CFRF CLIMATE FINANCIAL RISK FORUM

# Nature-related Risk: Handbook for Financial Institutions

**October 2024**

# Contents



This chapter represents the output from the Resilience Working Group, part of the Climate Financial Risk Forum (CFRF).

This CFRF guide has been written by industry, for industry. The recommendations in this guide do not constitute financial or other professional advice and should not be relied upon as such. The PRA and FCA have convened and facilitated CFRF discussions but do not accept liability for the views expressed in this guide which do not necessarily represent the view of the regulators and in any case do not constitute regulatory guidance.

# Acknowledgements

This chapter has been written by the Nature-related Risk sub-group of the Climate Financial Risk Forum (CFRF) Resilience Working Group.
It is largely written by practitioners, and is intended to support practitioners working in banks, insurers, and asset managers, who support risk identification and strategy for climate and/or the environment. It aims to enable firms to better understand their exposure to nature-related risks and opportunities and reflect outcomes from nature-related risk assessments within strategic decision making.
The views in this chapter reflect the individual participants and not necessarily the views of their employers.

**Resilience working group chair:** Billy Suid (Barclays)

**Sub-working group chair:** Sandy Trust (M&G)

**Sub-working group secretariat:**
Maxim Olliver (KPMG)
Brenna Carroll (KPMG)

**Lead authors:**
Nell Agate Tsui (HSBC)
Nick Talbot (NatWest)
Ryan Allison (Phoenix)
Rutang Thanawalla (LIBF)
William Powell (Santander UK)

**Contributors:**
Andrew Smithson (Paragon)
Ann Meoni (abrdn)
Antonio Rendina (Standard Chartered)
Antonio Timoner Salva (HSBC)
Charles Low (NatureAlpha)
Christy Zakarias (Barclays)
Conor Hartnett (Invesco)
Dounia Lich (Standard Chartered)
Emma O'Donnell (Oxford University)
Juan Rojas (Pimco)
Katie Leach (Lloyds)
Khalid Rashid (HSBC)
Leila Kamdem (HSBC)
Lewis Raper (NatWest)
Marine De Bazelaire (HSBC)
Matteo Oriani (HSBC)
Monika Sabolova (ICE)
Rebecca Lea (ABI)
Richard Mann (Lloyds)
Samuel Mary (Pimco)
Sophie Brucale (HSBC)
Vian Sharif (NatureAlpha)

**Guest Contributors:**
Andrew Pylypchuk (EarthDaily Agro)
Marion Messador (Kayrros)
James Steward (NatureMetrics)
Simas Gradeckas (Bloom Labs)
Dr Sophus zu Ermgassen (Oxford University)

**Reviewers:**
Jo Paisley (GARP)
Maxine Nelson (GARP)
Dr Nicola Ranger (Oxford University)
Dr Jimena Alvarez (Oxford University)

# 1 Foreword

By many metrics, humanity is prospering. Over the period since the Second World War the global population has increased to around 8 billion, with life expectancy rising from under 50 to over 70. Total wealth has increased to around $500 trillion. There have been incredible technological advances across the span of human endeavor. Capabilities that were in the domain of science fiction in the late 20th century are now commonplace for billions via the smartphone[1].

This growth in human economy, health, population and capability has been supported by significant increases in material and energy consumption. Energy consumption has more than tripled over the period 1960 to 2022[2] and the mass of human produced items is estimated to have exceeded the mass of all the biomass on the planet in 2020[3].

This has been accompanied by significant degradation of the natural world. We are using up Earth's resources at a faster rate than they can be replenished, breaching planetary boundaries on multiple dimensions[4], with 1.7 Earths required to satisfy current consumption rates[5]. The impact of human activity on nature is significant and we risk fundamentally changing the climate and the biosphere.

Without considering the moral case for preserving nature, this puts in jeopardy ongoing human prosperity. This is because nature, which we can think of as everything not man made, provides what we call ecosystem services - providing food and water, regulating the climate, providing raw materials like minerals and wood. The ongoing availability and predictability of these ecosystem services are required to support our society and provide the inputs to our economy.

Quite simply nature is the foundation on which our global society and economy rests. And as any aspirant tower block builder will tell you, taking blocks from the bottom of the tower is a perilous strategy. Thus, risks to nature are risks to our society and economy.

At a macro level, the risks associated with nature and the climate are complex system risks, cascading and compounding, with feedback loops with each other and human activity. Extreme weather and groundwater depletion may impact water, food and energy security. This might affect economic activity and migration, leading to political instability or even conflict. The resilience of human society to potential disruption is reduced if populations aren't healthy, which in turn is linked to healthcare infrastructure and the availably of high-quality nutrition.

For financial institutions, such macro factors as well as the micro impact on their portfolios and balance sheets represent emerging risks that need to be understood and managed.

This is a difficult task, more difficult than the management of climate-related risk, given that nature is multi-dimensional and the risk assessment infrastructure (for example nature scenario and economic modelling) is less established.

A first step would be for financial institutions to build their understanding of how their business can impact nature, how nature related risks can impact their business and what they can do to finance solutions. This is a nascent field and firms will need to follow a similar path to that trodden on climate change, developing capability, acquiring data, investigating risks and opportunities, allocating responsibilities and reporting transparently.

Although re-connecting finance and the economy to the biosphere we live in may seem like a daunting task, it is significantly less challenging than adapting to a world in which we lose or damage critical ecosystem services. We hope this document serves financial institutions well in getting started.

**Billy Suid (Barclays) and Sandy Trust (M&G)**

[1] As summarized in the Dasgupta review, Chapter 0. Final Report - The Economics of Biodiversity: The Dasgupta Review - GOV.UK (www.gov.uk)
[2] Energy Production and Consumption - Our World in Data
[3] Global human-made mass exceeds all living biomass | Nature
[4] All planetary boundaries mapped out for the first time, six of nine crossed - Stockholm Resilience Centre
[5] Section 4.5. Final Report - The Economics of Biodiversity: The Dasgupta Review - GOV.UK (www.gov.uk)

# 2 Overview

## Background

Nature underpins human society and our global economy. The Ecosystem Services that flow from nature provide food, water, energy and the raw materials that we rely on. These ecosystem services are the foundations on which our society and economy rests. The World Economic Forum (WEF) produces an annual report on risks that would impact a significant proportion of global GDP, population and natural resources. In 2024, the top 4 global risks identified by WEF over the next 10 years are environmental risks[6]: extreme weather events, critical change to earth systems, biodiversity loss and ecosystem collapse, and natural resource shortages.

Governments, corporates and financial institutions are becoming increasingly aware of the intricate relationship between climate and nature, which was recognised at COP28 with a first of its kind joint statement on climate and nature[7]. New guidance and protocols such as the Kunming-Montreal Global Biodiversity Framework and the Task Force for Nature-related Financial Disclosures (TNFD) recommendations also stress the importance of preserving and restoring nature.

However, nature is inherently more complex than climate. There is no single metric for nature equivalent to greenhouse gas concentrations or temperatures. While significant data exists, there is a complex array of interdependent variables, requiring ordering and interpretation to build the capability to assess the impact of nature risks on corporate entities and financial markets. Some financial institutions and regulators have begun their journey to build capabilities in nature, developing nature-related risk assessments, upskilling internally, and combining climate and nature in their sustainability strategies. However, regulatory progress on nature is nascent, with no specific prudential expectations on nature for firms in the UK. Similarly, market maturity is still low in comparison to climate, highlighting the need for knowledge sharing, education and increasing awareness of best practice approaches.

## Purpose and audience

This publication is an introductory guide for banks, insurers, asset managers or asset owners ("firms") who are embarking on their nature journey, covering information on:

- The context on nature-related risk for firms, including a definition of nature and how nature risks can be transmitted to financial institutions.
- Emerging practice on how to incorporate nature into Financial Services risk management frameworks.
- Case studies showing how a range of financial institutions are performing pilots to assess nature-related risks and opportunities across their portfolios.
- An overview of the nature data landscape and key applications of nature-related data and tools for financial institutions.

This document also signposts several other relevant resources on nature that financial institutions may find helpful.

This document should be used by financial institutions to inform the development of their own approach to nature-related risk. It is not intended as a comprehensive guide and the contents should be considered based on the proportionality principle, the size of your organisation, business model and level of exposure to nature-related risk.

This documentary is complementary to the recommendations of the TNFD. The TNFD is a disclosure framework, whereas this document is intended to be a more practical guide for

[6] The Global Risks Report 2024, World Economic Forum

[7] https://www.cop28.com/en/joint-statement-on-climate-nature

financial institutions who want to start assessing nature-related risk and integrating nature into their risk management framework.

# 3 Introduction to Nature

## Defining nature-related risk for Financial Institutions

### *Defining Nature*

The IPBES (The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services) Conceptual Framework[8], defines nature as "the natural world with an emphasis on the diversity of living organisms and their interactions among themselves and with their environment."

Biodiversity is defined as "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."[9]

Simon Zadek (Executive Director at Nature Finance and Executive Director of the TNFD) highlighted[10] that often in practice, the nature community focuses on biodiversity plus water (water is not included in biodiversity though it has living species within it).

The TNFD is also focused on biodiversity and water as these have historically been over consumed and not preserved. The TNFD is also explicit that it includes the interrelation between climate and nature *(see section on* Nature loss and declining biodiversity represent an existential threat to human society and our economy. This is because nature provides a set of ecosystem services that provide humanity with the essentials of life — food, water and air — as well as the feedstocks of our global economy — energy and materials. Threats to nature can therefore translate into threats to human society and our global economy.

Our natural environments are experiencing unprecedented destruction. For example, The World Wildlife Fund for Nature (WWF) stated in 2023:

*"The climate and nature crises are now more serious than ever before. Since 1970 global wildlife populations – indicators of healthy ecosystems – have plummeted by almost 70%, and the UK itself is in the bottom 10% for biodiversity globally – bottom of the G7 and G20. In 2021 alone, economic loss due to natural catastrophes was US$270 billion. The cost of not dealing with the crisis is predicted to be vastly greater than investment in change and solutions."*

Based on the current trends in biodiversity loss, one million animal and plant species are threatened with extinction - more than at any other point in human history. This trend is so pronounced, some are calling it the sixth mass extinction, with the current rate of extinction between 100-1,000 times higher than the pre-human background rate of extinction.

### *What has driven the nature crisis?*

The IPBES defines 5 broad drivers of nature loss:

1. **Climate change**, which in turn destabilises ecosystems e.g. it is the second-biggest cause of biodiversity loss at sea, and the fourth-biggest cause on land.
2. **Land and sea use change**, such as cutting down a forest to make way for agriculture. Every minute, deforestation destroys a wooded area the size of 27 football pitches worldwide - the equivalent of 200 times the area of London's Hyde Park every day.
3. **Overexploitation of natural resources**, through depleting resources faster than they can be replaced e.g. the unsustainable use of plants and animals not only threatens the species but also the livelihoods of people who rely on the species for food, fuel and income.
4. **Pollution** of air, land or water e.g. marine plastic pollution has increased tenfold since 1980.

[8] https://www.ipbes.net/conceptual-framework
[9] https://tnfd.global/wp-content/uploads/2023/09/Glossary_of_key_terms_v1.pdf
[10] Simon Zadek, (November 2023) GARP Climate Risk Podcast; TNFD and Beyond, an introduction to nature finance

5. **Invasive species**, where new animals or plants disrupt existing ecosystems e.g. Japanese knotweed.

All of these drivers are borne from human economic activity, which is intensifying in line with global population and per-capita consumption increases. If human economic activity increases at a rate greater than natural systems can sustain, this leads to a decreased natural capital stock per capita, and therefore reduced ecosystem services.

