentally sensitive areas.



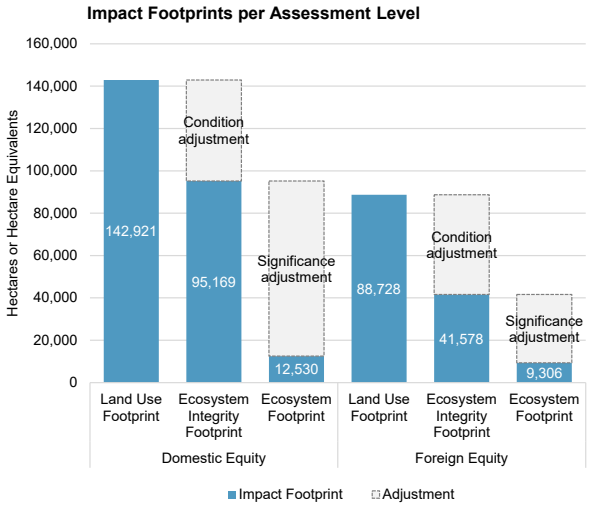
Nature & Biodiversity Risk
Impact Risks

UNDERSTANDING IMPACT ON NATURE

Impacts, as defined by the TNFD, refer to changes in the state of nature that can potentially affect the capacity of nature to provide social and economic functions. Businesses exert negative pressures on nature, referred to as 'Impact Drivers' in the TNFD, which can be direct, indirect, or cumulative in nature. Failing to address these impacts may expose businesses to various transition risks, including policy, reputational, market, and technological risks. The level of risk associated with a business's impacts depends on the magnitude of the impacts and the environmental and societal significance of the affected locations. These fundamental concepts form the core pillars of the nature risk methodology for assessing impacts.

The Sustainable1 approach begins by quantifying the land-use footprint in actual hectares occupied. This is done by either collecting geospatially resolved asset-level data for each investee (Tier2) or estimating the area occupied using business activity-specific land-use factors applied to investee revenues (Tier1). Subsequently, two adjustment factors, ranging from 0 to 1, are successively applied to the initial land-use area of each asset or business activity. The first adjusted footprint, described here as the **'Ecosystem Integrity Footprint'** (**EIF**), reflects the extent to which the ecosystem of the occupied area has been degraded compared to a reference 'pristine' state. The second adjusted footprint, described here as the **'Ecosystem Footprint'** (**EF**), captures the relative importance of the impacted ecosystem on both local and global scales, in addition to the EIF. At the portfolio-level impact footprints are apportioned to the investor. The closer the EIF and EF are to the original land-use footprint, the higher the level of ecosystem degradation and relative importance of the impacted areas. Further details on the calculation of the magnitude and significance adjustment factors are provided in subsequent sections and the appendices.

IMPACT FOOTPRINTS



LAND USE FOOTPRINT — L[ocate]1 - Business Footprint

Represents the total, unadjusted area in hectares occupied by the assets (tier 2) and business activities (tier 1) of investee companies, apportioned to the investor. For companies assessed using the top-down tier 1 approach, proprietary business activity-specific land-use factors are applied to revenue streams to arrive at an estimated total land use in hectares.

ECOSYSTEM INTEGRITY FOOTPRINT — L[ocate]2 - Nature Interface

Represents the total 'condition-adjusted' footprint in hectare equivalents, apportioned to the investor. Occupied locations in a 'pristine' natural state would be adjusted to zero, while locations in a fully degraded state would remain as 100% of the original Land Use footprint. The metric provides an understanding as to the current state-of-nature in the locations occupied.

ECOSYSTEM FOOTPRINT — E[valuate]4 - Impact Analysis

Represents the final 'condition- and significance-adjusted' footprint in hectare equivalents, apportioned to the investor. Occupied locations of the highest importance globally with respect to the protection of threatened species, or due to the criticality of the ecosystem services provided would remain at 100% of their Ecosystem Integrity footprint, whereas those with the lowest importance would be adjusted to zero.

FOOTPRINT ADJUSTMENT 1: ECOSYSTEM INTEGRITY IMPACT — L[ocate]2 - Nature Interface

A commonly employed method for assessing impacts at the ecosystem level involves calculating a 'condition-adjusted area'. This approach adjusts the total area occupied by applying a factor that represents the condition of the ecosystem in comparison to an 'intact' reference state. The underlying idea is that although there may be '100 hectares' of forest within a landscape, if its condition is only half that of an intact primary forest, its biodiversity value would be equivalent to having only 50 hectares of intact forest in that landscape.

In the methodology, the assessment of 'intactness' is accomplished through the use of an Ecosystem Integrity Index (EII). The EII evaluates the state of nature at a specific location across three distinct components: **Structure**, **Composition**, and **Function**. Each component, described in the section below, is assigned a 'remaining condition' value ranging from 1 for a pristine state to 0 for a fully degraded state. The most degraded component among the three is selected as the composite EII, which is utilized in calculating the condition-adjusted footprint (Land-use area * [1 - remaining condition]). This precautionary approach acknowledges the possibility of ecosystem condition reaching tipping points, where deterioration may lead to larger-scale systemic risks.

At the company level, the adjustment factors for Structure, Composition, and Function are determined as the land-use weighted average of the factors used for individual assets or business activities. Similarly, at the portfolio level, these factors are the apportioned land-use weighted average of the company-level factors. This provides an indication of the average degree to which the respective components are impacted at the locations occupied by investees. The 'Leading Factor Weight' represents the apportioned land-use share from investees whose most degraded component aligns with the indicated factor.

	Domestic Equity		Foreign Equity	
	Weighted-Average AdjustmentFactor	Leading Factor Weight	Weighted-Average AdjustmentFactor	Leading Factor Weight
STRUCTURE (0 = Pristine; 1 = Fully Degraded) Refers to the physical organization and arrangement of an ecosystem, including the living organisms and the non-living environment. This indicator accounts for the influence of habitat loss, quality and fragmentation due to the effects of land use at the landscape level as well as describing local intactness. An example of an impact on Structure could be a road that divides a previously interconnected ecosystem into a fragmented one.	0.64	98.3%	0.44	99.6%
COMPOSITION (0 = Pristine; 1 = Fully Degraded) Refers to the identity, diversity, and relative abundance of different species or functional groups within an ecosystem. This indicator accounts for changes in the make-up of ecological communities in response to human pressures. An example of an impact on Composition could include a reduction in the number of species of birds observed at the asset location.	0.31	0.2%	0.20	0.3%
FUNCTION (0 = Pristine; 1 = Fully Degraded) Refers to the ecological processes and interactions that occur within an ecosystem, influencing the flow of energy, matter, and nutrients. This indicator accounts for changes in the observed net primary productivity (NPP) of an area versus eco-regional 'natural' levels. An example of an impact on Function could include a loss or reduction in the ability to sequester carbon in certain locations due to a reduction in the volume of vegetation present.	0.18	1.5%	0.10	0.2%

Nature & Biodiversity Risk
Impact Risks

FOOTPRINT ADJUSTMENT 2: ECOSYSTEM SIGNIFICANCE

L[ocate]2 - Nature Interface

Beyond looking solely at the magnitude of impacts on nature, assessing the relative significance of the ecosystems impacted adds a crucial additional lens. It is important to highlight when impacts occur at sites holding vital stocks of environmental assets, or where they are locations critical to the continued supply of ecosystem services both locally and/or globally. In the methodology, 'Significance' is assessed at the global level using data layers that standardize two separate indicators, the first representing species extinction risk and the second on ecosystem service provision. See below for descriptions of each.

In the results shown, the top-level scores represent the EIF-weighted average of company-level significance of the locations impacted across the two assessment methods. The 'Leading Factor' weight represents the share of the apportioned EIF coming from companies whose highest significance adjustment factor is the one indicated, which in turn indicates the likely driver of the composite ecosytem significance adjustment at the underlying asset or business operations level. For more information on either adjustment factor please refer to the appendix.

	Domestic Equity		Foreign Equity	
	Weighted-Average AdjustmentFactor	Leading Factor Weight	Weighted-Average AdjustmentFactor	Leading Factor Weight
SPECIES SIGNIFICANCE (0 = Least significant; 1 = Most significant) Uses the Species Threat Abatement and Restoration (STAR) metric, which quantifies the potential for reducing global species extinction risk by reducing threats in specific locations. A high score represents an abundance of threatened species at the locations impacted. An example of the importance of species could include the presence of endangered animals at the asset location.	0.02	0.9%	0.03	1.5%
ECOSYSTEM CONTRIBUTION (0 = Least significant; 1 = Most significant) Uses the Critical Natural Assets (CNA) metric, which highlights areas that are critical for the continued provision of 90% of ecosystem services, looking both at the global and local level. A high score represents areas that are crucial to securing the top 5% of current ecosystem service provision. An example of Ecosystem Contribution could be the presence of a bees contributing to local pollination, or of a forest contributing to carbon sequestration.	0.13	99.1%	0.22	98.5%

ADJUSTMENT 1 VS 2 COMPARISON

L[ocate]2 - Nature Interface

The grids below show each portfolio's land-use weighted exposure to different levels of Ecosystem Integrity Impact (EII) and Ecosystem Significance (ES) adjustments. The distribution of adjustments have been split into quintiles, based on the full Sustainable1 universe of 17,000+ companies.

