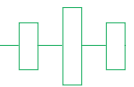




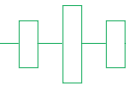
Biodiversity Loss:

An Introduction for
Risk Professionals



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Introduction

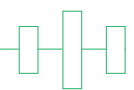
Risks from biodiversity are an increasing focus of financial services firms — and rightfully so. Biodiversity loss, after all, was one of the top three risks identified in the [World Economic Forum's 2022 Global Risks Report](#), joining climate change and extreme weather.

Regulators worldwide, moreover, are now examining more closely the impact of environmental threats — including biodiversity loss — on financial risks. Consequently, it's critical for financial institutions to understand both the ramifications of biodiversity loss for their portfolios and the impact of their financial activities on biodiversity.

There has, of course, been a sharp rise in the attention regulators, investors, and policymakers have paid to climate-change-driven financial risks since the 2015 Paris Agreement. But the emergence of biodiversity loss as a systemic threat has yielded important questions.

For example, what is biodiversity and why does it matter? How are biodiversity loss and climate change interconnected? How do financial activities impact biodiversity loss, and what are the risks for financial firms? Why is it important for risk professionals to build up their biodiversity loss skills and expertise?

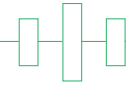




Key Facts

Before we address these questions in detail, let's consider the big picture. In the environmental space, the most commonly examined risk beyond climate change is biodiversity loss. Here are some other thought-provoking truths:

- Biodiversity is reducing faster than at any time in human history, with extinction rates running at tens to hundreds of times higher than they have averaged over the past 10 million years.
- Biodiversity loss is a “transverse risk” that affects existing risk types, such as credit, market, and operational risk.
- The current level of biodiversity loss is undermining progress on [80% of the UN's Sustainable Development Goals](#).
- The total [economic value of ecosystem services was recently estimated to be between USD 125 to 140 trillion](#) per year — significantly higher than global GDP.
- Roughly two-fifths of firms are already considering the impact of the environmental risks (aside from climate change) on their portfolio, while a similar proportion are thinking about their portfolio's impact on the environment.

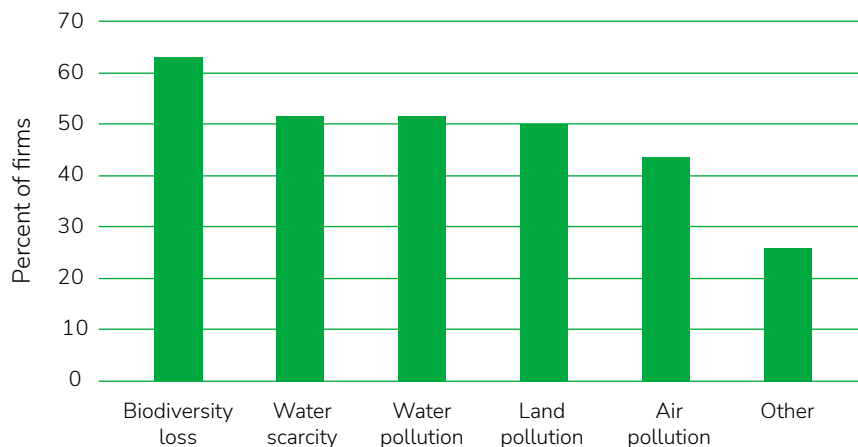


How Financial Firms Are Considering Environmental Risks Beyond Climate Change

In GARP's [Fourth Annual Survey of Climate Risk Management](#), we asked firms about the environmental risks beyond climate that they were considering. Seventy-six percent of firms look at one or more environmental risks beyond climate change, with 61% of firms examining multiple risks.

The risk most commonly considered is [biodiversity](#) loss — which 63% of firms examine. Furthermore, around half of firms look at water scarcity, water pollution, and land pollution (Figure 1). Other risks — such as deforestation, land use, waste management, animal welfare, and site contamination — are also being investigated. Since 42% of survey respondents report regulatory mandates covering these broader environmental risks, some firms may just be reflecting the interests of their regulators.

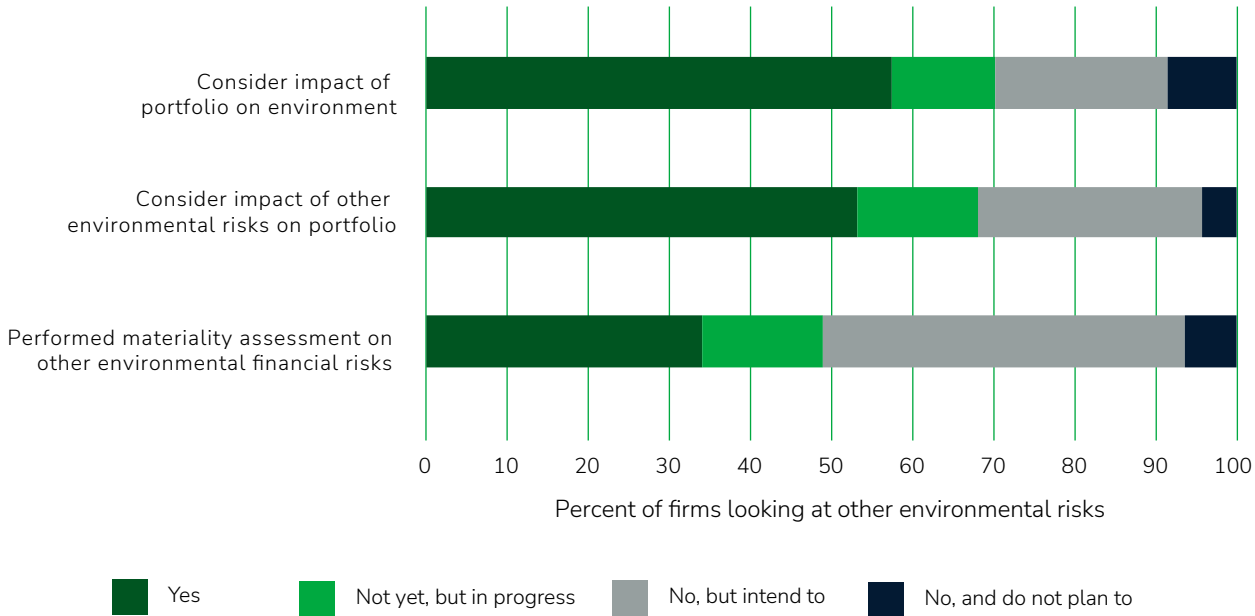
Figure 1: Environmental Risks Considered Beyond Climate