*Figure 2: Global capital stocks per capita. Source: The Dasgupta review / HM Treasury*

Figure 2 illustrates the relative change since 1992 of produced capital (physical assets generated by applying human productive activities to natural capital, and capable of providing a flow of goods or services), human capital (the productive capacities of an individual, both inherited and acquired through education and training) and natural capital (defined earlier in this chapter). It illustrates that a c.100% increase in produced capital since 1992 has correlated with a nearly 40% decrease in natural capital over the same period.

Another way of thinking of this is that human activity has been drawing down on natural capital assets at an unsustainable rate. This is now impacting the ongoing provision of ecosystem services per Figure 2.

***Why is the nature crisis important now?***

While it is important to understand these drivers of nature loss, the underlying root cause is because natural capital assets and ecosystem services are often intangible, invisible and taken for granted – we have been destroying nature at an unprecedented rate. A 2019 independent review on the economics of biodiversity, by University of Cambridge Professor Sir Partha Dasgupta (commissioned by HM Treasury), described nature as a "blind spot" in economics, with the economic value of nature missed or hidden in business-as-usual transactions. As businesses do not have to pay to access natural resources but do have the ability to generate profits from their use, this results in overexploitation.

Professor Dasgupta observes that it is difficult to adequately record the use made of natural resources due to the "three pervasive features – mobility, silence and invisibility", and that "we can no longer afford for it to be absent from accounting systems that dictate national finances, or ignored by economic decision makers." According to Global Footprint Network, "humanity is currently using the resources of 1.75 planets to provide the goods and services we demand when we only have one Earth."

***The nature crisis and the economy***

The degradation of our natural capital is already harming businesses and preventing economic growth. This is thrown into sharp focus with some studies estimating that $44trn of economic value generation annually (half of global GDP) is dependent on nature. Others more simply state '*the simple truth that 100% of the global economy is 100% dependent on nature.*'

Nature presents both a systemic risk to the global economy, but also micro-level risks that will emerge across regions and sectors. Financial institutions will have to consider both macro and micro nature-related risks and the impact on their portfolios.

Analysis led by the Green Finance Institute (GFI), with input from by University of Oxford, University of Reading amongst others has indicated that deterioration of the UK's natural environment could lead to an estimated 6-12% loss to GDP by 2030.

Risks to the economy are complex and potentially compounding and thus studies may materially under (or indeed over) estimate the risks. For example, water stress is a well-recognized issue in many regions. This may be exacerbated by over-use of groundwater resources (aquifer depletion) and climate change impacting rainfall patterns, which are themselves impacted by deforestation. Thus, utilization of forest resources for economic gain may impact the ongoing viability of, for example, food production in a downwind region which relies on precipitation that originates from evaporation from the forest. If the food production region has also exhausted its aquifers, then food production in that region may cease. This is not a hypothetical point, with examples such as the government-enforced contraction in Saudi Arabian wheat production (at one point the world's 6$^{th}$ largest producer of wheat) following the depletion of over 80% of its aquifers.

Supporting this concept, the UN adapted the language of tipping points to risks in their 2023 Interconnected Disaster Risk report, defining a risk tipping point as "*the point at which a given socio-ecological system ceases to buffer risks and to provide its expected functions, after which the risk of catastrophic impacts to the system increases substantially."* The report investigates a number of risks including accelerating extinctions, groundwater depletion, mountain glacier melting and unbearable heat.

*).* For the purposes of this document the TNFD approach to nature will be used i.e., when referring to nature, the document is focused on biodiversity plus water and the interrelation with climate.

## *What is Nature?*

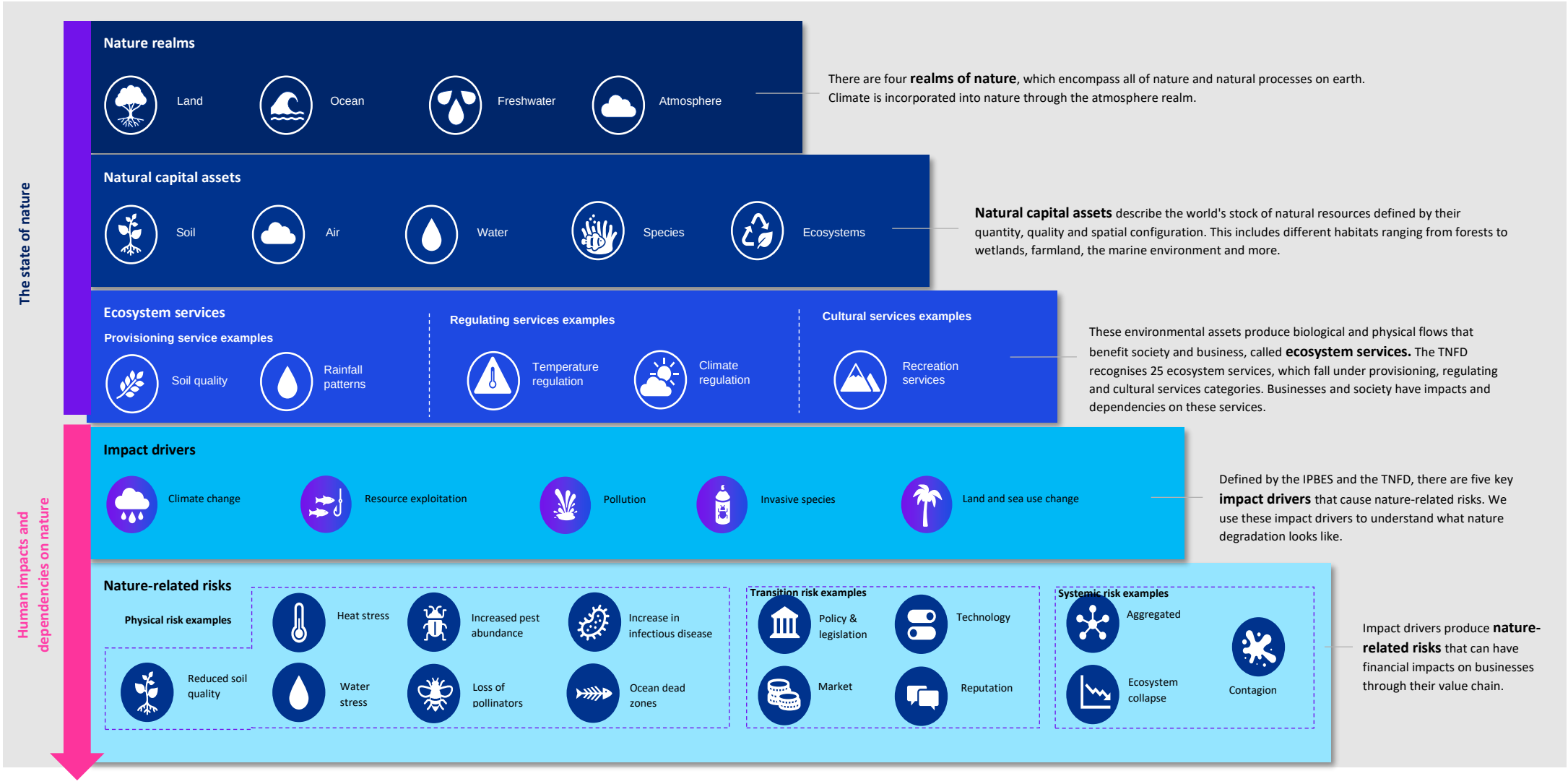


*Figure 1: Description of the state of nature and subsequent human impacts and dependencies on nature. Details and representations of nature derived from TNFD guidance and Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).*

### *What is the 'nature crisis'*

Nature loss and declining biodiversity represent an existential threat to human society and our economy. This is because nature provides a set of ecosystem services that provide humanity with the essentials of life — food, water and air — as well as the feedstocks of our global economy — energy and materials. Threats to nature can therefore translate into threats to human society and our global economy.

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10. **Invasive species**, where new animals or plants disrupt existing ecosystems e.g. Japanese knotweed.[16]

All of these drivers are borne from human economic activity, which is intensifying in line with global population and per-capita consumption increases. If human economic activity increases at a rate greater than natural systems can sustain, this leads to a decreased natural capital stock per capita, and therefore reduced ecosystem services.

[11] https://www.saveourwildisles.org.uk/business
[12] https://www.nhm.ac.uk/discover/news/2019/may/one-million-animals-and-plants-face-extinction.html
[13] https://www.nhm.ac.uk/discover/what-is-mass-extinction-and-are-we-facing-a-sixth-one.html
[14] https://www.wwf.org.uk/learn/effects-of/deforestation
[15] https://www.unep.org/news-and-stories/speech/roadmap-towards-circular-plastics-economy
[16] https://www.theguardian.com/environment/2023/may/16/the-war-on-japanese-knotweed

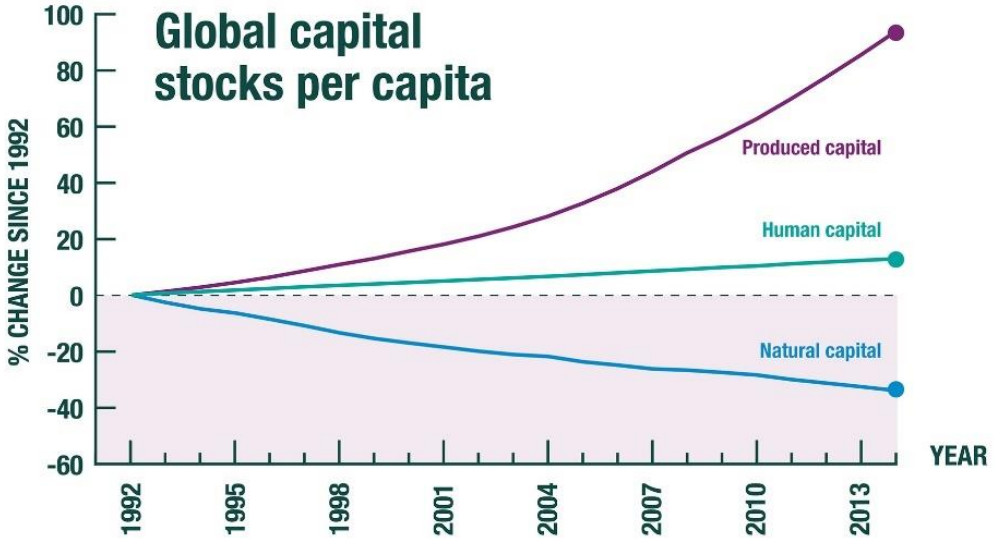


*Figure 2: Global capital stocks per capita. Source: The Dasgupta review / HM Treasury*

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*Figure 3: Nature's properties. Source: The Dasgupta Review / HM Treasury*

Professor Dasgupta observes that it is difficult to adequately record the use made of natural resources due to the "three pervasive features – mobility, silence and invisibility", and that "we can no longer afford for it to be absent from accounting systems that dictate national finances, or ignored by economic decision makers."[18] According to Global Footprint Network, "humanity is currently using the resources of 1.75 planets to provide the goods and services we demand when we only have one Earth."[19]

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[17] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/962785/The_Economics_of_Biodiversity_The_Dasgupta_Review_Full_Report.pdf
[18] https://www.cam.ac.uk/stories/dasguptareview
[19] https://footprintnetwork.org/living-planet-report/

annually (half of global GDP) is dependent on nature.[20] Others more simply state '*the simple truth that 100% of the global economy is 100% dependent on nature.*'[21]

Nature presents both a systemic risk to the global economy, but also micro-level risks that will emerge across regions and sectors. Financial institutions will have to consider both macro and micro nature-related risks and the impact on their portfolios.