The lower left corner of each grid represents exposure to companies with both ES and EI adjustments at the company level among the lowest 20% of the universe, while the upper right corner represents highest 20%. For reference, the quintile cut-offs are shown in the right-hand table.

Quintile	Eco-Integrity Impact	Ecosystem Significance
1st	0 to 0.76	0 to 0.08
2nd	0.76 to 0.81	0.08 to 0.1
3rd	0.81 to 0.82	0.1 to 0.13
4th	0.82 to 0.86	0.13 to 0.19
5th	0.86 to 1	0.19 to 1

Domestic Equity Land-Use Weight

Ecosystem Integrity (<<< Less Degraded -- More Degraded >>>)	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
5th Quintile	1.3%	0.3%	0.2%	0.3%	0.2%
4th Quintile	0.4%	31.9%	0.2%	0.4%	0.1%
3rd Quintile	0.0%	0.9%	0.1%	0.1%	0.0%
2nd Quintile	0.1%	0.1%	0.0%	0.3%	0.0%
1st Quintile	10.9%	0.8%	17.9%	9.1%	24.4%

Ecosystem Significance
<<< Less Significant --- More Significant >>>

Foreign Equity Land-Use Weight

Ecosystem Integrity (<<< Less Degraded -- More Degraded >>>)	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
5th Quintile	1.4%	0.1%	0.5%	0.2%	0.1%
4th Quintile	0.3%	0.1%	0.1%	0.3%	0.1%
3rd Quintile	0.0%	0.0%	0.0%	0.4%	0.3%
2nd Quintile	1.1%	0.1%	1.8%	0.6%	0.1%
1st Quintile	4.5%	1.0%	12.7%	25.7%	48.5%

Ecosystem Significance
<<< Less Significant --- More Significant >>>

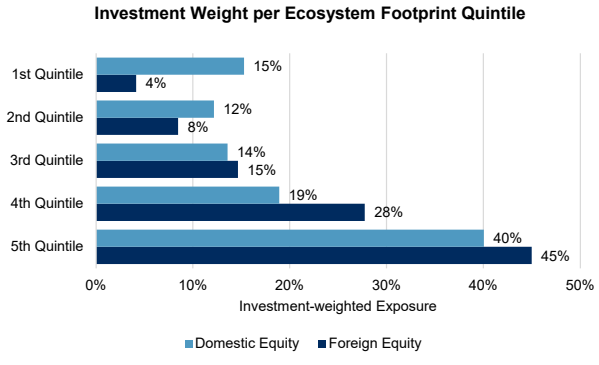
ECOSYSTEM FOOTPRINT DISTRIBUTION

L[ocate]2 - Nature Interface

The right-hand chart shows the distribution of final Ecosystem Footprints (EF) of companies in each portfolio, broken down by quintile with reference to the full Sustainable1 universe of 17,000+ companies.

The bars indicate the investment weighted exposure to investees based on the quintile in which they fall. Those with EFs in the highest 20% of the reference universe will contribute to the 5th Quintile exposure, while those in the lowest 20% will appear in the 1st Quintile.

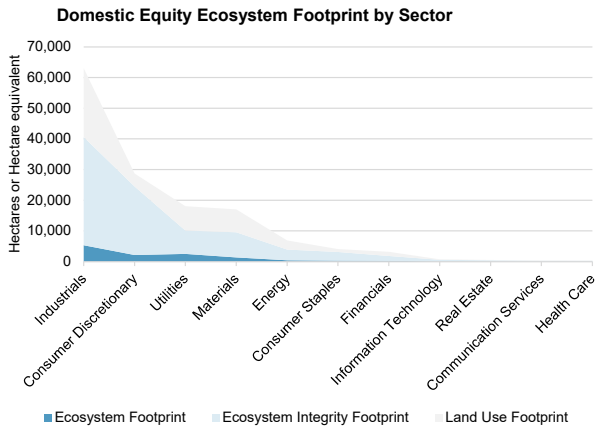
Quintile	Eco-Footprint (ha eq.)
1st	0 to 0.21
2nd	0.21 to 0.87
3rd	0.87 to 3.34
4th	3.34 to 21.99
5th	> 21.99

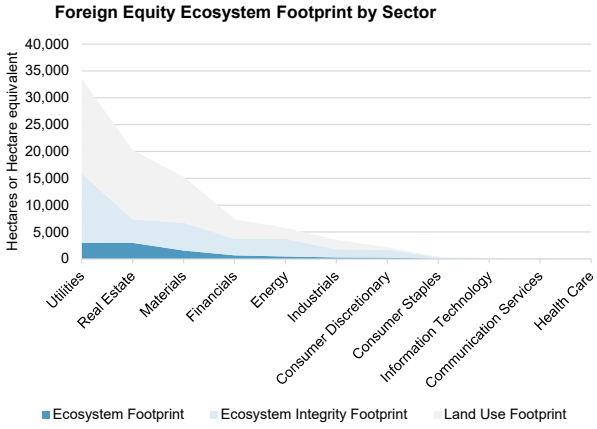


Nature & Biodiversity Risk
Impact Risks

IMPACT FOOTPRINTS BY SECTOR L[ocate]4 - Sector Identification

The chart below illustrate the relative drop in magnitude from original apportioned Land Use Footprint, through Ecosystem Integrity Footprint, to final Ecosystem Footprint broken down by sector.

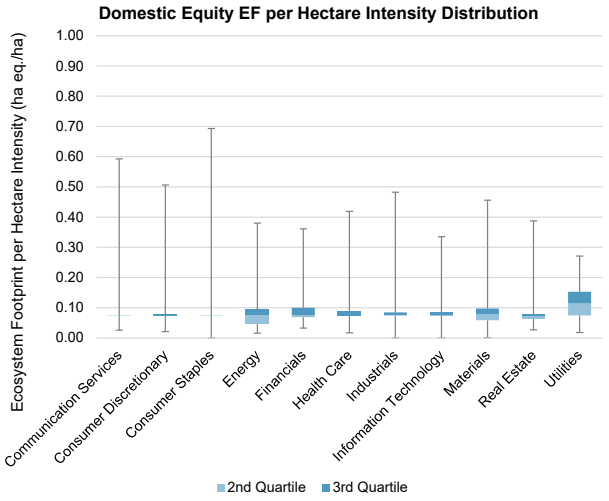


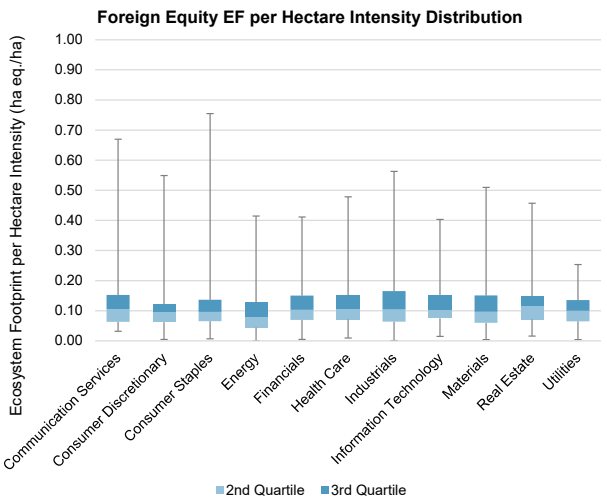


COMPANY ECOSYSTEM FOOTPRINT PER HECTARE INTENSITY DISTRIBUTION BY SECTOR L[ocate]4 - Sector Identification

The Ecosystem Footprint per hectare intensity, at the company-level, is calculated by dividing the Ecosystem Footprint by the Land-Use Footprint, giving an indication of the average per hectare degree of ecosystem impact and significance. Numbers tending towards zero indicate a relatively low per hectare impact and significance, while numbers tending towards 1 indicate the opposite. In the executive summary this metric is referred to as the Ecosystem Impact Ratio (EIR).

The charts below show the range of EIRs among investees, split by sector. The lines indicates the upper and lower quartiles of the intensities observed, while the shaded bars indicate the range observed covering the second (lighter) and third (darker) quartiles.