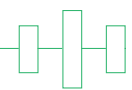


There are two perspectives (often referred to as “double materiality”) that firms must consider when evaluating broader environmental risks. One is the impact that they might have on the financial institution — via, e.g., risks to their counterparties. The other is how a financial institution might impact these risks, for example by lending to an industrialized agriculture company that is reducing biodiversity through land clearing or overuse of fertilizer.

About 55% of the firms that look at other environmental risks report that they are already considering the impact of the environmental risks on their portfolio, and a similar proportion are evaluating their portfolio’s impact on the environment (Figure 2). Forty-five percent of these firms are weighing both. Moreover, just over one third of them have actually undertaken materiality assessments on environmental risks beyond climate change, while an additional 60% have plans to do so.

Figure 2: How Mature Are Environmental Risk Assessments?





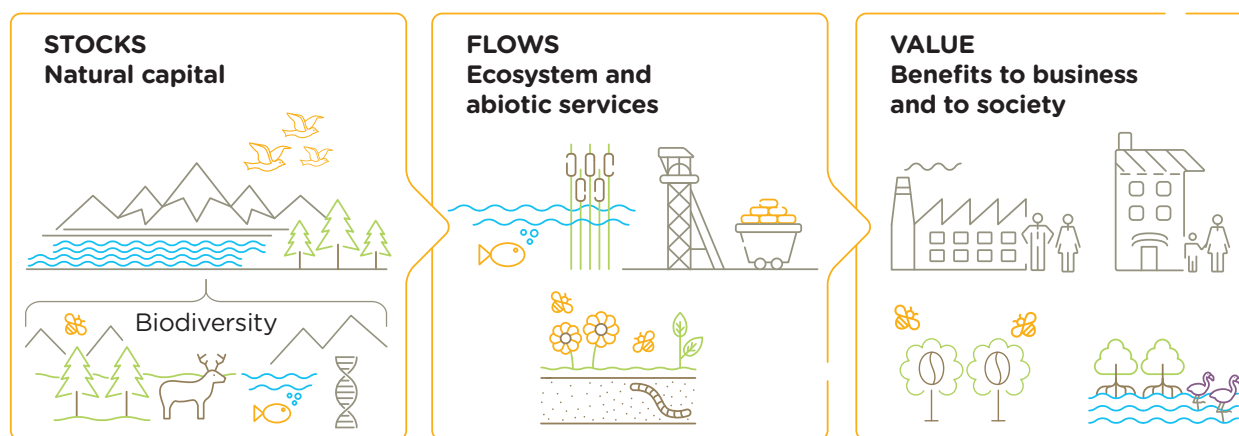
What Is Biodiversity and Why Does It Matter?

A Conceptual Framework

Biodiversity is probably being considered by most firms because it underpins our economies, health, and well-being. As discussed in a [GARP webcast with WWF](#), economies depend on food, water, medicine, the regulation of our climate, and other services that nature provides.

Nature — also called natural capital — can be thought of as a stock of resources (such as water, forest, and air) that provides ecosystem services that are the foundation of economic activities; these services yield societal benefits to human well-being (Figure 3).

