Environmental risks

"To effectively manage environmental risk, financial institutions must quantify it. Financial sustainability cannot be separated from environmental sustainability, and only numbers can prove it".
Janet Yellen[57]

As environmental risks increasingly attract the attention of supervisors and economic and financial institutions, there is a pressing need for effective measurement frameworks. Management Solutions is therefore making progress in developing a methodology to measure the impact of environmental risks on financial institutions' portfolios. This section provides an overview of the current regulatory environment for risks arising from natural environmental degradation and presents the methodological basis for quantifying them in a robust manner.

Definition of risks

Risks related to nature (often referred to as natural or environmental risks), encompass the potential negative impacts resulting from the degradation of ecosystems, the loss of biodiversity and the inability of ecosystems to continue to provide natural resources at the rate required by economic agents. These risks manifest themselves in various forms, such as physical disruptions caused by water scarcity, soil degradation, deforestation, or the collapse of ecosystems essential to industries such as agriculture or manufacturing. As experts increasingly recognize the link between natural ecosystems and economic activity, the importance of managing these risks has risen significantly on the global policy agenda.

The urgency stems from the rapid loss of biodiversity, which is occurring at a rate unprecedented in human history, as evidenced by the fact that, according to the Stockholm Resilience Center[58], six of the nine planetary boundaries of the Earth's living systems have already been breached (see Figure 22).

In addition to these physical impacts, companies also face transition risks. These include social pressures, regulatory changes and market transformations as stakeholders from governments to consumers demand greater transparency and accountability in the management of natural resources. The growing recognition of systemic risks, affecting entire economies through interconnected supply chains, puts biodiversity loss and nature degradation at the forefront of global policy agendas.

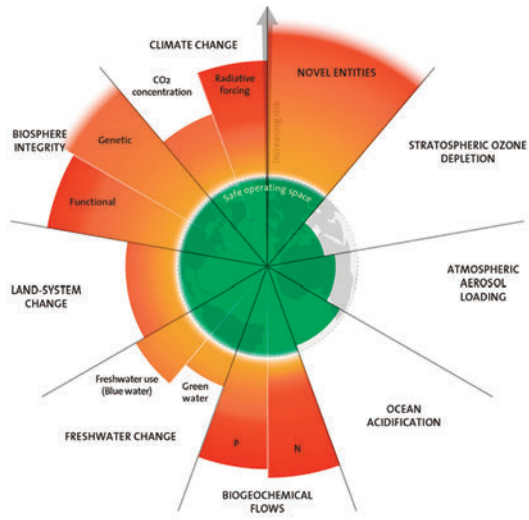
Governments are also stepping in, developing and implementing policies to prevent and mitigate these risks, while companies face the challenge of adapting to growing social awareness and regulatory obligations around natural resource management.

One of the main frameworks for addressing nature-related risks is the Taskforce on Nature-related Financial Disclosures Framework[59]. This initiative is led by experts from the financial, business and scientific sectors, as well as non-governmental organizations, with the support of international partners such as the United Nations and the World Economic Forum. Its mission is to create a framework to help organizations manage and disclose the financial risks related to nature, such as biodiversity loss and ecosystem degradation. The framework is based on four key pillars: governance, strategy, risk and impact management, and metrics and targets. This closely aligns with the structure established by the TCFD and reflects the growing intersection of climate and natural risk information.

The TNFD also distinguishes between acute and chronic natural hazards. Acute risks arise from immediate natural disasters - such as water shortages, biodiversity loss or ecosystem degradation - which can disrupt supply chains, damage infrastructure and cause significant economic losses. Chronic risks, on the other hand, stem from long-term environmental degradation - such as soil erosion or declining water quality - which can reduce agricultural productivity and undermine the long-term sustainability of natural resource-dependent industries.

[57] Janet Louise Yellen (2021), U.S. Secretary of the Treasury.
[58] Stockholm Resilience Center (2023).
[59] https://tnfd.global/.

Figure 22: Six of the nine planetary boundaries have been crossed.



Source: Richardson et al., 2023

The regulatory landscape for nature-related risks is evolving rapidly, driven largely by EU regulations such as the Corporate Sustainability Reporting Directive (CSRD)[60] and the European Sustainability Reporting Standards (ESRS)[61]. These frameworks impose extensive reporting requirements on companies, requiring transparency on environmental, social and governance (ESG) factors.