ECOSYSTEM FOOTPRINT PER HECTARE, REVENUE & VALUE INVESTED INTENSITY BY SECTOR L[ocate]4 - Sector Identification

An alternative to the 'per hectare' view of ecosystem intensity is to divide the Ecosystem Footprint by a financial indicator, such as apportioned revenues or value invested. In the table below we provide the total- and sector-level Ecosystem Footprint intensities for all three approaches.

		TOTAL	Communications Services	Consumer Discretionary	Consumer Staples	Energy	Financials	Healh Care	Industrials	Information Technology	Materials	Real Estate	Utilities
EF TO LAND-USE INTENSITY													
ha eq. / ha actual	Domestic Equity	0.09	0.08	0.08	0.08	0.06	0.08	0.11	0.08	0.11	0.08	0.08	0.14
	Foreign Equity	0.10	0.12	0.11	0.12	0.08	0.09	0.11	0.08	0.09	0.10	0.15	0.09
EF TO REVENUE INTENSITY													
ha eq. / billon JPY revenue	Domestic Equity	0.43	0.02	0.35	0.11	0.87	0.12	0.02	0.62	0.03	0.72	0.08	5.92
	Foreign Equity	0.74	0.03	0.16	0.03	0.35	0.40	0.01	0.19	0.01	1.62	24.57	8.84
EF TO VALUE INVESTED INTENSITY													
ha eq. / billion JPY invested	Domestic Equity	0.26	0.01	0.25	0.09	1.48	0.05	0.01	0.46	0.01	0.50	0.04	4.20
	Foreign Equity	0.20	0.01	0.05	0.01	0.18	0.09	0.00	0.06	0.00	0.71	2.66	2.17

Nature & Biodiversity Risk
Dependency Risks

UNDERSTANDING DEPENDENCY RISK

The TNFD has defined dependencies as aspects of ecosystem services that an organization relies on to function. This includes 'provisioning' services such as water flow and 'regulatory and maintenance' services such as the mitigation of hazards like fires and floods, or the sequestration of carbon. The dependency of a business on ecosystem services for its operations and business continuity may either be direct or through its supply chain. Risks associated with dependencies are highly material where a business' production operations cannot readily continue in a financially viable manner in the absence of ecosystem services. For example, mining businesses are heavily dependent on a supply of water. As such, a mining business would be at greater risk if one of its mines might no longer be able to access sufficient water from its existing sources.

Such risks are a form of physical risk to businesses and the financial institutions that are associated with them. They are increasingly becoming apparent due to the continuous decline in the state of nature. For example, they can arise when natural systems are compromised, due to the impact of climatic events, geologic events or changes in ecosystem equilibria, such as changes in soil quality or ocean chemistry. Changes in ecosystem condition and functioning will particularly lead to the rise of nature-related physical risks.

The materiality of risk associated with business dependencies on nature will hinge on the interaction between the level of reliance on ecosystem services (which ecosystem services the business depends upon and to what extent), and the ability of the ecosystems within which a business operates to sustain a continued flow of those services to that business. These two concepts represent the core 'pillars' of the dependency-based risk profiling methodology. Understanding this capacity for a continued flow of ecosystem services requires characterization of the ecosystem types and the condition of these ecosystems at the location of operations. This requires spatial location data. Declines in the state of nature often reduce the resilience of ecosystems and their capacity for providing ecosystem services. Importantly, only measuring the current flows of ecosystem service benefits may mean important declines in the underlying environmental assets that underpin these ecosystem service flows are missed. This means that while current risks may appear minimal, longer-term risks caused by ecosystem degradation may not be fully identified. This could lead to slow, irreversible declines in an ecosystem's capacity to provide services going undetected. For regulating and maintenance ecosystem services, in particular, it is therefore recommended to assess the condition of the ecosystem rather than the actual flows of services it currently provides.

ECOSYSTEM SERVICE DESCRIPTIONS

'Ecosystem services' refer to the benefits that humans derive from ecosystems. They encompass a wide range of resources and processes provided by nature, which contribute to human well-being and are essential for the functioning of societies and economies. Below is a description of each of the 21 ecosystem services against which investees are assessed as a part of the Sustainable1 approach to dependency analysis.

PROVISIONING SERVICES		Resilience Tested
Animal-based energy	Physical labour is provided by domesticated or commercial species, including oxen, horses, donkeys, goats and elephants. These can be grouped as draught animals, pack animals and mounts.	No
Fibres and other materials	Fibres and other materials from plants, algae and animals are directly used or processed for a variety of purposes. This includes wood, timber, and fibres which are not further processed, as well as material for production, such as cellulose, cotton, and dyes, and plant and animal material for fodder and fertiliser use.	No
Genetic materials	Genetic material is understood to be deoxyribonucleic acid (DNA) and all biota including plants, animals and algae.	No
Ground water	Groundwater is water stored underground in aquifers made of permeable rocks, soil and sand. The water that contributes to groundwater sources originates from rainfall, snow melts and water flow from natural freshwater resources.	Yes
Surface water	Surface water is provided through freshwater resources from collected precipitation and water flow from natural sources.	Yes

REGULATORY AND MAINTENANCE SERVICES		
Bio-remediation	Bio-remediation is a natural process whereby living organisms such as micro-organisms, plants, algae, and some animals degrade, reduce, and/or detoxify contaminants.	Yes
Attenuation of mass flows	Buffering and attenuation of mass flows allows the transport and storage of sediment by rivers, lakes and seas.	Yes
Climate regulation	Global climate regulation is provided by nature through the long-term storage of carbon dioxide in soils, vegetable biomass, and the oceans. At a regional level, the climate is regulated by ocean currents and winds while, at local and micro-levels, vegetation can modify temperatures, humidity, and wind speeds.	Yes
Dilution by atmosphere and	Water, both fresh and saline, and the atmosphere can dilute the gases, fluids and solid waste produced by human activity.	Yes
Disease control	Ecosystems play important roles in regulation of diseases for human populations as well as for wild and domesticated flora and fauna.	No
Filtration	Filtering, sequestering, storing, and accumulating pollutants is carried out by a range of organisms including, algae, animals, microorganisms and vascular and non-vascular plants.	Yes
Flood and storm protection	Flood and storm protection is provided by the sheltering, buffering and attenuating effects of natural and planted vegetation.	Yes
Maintain nursery habitats	Nurseries are habitats that make a significantly high contribution to the reproduction of individuals from a particular species, where juveniles occur at higher densities, avoid predation more successfully, or grow faster than in other habitats.	Yes
Mass stabilisation and erosion control	Mass stabilisation and erosion control is delivered through vegetation cover protected and stabilising terrestrial, coastal and marine ecosystems, coastal wetlands and dunes. Vegetation on slopes prevents avalanches and landslides, while mangroves and sea grass provide erosion protection of coastlines.	Yes
Mediation of sensory impacts	Vegetation is the main (natural) barrier used to reduce noise and light pollution, limiting the impact it can have on human health and the environment.	Yes
Pest control	Pest control and invasive alien species management is provided through direct introduction and maintenance of populations of the predators of the pest or the invasive species, landscaping areas to encourage habitats for pest reduction, and the manufacture of a family of natural biocides based on natural toxins to pests.	Yes
Pollination	Pollination services are provided by three main mechanisms: animals, water and wind. The majority of plants depend to some extent on animals that act as vectors, or pollinators, to perform the transfer of pollen.	Yes
Soil quality	Soil quality is provided through weathering processes, which maintain bio-geochemical conditions of soils including fertility and soil structure, and decomposition and fixing processes, which enables nitrogen fixing, nitrification and mineralisation of dead organic material.	Yes
Ventilation	Ventilation provided by natural or planted vegetation is vital for good indoor air quality and without it there are long term health implications for building occupants due to the build-up of volatile organic compounds (VOCs), airborne bacteria and moulds.	No
Water flow maintenance	The hydrological cycle, also called water cycle or hydrologic cycle, is the system that enables circulation of water through the Earth's atmosphere, land, and oceans. The hydrological cycle is responsible for recharge of groundwater sources (i.e. aquifers) and maintenance of surface water flows.	Yes
Water quality	Water quality is provided by maintaining the chemical condition of freshwaters, including rivers, streams, lakes, and ground water sources, and salt waters to ensure favourable living conditions for biota.	Yes

Nature & Biodiversity Risk
Dependency Risks

ECOSYSTEM SERVICE LEVEL DEPENDENCY ANALYSIS E[valuate]1 - ID of Relevant Ecosystem Services

Overall dependency at the company-level, and by extention portfolio-level, on the benefits provided by any individual Ecosystem Service (ES) is assessed using the two core pillars of 'reliance on' and 'resilience of' the ecosystem in which one operates.