Figure 3: Ecosystem Services Are Derived From Natural Capital

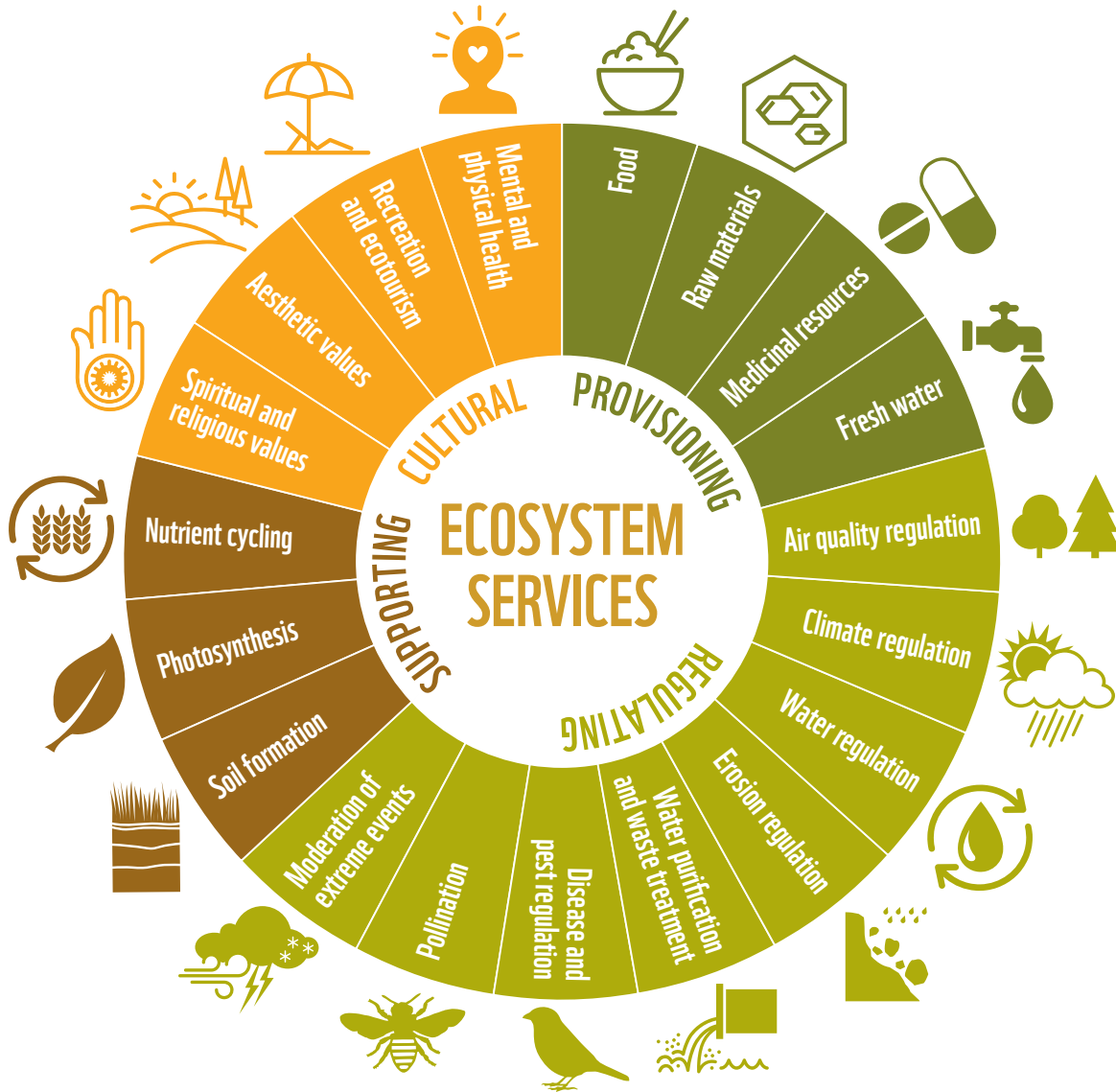


Source: [Capitals Coalition – Biodiversity Guidance](#)

Ecosystem services are commonly broken into four major sub-sectors, which can be seen in Figure 4:

1. **Provisioning services:** Products obtained from ecosystem services, such as food and medicine
2. **Regulating services:** Benefits obtained from the regulation of ecosystem services, such as pollination and water purification
3. **Cultural services:** Non-material benefits that people obtain from ecosystems, such as mental and physical health, and recreation
4. **Supporting services:** Services such as photosynthesis and soil formation that underpin other ecosystem services

Figure 4: Ecosystem Services



Source: WWF report

The total economic value of ecosystem services has been estimated to be between USD 125 and 140 trillion per year — well above global GDP. These ecosystem services depend upon nature being healthy.

Biodiversity (or more fully biological diversity) describes the variety of life on earth and is a key indicator of the health of nature; it includes diversity within species, between species, and of ecosystems.

Lamentably, over recent years, there have been significant declines in biodiversity. These reductions are not only undermining nature's productivity, resilience, and adaptability but also threatening food security and public health. For example, clearing of forests has reduced pollination, climate regulation, and water regulation, which in turn impact people's food supply and well-being.

Biodiversity Loss Is Too Rapid

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) — the biodiversity equivalent of the Intergovernmental Panel on Climate Change (IPCC) — is an independent intergovernmental body set up to strengthen the science-policy interface for biodiversity and ecosystem services. Its 2019 [Global Assessment](#) is a sobering read, documenting how 25% of animal and plant groups are threatened — with more than one million plant and animal species at risk of extinction, and many within decades.

In fact, biodiversity is reducing faster than at any time in human history, with extinction rates running at tens to hundreds of times higher than they have averaged over the past 10 million years. Recent studies — like the 2021 [Dasgupta Review](#) — have highlighted the extent to which human beings' increasing prosperity is responsible for this reduction, at a devastating cost to nature.

The main causes of biodiversity loss are land and sea use change, overexploitation of organisms, climate change, pollution, and invasive alien species. Highlighting the unsustainable nature of current consumption, the Dasgupta Review states that roughly 1.6 Earths would be required to maintain the world's current living standards without environmental degradation. Moreover, the report makes it clear that we need to rethink how we view economic success, and that metrics other than GDP are needed.

Impacts of Biodiversity Loss

This level of biodiversity loss is [undermining progress on 80% of the UN's Sustainable Development Goals](#) (SDGs), including goals related to poverty and hunger, health, clean water, and sustainable cities. According to IPBES, biodiversity loss is a multi-layered problem that cuts across environmental, developmental, economic, security, social, and moral issues.

There is growing recognition of the intimate relationship between reductions in biodiversity and climate change. In June 2021, IPBES and IPCC published their [first joint report on biodiversity and climate change](#), noting that they are “inextricably connected.” For example, they share many common drivers such as deforestation and over-exploitation of natural resources, which not only lead to habitat loss and degradation but also increase greenhouse gases and reduce the effectiveness of natural carbon sinks.