In particular, the Directive requires companies to publish detailed information on their nature-related risks and impacts. This includes the concept of dual materiality, which assesses not only the financial impact of natural risks on the company, but also the company's own impact on nature. Reporting under the CSRD covers a wide range of topics, including greenhouse gas reduction targets, biodiversity conservation, pollution mitigation and water resource management. The CSRD and ESRS establish a transition period for companies to fully comply with these disclosure standards, with adoption deadlines varying depending on the size and type of company.

These regulations aim to standardize and improve corporate transparency on nature-related risks and ensure that stakeholders, including investors and consumers, are well informed about how companies manage their environmental impacts. This change is crucial as financial institutions, such as banks and asset managers, increasingly scrutinize the nature-related risks included in their portfolios.

European banks, in particular, have been proactive in adapting their operations to these regulatory changes. Many have adopted tools such as the Exploring Natural Capital Opportunities, Risks and Exposure (ENCORE)[62] framework and the Aqueduct Water Risk Atlas[64] to assess nature-related risks in their business models. These tools help financial institutions map their dependence on natural resources and assess risks associated with biodiversity loss and water stress. At present, this framework does not fully integrate a forward-looking vision, which is one of the drawbacks of this approach. However, the lack of nature-related scenarios is a limitation that, once addressed, will make it possible to incorporate such a prospective approach.

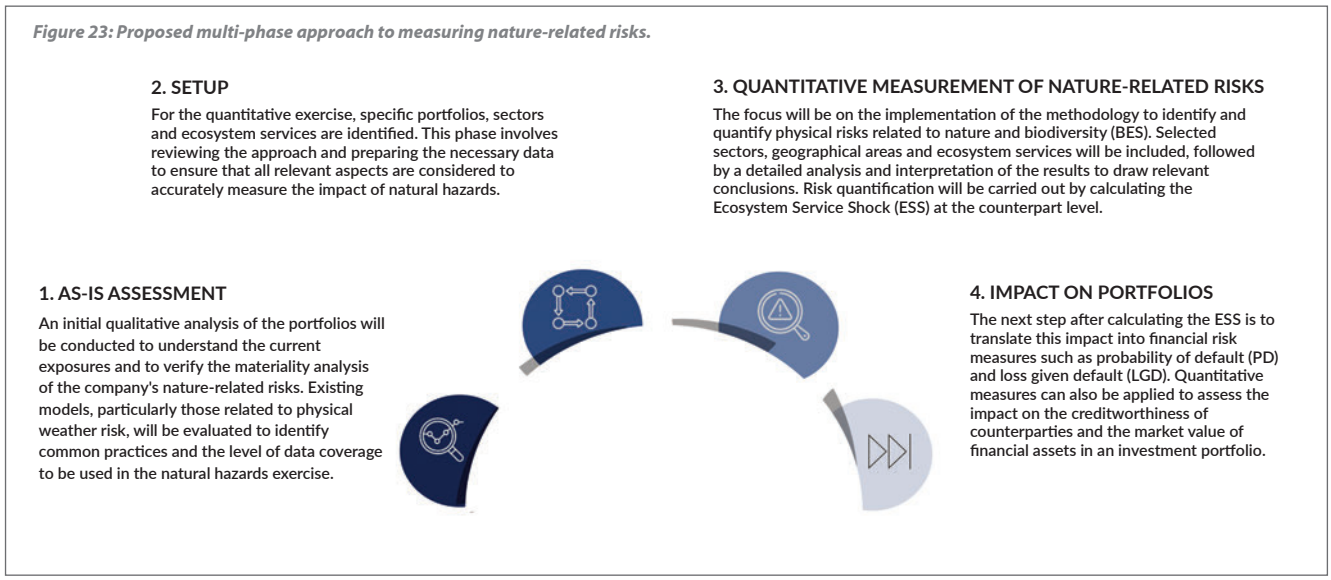
TNFD also recommends sector- and nature-specific guidance to help companies navigate the complex landscape of nature-related risks. As biodiversity becomes an integral part of financial risk assessment, TNFD's LEAP (Locate, Assess, Assess, Assess, Prepare) methodology provides companies with a systematic approach to assess how nature-related risks affect their operations. Financial institutions, particularly in the EU, are now required to integrate these assessments into their governance and risk management structures.

Looking ahead, the integration of nature-related risks into corporate governance is set to become even more stringent as regulators increasingly emphasize the need for nature-friendly business practices. Financial institutions that fail to take these risks into account may face significant legal, solvency and reputational consequences as global regulations tighten and stakeholders demand greater accountability.

In conclusion, natural risks represent a growing challenge for both companies and the financial sector, as biodiversity loss and environmental degradation intensify. With the emergence of frameworks such as the TNFD and regulatory developments in certain regions, especially the European Union, the regulatory landscape is becoming clearer, laying

[60] Directive on corporate sustainability reporting.
[61] ESRS: European Sustainability Reporting Standards.
[62] ENCORE (2023).