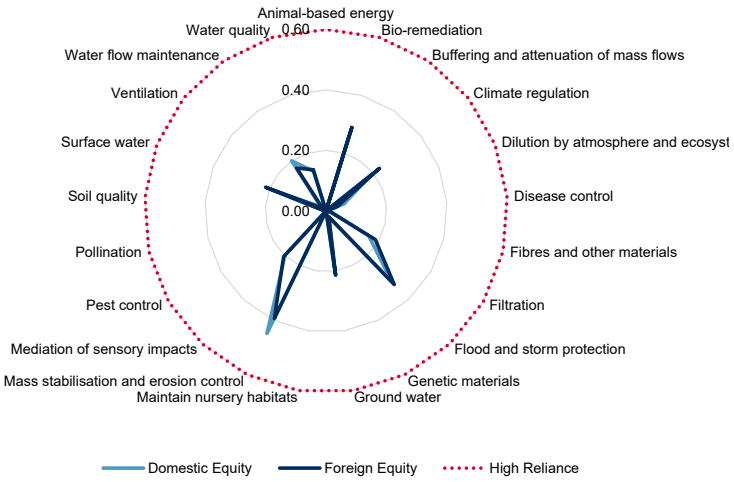
RELIANCE ON ECOSYSTEM SERVICES

Reliance on each individual ES is assessed at the asset or business activity level first by looking at its materiality to a sector, and second by looking at the relevance of the materiality based on location.

Materiality of the 21 ecosystem services on production processes across the global economy have been taken from the ENCORE knowledge base (Natural Capital Finance Alliance 2022), which provides qualitative materiality ratings from 'Very low' to 'Very high'. Relevance of a materiality rating may vary depending on location. For example, the potential for a benefit to be gained from flood protection services will be highest in areas of high flood.

The righthand chart provides the investment weighted average Reliance score per ecosystem service at the portfolio level, with 0.6 or higher indicating a 'significant' reliance.

Ecosystem Service Reliance



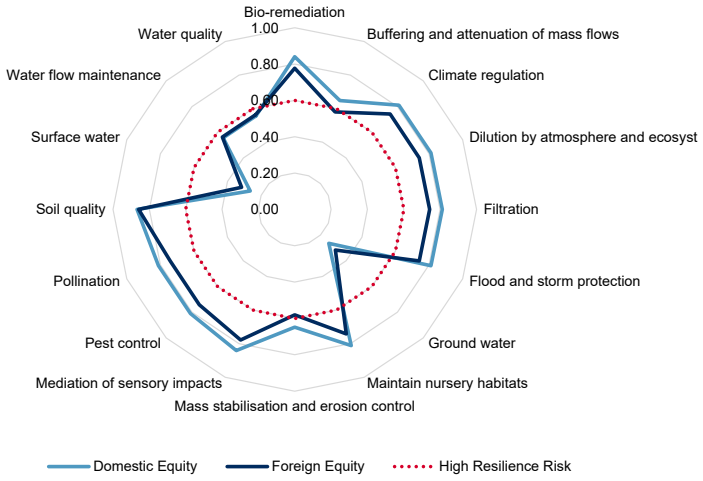
RESILIENCE OF ECOSYSTEM SERVICES

Resilience describes the ability of an ecosystem within which a business operates to sustain a continued flow of services.

Depending on the ES analysed, its overall health is assessed at either local, landscape or basin level, using either the Ecosystem Integrity Index (EII) that was introduced in earlier sections, or ES-specific indicators, such as water stress. These allow us to estimate the condition and capacity of the ecosystems where business operations are taking place. The condition, rather than the flow of ecosystem services is assessed, as longer term degradation might not yet be fully identified. Generally, more degraded ecosystems have a reduced capacity to provide a flow of services.

The righthand chart provides the investment weighted average Resilience score per ecosystem service at the portfolio level. 1 indicates a high risk of ES disruption due to a degraded state of nature, while 0 indicates a low risk.

Ecosystem Service Resilience



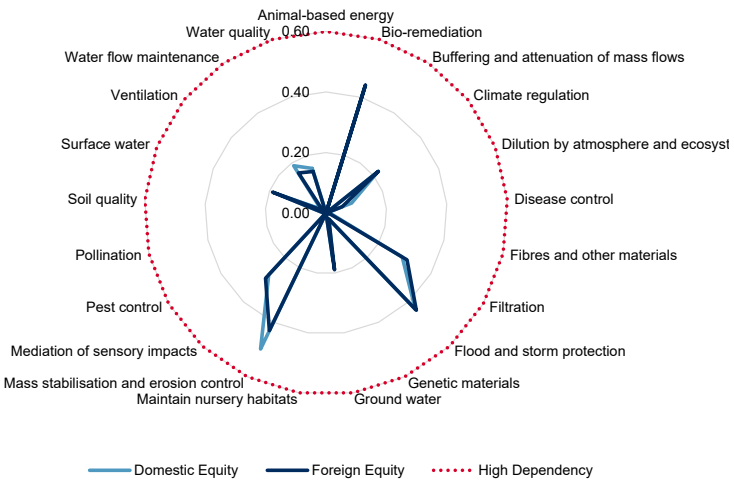
DEPENDENCY ON ECOSYSTEM SERVICES

Dependency, as referred to here, indicates the combination of the two pillars of the Sustainable1 approach - Reliance and Resilience. It is calculated by taking the geometric mean of the two scores at the asset or business activity level, before aggregating to the company level using and asset value weighted average (Tier2), or revenue-weighted average (Tier1).

The righthand chart provides the investment weighted average Dependency score per ecosystem service at the portfolio level.

As with the starting ENCORE materiality scores, the Dependency scores can be viewed in similar tiers, with <0.6 indicating very low to moderate Dependency, and >=0.6 indicating high to very high Dependency.

Ecosystem Service Dependency

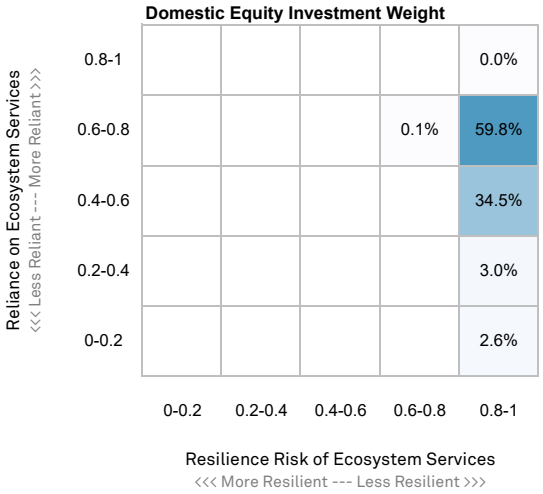


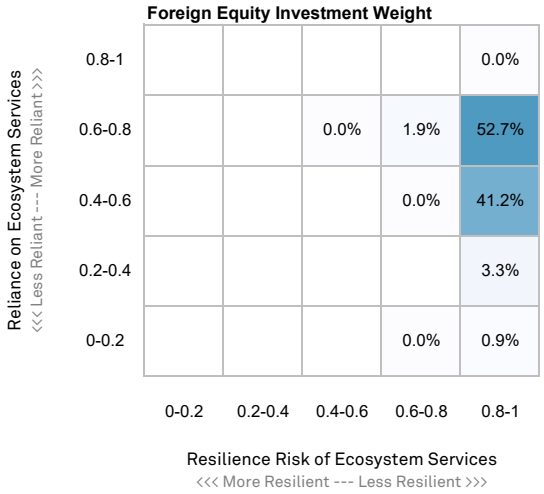
Nature & Biodiversity Risk
Dependency Risks

RELIANCE VS RESILIENCE E[valuate]3 - Dependency Analysis

The grids below show each portfolio's investment-weighted exposure to different Reliance and Resilience scores. The distribution of scores are broken down in line with the ENCORE materiality scoring system ranking from very low (0-0.2) through to very high (0.8-1).