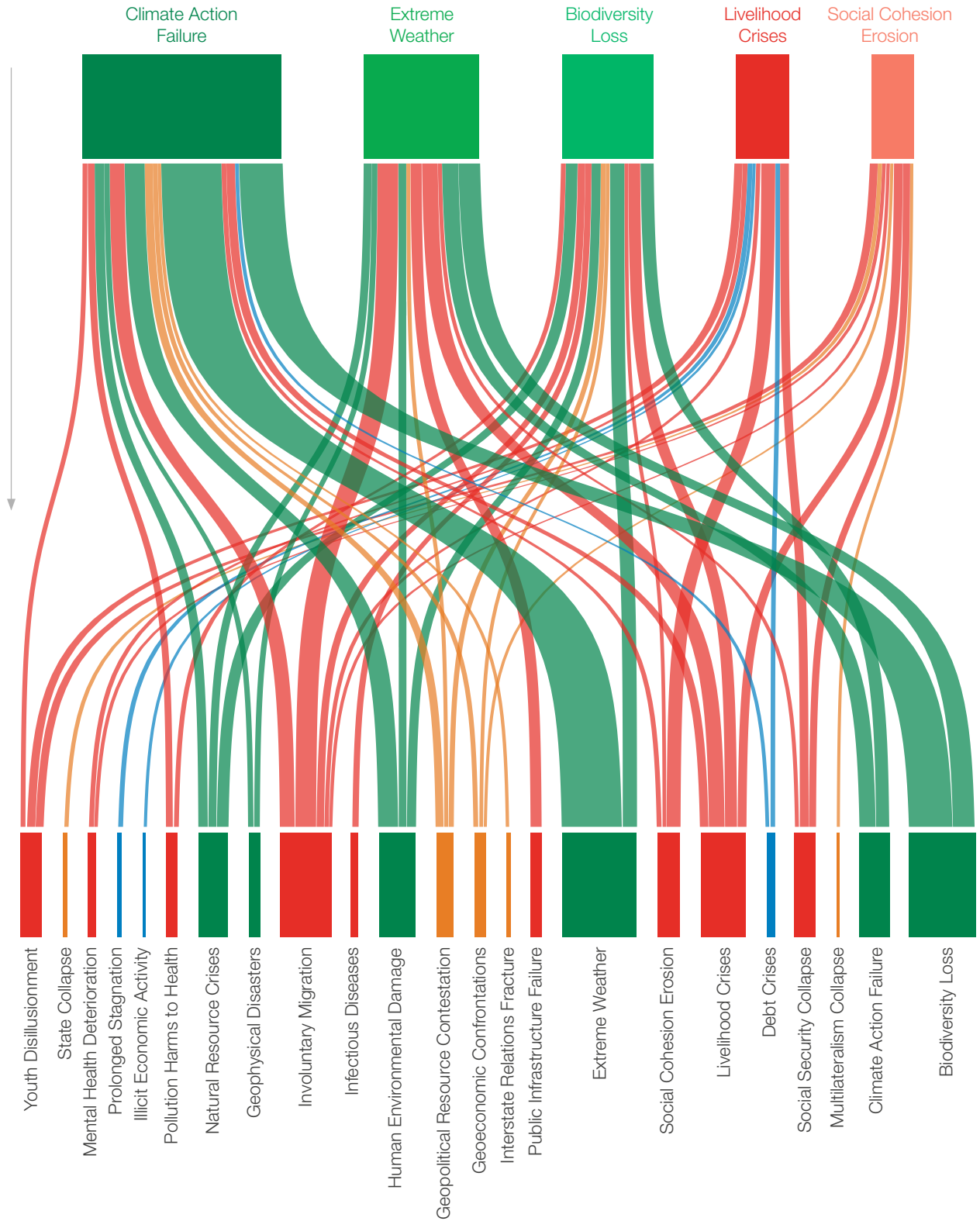
Climate change is also a direct driver of biodiversity loss: One example is the impact that increased atmospheric greenhouse gas concentrations have on rising ocean acidification, which is negatively affecting oceanic biodiversity. Climate-connected natural disasters, including increased wildfires and more frequent and intense flooding, have also yielded biodiversity fallout. On the other hand, healthy ecosystems provide resilience to growing climate shocks.

The significance and interconnections between these environmental risks is highlighted in the WEF's aforementioned 2022 report on global risks. The top three most severe global risks (see top row of Figure 5, below) are failure of climate action, extreme weather, and biodiversity loss.

As depicted in the figure, biodiversity loss is exacerbated by both climate action failure and extreme weather. Biodiversity loss, in turn, aggravates many different risks — ranging from pollution which harms health and climate action failure to geopolitical resource contestation and livelihood crises.