Analysis led by the Green Finance Institute (GFI), with input from by University of Oxford, University of Reading amongst others has indicated that deterioration of the UK's natural environment could lead to an estimated 6-12% loss to GDP by 2030.[22]

**Box 1: GFI analysis on the materiality of Nature-Related Financial Risks for the UK**

Key messages from the GFI's analysis:

- Damage to the natural environment is slowing the UK economy and could lead to an estimated 6-12% reduction to GDP in the years ahead – at the top end of the scale larger than the hit to GDP from the global financial crisis or Covid-19.
- Nature-related risks are as detrimental to the economy as those from climate risks.
- Three quarters of the UK has a high level of ecosystem degradation, with risks to financial services and the wider economy as a result. However, half of the UK's nature-related financial risks originate overseas.
- Some sectors in particular face higher levels of nature-related financial risk. Highlighted in the analysis are agriculture, manufacturing, and utilities.
- Some banks could see reductions in the value of their domestic portfolios of up to around 4 – 5% in some cases.

**The GFI and technical team make several recommendations for the public and private sectors. These include disclosures of nature-related risks and taking urgent action to meet the targets included within the Global Biodiversity Framework (GBF).**

Risks to the economy are complex and potentially compounding and thus studies may materially under (or indeed over) estimate the risks. For example, water stress is a well-recognized issue in many regions. This may be exacerbated by over-use of groundwater resources (aquifer depletion) and climate change impacting rainfall patterns, which are themselves impacted by deforestation. Thus, utilization of forest resources for economic gain may impact the ongoing viability of, for example, food production in a downwind region which relies on precipitation that originates from evaporation from the forest. If the food production region has also exhausted its aquifers, then food production in that region may cease. This is not a hypothetical point, with examples such as the government-enforced contraction in Saudi Arabian wheat production (at one point the world's 6th largest producer of wheat) following the depletion of over 80% of its aquifers.[23]

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[20] Research by the World Economic Forum, based on 2019 World Bank Data – WEF, New Nature Rising: Why The Crisis Engulfing Nature Matters For Business and the Economy, January 2020, p.13
[21] The Future of Nature Markets | Taskforce on Nature Markets
[22] Assessing the Materiality of Nature-Related Financial Risks for the UK (greenfinanceinstitute.com)
[23] https://interconnectedrisks.org/
[24] https://interconnectedrisks.org/

### Box 2: Potential impacts from water stress

Building on the water stress theme, the report explores a risk cascade caused by groundwater depletion, leading to a lack of water for irrigation, leading to crop failure if sufficient rainfall does not occur. Water stress may be further exacerbated by mountain glacier melting and heat spikes. While there is an immediate threat to the livelihoods of the farmers growing the crops, risks may propagate through the social and environmental systems they are connected with, cascading through food systems, ecosystems and communities forced to contend with possibly drastic changes to agriculture. Research by the University of Oxford Environmental Change Institute suggests that global direct and indirect (upstream) risks associated with water supplies could exceed $7 trillion and further risks related to water quality nearly $1.5 trillion.

Source: The Green Scorpion: The Macro-Criticality of Nature for Finance. Ranger et al. 2023 (https://www.ngfs.net/en/the-green-scorpion-macro-criticality-nature-for-finance)

Lloyd's Futureset and the Cambridge Centre for Risk Studies explore a climate driven food system shock as a result of extreme weather leading to potential 5-year economic losses of $5 trillion (average loss across three scenario severities modelled).[25] In this systemic risk analysis they provide loss estimates for the three individually modelled scenarios ranging from major (1-in-50 year) to extreme (1-in-300 year). In the extreme scenario they estimate the 5-year global economic loss to be $18 trillion.[26] Given the shifting distribution of climate change impacts it is reasonable to ask for how long these probabilities remain appropriate, i.e., will the events they describe become more likely?

## Nature loss and Financial Institutions - Transmission channels

Nature loss acts as a causal risk factor to Financial Institutions (FIs) through three principal drivers: physical, transition and liability. Nature also presents systemic risks at a macro-level across the global economy. The table below provides details on nature-related physical, transition and liability risks.

| Physical[27] | Transition[28] | Liability |
|---|---|---|
| Arise when natural systems are compromised, due to the impact of climatic (i.e. extremes of weather), geologic (i.e. seismic) events or widespread changes in ecosystem equilibria, such as soil quality degradation or marine ecology changes.<br><br>Physical risks can be acute (e.g. spread of disease as a consequence of reduced natural resistance) and / or chronic (e.g. gradual reduction in diversity of pollination species).[29] | The risk of economic costs and financial losses resulting from the misalignment of economic actors with actions aimed at protecting, restoring, and/or reducing negative impacts on nature.<br><br>Transition risks can be prompted, for example, by changes in regulation and policy, legal precedent, technology, or investor sentiment and consumer preferences.<br><br>**Exposure to transition generally originates from impact on nature**. | Arise if parties that (may) suffer loss or damage from the effects of environmental change seek compensation from those they hold responsible.<br><br>Liability risks include potential pay-outs, fines, legal and administrative costs, insurance costs, financing costs, and reputational costs.<br><br>**Exposure to liability risk generally results from attributable impact on nature and subsequent losses incurred.** |

[25] Extreme weather leading to food and water shock - Lloyd's (lloyds.com)
[26] Economic impact - Lloyd's (lloyds.com)

[27] ngfs_conceptual-framework-on-nature-related-risks.pdf
[28] ngfs_conceptual-framework-on-nature-related-risks.pdf

| | | |
|---|---|---|
| **Exposure to physical risk generally originates from dependency on nature** | | |

Liability risk could be positioned as a sub-set or derivative of physical risk and transition risk. However, to maximise transparency, we have chosen to represent liability risk here as its own separate risk type.[30]

### Why nature loss is a financial and non-financial risk to FIs

Nature loss becomes a financial risk when the above referenced physical, transition and liability risk drivers cause negative impacts upon:

(1) Companies, households and governments, to which FIs are exposed to via loans, debt, insurance and/or equity holdings and/or revenues;
(2) Financial markets, including commodity and money markets, to which FIs have exposure through investments or financial services (e.g. derivatives); and
(3) The operations or property of FIs e.g. a lack of green space in cities can lead to fast water runoff, in turn causing flash flood damage to property.

These exposures lead to increased existing financial risks arising for FIs e.g. credit, liquidity, market and operational risks. To provide a materiality context, in '*When the bee stings*'[31], Bloomberg NEF provide a number of examples of corporate financial loss relating to nature risk. This report covers 10 examples of nature-related financial loss, across a range of sectors including transportation, power generation, food production, mining and chemicals. The result was "…companies suffering material financial losses…that amounted to at least $80 billion in financial impacts". Other exploratory analytical work from central banks and supervisors (see Table) also showed that financial institutions in some jurisdictions appear to have sizable exposures to nature risk via investments and lending/financing.

*Table 1: Samples of analytical work performed by central banks and supervisors[32]*

| Paper | Jurisdiction | Key insights |
|---|---|---|
| DNB(2020) | Netherlands | **Physical risks:** 36% of financial sector exposures (via equity and bond investments and bank loans) are to firms with high or very high dependency on at least one ecosystem service.<br><br>**Transition risks:** Biodiversity footprint of equity investments by Dutch financial institutions at a given point in time contributes to the financing of activities that is comparable to the loss of over 58,000 $km^2$ of pristine nature, representing 1.7 times land surface of Netherlands. |
| Banque de France (2021) | France | **Physical risks:** 42% of equity and debt securities held by French financial institutions are to firms with high or very high dependency on at least one ecosystem service.<br><br>**Transition risks:** Biodiversity footprint of French securities alone is comparable to a loss of 130,000 $km^2$ of "pristine" nature corresponding to 24% of the area of metropolitan France. |

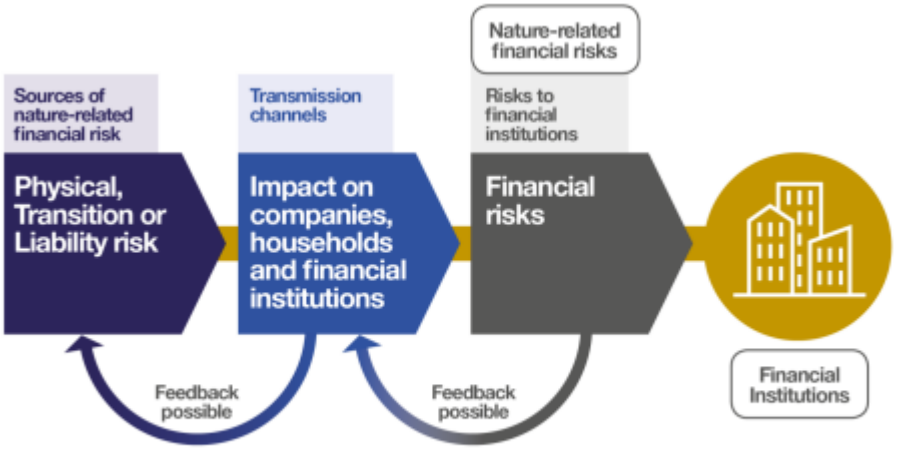
[30] Approach is similar to how the risk drivers are represented in the Bank of England's 'Explainers' for Climate Change: Climate change: what are the risks to financial stability? | Bank of England

[31] https://assets.bbhub.io/professional/sites/24/BNEF_Nature-Risk.pdf

[32] FSB July 2024 – stocktake on nature-related risks: https://www.fsb.org/wp-content/uploads/P180724.pdf

| | | |
|---|---|---|
| World Bank (2023) | Emerging markets | **Physical risks:** On average 55% of bank loan exposures in a sample of 20 emerging markets are exposed to activities that are highly or very highly dependent on at least one ecosystem service. |

The risk drivers may also lead to financial loss from non-financial risks e.g. litigation, reputational damage and operational resilience.




Source: Cambridge Institute for Sustainability Leadership (CISL)

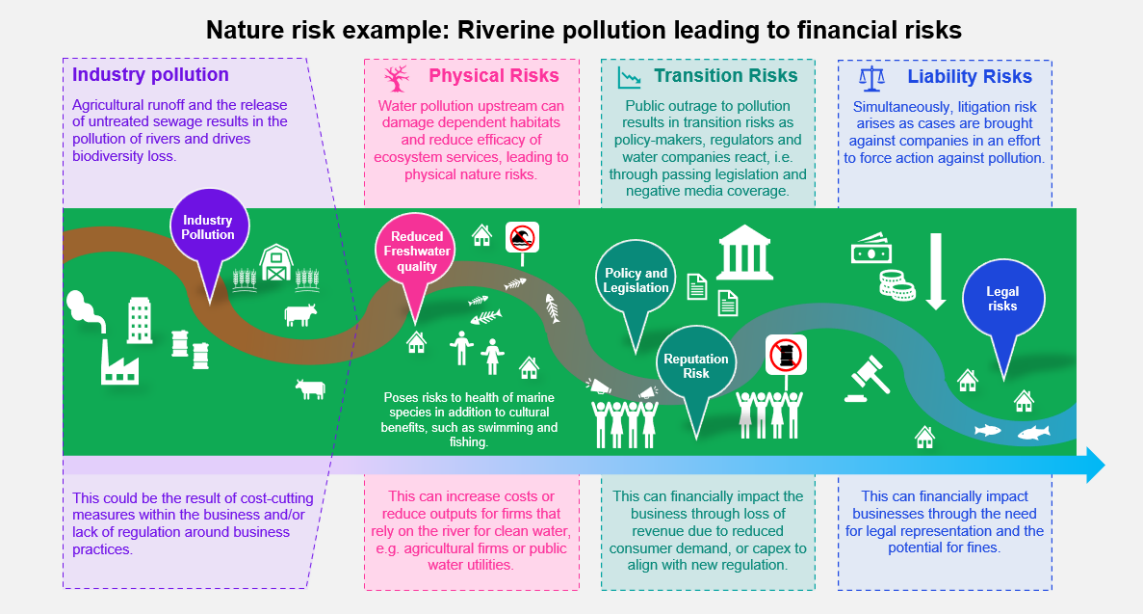
As well as the impact from nature on FIs, there are impacts arising from the financing activities of FIs on nature e.g. financing of the establishment of wind or solar farms that requires deforestation that in turn leads to nature degradation. It is important for FIs to consider nature-related risks from both of these perspectives: an 'outside-in perspective' (impact from nature) and 'inside-out perspective' (impact on nature).