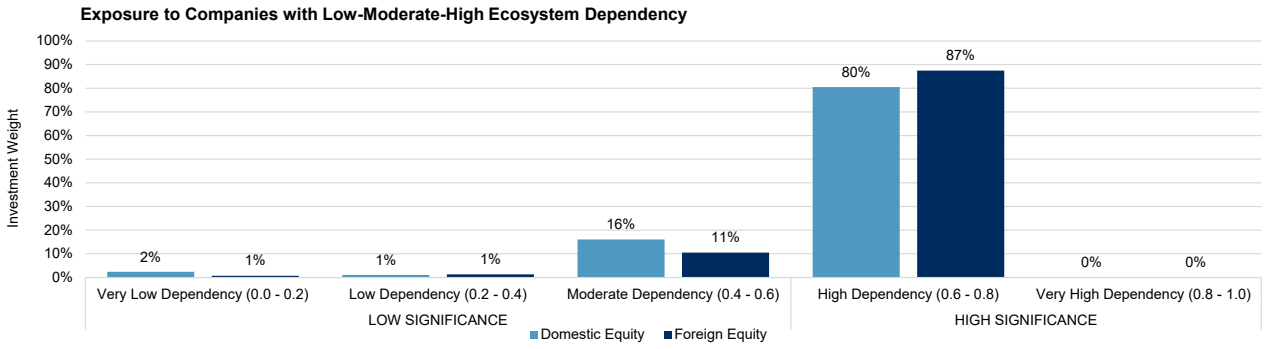
The lower left corner of each grid represents exposure to companies with both the lowest level of sector-based reliance on ecosystems, and lowest level of location-based ecosystem resilience risk, i.e. risk of disruption to the flow of ecosystem services due to drop in ecosystem integrity.





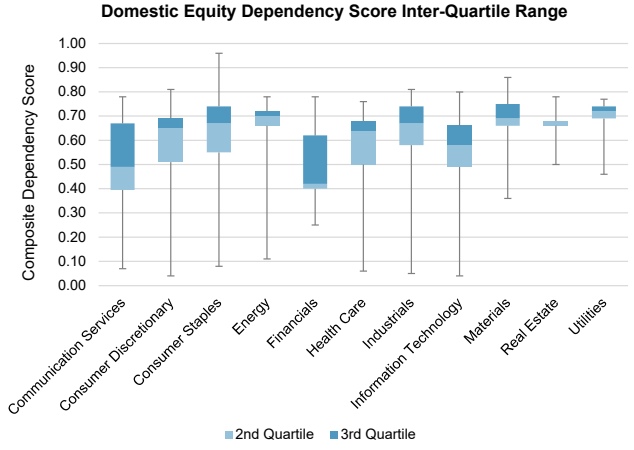
EXPOSURE TO ES DEPENDENCY E[valuate]3 - Dependency Analysis

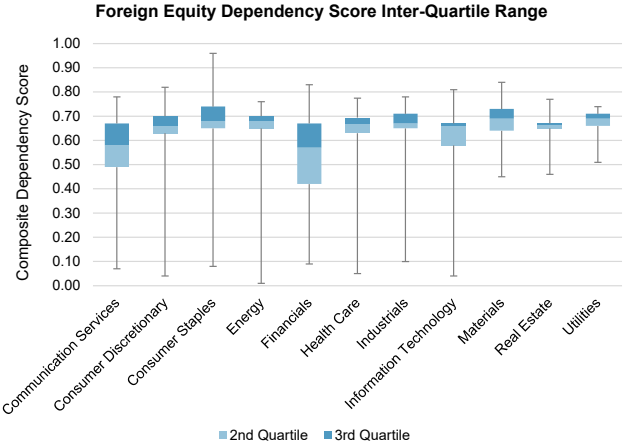
The chart below shows the investment weighted exposure to Composite Dependency score groupings at the company-level from Very Low (below 0.2) to Very High (above 0.8) for each portfolio.



COMPANY ECOSYSTEM SERVICE DEPENDENCY DISTRIBUTION BY SECTOR L[ocate]4 - Sector Identification

The charts below shows the range of final Dependency scores among investees in each portfolio, split by sector. The lines represent the upper and lower quartiles of observed scores, while the while the shaded bars indicate the range observed covering the second (lighter) and third (darker) quartiles.





Nature & Biodiversity Risk
Dependency Risks

ECOSYSTEM SERVICE DEPENDENCY BY SECTOR L[ocate]4 - Sector Identification

The tables below provides the investment weighted average ecosystem service 'Dependency' across the portfolios, both at the individual ecosystem service level and at the composite level. The ecosystem services have been split into the broader categories of 'provisioning' and regulatory and maintenance' services. Moderate dependencies (0.4-0.6) are highlighted in orange, while high and very high dependencies (0.6-1.0) are highlighted in red.

Domestic Equity

	TOTAL	Communications Services	Consumer Discretionary	Consumer Staples	Energy	Financials	Healh Care	Industrials	Information Technology	Materials	Real Estate	Utilities
PROVISIONING												
Animal-based energy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fibres and other materials	0.02	0.01	0.02	0.03	0.03	0.06	0.00	0.02	0.00	0.03	0.04	0.04
Genetic materials	0.02	0.00	0.00	0.04	0.00	0.00	0.23	0.00	0.00	0.01	0.00	0.00
Ground water	0.16	0.15	0.15	0.15	0.20	0.19	0.11	0.18	0.11	0.22	0.14	0.26
Surface water	0.16	0.15	0.15	0.15	0.20	0.19	0.11	0.18	0.11	0.22	0.14	0.26
REGULATORY & MAINTENANCE												
Bio-remediation	0.43	0.48	0.43	0.49	0.38	0.34	0.47	0.43	0.44	0.38	0.52	0.34
Buffering and attenuation of mass flows	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Climate regulation	0.22	0.14	0.25	0.08	0.66	0.30	0.03	0.31	0.08	0.40	0.25	0.59
Dilution by atmosphere and ecosystems	0.09	0.01	0.18	0.11	0.02	0.00	0.14	0.06	0.13	0.10	0.00	0.00
Disease control	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Filtration	0.29	0.21	0.36	0.36	0.31	0.20	0.36	0.30	0.23	0.30	0.30	0.32
Flood and storm protection	0.43	0.35	0.56	0.45	0.66	0.41	0.28	0.49	0.27	0.46	0.55	0.57
Maintain nursery habitats	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass stabilisation and erosion control	0.50	0.52	0.51	0.49	0.56	0.54	0.43	0.48	0.50	0.50	0.56	0.48
Mediation of sensory impacts	0.28	0.28	0.41	0.33	0.03	0.16	0.28	0.27	0.24	0.20	0.40	0.00
Pest control	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Pollination	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Soil quality	0.01	0.00	0.00	0.08	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Ventilation	0.02	0.00	0.07	0.00	0.01	0.00	0.00	0.02	0.01	0.05	0.00	0.00
Water flow maintenance	0.19	0.03	0.30	0.15	0.28	0.11	0.24	0.20	0.06	0.42	0.03	0.50
Water quality	0.15	0.02	0.26	0.14	0.38	0.09	0.19	0.15	0.05	0.31	0.03	0.39
COMPOSITE												
Aggregate	0.65	0.61	0.69	0.65	0.72	0.61	0.67	0.66	0.59	0.70	0.68	0.72

Foreign Equity

	TOTAL	Communications Services	Consumer Discretionary	Consumer Staples	Energy	Financials	Healh Care	Industrials	Information Technology	Materials	Real Estate	Utilities
PROVISIONING												
Animal-based energy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fibres and other materials	0.02	0.00	0.01	0.05	0.00	0.01	0.01	0.02	0.02	0.03	0.01	0.03
Genetic materials	0.02	0.00	0.00	0.03	0.00	0.00	0.14	0.00	0.00	0.01	0.00	0.00
Ground water	0.19	0.11	0.17	0.25	0.19	0.17	0.17	0.17	0.21	0.23	0.11	0.34
Surface water	0.19	0.11	0.17	0.25	0.19	0.17	0.17	0.17	0.21	0.23	0.11	0.34
REGULATORY & MAINTENANCE												
Bio-remediation	0.44	0.50	0.46	0.45	0.41	0.37	0.46	0.44	0.49	0.35	0.52	0.34
Buffering and attenuation of mass flows	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Climate regulation	0.22	0.04	0.23	0.20	0.53	0.17	0.14	0.28	0.20	0.40	0.11	0.52
Dilution by atmosphere and ecosystems	0.06	0.00	0.05	0.11	0.01	0.01	0.10	0.13	0.04	0.13	0.00	0.00
Disease control	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Filtration	0.31	0.26	0.28	0.37	0.40	0.24	0.37	0.33	0.31	0.29	0.32	0.23
Flood and storm protection	0.44	0.33	0.47	0.48	0.55	0.37	0.38	0.50	0.46	0.42	0.46	0.50
Maintain nursery habitats	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass stabilisation and erosion control	0.43	0.50	0.44	0.42	0.29	0.46	0.40	0.43	0.45	0.37	0.49	0.37
Mediation of sensory impacts	0.29	0.34	0.37	0.20	0.06	0.28	0.29	0.37	0.35	0.22	0.43	0.02
Pest control	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pollination	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Soil quality	0.01	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ventilation	0.01	0.00	0.02	0.01	0.01	0.00	0.01	0.05	0.01	0.06	0.00	0.00
Water flow maintenance	0.16	0.03	0.08	0.29	0.17	0.07	0.28	0.25	0.09	0.38	0.04	0.29
Water quality	0.14	0.02	0.07	0.25	0.34	0.05	0.23	0.21	0.08	0.30	0.03	0.23
COMPOSITE												
Aggregate	0.66	0.60	0.65	0.69	0.68	0.60	0.68	0.69	0.67	0.69	0.65	0.68

Nature & Biodiversity Risk

GLOSSARY OF TERMS

Biodiversity: The variability among living organisms from all sources, including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (Convention on Biological Diversity, 1992).