Figure 5: World Economic Forum's Top 5 Global Risks 2022

■ Economic ■ Environmental ■ Geopolitical ■ Societal ■ Technological

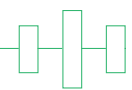


Source: [World Economic Forum Global Risks Report 2022](#)

Biodiversity loss may lead to losses across the financial industry, although sizing either the exposure or impact is not straightforward. Several countries, however, have estimated the dependence of their financial institutions on ecosystem services:

- Recent [Bank of England analysis](#) found that “over half [52%] of U.K. GDP and nearly three-quarters [72%] of the stock of U.K. lending exhibits dependence on ecosystem services.”
- A [joint 2022 study conducted by World Bank and Bank Negara Malaysia](#) found that 54% of Malaysian commercial loan portfolios are exposed to sectors that depend to a high extent on ecosystem services, while 87% are exposed to sectors that strongly impact ecosystem services.
- In a separate report, World Bank also found that [46% of Brazilian banks' corporate loan portfolio was concentrated in sectors “highly” or “very highly” dependent upon ecosystems.](#)
- Forty-two percent of the market value of securities held by French financial institutions are from issuers that are dependent or highly dependent upon ecosystem services — and all securities issuers are at least slightly dependent on ecosystem services, according to [a Banque de France report.](#)
- An early study by De Nederlandsche Bank (DNB) in 2020 found that [36% of investments by Dutch financial institutions are highly or very highly dependent upon ecosystem services.](#) The study claimed that the loss of such services would lead to substantial disruption of business practices and financial losses. Notably, it only examined risks with available data, and took into account only first-order effects. Processed food companies' dependency on animal pollination was, for example, not included, and the actual dependency that business has on nature in the Netherlands could therefore be even higher.

Given the data cited in these studies, it is reasonable to assume that there is a significant connection between biodiversity loss and financial risk in countries across the world.



How Biodiversity Loss Fits Into Risk Management

Financial Risk Drivers

Natural capital has tended to be overlooked in financial decision making. However, as the U.K., Malaysian, Brazilian, French, and Dutch studies show, the potential financial risks from adverse effects of biodiversity reduction on nature and ecosystem services — and the subsequent impact on corporates and households — could be large. Consequently, similar to climate risk, firms should be assessing both how biodiversity can impact their portfolio and how their portfolio impacts biodiversity.

Similar to climate change, the biodiversity causal factors that can give rise to a financial risk can be [split into physical risks and transition risks](#).

Physical risks from biodiversity loss arise when a financial institution lends to, insures, or invests in companies that depend upon ecosystem services. The risks are three-fold: (1) chronic, such as a gradual reduction in the diversity of pollination species, thereby reducing crop yields; (2) acute, such as disease spreading as a consequence of reduced natural resistance; or (3) both chronic and acute, such as disruption to microclimates and the hydrological cycle caused by deforestation.

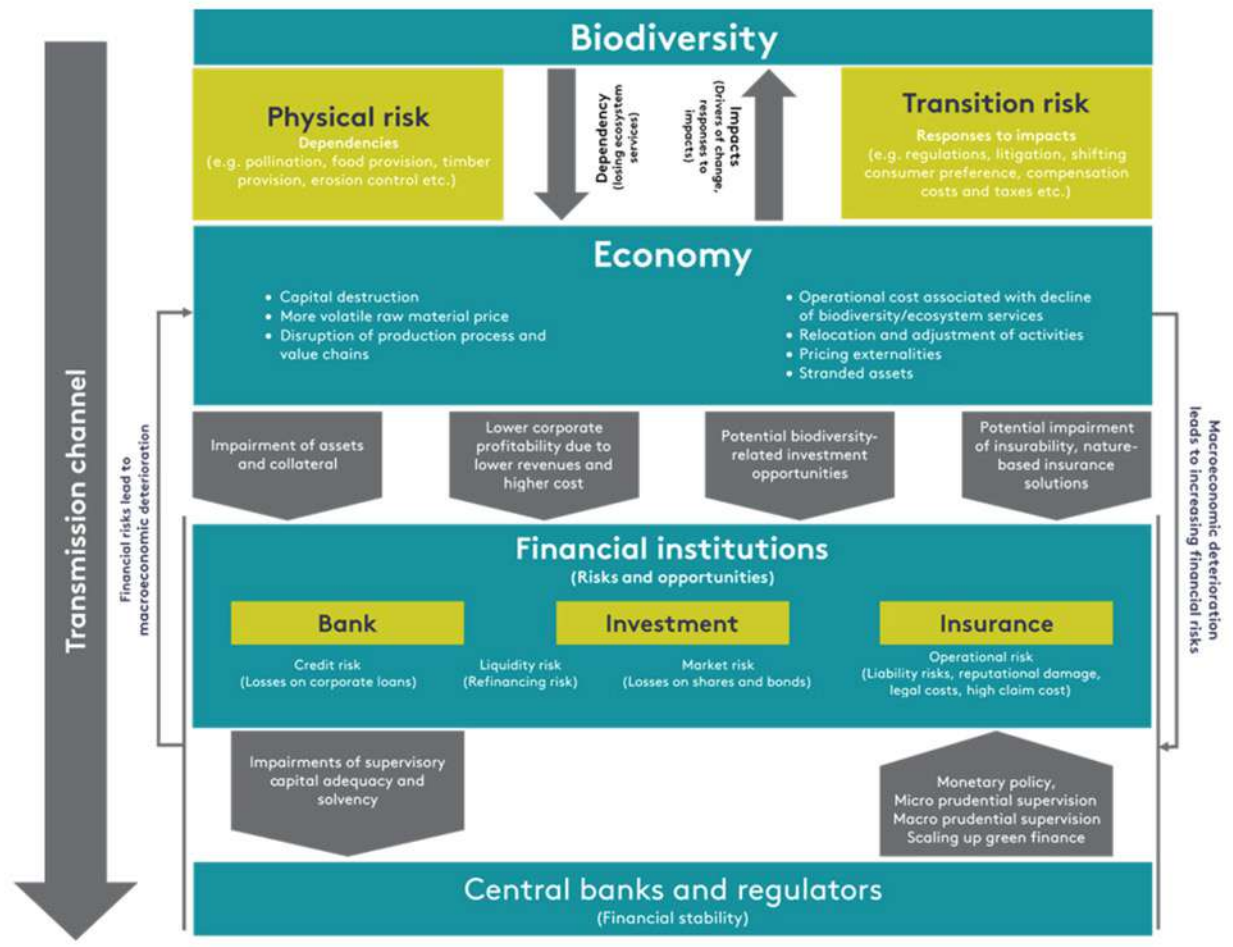
Transition risks, according to the NGFS, arise from “the misalignment between the impacts on biodiversity associated with financial institutions’ portfolios and developments aimed at reducing or reversing the damage to biodiversity and ecosystems.” In other words, transition risks arise if you are exposed to companies that are negatively impacting biodiversity.