## Nature-related risks and FIs – An example of the transmission channels

The understanding of the transmission of nature-related risk to financial services is still relatively immature, in contrast to the sophistication that has been developed in financial services with relation to climate risk. This is exacerbated by the complexity of nature – as demonstrated through Figure 1's illustration of the scope of nature – and the related challenge of determining the appropriate metrics (and obtaining the data) to measure the risks arising from the degradation in nature. The examples detailed below are therefore to help the reader start to understand how the transmission mechanisms from nature to financial risk work and should not be interpreted as a comprehensive guide to how nature-related risks impact FIs.

Given how nascent nature is as a topic in Financial Services, firms may wish to consider an experimentation 'test and learn' mindset in terms of how to identify and assess the risks arising and, as with the approach to climate-related risks, not let "perfection be the enemy of progress".[33]

[33] Sarah Breeden, "Climate Action: approaching a tipping point?", April 2023.




*Source: KPMG*
*Figure 4. These three risks therefore result in the adjustment of activities for companies and potentially lead to pricing changes as some of the costs are passed on to customers. Consequently, investors are exposed to financial risks, and may wish to in turn act – for instance, they might take the view that these companies make a poor investment as future dividends may not pay out.*

We describe below how the scenario set out in Figure 4 could impact different types of FIs. These are not designed to be comprehensive in their analysis but rather give a flavour of the types of impact that may occur. While the descriptions are segmented by type of FI so that the reader can see the breadth of applicability, nevertheless there are instances where the described impact could be attributed to the other types of FI. Further expanded details on the types of nature-related risk impacts can be found in the later section on

The natural environment is a vast and complex system, with equally diverse measurement options. What is important to distinguish is the level of bias inherent to any type of data. The closer the nature data are to absolute readings, expressed in standard scientific units, the lower the likelihood of bias. Conversely, the closer the nature data are to conventional financial parameters, expressed in monetary terms, the higher the likelihood of bias and crucially - interpretation error. As long as the data are utilised appropriately, with any assumptions clearly acknowledged, meaningful insights can be derived that enable effective decision-making.

## Technical Data Guidance

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The quantification of nature risk presents new data challenges and opportunities for Financial Institutions, that are unlike those observed through climate risk. In particular, utilising a new, complex range of science-based metrics can be formidable to translate into monetary parameters, for most risk practitioners. However, this additional dimension is key to unlocking the nuance needed to assess location-dependant nature risks.

To track progress on nature positive outcomes, metrics used by financial institutions must be held to high standards. The following table is an extract from NatCap Research which summarises the key attributes of good quality nature data. While it is likely that not all forms of nature data may be able to simultaneously satisfy all these attributes, the aim should be to prioritise metrics that do meet as many

as possible. In the absence of good quality nature data, proxy metrics or indicators may be adequate, if their limitations are well documented.

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The following chapter on Case Studies aims to demonstrate early practical applications of available science-based nature metrics, as well as separate data aggregation services. Aside from rising regulatory pressures in Europe; the broadening of nature use-cases within the financial services sector, will be largely driven by the type, scale, and frequency of new time-series metrics.

Case Studies. These are just discrete examples, nature-related risks are complex and cut across sectors and supply chains, and can therefore have widespread impacts across the global economy.

*Bank*
Focusing on the agricultural impact, the scenario could lead to the introduction of new policies, including restrictions on the type and volume of fertilizers and pesticides within local areas that contribute to agriculture run-off. These may introduce additional costs to local farmers via new production methods that need to meet the new regulatory requirements and due to the reduced productivity of the land arising from the new restrictions. This could in turn impact farmers' ability to operate profitably and service outstanding credit facilities, driving increased credit risk exposure.

*Insurer*
The example could impact both sides of insurers' balance sheets. For instance, on the asset side, insurers' investments in water companies could be impacted as companies are fined or are required to spend money in reversing damage, impacting dividend pay outs and their share price. On the liability side, as litigation may be brought against these companies, this could result in claims against Directors' & Officers' liability insurance.

*Asset manager and Asset Owners*
The direct impacts of river pollution may first manifest in market and asset valuation risks. Investments tied to agriculture, water utilities, manufacturing, and other river-dependent sectors could face markdowns as productivity declines and costs rise for water treatment and compliance. This revaluation, in turn, may drive portfolio risks and losses. Similar to the bank, credit risk would increase as companies, dependent on the damaged ecosystems, face higher default rates.

All three types of FI may also need to consider reputational risk consequences arising from association with polluting companies. Further, regulatory reactions could lead to additional compliance burdens and necessitate strategic changes to sectors tied to river degradation.

This confluence of risk impacts underscores the need to integrate nature-related risk analysis into

risk management, portfolio construction and capital allocation. Proactively assessing nature-related vulnerabilities across sectors, engaging with companies on mitigation strategies, and diversifying holdings can help FIs enhance resilience in the face of nature degradation as well as identify opportunities to address.

**Box 3: The climate-nature nexus**

Climate change and nature are closely linked. Nature has a vital role in climate mitigation and achieving global net-zero targets through its ability to capture and store carbon e.g. via oceans, forests, peatland and mangroves. Moreover, nature also has an important role in climate adaptation as it provides ecosystem services that protect us from the physical risks of climate change e.g. mangroves acting as flood defenses.

More information on the climate-nature nexus can be found in the supplement to this guide *"Technical Data Guidance for Financial Institutions".*

# 4 Integration of nature into risk management

## Context

As financial institutions recognise the importance of nature-related risks, including their interdependency with climate-related risks, they will need to consider whether and how to incorporate nature into their Risk Management Frameworks (RMFs).
The first step to approach this, in line with any other risk type, would be to assess the materiality of the risk to the institution's balance sheet and business model.
Once materiality has been assessed, there are a number of ways in which nature could be incorporated into RMFs on a proportional basis. At a high level, these risk considerations might include:

- Recognition of nature as a new or cross-cutting risk type, for example, through existing Emerging Risk processes.
- Building understanding of nature risk at an organisational level, which may include collaboration in industry initiatives or formal training.
- Assessing transmission channels and materiality of nature risks.
- Understanding regulatory requirements, now and in the future[34].
- Developing recommendations as to how to incorporate nature risk into the organisation's RMF, for example, as a new risk type, a cross-cutting risk or integrating with climate risk in a manner that's proportional to the institution and the regulatory environment.
- Development of appropriate risk tools such as risk appetite, key risk indicators, relevant reporting and scenario analysis.

There are many overlaps with the processes firms have been through to incorporate climate change into RMFs. As firms mature, they might expect to include nature in the RMF and more broadly across the firm, covering:

I. Governance, roles & responsibilities
II. Training, culture, performance & incentives
III. Risk drivers, identification, materiality & assessments

Reporting and disclosures on nature-related risks and opportunities is covered in the Appendix.

This section provides initial guidance on how firms can begin to incorporate nature-related risks across these areas. As with climate-related financial risks, there is no single right answer on how to develop capability across different firms. What is right for one firm, may not work for another, with a proportionate and effective approach depending on, amongst other things, scale, business model, maturity, risk exposure, geography, the regulatory environment, and the firm's products.

## Governance, roles & responsibilities

Effective governance requires clear understanding, oversight and accountability at all levels of the organisation and across the three lines of defence model.

Boards of financial institutions should develop an appreciation of the transmission channels for nature-related risks and the impact these could have on their businesses. Appropriate training is likely to be required to raise Board members' awareness and ensure guidance is cascaded down through the organisation.

Senior Management responsibility is also required to support accountability for the appropriate integration of nature-related risks. When assigning Senior Management responsibility, FIs should consider the fit with existing risk types (including climate and other sustainability risks) and how to

[34] FSB July 2024 – stocktake on nature-related risks: https://www.fsb.org/wp-content/uploads/P180724.pdf

align them to provide effective oversight of sustainability-related risks.

Senior Management responsibilities could include establishing key roles and responsibilities across the organisation, delegating ownerships of risk identification and assessment, and developing RACI matrices to document accountability.

The table below provides examples of key roles and responsibilities across the three lines of defence. In practice, while financial institutions build their capability in this space, there is likely to be some fungibility between 1st and 2nd line of defence activities and, again, proportionality should be applied to the extent to which new capabilities are established. One approach several larger institutions used for climate was to set up a focused cross-functional working group to develop the organisation's approach. Here, the materiality assessment can inform the priority and focus that a firm may apply to embedding roles and responsibilities.

| | |
|---|---|
| **1st line of defence** | • Identify nature risks and opportunities, both from an impact and dependency perspective<br>• Identify how nature-related risks and opportunities might impact the execution of FIs' strategy, including public commitments, if any<br>• Ensuring adherence to the risk appetite framework as it pertains to nature risk<br>• Embedding nature risk into Business-as-Usual activities, such as client or transaction due diligence, portfolio management and strategy<br>• Identify training needs and develop appropriate training |
| **2nd line of defence** | • Develop (or integrate) policy and minimum standards to manage the risk<br>• Establish and own a risk framework identification, alongside controls; and propose and oversee risk appetite<br>• Ensure the effectiveness of risk management and control processes<br>• Work with 1st line colleagues to identify nature risk exposures and develop nature risk metrics, noting that the research around these is still evolving and a consensus around the most significant or representative one is yet to emerge<br>• Provide guidance to business lines and advise on high-risk transactions<br>• Escalate material nature risks to appropriate governance levels<br>• Establish a training roadmap, alongside 1st line colleagues, to raise awareness through the organisation |
| **3rd line of defence** | • Provide assurance on the effectiveness and control processes<br>• Identify areas of improvement across 1st and 2nd line of defence |

Over time, and depending on their level of complexity, the materiality of nature-related risks and the defined risk environment, FIs should also integrate nature-related considerations appropriately into existing sustainability or risk committees. This should support direct reporting to the Board. Or alternatively firms could establish ad-hoc nature-related working groups or committees which directly report to the Board.

## Training, culture, performance & incentives

Relevant staff within financial institutions, including those with risk management responsibilities, will need to understand nature-related risk and the relationship between nature and climate change in order to manage risks, identify opportunities and meet future regulatory disclosure requirements. Firms will need to consider how to integrate nature appropriately within training, culture, performance, and incentive processes and structures.

Similar to climate-related financial risks, there is likely to be a need for both formal and informal training. This might consist of lower-level, broad-brush training for most staff, with more focused and specialist training for teams and individuals more closely involved with managing nature risk. There may be a need to tailor this training for individual teams. There are now many providers of sustainability education for financial services, with options including courses designed by professional organisations and membership bodies, university courses and the option to develop bespoke in-house training.[35]

As a starting point, the firm-wide training may concentrate on key concepts such as the four realms of nature, ecosystem services and natural capital. If the firm has commercial and corporate arms, the relationship teams should seek to understand how their client operations are impacted by nature loss, as well as how they can impact nature. Additional training can include providing colleagues with material produced by the TNFD, demonstrations of biodiversity tools, webinars and partnering with organisations to build an understanding of the impact on the actual value chains and their reliance on nature.

Collaborations with external organisations can be helpful, supporting development of resources, raising awareness and providing colleagues with external training. For example, for UK financial institutions, the Save Our Wild Isles[36] UK-orientated film series can be used to run a virtual event in partnership with one of the NGOs who supported this initiative. This may be a cost-effective way of educating staff on why this topic is important. On a more technical level, an example of a partnership could be with the WWF who have a Biodiversity Risk Filter and Water Risk Filter tool. This tool would allow firms and colleagues to understand and assess biodiversity/nature risks and water risks globally.

From a culture perspective, it will be important for firms to set the tone from the top, and for senior management to articulate why nature is important and how it fits into the firm's overarching strategy.