Cumulative impact: A change to the state of natural capital that occurs due to the interaction of activities of different actors operating in a landscape, not only the target organisation (as referenced in TNFD Beta framework).

Dependencies: Aspects of ecosystem services that an organisation or other actor relies on to function. Dependencies include ecosystems' ability to regulate water flow, water quality, and hazards like fires and floods; provide a suitable habitat for pollinators (who in turn provide a service directly to economies), and sequester carbon (in terrestrial, freshwater and marine realms) (as referenced in TNFD Beta framework).

Direct impact: A change in the state of natural capital caused by a business activity with a direct causal link (as referenced in TNFD Beta framework).

Ecosystem condition: "The quality of an ecosystem measured in terms of its abiotic and biotic characteristics. Condition is assessed with respect to an ecosystem's composition, structure and function which, in turn, underpin the ecological integrity of the ecosystem, and support its capacity to supply ecosystem services on an ongoing basis" (as referenced in TNFD Beta framework).

Ecosystem services: The contributions of ecosystems to the benefits that are used in economic and other human activity, drawn from UN-SEEA (2021) System of Environmental-Economic Accounting-Ecosystem Accounting (as referenced in TNFD Beta framework).

Impacts: Changes in the state of nature, 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 and can be direct, indirect or cumulative (as referenced in TNFD Beta framework).

Indirect impact: A change in the state of natural capital caused by a business activity with an indirect causal link (e.g. indirectly caused by the climate change and greenhouse gas emissions)

Natural capital: The stock of renewable and non-renewable natural resources (e.g., plants, animals, air, water, soils, minerals) that combine to yield a flow of benefits to people (as referenced in TNFD Beta framework).

Nature: The natural world, with an emphasis on the diversity of living organisms (including people) and their interactions among themselves and with their environment (as referenced in TNFD Beta framework).

Nature-related: risks Potential threats posed to an organisation linked to their and wider society's dependencies on nature and nature impacts. These can derive from physical, transition and systemic risks (as referenced in TNFD Beta framework).

Provisioning services: "The contributions to benefits that are extracted or harvested from ecosystems (e.g. timber and fuel wood in a forest, freshwater from a river)" (as referenced in TNFD Beta framework).

Regulating and maintenance services: "The ability of ecosystems to regulate biological processes and to influence climate, hydrological and biochemical cycles, and thereby maintain environmental conditions beneficial to individuals and society." (as referenced in TNFD Beta framework).

Resilience (of ecosystems): "The level of disturbance that an ecosystem or society can undergo without crossing a threshold that creates different structures or outputs. Resilience depends on factors such as ecological dynamics and the organisational and institutional capacity to understand, manage and respond to these dynamics" (IPBES 2019, as referenced in the TNFD Beta framework).

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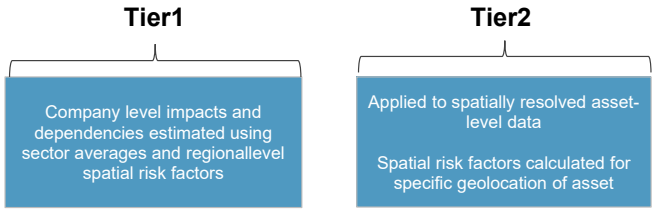
APPENDIX: NATURE RISK

THE NATURE RISK PROFILE METHODOLOGY'S TIERED APPROACH

The methodology developed here is aimed at using input data with different levels of spatial detail, structured around two core 'tiers' (Figure 5). The most accurate and spatially precise profiles of nature-related risk exposure will be based on geolocated asset level data ('Tier2' e.g., buffered point, polygon or line data), in line with the focus of the TNFD on understanding location-specific nature-related risks. Where asset level data is not readily available, estimates of metrics at a broader sectoral and spatial resolution can be used to estimate potential risk exposure ('Tier1'). Methods to estimate likely locations of sector activities within countries can be used to refine sectoral approaches used in Tier1 assessments. For example, layers representing the spatial breakdown of GDP production within countries can be used to weight average impacts and spatial risk factors.

Figure 5: Tiered approach to the Nature Risk Profile methodology



IMPACT SCORING APPROACH

Exposure to impact-related risk is calculated at either the individual asset level or the company level by estimating footprints for magnitude of impact associated with business activities and analysing the metrics for location significance where these impacts occur. The core approach to quantifying magnitude of impact is to calculate a footprint on ecosystem integrity, expressed as a **condition-adjusted area**. The significance of this footprint is then assessed through data layers that place the location of operation on a relative **significance scale**. At the individual asset level, this approach is supplemented with additional asset level flags which can be used to evaluate reputational and regulatory risks.

Condition-Adjusted Footprint (or 'Magnitude' of Impact)
The condition of ecosystems reflects their ability to provide ecosystem services, support viable species populations and adapt to future environmental change. Translating how the ecosystem use associated with business operations reduces ecosystem condition indicates the degree to which operations are pushing ecosystems towards tipping points. These tipping points can be either at a local level (where ecosystems fundamentally change in their capacity to supply ecosystem services) or they can be at a global level (where they contribute to large scale systemic risks).

A common metric for assessing impacts at the ecosystem level is 'condition adjusted area' (United Nations et al. 2021; Endangered Wildlife Trust 2020). Measuring the condition adjusted area involves quantifying the extent of ecosystem coverage in an area of interest and then reducing this total extent by a factor representing its condition compared to an 'intact' reference state. The concept behind this is that although there may be '100 hectares' of forest within a landscape, if the condition is only half that of an intact primary forest, then it is equivalent to having only 50 hectares of intact forest within that landscape in terms of biodiversity value.

The impact of a given business activity can be expressed in a similar way, in terms of the reduction in conditionadjusted area of an ecosystem caused by the activity. The total area of land occupied by a business activity can be adjusted for the degree to which condition is reduced, thereby expressing impact of different business activities on a common scale. This provides a measure of the equivalent area where condition is reduced to zero, calculated using the below formula:

*Footprint (Condition adjusted area) = Area * (1- remaining condition)*

Condition of ecosystems can be measured in many ways and at different scales. At the portfolio scale, it can be challenging to assess the condition of individual ecosystem types. Instead, pressure-based modelling approaches can be used to infer remaining condition at specific locations. These approaches effectively ignore the specific ecosystem types that are present and the results of these models can be input into the calculation of the integrity-adjusted area footprint. There are multiple different metrics that describe condition based on models. The **Ecosystem Integrity Index** below is presented here as a best practice metric for calculating the 'remaining condition' element of the footprint calculation.

The Ecosystem Integrity Index (EII)
EII is a combination of geospatial layers representing the three components of ecosystem integrity. These three layers include ecosystem **structure**, ecosystem **composition** and ecosystem **functioning**. A description of these layers is provided in Hill et al. (2022) and summarized below:

- **Structure**: The metric is derived from a total of 11 biodiversity pressure layers including population density, built-up areas, agriculture, roads, railroads, mining, oil wells, wind turbines and electrical infrastructure. These pressure layers are aggregated using the methodology described in the Human Modification Index to produce a single pressure index (Kennedy et al. 2019). This index is transformed using the methods described in Beyer et al. (2019) so that it can account for the influence of habitat loss, quality and fragmentation. The final structural layer that is produced thus captures effects of land use at the landscape level as well as describing local intactness. This feature of EII is a distinct advantage over other condition metrics, which often focus on impact at local levels, without the context of the wider landscape.
- **Composition**: The metric chosen for this layer is the Biodiversity Intactness Index (BII), which summarizes change in the make-up of ecological communities in response to human pressures (Newbold et al. 2016; Hill et al. 2019). The BII is calculated using two models estimated using data taken from the PREDICTS database (Hudson et al. 2017). The first assesses the impact of human pressures on the total abundance of species within a community and the second analyses the similarity between the relative abundance of each of the species in a community in a non-natural landscape with those in a natural landscape. The product of the two models, projected onto maps of human pressures, results in the BII.
- **Function**: The functioning component is estimated using the difference between potential natural and current net primary productivity (NPP) within each 1km2 grid cell. The functioning component is a metric which describes the ratio between observed net primary productivity (NPP) and ecoregion 'natural' reference NPP levels. Current NPP is derived from remote sensed geospatial layers (Running and Zhao 2019). The natural, potential NPP layer is modelled using environmental input data including temperature, precipitation, landforms, and soil types.
- **Aggregated EII**: The three component layers are then aggregated to give a single metric: EII. A minimum value approach is employed, whereby the value per grid cell is taken from the lowest scoring of structure, composition and functioning. This method was chosen with the reasoning that the integrity of an ecosystem is limited and determined by minimum score from any of the three contributing layers.