Figure 23: Proposed multi-phase approach to measuring nature-related risks.



the groundwork for more comprehensive and standardized disclosure of nature-related information. In this context, companies must not only recognize their dependence on natural ecosystems, but also proactively manage the risks associated with their degradation to ensure long-term sustainability.

Measuring the impact on the asset portfolio: investment and loan portfolio

The approach proposed in this section for measuring the impact of nature-related risks on asset portfolios - in particular investment and credit portfolios - is based on integrating biodiversity and ecosystem services (BES) into financial risk assessment, and overcoming challenges such as data availability and the current development of scenario analysis for these risks.

This approach, structured in several phases (see Figure 23), focuses on assessing the material impacts of biodiversity and ecosystem services on economic and financial activities. Natural risks, especially physical risks such as water scarcity, deforestation and land degradation, are considered to be immediate threats and highly relevant to portfolio stability.

The objective is to establish a quantitative framework for measuring the impact of these physical risks on the credit risk of a corporate loan portfolio or on the market risk in an investment portfolio, with a focus on short-term risk exposure. This is because forward-looking scenario analysis on nature-related risks is still in its infancy. A 2023 Network for Greening the Financial System (NGFS) report[64] highlights the importance of assessing economic and financial risks linked to nature. While comprehensive, forward-looking scenarios for these risks do not yet exist, the NGFS emphasizes that qualitative and static assessments can provide valuable insight into the current exposure of portfolios to natural risks.

The steps in the proposed approach to quantitatively measure a financial institution's exposure to physical natural risk are described below.

1. The first step is to assess the current state of the portfolio and its exposure to natural risks. To this end, a preliminary qualitative analysis is carried out to identify the sectors and assets with the greatest exposure, taking into account the critical ecosystem services for each sector. In addition, the materiality of these risks is assessed by analyzing the extent to which biodiversity loss and ecosystem degradation affect key sectors of the portfolio, such as agriculture, forestry and water-intensive industries. This phase also includes an assessment of any physical climate risk models already in use at the company, to identify possible methodological synergies and explore the availability of relevant data.

2. The second phase, called "set-up", consists of refining the approach and collecting the necessary data to measure the exposure to natural hazards as accurately as possible, based on the findings of the first phase. This phase involves a detailed identification of counterparty and sector information, including specific data on the activities and geographic locations of clients and their production sites, so that location-specific natural risks are captured. During this stage, a preliminary data model is also established to identify gaps and possible strategies to ensure adequate coverage of relevant information.

[64] NGFS (2023).

3. The core of the approach is the third step: quantifying the physical risks related to nature and their impact on the portfolio. It should be noted that these risks are defined as the threat of loss of natural capital, which includes the decline of renewable and non-renewable natural resources, the extinction of animal and plant species, and the deterioration of the interactions between these elements. These risks are generally associated with the loss of biodiversity and ecosystem services (BES).

   In this process, a comprehensive analysis of the sectoral exposure to BES is performed, taking advantage of the analysis performed in the first step and focusing on those BES that represent a greater risk materiality for the entity. This allows quantification of the ecosystem services most vulnerable to natural hazards. The assessment can be based on tools such as the ENCORE methodology or WWF's "Scape Risks" map[65], which help prioritize the ecosystem services and sectors most relevant to the portfolio. Risk quantification is done by calculating the Ecosystem Service Shock (ESS), which combines hazard probability, sector exposure and geographic area vulnerability to estimate the financial impact of these risks in specific sectors and geographic areas. For example, risks such as water scarcity or deforestation are assigned a score based on their potential impact on specific sectors. The ESS is calculated for each sector and geographic region of each counterparty, assessing how ecosystem services, such as water availability or pollination services, affect the counterparties in the portfolio. The ESS quantification methodology is based on several key components. First, hazard probability is calculated, using historical data such as the World Bank's Development Indicators database[66] and other sources[67] that provide estimates of the likelihood of certain natural hazards affecting specific sectors. The next step is to analyze sectoral exposure, or the degree to which a sector depends on particular ecosystem services; for example, sectors that rely heavily on water or fertile soils are more vulnerable to events such as drought or soil erosion. Finally, the vulnerability of each country is considered, taking into account specific factors such as economic resilience and environmental policies. Countries with weaker environmental protection or a high dependence on natural capital are considered more vulnerable. At the end of this process, the ESS provides a quantitative estimate of potential losses from ecosystem degradation or biodiversity loss, giving a detailed picture of the impact of natural hazards on portfolio stability.