Sources of transition risk from biodiversity loss include the following:

- legal or regulatory changes — for example, if an area is protected and businesses consequently need to move or alter the way that they operate;
- changing consumer preferences, such as consumers boycotting products that use palm oil because rainforests have usually been destroyed to establish the palm oil plantations;
- technology changes; and
- reputational risks — from polluting waterways and oceans, for example, and thereby killing plants and fish.

Figure 6 provides a useful diagram of the transmission mechanisms between biodiversity, the real economy, and financial institutions.

Figure 6: Financial Risk Transmission



Source: NGFS

Turning to the impact on a firm's portfolio, biodiversity loss, like climate change, can be thought of as a “transverse risk” that affects existing risk types, such as credit, market, and operational risk (Figure 7).

Figure 7: Examples of Financial Risks Impacted by Environmental Degradation

Event/Shock	Examples of Impacts	Examples of Risk Types Affected
<p>Physical risk Land-use change, such as deforestation to create more land for crops or dairy.</p>	<p>Disruption of local climate regulation and water supply.</p> <p>Reduction of the genetic diversity of crops and an increase in their vulnerability to pests.</p> <p>Potential reduction in crop yields, decreasing land value and compromising business viability.</p> <p>Water supply for other industries could be reduced, affecting their profitability.</p>	<p>Credit risk – via increasing probability of default and decreasing collateral value.</p> <p>Market risk – regional commodity markets could be impacted.</p>
<p>Physical risk Reduction in pollinating animals, such as bees.</p>	<p>Most common food crops depend on animal pollination. A reduction in pollinating animals can reduce the yield. This may decrease the income of agricultural companies and increase the costs of food processing companies, thereby decreasing their profitability.</p>	<p>Credit risk – via reduced counterparty income and collateral value.</p> <p>Market risk – regional commodity markets could be impacted.</p>
<p>Legal or regulatory changes Protection of ecosystem.</p>	<p>Oil and gas companies that operate in areas that need to be conserved can suffer large losses in value.</p> <p>The Netherlands, for example, has to reduce nitrogen emissions by 50% by 2030 to comply with EU rules about reducing nitrogen pollution. This is already having significant impacts on agriculture, which contributes about half of all nitrogen emissions.</p>	<p>Credit risk – via reduced counterparty income and collateral value.</p> <p>Market risk – from changes to the supply of commodities.</p>
<p>Legal or regulatory changes Law changes requiring companies to demonstrate that their supply chains do not contribute to deforestation.</p>	<p>Europe is proposing a law requiring companies to verify that goods sold in the EU have not been produced on deforested or degraded land anywhere in the world. Supply chain companies that can't prove the source of their raw materials may have increased costs and/or a decrease in the demand for their product.</p>	<p>Credit risk – via reduced counterparty income and collateral value.</p> <p>Market risk – from changes to the supply of commodities.</p> <p>Sovereign risk – for supply-chain countries that may have a reduction in exports, as well as for importing countries that could face an increase in the cost of imported materials.</p>

Sources: GRI research and the [University of Cambridge Institute for Sustainability Leadership \(Handbook for Nature-related Risks\)](#)

Why Has Biodiversity Attracted Less Attention Than Climate Change?

Given the potential risk to financial stability from the high levels of dependence on ecosystem services, one may wonder why biodiversity loss hasn't received more attention. One reason that it has had less of a policy focus than climate change is that it has lagged behind in terms of international policy frameworks.

The IPBES, for example, was established as an independent body by governments in 2012 but did not release its first global assessment until 2019; in contrast, the IPCC was created in 1988 and released its first Assessment Report in 1990. So IPBES has some catching up to do.

Nature and biodiversity loss are also more difficult to measure than greenhouse gas (GHG) emissions. For climate change, the key metric of interest is the concentration of carbon dioxide and other greenhouse gases in the atmosphere. Moreover, it doesn't matter where those greenhouse gases are emitted: one ton of carbon dioxide in the atmosphere will contribute to global climate change, irrespective of where those emissions take place.

Biodiversity, in contrast, is far more complex, localized and multi-dimensional, and there are many different aspects that could be measured. For example, the number and/or distribution of plant and animal species; the number of unique species; species at risk of extinction; and threats to biodiversity, such as trends in invasive alien species. Complicating matters further, each dimension could be different in different parts of the world, which makes it harder to create a global, or even a countrywide, measure of biodiversity.

International Frameworks and Policy Action on Biodiversity

The key international framework is the [UN Convention on Biological Diversity \(CBD\)](#). This came into effect on December 29, 1993, with three main goals:

- the conservation of biological diversity;
- the sustainable use of its components; and
- the fair and equitable sharing of the benefits from the use of genetic resources.