Firms are likely to take different approaches to delivering nature training in line with the results of a materiality assessment, risk appetite, and budget. However, the ownership for the development and delivery of a biodiversity/nature training programme should mirror the approach taken for other risk training, with appropriate coverage including all three lines of defence. Again, a supportive tone from the top is likely to help with engagement and recognising the importance of the training.

Incorporating nature into performance and incentives is likely to be highly role-specific, as not all teams in financial institutions will have significant responsibilities in this space. As firms develop their strategy and approach, they may be able to derive appropriate performance metrics and incorporate these into staff's performance incentives.

## Risk drivers, identification, materiality & assessment

Financial institutions, including banks, insurers and asset managers, need to build an understanding of how nature-related risks may impact their business and hence also their existing risk taxonomy.

The integration of nature risks into risk management frameworks, (either as a standalone risk type or as a cross-cutting risk type) should reflect the double materiality perspective for both impacts and dependencies of nature-related risks.

FIs should take into account a broad range of considerations when deciding on the right approach

[35] See e.g. GARP's Sustainability and Climate Risk (SCR) Certificate | GARP and CFA Sustainability at CFA UK
[36] Save Our Wild Isles: https://www.saveourwildisles.org.uk/business

for nature-related risks, including internal factors (such as business model, organisational complexity and geographical footprint), and external factors (such as regulatory and policy landscape, level of exposure to nature loss and impact on nature).

Engagement with customers and how well they understand their own risks are also factors FIs can consider when defining the right risk environment for nature-related risks.

If nature risks are deemed a standalone risk type, dedicated policies and frameworks may need to be developed to ensure a consistent and standardised risk management approach.

If nature risks are deemed a cross-cutting risk type, risk types should be prioritised according to the relevant transmission channel. These policies and frameworks should be first updated for higher priority risks. A dedicated nature-related policy can also be explored.

A materiality assessment typically paves the way for FIs to identify short-term and long-term risk drivers, understand the level of exposure to nature and the channels through which nature-related risks can lead to financial and non-financial risks. This would be a good first step into integrating nature-related risks in an RMF. Factors to consider in the materiality assessment include the level of FIs' financial exposures to nature through their financing, investing and insuring activities, possible dependencies between them and their financing, investing and insurance activities impact on nature ("double materiality").

A key challenge would be identifying how nature-related risks play out on their portfolios. FIs will have different types of exposure to nature-based risks given the different industries they operate in. For example, a client that operates a food and beverage company may be particularly exposed to physical risk due to water stress in its supply chain, whereas a chemical industry client may be more exposed to legal risk if it pollutes natural resources.

The assessment of nature-related risk is still at an early stage, with clarity on which datasets to use and accessing data in decision useful formats being a key challenge (e.g. a look-through that assesses vulnerabilities across supply chains and/or the financing activities of the financial institutions are still in the early stages of development). The development and selection of appropriate methodologies is also in progress. As such, FIs should adopt an approach that is phased, proportionate to the pace of their development and flexible to future changes.

**Methodologies for assessing nature-related risk**

There are 3 key approaches that can be used to assess FIs' exposures to nature-related risks:

1. *Nature risk heatmaps*

The construction of thematic heatmaps helps summarise, from a qualitative perspective, pockets of risks which lending/investing/insurance portfolios are exposed to.

When deciding the methodology to adopt when deriving risk heatmaps, FIs can either:

- use a reference public methodology (such as ENCORE tool ("Exploring Natural Capital Opportunities, Risks and Exposure") and/or the SBTN ("Science Based Targets Network" Materiality Screening Tool),
- deploy scoring methodologies provided by third-party providers, or
- develop internal methodologies leveraging in-house knowledge and understanding.

Methodologies from third-party providers and internal methodologies can potentially better calibrate FIs' current and forward-looking exposures to nature-related risks. However, public methodologies bring the benefit of standardization and an ability to benchmark against other FIs.

Regardless of the methodology employed and recognising the complexity and novelty of nature-related risks, FIs should understand and clearly communicate the level of uncertainty surrounding

underlying metrics and data, both in internal risk reporting and where relevant also externally in the appropriate disclosures. Specifically, it may be helpful for firms to also recognise feedback loops between meeting net-zero targets and negative ecosystem consequences and vice versa.

*2. Deep dives for high-risk sectors*

The nature-risk heatmap will typically provide insights that may be limited to risk identification at a sector average perspective across the lending/investing/actuarial book without necessarily taking into account the firm's idiosyncratic risk factors.

As such, nature heatmaps should be considered as the starting point upon which to build a broader understanding of nature risk exposure, supplemented by deep dives for high-risk sectors.

Deep dives can be prioritised for those client sectors that the heatmap points to as having both the highest impact to and highest dependency on nature. Materiality of exposure of the sector within the FIs' own lending/investing/actuarial book can also be a factor to consider when selecting the sectors in scope for deep dives. Concurrently, an assessment of the most prominent thematic issues (such as deforestation, pollution, invasive species) can be used to tailor the risk identification to specific drivers of nature loss.

The deep dives can help shape the risk environment by framing, on a client basis:

- level of exposure to the risk of nature loss,
- past and forward-looking performance of nature-based metrics, and
- potential actions clients have established to mitigate nature-related losses and/or support nature-positive outcomes.

During the deep dive stage, FIs can gather key client-level data points that would help identify key risk sources, and potentially build preliminary risk metrics (based on *exposure materiality* or *thematic issues*) as suggested by the TNFD.

*3. Development of nature-related scenario analysis capabilities*

The development of nature-related scenario analysis capabilities can help progress the translation of nature risk drivers into financial impacts.

While some firms may have piloted some initial nature-based scenario analysis, across the industry the data, frameworks and methodologies to support nature-related scenario analysis are under development.

The pace of development is high and joining or participating in the relevant industry groups on scenario analysis will allow FIs to be close to the development of new capabilities.[37] This may, for example, include the development of nature-based transmission channels and outcomes in existing climate scenarios. For example, Banque de France has applied a nature-economy interaction framework into global integrated assessment models (IAMs), which was initially built to link macroeconomy with climate, but recently extended to broader dimensions of nature[38].

Pilot exercises performed by other FIs and focused on the largest clients and/or exposure to specific nature loss drivers (such as water stress) can also be used to support upskilling.

The TNFD has produced guidance on nature-related scenarios[39] and a scenario analysis toolbox[40] for institutions, providing details of a step-by-step process for firms to follow. The four scenario narratives proposed by the TNFD in this guidance note are replicated in the diagram below.

[37] There are likely to be several academic groups, professional associations and trade bodies looking at this. Here are two select examples:
The ECI-Oxford research group focused on nature scenarios, e.g. INCAF-MacroCriticality_of_Nature-December2023.pdf (ox.ac.uk) and IPBES, e.g. Scenarios and models | IPBES secretariat
[38] Banque de France: Assessment Integrated Assessment Models for Building Global Nature – Economy Scenarios: https://www.banque-france.fr/en/publications-and-statistics/publications/assessing-integrated-assessment-models-building-global-nature-economy-scenarios
[39] TNFD Scenario Analysis: https://tnfd.global/wp-content/uploads/2023/07/TNFD_Scenarios_Discussion-Paper_v03_A-1.pdf
[40] TNFD Scenario Analysis worksheet: https://tnfd.global/wp-content/uploads/2023/10/TNFD_Scenario-analysis-worksheet_V1.pdf

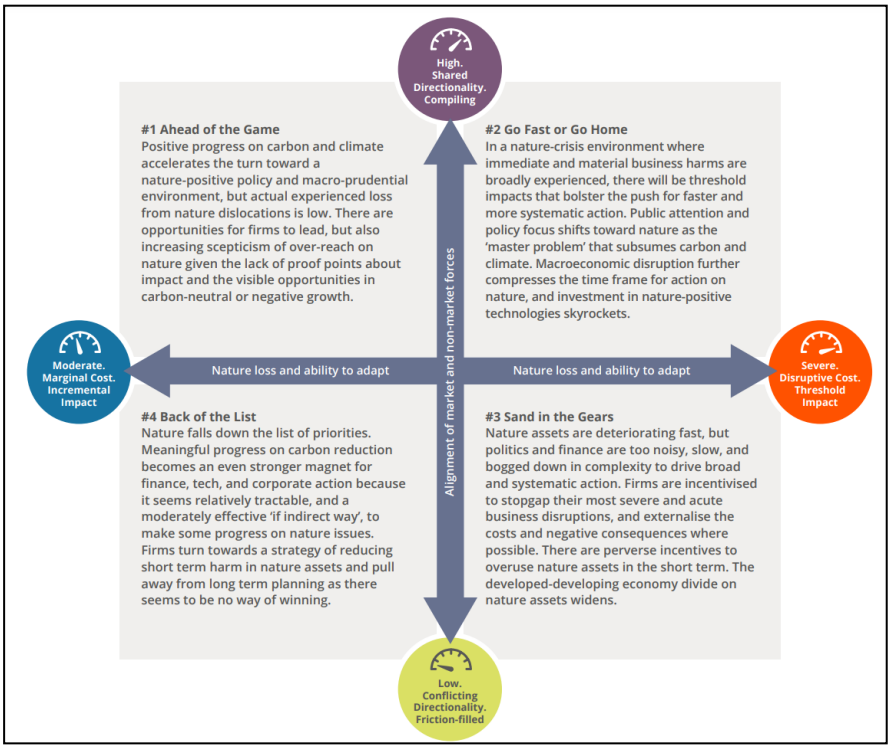


*Figure 5. TNFD Nature Scenarios.*[41]

**Leveraging existing work performed for climate risk embedding**

An approach that can be considered is to incorporate nature risk into existing climate risk frameworks. Practices adopted for climate risk management can also be gradually adopted for some or all the steps outlined above: heatmapping, deep-dives or nature-based scenario analysis.

For example, a key commonality relates to the importance of clients' physical asset locations. As part of the climate-related physical risk assessments, FIs will have already built datasets containing the location of clients' key operating assets. The same datasets can then be leveraged to assess the extent to which clients operate in areas which are in, or in close proximity to:

- protected areas and/or key Biodiversity Areas, where clients' activities might significantly impair the indigenous ecosystem; or
- areas likely to undergo significant nature degradation, where clients' activities will no longer benefit from the ecosystem services provided by the natural world, hence facing risks of business disruption and/or revenue loss.

Concurrently, FIs can develop plans to perform stand-alone client-level risk assessments (for prioritized sectors at a minimum) or integrate them in existing risk assessment frameworks developed for climate risk. Clients' own nature-based financial disclosures should also become a rich source of information over time. Ideally, such nature-based assessments would summarise:

- their understanding of nature-related topics,
- their ability to minimize negative impacts on nature, and
- their preparedness towards potential nature loss and potential risk mitigants.

For ongoing risk monitoring, FIs can construct risk appetite metrics based on the principles of materiality of risk drivers and sector exposures. A starting point would be to leverage the core and additional metrics proposed by TNFD.

[41] TNFD Scenario Analysis (Figure 2): https://tnfd.global/wp-content/uploads/2023/07/TNFD_Scenarios_Discussion-Paper_v03_A-1.pdf

## Reporting & disclosure

Disclosure and regulatory reporting are important elements of the risk management process. Firms should develop a clear understanding of what is required today for nature-related reporting in the jurisdictions they operate in and also in the short term, given the rapid pace of regulatory developments and clients' changing expectations. Firms may want to build or hire expertise, outsource data, and build out relevant teams to manage the requests relating to reporting and disclosures. Firms should also look to understand lead times for current disclosure and regulatory reporting requirements, and undertake horizon scanning to understand what lies ahead.