4. Once the ESS has been calculated, the next step is to translate this impact into traditional financial risk parameters such as probability of default (PD) and loss given default (LGD). For this purpose, structural valuation

[65] Biodiversity RiskFilter_Methodology, WWF Risk Filter, WWF.
[66] World Bank - World Development Indicators.
[67] NGFS (2023).

models are used to estimate PD and LGD. Similarly, it is possible to extend the analysis using quantitative methods to assess the impact on the creditworthiness of counterparties and, in addition, to estimate the impact on the market value of financial assets in an investment portfolio.

The approach described allows a first estimate of the exposure to natural risk to be obtained through a quantitative and granular analysis. From these results, aggregate visualizations and heat maps can be generated to facilitate more precise materiality exercises and, on the other, provide economic assessments of the impact on the entity. By way of illustration, we present the results obtained for a fictitious portfolio of corporate loans (see Figure 24).

The values shown are obtained by consolidating the ESS of the counterparties, determined by individually assessing each counterparty's natural risk exposure, in the main country/sector groups.

These models provide general estimates of how nature-related risks affect solvency and potential losses. However, they do not take into account counterparty-specific mitigation strategies and resilience factors, which would require more detailed data and complex analysis.

The methodology described has limitations, such as the lack of forward-looking scenarios comparable to those for climate risks, and in 2024 there are still no widely accepted models for these risks. It therefore focuses on short-term assessments using historical data and static analysis. However, it is possible to integrate this methodology for certain specific natural hazards (some BES) using IPCC scenario projections. This approach represents a key area for the future development of quantitative measurement methodologies.

In addition, the limited availability of data on ecosystem services, sectoral dependencies and geographic exposure implies resorting to approximations that may affect accuracy. The lack of detailed geolocation of assets also makes it difficult to adequately capture local risks.

Despite these limitations, the methodology provides a structured approach to measuring the impact of biodiversity loss and ecosystem degradation on investment and credit portfolios. By integrating ecosystem services data into traditional risk models, financial institutions can take a first step toward quantifying their exposure to these emerging risks. This leads to a more robust future assessment that not only helps meet regulatory requirements, but also strengthens internal risk management and facilitates better-informed decisions to mitigate these impacts.

Figure 24: Example of aggregation of results for an illustrative portfolio, showing the portfolio's ESS broken down by country and sector.

Sector/Country	United States	France	Germany	China	United Kingdom	Italy	Spain	Switzerland	Netherlands	India	Rest of the World
CONSUMER DISCRETIONARY	-0.022%	-0.014%	-0.014%	-0.008%	-0.003%	-0.001%	-0.003%	-0.001%	-0.001%	0.000%	-0.022%
CONSUMER STAPLES	-0.049%	-0.017%	-0.023%	-0.012%	-0.003%	-0.004%	-0.002%	-0.002%	-0.001%	-0.002%	-0.030%
ENERGY	-0.013%	-0.006%	-0.001%	-0.006%	-0.004%	-0.006%	-0.002%	-0.001%	-0.004%	-0.005%	-0.025%
FINANCIALS	-0.019%	-0.012%	-0.005%	-0.005%	-0.008%	-0.008%	-0.008%	-0.004%	-0.005%	-0.009%	-0.033%
HEALTH CARE	-0.119%	-0.064%	-0.038%	-0.053%	-0.022%	-0.027%	-0.004%	-0.016%	-0.005%	-0.009%	-0.097%
INDUSTRIALS	-0.028%	-0.008%	-0.011%	-0.007%	-0.004%	-0.001%		-0.006%	-0.003%	-0.003%	-0.043%
INFORMATION TECHNOLOGY	-0.049%	-0.012%	-0.002%	-0.004%	-0.020%	-0.003%		-0.004%	-0.008%		-0.028%
MATERIALS	-0.063%	-0.003%	-0.011%	-0.004%	-0.003%	-0.001%	-0.002%	-0.006%	-0.001%	0.000%	-0.014%
REAL ESTATE	-0.065%	-0.027%	-0.013%	-0.009%	-0.024%	-0.007%	-0.014%	-0.004%	-0.008%	-0.002%	-0.049%
TELECOMMUNICATION SERVICES	-0.023%	-0.025%	-0.007%	-0.009%	-0.009%	-0.024%	-0.009%	-0.004%	-0.006%	-0.005%	-0.052%
UTILITIES	-0.085%	-0.016%	-0.008%	-0.014%	-0.005%	-0.005%		-0.002%	-0.003%	-0.001%	-0.027%