In 2002, the CBD was updated to include a commitment to achieve a [significant reduction in biodiversity loss by 2010](#). Unfortunately, [none of the goals in the 2002 update were met](#); in some cases, in fact, the rate of biodiversity loss actually increased.

Consequently, there was another update in 2010, which not only provided biodiversity targets until 2020 (the so-called [Aichi Biodiversity Targets](#)) but also offered a biodiversity framework for the entire UN system. To address failures in the previous targets, this framework was structured around strategic goals to address the underlying causes of biodiversity loss.

However, according to the [CBD's Fifth Global Biodiversity Outlook \(GBO-5\)](#), the national targets in the 2010 CBD update were "poorly aligned with the Aichi Biodiversity Targets, in terms of scope and the level of ambition." Consequently, many of the goals highlighted in 2010 have not been met, with just six partially met. This failure to meet the direct objectives of the CBD also undermines efforts to address climate change and threatens the achievement of the Sustainable Development Goals.

According to the scientific journal [Nature](#), the goals of the 2010 CBD update were not met partly because they weren't readily measurable and partly because participating countries did not need to report the steps they were taking to achieve the goals.

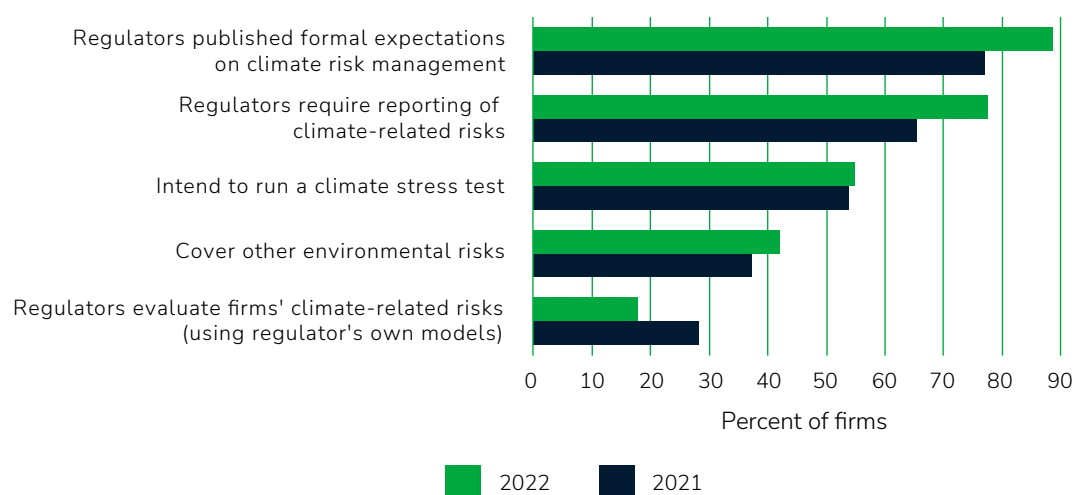
After COVID-related delays, in December 2022, a [revamped Global Biodiversity Framework](#) was agreed to at [COP 15](#) — a UN biodiversity conference held in Montreal. Specifically, participating CBD countries agreed to protect 30% of nature by 2030 — the so-called 30 by 30. Among the targets that were approved were a couple that are particularly relevant for financial institutions:

- Target 15, which requires large and transnational companies and financial institutions to “monitor, assess, and transparently disclose their risks, dependencies and impacts on biodiversity” for their “operations, supply, and value chains and portfolios.”
- Target 19, which calls for substantial and progressive increases in the level of financial resources from all sources (including private businesses) to implement national biodiversity strategies. This includes payment for ecosystem services, green bonds, and biodiversity offsets and credits.

What Actions Are Regulators Taking?

Our Fourth Annual Climate Risk Management Survey found that an increasing number of regulators (42%) are now explicitly looking at risks beyond climate change (Figure 8).

Figure 8: Regulatory Expectations



When we discuss regulators’ expansion into non-climate environmental risks, it makes sense to start with the latest work performed by the Network of Central Banks and Supervisors for Greening the Financial System (NGFS). As part of its 2022-2024 workplan, the NGFS launched a [Task Force on Biodiversity and Nature-Related Risks](#), with the objective of mainstreaming the consideration of these risks across NGFS workstreams.

This development comes on the heels of a [2022 report on Biodiversity and Financial Stability](#) jointly researched and written by the NGFS and the International Network for Sustainable Financial Policy Insights, Research, and Exchange (INSPIRE), an independent research network developed to better understand the financial risks from biodiversity loss.

The report cited biodiversity loss as a source of economic and financial risk that could have significant macroeconomic implications, potentially creating financial stability risks. It also urged the assessment of the financial system’s exposure to biodiversity losses, and recommended that supervisors should consider not only how to set expectations for those risks and opportunities but also how to mobilize investment for a biodiversity-positive economy.

The biodiversity efforts of the NGFS evolved alongside bank regulation of this emerging risk. In Europe, as previously mentioned, De Nederlandsche Bank (DNB) became the first regulator to investigate [how exposed financial institutions are to biodiversity loss](#). French financial institutions are required to [disclose biodiversity related information](#) including how they comply with the CBD, and the double materiality of the impacts of their portfolio and the risks from dependencies on biodiversity. Also, the Bank of England is to investigate how other environmental risks might arise, how much they could impact the U.K. financial system, [and whether they should be covered by the regulatory regime](#).