Good practice for firms in this space entails identifying nature-related risks and opportunities by exposure to different sectors, sites, and geographies. Where possible, the risk identification should be underpinned by appropriate quantification and risk metrics. Nature-related risk could also be a formalised and recorded part of stakeholder conversations for identifying and managing business risks. TNFD provides a very helpful disclosure framework for reporting on nature-related risks and opportunities. It is considered industry best practice.

## Differing risk management approaches across banks, insurers & asset managers

All firms may need to start giving more regard to nature-related considerations and consider disclosing their reliance on natural capital through their value chains. Depending on the services they provide, a few differences should be expected in the respective risk management priorities of asset owners, asset managers, insurers and banks (building societies). Some suggestions are provided below.

Asset owners may be expected to play a more active stewardship role and secure greater recognition for the importance of natural capital and nature-related risks across their portfolios. Asset managers should be even more considered in their selling practices of sustainable products and their asset selection, and report progress made in integrating nature alongside their fiduciary duties. They will also need to give a new focus to possible capital destruction and stranded assets from the degradation of natural assets, or the transition of the economy to a nature-neutrality focus, and the implications this might have on physical assets, as well as the volatility of raw materials and prices in resource-intensive sectors and regions.

Insurance firms could face a potential increase in insurance losses, a widening insurance protection gap and limitations in their ability to diversify risks (e.g. because of risks impacting entire regions or sectors at once). [42,43] Therefore, they have a significant role to play in actively managing the risks associated with ecological degradation, given the positive correlation with environmental disasters. They may opt to consider the merits of considering global risk pools that pre-empt disasters and provide nations with security in the event of such extreme events. If coordinated, this may be economically more attractive than repricing their products after the risks play out.

Banks will be primarily exposed to nature-related risks through increased corporate defaults, reductions in the value of assets held as collateral and involvement in commodity markets. Current supervision on banks on nature-related risks (e.g. ECB) is focussing on performing risk assessments, including scenario analysis. This can be used to inform engagement with counterparties and approaches to mitigating nature-related risks.

[42] EIOPA paper exploring nature-related risks for (re)insurers: EIOPA Staff paper on nature-related risks and impacts for insurance - European Union (europa.eu)

[43] ECB on the climate insurance protection gap: The climate insurance protection gap (europa.eu)

# 5 Nature Metrics

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[44] Environmental spatio-temporal data: https://www.nature.com/articles/s41598-020-79148-7

[45] NatCap Research: https://www.natcapresearch.com/resources/what-makes-a-good-metric

# 6 Case Studies

## Introduction

We have compiled a series of case studies from a range of financial services firms who have conducted TNFD pilot testing exercises. Whilst the case studies disclosed here are not intended to be exhaustive, we have attempted to gather case studies from a cross-section of the financial services industry (including banks, asset managers, insurers, and data providers).

These case studies showcase the range of different approaches that practitioners can take when starting their work on nature, and some of the key findings from TNFD pilot testing to date.

There are a number of resources and datasets available to help practitioners develop their thinking on nature. Some of these resources are referred to in the following case studies, and we encourage practitioners to refer to this library of resources for further information.

# Case study: abrdn – Nature-based solution

### Context

abrdn has been exploring the merits of different nature-related metrics. Given the complex and emerging data landscape, abrdn formed a collaboration with EY and the Natural History Museum (NHM) – a world-leading science research centre and the most-visited indoor attraction in the UK last year.

### Objective

The objective of the exercise was to carry out a TNFD pilot study – bringing together EY's insights on the data and reporting required to align to the TNFD Beta Framework, while drawing on NHM's expertise to measure the potential biodiversity gain for one or more of abrdn's managed real asset investments.

Using NHM's Biodiversity Intactness Index (BII) it's possible to measure an asset's biodiversity baseline and also model how different land management practices will alter that state. The BII uses the most comprehensive evidence base of its kind, comprising nearly five million data points from over 48,000 sites in over 100 countries.

A taxonomy of 58,000 unique plant, animal and fungal species work alongside NHM's Biodiversity Intactness Index models that enables analysis of different scenarios.

A BII score of 100% is a pristine location where there are no signs of human interference. Any area with a BII above 90% is considered to have enough biodiversity to be a resilient and functioning ecosystem.

### Outcome

abrdn asked NHM to pilot the tool at Far Ralia, a site of more than 1,440 hectares in the Cairngorms National Park in Scotland, which is held in one of abrdn's managed real assets investment trusts.

The site was chosen due to its size and planned restoration objectives of creating one of the largest native woodland and peatland projects in the UK, with a positive climate, nature and social impact.

The NHM modelled the current BII score of the site. Despite it being open land and perceived as 'green countryside', its historic use for grouse shooting meant that it only scored a BII of less than 52%.

NHM then modelled the restoration plans for the site over from present day to 2097. The results showed a significant improvement taking the depleted landscape up to 73% in just 30 years and eventually 94% over the longer term (Figure 6)

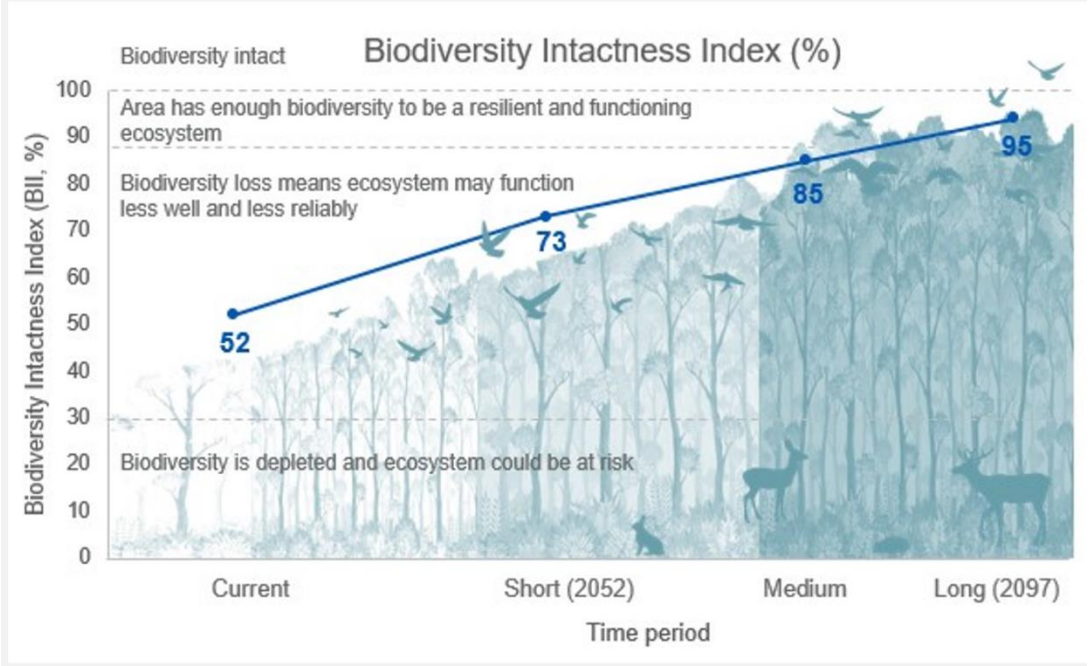



*Figure 6 Source: Partnership between NHM, abrdn and EY, November 2022*

This collaboration and pilot study identified that:

- The BII is a robust indicator that, unlike many other biodiversity indicators, is able to provide a modelled view on how an area of land will respond due to planned activities;
- The BII can be used to model the impact of a range of use cases including, but not limited to, regeneration projects, real estate assets, infrastructure development and changes in farming practices;
- A suite of metrics is required to fully assess and understand the condition of ecosystems. The BII can provide one way to measure biodiversity and can do so globally, at scale, and in line with the planetary boundaries – defining the safe operating space for sustainable human activity.

**Key insight:** The Biodiversity Intactness Index is able to provide both a current and a modelled view of how an area of land will respond to planned activities and is therefore an effective indicator for assessing the effectiveness of land management practices. It may be particularly useful for real estate assets.

## Case study: PIMCO – TNFD pilot on fixed income portfolio

### Context

PIMCO has recently formalised its Natural Capital Framework which seeks to assess nature-related financial risks and opportunities from impacts (such as externalities or damages to natural capital) and dependencies (such as heavy reliance on natural capital).

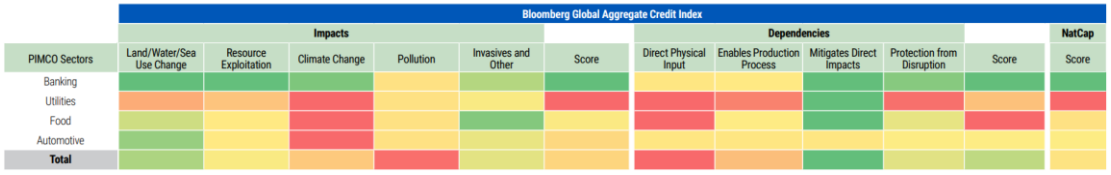
- **Risks**: Heavy reliance on natural capital can adversely affect businesses if depleted. Also businesses with high impacts on natural capital might face stricter regulation causing transition risks.
- **Opportunities**: Increased data availability across supply chains provides more visibility per geography/location and differentiation across issuers' sustainability strategies.

### Objective

As part of its TNFD pilot exercise, PIMCO wanted to identify ways in which it could expand and further refine the methodologies and tools underpinning its Natural Capital Framework. The objective of this exercise was to leverage external databases to support the internal evaluation and external reporting of nature-related risks for fixed income portfolios (in particular corporate credit and sovereign debt) and identify the main challenges and gaps in terms of data and methodology design.

### Outcome

The scoring methodology starts with assessing both impacts and dependencies on nature per sector. For impacts, sectors are scored under the five direct drivers of biodiversity loss identified by the Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services (IPBES). For dependencies, PIMCO follows ENCORE (the UN's Exploring Natural Capital Opportunities, Risks and Exposure tool), looking at ecosystem services and grouping them by the four functions they provide.



| | Bloomberg Global Aggregate Credit Index | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Impacts | | | | | | Dependencies | | | | | NatCap |
| PIMCO Sectors | Land/Water/Sea Use Change | Resource Exploitation | Climate Change | Pollution | Invasives and Other | Score | Direct Physical Input | Enables Production Process | Mitigates Direct Impacts | Protection from Disruption | Score | Score |
| Banking | | | | | | | | | | | | |
| Utilities | | | | | | | | | | | | |
| Food | | | | | | | | | | | | |
| Automotive | | | | | | | | | | | | |
| **Total** | | | | | | | | | | | | |

*Source: PIMCO Sustainable Investing Report 2022*

To complement the sectoral analysis, PIMCO incorporates company-level data and engagement to differentiate across leaders, improvers, and laggards, and analyses the specific risks and opportunities given an issuer's context.

PIMCO did industry deep-dives where nature-related risks and opportunities are material. For example, on the food and beverage sector, PIMCO complemented the assessment with data from sources like CDP Water and Forest500. This data was used to assess themes such as water scarcity, soft commodities exposure and supply chains, and the circular economy. On banks, PIMCO developed a deforestation engagement program, looking at the financed exposure, and commitments to mitigate risks.

The TNFD pilot exercise has also helped PIMCO to develop its understanding of (sub)sovereign level exposure to nature-related risks and opportunities. For example, PIMCO did this by dissecting countries according to their economy and GDP sector composition and overlaying this with the corporate heat-map of impacts and dependencies discussed above. A preliminary finding points to more material nature-related impacts and dependencies for emerging markets than for developed markets.

Notable challenges and next steps include expanding ENCORE with Science Based Targets for Nature (SBTN) mappings to include the upstream value chain, creating a proprietary scoring system for each of the thematic pillars and themes under impacts and dependencies, and using physical climate change datasets with location data to enhance individual issuer level assessments.

**Key insight:** It is possible to combine sectoral analysis, company level data, and engagement activities to differentiate between leaders, improvers, and laggards, and to analyse the specific risks and opportunities given an issuer's context.