The index provides a simple and scientifically robust way of measuring, monitoring and reporting on ecosystem integrity at any geographical scale. The first component of EII, ecosystem structure, is designed to reflect the effect of habitat area, intactness and fragmentation. The second component, ecosystem composition, refers to the species present and the overall species diversity. The third component, ecosystem function, is defined as the core processes that occur within the ecosystem, as a result of interactions between the living and non-living components.

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Applying the Ecosystem Integrity Index (EII)

The EII provides a robust and comprehensive multiplier of condition that can be used within condition-adjusted area metrics and to estimate the impact of company activities. The approach used in the calculation of an EII coefficient for the purposes of the Nature Risk Profile methodology is known as the 'characteristic approach'. The approach estimates the total reduction in EII at a specific location compared to an 'intact' reference state (condition = 1). Taking the average EII values over a specific location 'characterizes' the average integrity of ecosystems within that area. It captures the impact of all pressures at that location, even if they are not directly associated with the business activity of interest. This provides an estimate of the overall resulting or current state of EII at the location that can be used to track progress.

- **Tier1**: The average EII values over broad-scale land use classes can be averaged for each country (this will be provided as a separate technical annex in future). These can then be linked to relevant sectors to provide a relevant EII multiplier to be used to estimate a footprint of the total land use associated with that sector.
- **Tier2**: To estimate the characteristic EII of assets, asset data first can be input into the composition and structural layers. This is suggested as best practice as it ensures assets of interest are contributing to the total reduction in intactness at their locations. Once layers are updated with asset level data as needed, average EII values under a specific asset polygon can be taken to provide a multiplier. This can then be combined with the area of the polygon to calculate the condition-adjusted area footprint.

Location Significance

A limitation of only looking at the magnitude of impacts through footprinting approaches is that the relative significance of the ecosystems impacted is not fully taken into account. Areas that hold important stocks of environmental assets, such as biodiversity, water and soil, may hold elevated significance for nature-related risks. Similarly, areas integral to the continued supply of ecosystem services at a range of scales are important both from the perspective of a company and the perspective of other groups who rely on those services (including and especially women and girls, Indigenous Peoples, local communities and other stakeholders that are considered vulnerable).

There are multiple dimensions to nature significance. These reflect the multiple components of natural capital, the multiple values and benefits it provides and the multiple dimensions of nature-related risks. Risks may be elevated if a company's footprint occurs in these areas of high significance or if it occurs in areas where the species or ecosystems are deemed irreplaceable if lost at that location.

Within the methodology, significance is assessed at the global level using data layers that are standardised so that values in each location represent a proportion of high significance value globally for that variable. Data layers can be standardised between 0 and 1 so that pixels with a value of '1' represent the highest significance areas for that variable and values below are a proportion of that maximum significance. Data layers of multiple variables can be stacked together and the highest value for each pixel can be taken as the significance value to capture the significance of multiple factors.

This 'significance index' approach allows interpretation of impacts in terms of their relative location significance. It is recommended that best available data on multiple aspects of biodiversity and the provision of ecosystem services is applied as best practice. A methodology for species extinction risk, and ecosystem service provision, is provided below as an example.

- **The Species Threat Abatement and Restoration (STAR) metric**: The STAR metric quantifies the potential opportunity for reducing global species extinction risk by reducing threats in specific locations (Mair et al. 2021). Individual species are given a score based upon their threat status and this score is then distributed across the range of the species. High STAR scores are found in areas with high richness of range restricted Threatened species. Reducing identified threats in these locations will have a high contribution to reducing species' global extinction risk. Failure to do so represents a high opportunity cost and contributes disproportionately to driving species to extinction.
- **Critical Natural Assets (CNA)**: CNA, as defined by Chaplin-Kramer et al. (2022), represent areas that are integral to securing 90% of current levels of ecosystem service provision. Critical Natural Assets are defined separately for global ecosystem service provision (e.g. carbon sequestration) and local ecosystem service provision (e.g. pollination). Within global layers presented in Chaplin-Kramer et al (2022), the highest pixel scores are found in areas that would need to be protected to secure the top 5% of current levels of ecosystem service provision. Each subsequent score represents areas providing the next 5% of ecosystem services, down to the lowest pixel scores which are found in areas that only need to be protected if a target is to secure 100% of current ecosystem service provision.

For certain use cases it may be required to create a single index that combines magnitude and significance into a single footprint. Combining metrics in this way reduces the interpretability of the individual scores but can provide a high-level footprint for comparing companies across sectors and geographies. It can also guide to where more detailed interpretation of the underlying metrics is most required.

The metric for 'magnitude of impact', condition adjusted area footprint, places two aspects of magnitude of impact (the area of land impacted and the degree to which integrity is reduced) into a single combined score for comparison. By further weighting this value for the value of the significance index described above, this condition-adjusted area footprint can be expressed as a footprint of 'highest significance' area. Importantly, this metric is not a physical area to be managed, but a useful conceptual way of comparing impact that considers the relative footprints of different activities/companies as if they were all operating in the highest significance areas globally.

*Highest significance area footprint (equivalent ha) = Magnitude (Condition adjusted area) * Significance (location significance index)*

ASSET LEVEL SIGNIFICANCE FLAGS

In addition to global data layers that provide a scale of relative location significance, asset level data can be assessed for significance by overlaying them with areabased data layers defining areas of high significance. In contrast to the continuous 'significance index' approach described above, these provide additional binary contextual flags as to the significance of the location of the assets and the associated asset-level impacts. It is recommended that these additional asset level flags are included as best practice. Although many different areabased designations exist, which reflect a range of regulatory and reputational risks at a range of scales, two global standard datasets are recommended as detailed below. In the future, these can be complemented with other relevant datasets that become available.

- **World Database of Key Biodiversity Areas**: Key Biodiversity Areas (KBAs) are sites contributing significantly to the global persistence of biodiversity (International Union for Conservation of Nature [IUCN] 2016). KBAs are identified at the national, sub-national or regional level by local stakeholders based on standardised scientific criteria and thresholds. Operating within KBAs poses a series of potential transition risks for businesses. They are also featured in major standards such the International Finance Corporation's Performance Standard 6 on Biodiversity Conservation and Sustainable Management of Living Natural Resources (International Finance Corporation 2012). The World Database of Key Biodiversity Areas is curated by BirdLife International on behalf of the KBA partnership and made available for commercial use via the Integrated Biodiversity Assessment Tool (IBAT).
- **World Database on Protected Areas**: A protected area is "a clearly defined geographical space, recognized, dedicated and managed through legal or other effective means to achieve the long-term conservation of nature with associated ecosystem services and cultural values" (Dudley 2008). Protected areas are the cornerstones of in-situ conservation. They are also featured in major standards, including the Global Reporting Initiative Standards (GRI 304) and the International Finance Corporation Performance Standard 6. Certain types of protected areas allow economic production to occur within their boundaries, however, they should always be approached with caution and any negative impacts on these areas should be avoided.

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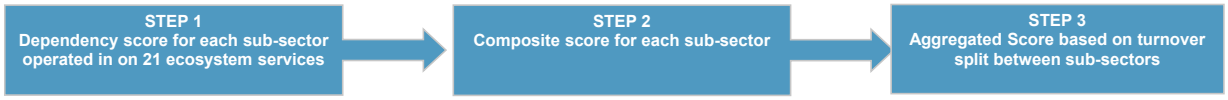
APPENDIX: NATURE RISK

DEPENDENCY SCORING APPROACH

A score at either the individual asset or business level for overall exposure to dependency-based risk is calculated by breaking-down total turnover into the different economic sectors operated in. Once this is done, scores for the materiality associated with these sectors on 21 individual **ecosystem services** (**ES**) are applied (see p11 for ES descriptions). The overall process consists of three steps, shown below in Figure 6.

Figure 6: Scoring process for ecosystem services



STEP 1:
A given business or asset's dependencies on each of 21 ecosystem services is first assessed by combining scores of a) The **materiality** of the dependency on that service, b) The **relevance** of that service based on the locations operated in, c) The **resilience** of the ecosystem providing the services (explanations below).