In Asia, several regulators — including Bank Negara Malaysia, the Hong Kong Monetary Authority, and the Monetary Authority of Singapore (MAS) — have a [broad scope](#) covering climate and environmental risk. MAS, for example, [expects banks to manage environmental risks](#) using standard risk management practices such as governance, risk identification, and assessment. As part of their due diligence for credit facilities and capital markets transactions, banks reporting to MAS will need to assess their customers' environmental risk.

Measurement and Disclosure Frameworks

To date, there isn't a universal framework for measuring biodiversity-related losses. However, several initiatives have been established to provide frameworks, and to develop and communicate metrics. These initiatives include:

- [Finance for Biodiversity Pledge](#): Through this action network, financial institutions can pledge to help protect and restore biodiversity and ecosystems via financing and investments. As of mid-December 2022, the pledge had been signed by 111 financial institutions with EUR 16 trillion in assets.
- UNEP FI's Principles for Responsible Banking cover a variety of topics and offer [Guidance on Biodiversity Target-setting](#), with examples of marine, terrestrial, and freshwater targets, criteria, and key performance indicators (KPIs). More than half of global banks have signed up for this initiative, and its signatories are expected to have specific, measurable, achievable, relevant, and time-bound (SMART) and ambitious targets, supplemented by defined KPIs, milestones, and action plans.
- The National Capital Finance Alliance and UNEP-WCMC have teamed up to develop [ENCORE](#) — a tool that helps businesses assess their exposure to a variety of natural capital risks, including biodiversity loss. ENCORE shows the connections between 21 ecosystem services — such as disease control, groundwater, and pollination, and production processes — under Global Industry Classification Standards (GICS).
- A Taskforce on Nature-related Financial Disclosures ([TNFD](#)) — comprising a working group of 40 financial institutions, corporates, and market service providers with more than USD 20 trillion in assets — has been established. The TNFD expects to publish a risk management and disclosure framework in September 2023.
- [Standards for the disclosure of sustainability-related financial information](#) (including biodiversity) are being developed by the International Financial Reporting Standards (IFRS) Foundation. These standards will leverage the [CDSB Biodiversity Application Guidance](#), which contains a framework for providing investors with decision-useful information.
- The [Science Based Targets for Nature](#) project measures underlying drivers of environmental degradation and biodiversity, and provides a helpful conceptual framework for linking them (Figure 9). For example, pressure on land arises from land conversion and deforestation, land degradation and overexploitation, soil pollution, and invasive species. Each of these can be measured, as can the species on land and their extinction rates, ecosystem extent (the physical area covered by an ecosystem), and the contribution of land-based species to people.

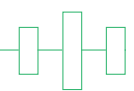
Figure 9: Pressures on Nature and States of Nature

		REALMS		
		LAND	FRESHWATER	OCEAN
PRESSURES ON NATURE	Land/Water/Sea Use Change	Conversion & deforestation	Conversion & drainage	Conversion & dredging
		<i>Habitat fragmentation</i>		
	Resource Exploitation	Land degradation (net primary production, soil carbon)	Water use (withdrawal / consumption)	
		Overexploitation of land resources, e.g. unsustainable logging	Overexploitation of freshwater resources, e.g. fishing	Overexploitation of marine resources, e.g. fishing
	Climate Change	GHG Emissions		
	Pollution	Soil pollution	Water pollution	Marine pollution
Invasive Species & Other		<i>Terrestrial invasives</i>	<i>Freshwater invasives</i>	<i>Marine invasives</i>
		Accidental mortality		
STATE OF NATURE	Species	Species population and abundance, species extinction rates		
	Ecosystems	Ecosystem extent, connectivity, and integrity		
	Nature's Contributions to People	<i>Various (e.g. pollination, water filtration, food provisioning)</i>		

SBTs or interim targets can be set	Baseline can be derived	Data gathering is possible
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Source: [Science-Based Targets for Nature – Initial Guidance for Business](#)

- Europe’s [Corporate Sustainability Reporting Directive \(CSRD\)](#) will apply to companies based in Europe and foreign companies that generate large amounts of revenue within Europe. Under its auspices, mandatory EU Sustainability Reporting Standards are being developed, which will cover the six EU environmental objectives, including biodiversity and ecosystems. The standards are intended to take effect in 2024.



Conclusion

Biodiversity loss is gaining increasing attention as an urgent and systemic risk that needs to be addressed alongside other environmental risks, such as climate change and pollution. Regulators are therefore now examining the financial risks from a broad range of environmental risks. Similarly, the scientific communities involved in assessing and addressing climate change and biodiversity loss are beginning to collaborate more closely.

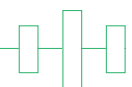
In line with this increasing focus on biodiversity and natural capital, there are likely to be profound changes in the way environmental degradation is identified, measured, monitored, managed, and reported, much as we have seen large changes for climate-related risks. It is now critical for us to understand not only the value of ecosystem services to humans but also the interconnections between climate change, biodiversity, and natural capital.

To meet the expectations of a growing range of stakeholders, risk professionals need to build up their capability and expertise in biodiversity. They must comprehend not just the risks of biodiversity loss to finance but also the biodiversity impact of their firm's financial activities. The resources identified in this primer are an excellent place to start.

About the authors

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Maxine Nelson, Senior Vice President, GARP Risk Institute (GRI), currently focuses on climate risk management. In her career, she has held several senior roles where she was responsible for global capital planning and risk modelling at banks, including global head of wholesale risk analytics and head of capital planning at HSBC. She also previously worked at the U.K. Financial Services Authority, where she was responsible for significantly expanding counterparty credit risk management during the last financial crisis.



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