## Case study: Phoenix – TNFD pilot on listed equity & credit

**Context**

Phoenix sees nature and nature loss as a critical component of risk assessment and investment opportunities. Its customers indicate that nature and biodiversity are an increasing priority for them. The business recognises that nature is a complex and multi-faceted challenge requiring early engagement and knowledge/capacity building.

**Objective**

The objective of the TNFD pilot exercise was to:

- Help build internal capacity and understanding ahead of mandatory disclosure and reporting requirements in the medium-term, as well as for the integration of nature as a value driver for Phoenix.
- Provide practical and detailed feedback to the TNFD to incorporate in iterations of beta versions of the framework and guidance materials to help shape the final framework and guidance.

Phoenix tested the TNFD LEAP (Locate, Evaluate, Assess, Prepare) guidance for a small sample of listed equity and listed credit portfolios, for both passive and active strategies. Phoenix worked with two asset manager partners (abrdn and Robeco) and was supported by a consultancy consortium led by The Biodiversity Consultancy. Phoenix also worked with two existing ESG data providers to test the extent to which their nature data can support implementation of LEAP.

**Outcome**

This collaboration and pilot study identified that:

- The LEAP guidance in its current form may require some adaptation by financial institutions to be implementable. For example, 'Locate' is not necessarily an appropriate entry point for financial institutions. Phoenix found that initial work was required to identify priority companies and operations (i.e. steps currently characterised in 'Evaluate, Assess and Prepare') before location data was linked to assets.
- Location specific data for company assets is not comprehensively available across market sectors, which limits a bottom-up assessment of risks and opportunities.
- Data coverage across core disclosure metrics is variable across portfolios. In addition, methodologies behind metrics provided by data providers can be opaque, which makes it difficult to assess data quality.
- Top-down assessments at the sector or sub-industry group level are possible for impact and dependency exposure, allowing exposure and potential risk heat-mapping across portfolios.

**Key insight:** The TNFD LEAP guidance may require some adaptation by financial institutions to be implementable. 'Locate' is not necessarily an appropriate entry point for financial institutions, and initial work (by way of a top-down assessment) may be required to identify priority companies / operations before location data is linked to assets.

## Case study: HSBC – Heatmap on corporate loans

**Context**

HSBC identifies that significant collaborative work is needed to measure nature-related impacts and dependencies, and to help develop opportunities to address them. The following pilots was conducted in 2022.

**Objective**

There were two components to HSBC's TNFD pilot testing exercise:

- Assessment of a random sample of a global corporate loan portfolio: The objective of this exercise was to identify dependencies of corporate production processes on natural services. It was based on the ENCORE database. The random sample consisted of 1,000 large corporates across all sectors, geographies, and with a dependency on a range of natural services.
- Assessment of how water stress could impact heavy industry in an East Asian country: The objective of this exercise was to determine the impact of water curtailment on the credit rating of heavy industry. A three-month production shutdown due to lack of water translated into a reduction to turnover, and the exercise explored how this translated to an impact on Credit Risk Rating (CRR) and risk-weighted assets (RWA).

**Outcome**

This pilot study identified that:

- Whilst it is possible to produce a heatmap showing a relative nature-related risk rating for each sector/natural service combination (with an indicative prioritisation), it is necessary to complement ENCORE data with further detail on how a dependency on nature is impacted by geographical location.
- In particular, location specific data for company assets and supply chains is not currently comprehensively available. This meant that initial analysis using ENCORE data could not be augmented.
- A focus only on how water stress (in this example) translates to CRR and RWA misses other aspects for consideration, such as loan loss provision and loss given default. This exercise provides a simplistic indication of financial impact, however will likely need to be refined over time to deliver a more sophisticated output.

**Key insight:** The ENCORE dataset can be used to determine a nature-related risk rating for each sector / natural services combination, with indicative prioritisation. It is necessary to complement this data further to determine how a dependency on nature is impacted by location.

## Case study: Barclays – TNFD pilot on food & agriculture Portfolio

### Context

In 2022-23, Barclays alongside other financial institutions participated in UNEP FI's TNFD pilot focusing on European agriculture and fisheries, which in Barclays' context means the Agriculture and Food portfolio. The bank worked with an external expert to test the TNFD framework and LEAP guidance on its Agriculture and Food Lending Portfolio in Europe, with a focus on UK farming, in which Barclays has a significant presence.

### Objective

Through the pilot, Barclays aimed to better understand the geographical interlinkages and nature risk factors associated with the value chains of the bank and its clients, subsequently using this to inform the potential impact on counterparty profits and Barclays' credit exposures. This involved assessing their clients' locations in terms of production and sales and applying a number of biodiversity metrics to each location to determine where key impacts and risks may arise. A number of different 2030 scenarios were also used to stress the portfolio and individual counterparties, to see whether material financial impact could arise as a result of nature-related transition and physical risks.

### Outcome

Barclays used the results of the pilot to inform the management of nature-related risks identified during the assessment. For example, the results informed the development of new questions for the Client Transition Tool for UK farmers, which are due to be incorporated in 2024. This will help identify clients that may need support in managing their nature-related risks alongside decarbonisation actions, and to inform Barclays' client engagement proposition. Further, in recognition of nature-related impacts identified in the agricultural value chain, Barclays updated its Forestry and Agricultural Commodities Statement, which included strengthening existing restrictions and introducing additional new restrictions on clients operating in agricultural commodity sectors exposed to significant deforestation risk.

**Key insight:** The TNFD LEAP framework can be applied to specific lending portfolios, to help to better identify geographical interlinkages and nature risk factors across complex value chains.

# Case study: NatureAlpha – Biodiversity Value at Risk

### Context

NatureAlpha sought to develop a forward-looking, returns-based metric to support investors analysing the financial materiality of nature and biodiversity-related considerations that impact their portfolios.

### Objective

The goal was to establish a Biodiversity Value at Risk (BVaR) calculated over time by leveraging TNFD scenarios, scientific research, and academic insights. The financial implications, for companies, of declining biodiversity to be presented in a format which could be easily incorporated into investment decision-making processes by aligning BVaR with the newly released scenarios issued in the final guidance of the TNFD.

### Method

This was achieved by identifying the key themes of TNFD scenarios, augmenting them with academic literature and insights from academic partners, and incorporating geospatial insight. Four distinct scenario pathways were created, contingent on the level of impact mitigation in the market. Each pathway represented a varied year-on-year incremental increase or decrease in BVaR for individual firms.

From here, companies were categorised as low, medium, or high risk based on their material impacts and dependencies. This classification also influenced the level of incremental increase or decrease in BVaR for each firm. These data points and scenario pathways were combined to generate a tailored score and set of 16 scenarios for each company.

### Outcome

This initiative resulted in the introduction of one of the first VaR metrics related to nature and biodiversity available for use by investors. The produced VaR metric covered a company universe equivalent to the MSCI ACWI, offering data across 16 scenarios. Within this tool, a VaR metric was produce that considered impact, dependencies, and company assets was provided, encompassing both physical and transition risks.

Findings suggested that, in the short term, the most substantial financial risk to a company's operations stemmed from physical risk factors. However, in the medium and long term, the primary financial risks arose from an inability to adapt to the transitioning economy. Clients utilised these findings to employ other metrics in the NatureAlpha product suite, such as Unmanaged Risk, to advise portfolio companies on improving governance and management related to a nature transition and reduction in biodiversity risks, thereby increasing the potential for resilience, mitigating risk, and increasing alignment towards a nature-positive future.

**Key insight:** It is possible to use a Biodiversity Value at Risk metric which is forward-looking, returns-based, and can support investors in analysing the financial materiality of nature and biodiversity-related considerations on their portfolios.

# 7 Appendix

## Reference guide

The table below includes a list of useful publications and potential uses for financial institutions.

| Publisher | Document | Summary and Overview of Key Uses |
|---|---|---|
| IPBES | The global assessment report on biodiversity and ecosystem services | Provides insight into international regulatory progress on nature, including likelihood of meeting established target deadlines. This paper also supplies detailed insight into scenarios and pathways to achieve SDGs utilising nexus thinking (combining climate and nature), providing context for incorporation into nature risk mitigation procedures and transition planning. |
| CBD | Kunming-Montreal Global Biodiversity Framework | Provides four overarching goals and 23 targets to be achieved by 2030, which can inform and supply best practice (and SDG-aligned) nature-related targets to incorporate into overarching business goals. |
| NGFS | Nature-related Financial Risks: a Conceptual Framework to guide Action by Central Banks and Supervisors | Provides deep insight into banking specific risks resulting from impacts to nature, including information on the climate-nature nexus, and both micro and macro effects to business. This guidance is specifically helpful to design nature-related risk assessments through the identification of physical, transitional, and economic-specific risks at the organisational level and within the financial system. |
| NGFS | Recommendations toward the development of scenarios for assessing nature-related economic and financial risks | Provides key guidance on challenges in developing integrated climate and nature scenarios, highlighting multiple nature-related scenarios and modelling frameworks being piloted today for both physical and transition nature risks. This paper also includes guidance on cascading risks, and how these can propagate throughout value chains. Overall, this paper provides insights into the state of maturity of nature-related scenario analysis, with abundant guidance on development to assess an organisation's nature (and climate) risk. |
| NGFS | The Green Scorpion: the Macro-Criticality of Nature | NGFS occasional paper providing further guidance on foundations for scenario-based analysis of complex and cascading physical nature-related financial risks. |
| CISL | Handbook for nature-related risks | Provides a succinct introduction to nature related risk for financial institutions, and supplies a |

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| | | framework for identification of nature risks, aligned with and incorporating NGFS guidance. Includes high level case studies (such as agriculture) and details the process to incorporate first-order and second-order effects. This paper provides deep dives into a wide range of nature-related risks financial institutions may find within their value chain and can be utilised as a reference when developing nature-related risk assessments. |
| GARP | Biodiversity Loss: An Introduction for Risk Professionals | Provides a detailed introduction to biodiversity and biodiversity-related risks aimed at financial institutions. This paper provides additional insight into biodiversity-specific measurement and disclosure frameworks and can be utilised as a reference when developing nature-related risk assessments. |
| TNFD | V1.0 Recommendations | The updated Key Recommendations from the TNFD were published in September of 2023. This guidance provides insight into disclosure requirements aligned to the TCFD's four pillars (Governance, Strategy, Risk & Impact Management, and Metrics & Targets). This can be used to develop business' approach to nature-related risk assessments and scenario analysis. |
| TNFD | Additional guidance for financial institutions | Guidance to be used in conjunction with the TNFD V1.0 Recommendations *(above)* providing more context for financial institutions on TNFD recommendations, metrics and additional resources and references. |
| GFI | Assessing the Materiality of Nature-Related Financial Risks for the UK | This report quantifies the significant economic risks that nature degradation and loss of ecosystem services pose to the UK economy and financial sector, through chronic risks like biodiversity loss as well as acute shocks like wildfires or disease outbreaks. As these nature-related risks are currently unaccounted for in prudential policies or risk management, the report highlights the need to assess and mitigate these material economic threats. |
| OECD | Supervisory framework for assessing nature-related financial risks | Provides a methodological framework aimed at financial institutions to assess nature and biodiversity-related risks, including impacts and dependencies, and highlighting physical and transition risk transmission channels. |
| A4S | Managing Nature Risks and Investing in the Opportunities | Provides guidance aimed at pension fund chairs and trustees to help manage nature-related risks and |