These scores are combined using the following formulae:

$$Reliance\ score_i = \sqrt[n]{Materiality\ score_i * Relevance\ score_i}$$

$$Dependency\ score_i = \sqrt[n]{Reliance\ score_i * Resilience\ score_i}$$

Where:
- i: Ecosystem service i
- n: Number of relevant score components for ecosystem service i
- All 3 materiality, reliance and resilience scores range from 0 to 1

STEP 2:
Once the dependency on each ecosystem service is scored, the scores of the 21 service dependencies are combined using a logarithmic function. This results in one dependency score for each sector. The assumption here is that the majority of risk stems from having high dependencies on a low number of ecosystem services and additional ecosystem service dependencies then cause incremental additional risk exposure. By applying a logarithmic function, this decreasing marginal contribution effect of additional ecosystem services is captured.

$$Composite\ score_j = f\left(\sum_{i=1}^{m} Dependency\ score_i\right)$$

Where:
- i: Ecosystem service i
- j: Sector/process j
- m: Number of ecosystem services

STEP 3:
Company or asset-level turnover data is then used to produce an overall company-level, or asset-level dependency score, based on the distribution of turnover within different sub-sectors.

$$Aggregate\ score_k = \sum_{j=1}^{z} w_j * Composite\ score_j$$

Where:
- j: Sector j
- wj: Weight of sector/asset j in company revenue
- z: Number of sectors/assets in company portfolio

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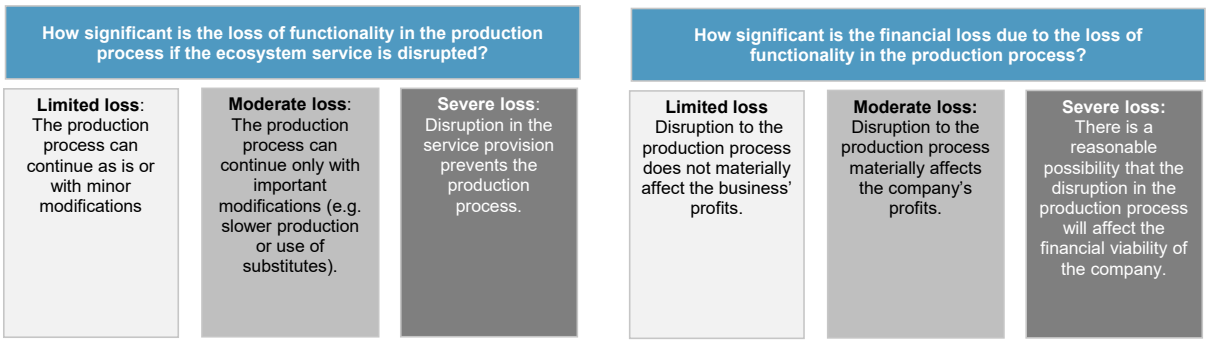
Ecosystem Service Materiality

The materiality rating component of the dependency scores are taken from the ENCORE knowledge base (Natural Capital Finance Alliance 2022). The ENCORE knowledge base assesses the links between each sector of the global economy, the ecosystem services that support their production processes and the natural capital assets that support those services.

The reliance of production processes on ecosystem services is scored through qualitative materiality ratings (Very Low to Very High) through the following criteria:

Figure 7: ENCORE materiality scoring framework



These qualitative ratings are turned into the following quantitative scores:

No Dependency	*~0.0*
Very Low Dependency	*~0.2*
Low Dependency	*~0.4*
Moderate Dependency	*~0.6*
High Dependency	*~0.8*
Very High Dependency	*~1.0*

For sectors comprised of more than one production process, materiality ratings for each production process are aggregated up to sector level. Where it is deemed that disruption to any of the production processes would hinder the production of the overall sub-sector, i.e. they are complementary to each other, the maximum ratings for the production processes are taken to represent the sub-sector. For sub-sectors where the production processes are mutually exclusive, the average of the ratings is taken.

Ecosystem Service Relevance

The potential for benefits to be gained from many regulating services is unevenly distributed spatially and depends on the degree to which a given location is at risk from disruptions, like natural hazards, that the ecosystem service helps to regulate. For example, the potential for a benefit to be gained from flood protection services will be highest in areas of high flood risk and the potential for a benefit to be gained from water filtration services will often be highest in heavily polluted areas. Where the potential benefit of the ecosystem service is low or negligible, the relevance of the ecosystem service will also tend to be low despite a potentially high materiality rating estimated at the sector or business activity level. Consequently, for certain ecosystem services, materiality ratings should be adjusted for the potential benefit.

- **Tier1**: Data layers representing the need for the identified regulating services should be normalized between 0 and 1. Country level averages can then be taken and applied where asset level data is not available (this will be provided as a separate technical annex in future).
- **Tier2**: Data layers representing these identified regulating services should be normalized between 0 and 1. The average of these scores can then be taken from the location of the individual asset.

The following ESs are those that may be adjusted for local relevance:

1. Buffering and attenuation of mass flows
2. Flood and storm protection
3. Mass stabilisation and erosion control

Ecosystem Service Resilience

The likelihood that dependency-related risks materialize depends on the capacity of ecosystems to continue to provide the necessary ecosystem services. For direct resource use, the resilience of continued supply of provisioning ecosystem services will relate directly to the continued availability of that resource within the area where operations are taking place. However, the capacity of ecosystems to provide regulating and maintenance services is more complex to measure. The links between different ecosystem variables and capacity are often unknown. This is also often true for the link between different drivers of change and ecosystem capacity. It remains important that initial scores for reliance are adjusted for the resilience of the ecosystems providing the ecosystem services. A list of ecosystem services where reliance scores should be adjusted is provided on p11.

Given the uncertainty associated with measuring ecosystem capacity, an initial proxy for the resilience of these services is the condition of the ecosystems providing the services. Generally, more degraded ecosystems have a reduced capacity to provide services. However, it is important to emphasize that this relationship is often not linear. Ecosystem service disruption may not appear until the supporting ecosystem is nearing collapse or it may appear abruptly with only mild supporting ecosystem degradation. Additionally, ecosystems are dynamic and condition measures capture a point in time rather than trends in ongoing environmental change. The spatial scale at which services are provided is also highly variable and uncertain. As a starting point, average ecosystem condition of the ecoregion operated in can act as a proxy for the capacity of the ecoregion to provide services. While this approach may also not fully capture dependencies on individual species, such as individual pollinators, it can be built upon to consider such fine levels of detail in the future.

The Ecosystem Integrity Index (EII) is a best practice measure for providing an estimation of the condition and capacity of the ecosystems where business operations are taking place.

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FEEDBACK AND FUTURE DEVELOPMENTS

The building blocks for the methodology have benefited from extensive review by S&P Global Sustainable1's Knowledge Community as well as by key experts within the scientific and conservation community. Feedback from the consultation process has helped to inform the development of this first iteration of the methodology, however there is also much that has been highlighted as key priorities for future developments. These are listed below:

1. **Impacts on vulnerable groups, including diverse groups of women and girls**: While this is not included in the current version of the methodology, it is foreseen to be added in the impact component in the next iteration. This will be reliant on the availability of suitable global spatial data. Some options for consideration include data on Indigenous and Community Conserved Areas (ICCAs) and Other Effective Area-based Conservation Measures (OECMs). However, the appropriateness of these data for inclusion will be duly considered along with additional data sources through a full scoping exercise in 2023. As with other elements of the methodology, the intention will be to align with the TNFD's approach. In this instance, this will include aligning with the TNFD's thinking on gender considerations and other social elements of nature-related risk management and disclosures, which is still developing (see TNFD 2022). It will also involve aligning with the recommendations/approach of the evolving TFID (Taskforce on Inequality-related Financial Disclosures, n.d.) when it comes to integrating social impacts in the methodology.
2. **Integration of value chain scores in the methodology**: The first iteration of this methodology captures direct dependencies and impacts. The next will extend to cover value chain impacts and dependencies and integrate them into the overall scoring approach. This will draw on Input-Output modelling and Life Cycle (Impact) Assessment approaches to cover upstream and downstream links respectively.
3. **Capacity of ecosystems to provide regulating/ maintenance ecosystem services**: The next iteration of the methodology will consider how to assess the ability of ecosystems to provide regulating and/or maintenance services in more detail. The current approach is based on a global dataset that assesses the integrity of ecosystems. While this is a good starting point, it would be ideal to assess the ability of individual ecosystem types to provide different ecosystem services. Scoping approaches to do this at the global level will be a key priority for the next iteration of the methodology.
4. **Addition of risk mitigation in the methodolo**gy: The current version of this methodology captures exposure to risk but does not fully extend this to the actions that companies may have in place to mitigate such risks. This will be a core component to add in the future, but will require company and location-specific information.
5. **Coverage of freshwater and marine ecosystems**: While the methodology is suitable to assess these realms, sufficient data and techniques are still lacking to assess them to the standard suggested in this methodology for terrestrial ecosystems.

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