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| | | invest in nature-related opportunities. This paper provides helpful examples of nature-related risks and how these can both produce investment-related risks and potential investment opportunities that could be useful for pension funds. |
| ABI | Guide to action on nature | Provides guidance and a framework aimed at the insurance and the long-term savings industry to assess nature-related risks and approaches to identifying nature-related opportunities. Additionally, there are detailed 'drivers of change' covering regulatory, policy and framework developments that could be useful for the insurance industry. |
| CGFI | Enabling data-driven investment in adaptation and nature: introducing the resilient planet data hub | Launched at COP28, the Resilient Planet Data Hub provides global open access risk and resilience data for both nature and climate, aimed at increasing the quality of public data and subsequent action and finance for assessing and mitigating nature-related risk. Financial institutions can utilise this resource to begin building nature-related data capabilities and develop an understanding to assess nature-related risks, including the use of scenario analysis. |
| FSB | Stocktake on Nature-related Risks: Supervisory and regulatory approaches and perspectives on financial risk | In February 2024, the G20 Finance Ministers and Central Bank Governors tasked the Financial Stability Board (FSB) with examining regulatory and supervisory efforts related to identifying and assessing financial risks associated with nature degradation. The FSB's report outlines current and planned actions and highlights key challenges for authorities in addressing nature-related financial risks. It also includes case studies on initiatives by authorities and international organizations such as the Network for Greening the Financial System (NGFS), World Bank, OECD, Taskforce on Nature-related Financial Disclosures (TNFD), and De Nederlandsche Bank (DNB). |

## Glossary of terms

The table below includes a list of useful terms and definitions present throughout the document, sourced from the TNFD[46].

| Term | Definition |
|---|---|
| Acute risk | Occurrence of short-term, specific events that change the state of nature. For example, oil spills, forest fires or pests affecting a harvest.<br><br>Adapted from Task Force on Climate-related Financial Disclosures (2017) Final Report: Recommendations on Climate-related Financial Disclosures, Financial Stability Board (2022) Final report: Supervisory and Regulatory Approaches to Climate-related Risks, Network for Greening the Financial System (2023) Nature-related Financial Risks: A Conceptual Framework to guide Action by Central Banks and Supervisors |
| 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) Article 2 |
| Critical habitat | Any area of the planet with high biodiversity conservation significance, based on the existence of habitat of significant importance to critically endangered or endangered species, restricted range or endemic species, globally significant concentrations of migratory and/or congregatory species, highly threatened and/or unique ecosystems and key evolutionary processes. International Finance Corporation (2012) Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resource |
| Deforestation | The conversion of forest to other land use independently of whether human-induced or not. Explanatory notes:<br>1. Includes permanent reduction of the tree canopy cover below the minimum 10% threshold.<br>2. Includes areas of forest converted to agriculture, pasture, water reservoirs, mining and urban areas.<br>3. The term specifically excludes areas where the trees have been removed as a result of harvesting or logging, and where the forest is expected to regenerate naturally or with the aid of silvicultural measures.<br>4. The term also includes areas where, for example, the impact of disturbance, overutilization or changing environmental conditions affects the forest to an extent that it cannot sustain a canopy cover above the 10% threshold.<br>5. The concept of long-term is central to this definition and is defined as ten years.<br>6. Note that to determine whether the removal of trees from an area is classed as deforestation, it is necessary to predict the future development of the area. If new forest trees are established in the near future, the land is classified as forest throughout the regeneration period. This regrowth is considered 'reforestation' and the full process 'conversion'. If, on the other hand, a sufficient density of trees is not established in the near future, or if land is converted to other land use, the area should be considered deforested.<br><br>Food and Agriculture Organization (2020)<br>Forest Resources Assessment - Terms and Definitions, Food and Agriculture Organization (2000)<br>Forest Resources Assessment - Definitions of Forest Change Processes |
| Dependencies (on nature) | Dependencies are aspects of environmental assets and ecosystem services that a person or an organization relies on to function. A company's business model, for example, may be dependent on the ecosystem services of water flow, water quality regulation and the regulation of hazards like fires and floods; provision of suitable habitat for pollinators, who in turn provide a service directly to economies; and carbon sequestration. Adapted from Science Based Targets Network (2023) SBTN Glossary of Terms |
| Direct impacts | A change in the state of nature caused by a business activity with a direct causal link. Climate Disclosure Standards Borad (2021) Framework Application Guidance for Biodiversity-related Disclosures, Endangered Wildlife Trust (2020) The Biological Diversity Protocol, Capitals Coalition and Cambridge Conservation Initiative (2020) Integrated Biodiversity into Natural Capital Assessments |
| Double materiality | Double materiality has two dimensions, namely: impact materiality and financial materiality. European Commission (2023) Annex 1 to the Commission Delegated Regulation, supplementing Directive 2013/34/EU as amended by Directive 2022/2464 (CSRD), as regards sustainability reporting standards (ESRS E1) |
| Ecosystem | A dynamic complex of plant, animal and microorganism communities and the non-living environment, interacting as a functional unit. Convention on Biological Diversity (1992) Article 2; Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (2019) Global Assessment Report on Biodiversity and Ecosystem Service |

[46] Glossary of key terms, TNFD

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| Ecosystem services | The contributions of ecosystems to the benefits that are used in economic and other human activity. United Nations et al. (2021) System of Environmental-Economic Accounting - Ecosystem Accounting |
| Environmental assets | The naturally occurring living and non-living components of the Earth, together constituting the biophysical environment, which may provide benefits to humanity. United Nations et al. (2021) System of Environmental-Economic Accounting - Ecosystem Accounting |
| Financial exposure | The amount (usually expressed in monetary terms) of exposure to the risk of suffering a loss in a particular transaction or with respect to any kind of investments. Corporate Finance Institute Basel Committee on Banking Supervision (BCBS) - Concept of Exposure at Default (or credit exposure) for Banks |
| Financial impact (referred t by TNFD as financial effect to avoid confusion wit impacts on nature) | Financial impact occurs when financial items such as physical assets, capital expenditures, operational expenditures and revenues are affected, whether positively or negatively. Task Force on Climate-related Financial Disclosures (2020) Guidance on Scenario Analysis for Non-Financial Companies |
| Financial stability risk | Risk that a materialisation and compounding of physical and/or transition risk leads to the destabilisation of an entire financial system. It is one type of nature-related systemic risk. Goldin, I. & Mariathasan, M. (2014) The Butterfly Defect: How Globalisation Creates Systemic Risks and What to do about it, International Risk Governance Centre (2018) IRGC Guidelines for the Governance of Systemic Risks, Kaufmann, G. & Scott, K. (2003) What Is Systemic Risk, and Do Bank Regulators Retard or Contribute to It?, Network for Greening the Financial System (2023) Nature-related Financial Risks: A Conceptual Framework to guide Action by Central Banks and Supervisors, Organisation for Economic Co-operation and Development (2023, forthcoming) A prudential framework for assessing nature related financial risks: identifying and navigating biodiversity risks |
| Habitat | The area, characterised by its abiotic and biotic properties, that is habitable by a particular species. Keith, D. et al (2020) IUCN Global Ecosystem Typology 2.0: Descriptive Profiles for Biomes and Ecosystem Functional Groups |
| Impact (on nature) | Changes 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 organization's or another party's actions and can be direct, indirect or cumulative. A single impact driver may be associated with multiple impacts. Science Based Targets Network (2023) SBTN Glossary of Terms, Climate Disclosure Standards Board (2021) Application guidance for Biodiversity- related Disclosures See further definition of impacts from Impact Management Platform |
| Indirect Impact | A change in the state of nature caused by a business activity with an indirect causal link (e.g., a change indirectly caused by climate change, to which an organization's greenhouse gas emissions contributed). Climate Disclosure Standards Board (2021) Framework Application Guidance for Biodiversity-related Disclosures, Endangered Wildlife Trust (2020) The Biological Diversity Protocol, Capitals Coalition and Cambridge Conservation Initiative (2020) Integrated Biodiversity into Natural Capital Assessments |
| Liquidity risk | Banks' access to stable sources of funding could be reduced as market conditions change. Nature-related risks may cause banks' counterparties to draw down deposits and credit lines. For example, there may be pressure to liquidate assets due to rapid nature degradation as a result of crossing a tipping point or new regulations affecting particular assets that influence cash flows and collateral values. Adapted from Task Force on Climate-related Financial Disclosures (2017) Final Report: Recommendations on Climate-related Financial Disclosures, Financial Stability Board (2022) Final report: Supervisory and Regulatory Approaches to Climate-related Risks, Network for Greening the Financial System (2023) Nature-related Financial Risks: A Conceptual Framework to guide Action by Central Banks and Supervisors, Organisation for Economic Cooperation and Development (2023, forthcoming) A prudential framework for assessing nature-related financial risks: identifying and navigating biodiversity risks. |
| Materiality | Report preparers should use the definitional guidance regarding materiality provided by the regulatory authorities for their reporting jurisdiction(s). In the absence of any such guidance, the TNFD recommends that organizations apply the ISSB's approach to identifying information that is material for users of general financial reports as a baseline. Report preparers who want or need to report to a different materiality approach may apply an impact materiality approach to identify information in addition to the ISSB's baseline. With respect to impact materiality, the TNFD has aligned its recommendations (and supporting additional guidance) with the language and approach of the GRI's Sustainability Reporting Standards. Organizations seeking to align with Target 15 of the GBF will want to consider the application of an impact materiality lens to identify information that is incremental to the global baseline. International Financial Reporting Standards (2023) S1 General Requirements for Disclosure of Sustainability-related Financial Information, GRI (2021) GRI 1: Foundation 2021, Section 2.2 |
| 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. Capitals Coalition (2016) Natural Capital Protocol |
| Nature | The natural world, with an emphasis on the diversity of living organisms (including people) and their interactions among themselves and with their environment. Adapted from Díaz, S et al. (2015) The IPBES Conceptual Framework – Connecting Nature and People |
| Nature Loss | The loss and/or decline of the state of nature. This includes, but is not limited to, the reduction of any aspect of biological diversity e.g., diversity at the genetic, species and ecosystem levels in a particular area through death (including extinction), destruction or manual removal. Intergovernmental Science-Policy Platform on Biodiversity and |

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| | Ecosystem Services (2019) Global Assessment Report on Biodiversity and Ecosystem Services |
| Nature-related opportunities | Activities that create positive outcomes for organizations and nature by creating positive impacts on nature or mitigating negative impacts on nature. Nature-related opportunities are generated through impacts and dependencies on nature, and can occur: • When organizations avoid, reduce, mitigate or manage nature-related risks, for example, connected to the loss of nature and ecosystem services that the organization and society depend on; • Through the strategic transformation of business models, products, services, markets and investments that actively work to reverse the loss of nature, including by restoration, regeneration of nature and implementation of nature-based solutions. Adapted from WWF (2022) A Biodiversity Guide for Business |
| Nature-related risks | In line with ISO, the TNFD defines nature-related risks as potential threats (effects of uncertainty) posed to an organization that arise from its and wider society's dependencies and impacts on nature. Climate Disclosure Standards Board (2021) Framework application guidance for biodiversity-related disclosures, International Organization for Standardisation (2018) ISO 31000, Risk Management – Guidelines, Task Force on Climate-related Financial Disclosures (2017) Final Report: Recommendations on Climate-related Financial Disclosures |
| Policy risk | 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. Adapted from Task Force on Climate-related Financial Disclosures (2017) Final Report: Recommendations on Climate-related Financial Disclosures, Financial Stability Board (2022) Final report: Supervisory and Regulatory Approaches to Climate-related Risks, Network for Greening the Financial System (NGFS) (2023) Nature-related Financial Risks: A Conceptual Framework to Guide Action by Central Banks and Supervisors |
| Pollution | Presence of substances and heat in air, water and/or land whose nature, location, or quantity produce harmful and undesirable environmental effects. United Nations (1997) Glossary of Environment Statistics |
| Water stress (areas of) | Water stressed (region): defined in three levels: 25%, below which no water scarcity exists; 60%, indicating approaching scarcity; 75%, above which strong water scarcity is identified. Anything above the 60% figure, approaching scarcity, is considered 'water stressed. Adapted from UN Water (2021) Summary Progress Update 2021: SDG 6 — water and sanitation for all |