Primer on biodiversity and nature-related risks, opportunities and regulation for those working in financial institutions

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This paper looks at the current crisis in nature, how it represents financial and economic risks, the growing policy and regulatory engagements, and how biodiversity and nature-related (biodiversity) risks intersect with climate and other risks, including the emerging efforts to include them in climate scenarios.

It will help those in financial institutions looking for an overview of the key biodiversity issues ahead of deeper dives into specific elements.

INTRODUCTION: NATURE IS IN CRISIS

Is there any more precious commodity than life on earth? Dr Katie Collins, at the Natural History Museum, states that the background extinction rate is between 0.1 and 1.0 species per 10,000 species per 100 years. She says, "The current rate of extinction is between 100 and 1,000 times higher than the pre-human background rate of extinction, which is jaw-dropping. We are definitely going through a sixth mass extinction."[1]

The scale and impact of this biodiversity crisis show up in many different ways. Approximately 1 million plant and animal species are threatened with extinction, alongside which the 2022 Living Planet Report by the World Wide Fund for Nature (WWF)[2] shows a 69% decline in wildlife populations since 1970. This decline has been more prevalent in areas of relative abundance, with a 94% decline observed in Latin America and the Caribbean.[3] Humanity's use, and misuse, of our planetary resources are driving these changes. Approximately 46% of the land once covered by forests, wild grasslands and shrubs has been lost since humanity developed agriculture.[4] Today agriculture accounts for over half of all habitable land[5] with agricultural expansion causing almost 90% of today's global deforestation.[6] Other impacts from land use changes include changes in water use and pollution from chemicals and plastic waste.

It is estimated that we currently exceed the sustainable capacity of nature's resources by over 70%[7] with a global population that is still predicted to rise another 30%.[8] Moreover, there are very significant inequalities in the use of resources, with the richest 16% of the population responsible for almost 50% of gross domestic product (GDP) and a hugely disproportionate level of resources. [9] These challenges are urgent and intertwined. They can't be solved without radical changes in how we engage with nature and each other.

[1] Begum, T. (21 February 2023). What is mass extinction and are we facing a sixth one? Natural History Museum. Retrieved 1 February 2024 from https://www.nhm.ac.uk/discover/what-is-mass-extinction-and-are-we-facing-a-sixth-one.html.

[2] WWF. Living Planet Report 2022. Retrieved 1 February 2024 from https://wwfint.awsassets.panda.org/downloads/embargo_13_10_2022_lpr_2022_full_report_single_page_1.pdf.

[3] WWF (12 October 2022). WWF's Living Planet Report reveals a devastating 69% drop in wildlife populations on average in less than a lifetime. Retrieved 1 February 2024 from https://wwf.panda.org/wwf_news/?6574941/WWFs-Living-Planet-Report-reveals-a-devastating-69-drop-in-wildlife-populations-on-average-in-less-than-a-lifetime.

[4] Ehrenberg, R. (2 September 2015). Global forest survey finds trillions of trees. Nature. Retrieved 1 February 2024 from https://www.nature.com/articles/nature.2015.18287.

[5] Ritchie, H. (11 November 2019). Half of the world's habitable land is used for agriculture. Our World in Data. Retrieved 1 February 2024 from https://ourworldindata.org/global-land-for-agriculture.

[6] Food and Agriculture Organization of the United Nations (6 November 2021). COP26: Agricultural expansion drives almost 90 percent of global deforestation. Retrieved 1 February 2024 from https://www.fao.org/newsroom/detail/cop26-agricultural-expansion-drives-almost-90-percent-of-global-deforestation/en.

[7] Lin, D. et al. (May 2023). Estimating the Date of Earth Overshoot Day 2023. Global Footprint Network. Retrieved 1 February 2024 from https://www.overshootday.org/content/uploads/2023/06/Earth-Overshoot-Day-2023-Nowcast-Report.pdf. 1.1 / 1.5 shortfall/biocapacity (gha pp) = 73%.

[8] United Nations. Global Issues: Population. Retrieved 1 February 2024 from https://www.un.org/en/global-issues/population. 10.4 bn / 8 bn = 1.3.

[9] Dasgupta, P. (2021), The Economics of Biodiversity: The Dasgupta Review. Abridged Version, Table 1. (London: HM Treasury). Retrieved 1 February 2024 from https://assets.publishing.service.gov.uk/media/6014329ce90e076265e4d9ba/Dasgupta_Review_-_Abridged_Version.pdf. 16% of population.

BIODIVERSITY AND NATURE-RELATED RISKS ARE FINANCIAL AND ECONOMIC RISKS

The World Economic Forum 2023 global risks report[10] ranked biodiversity loss and ecosystem collapse as its third-largest risk over the next 10 years and it has estimated that $44 trillion, over 50% of global GDP, is moderately or highly dependent on nature.[11] Ecosystems provide various benefits to society which are described as "ecosystem services." Whilst ecosystems provide tangible and intangible benefits, their "ecosystem services" can be thought of in a financial sense in the value of the goods produced or the cost of replicating the services provided.[12] The range of ecosystem services and dependencies are illustrated in Figure 1.

FIGURE 1: ECOSYSTEM SERVICES AND DEPENDENCIES

Ecosystem Services	Example Services and Provisions
Provisioning Services	Food and feed Fibres and other materials (e.g., cotton, timber)
Regulating Services	Air quality and local/global climate Water security Hazard regulation (e.g., vs. flood/storms) Habitat intactness (e.g., to support provisioning or disease control)
Cultural Services	Recreation-related services Visual amenity services Education, scientific and research services Spiritual, artistic and symbolic services
Supporting Services	Soil and sediment retention Solid waste remediation

Source: Based on Nature-related Financial Risks: A Conceptual Framework to Guide Action by Central Banks and Supervisors, Network of Central Banks and Supervisors for Greening the Financial System 2023[13]; Handbook for Nature-related Financial Risks, CISL, 2021. [14]

[10] World Economic Forum. The Global Risks Report 2024, 19th ed. Retrieved 1 February 2024 from https://www3.weforum.org/docs/WEF_The_Global_Risks_Report_2024.pdf.

[11] Russo, A. (19 January 2020). Half of World's GDP Moderately or Highly Dependent on Nature, Says New Report. World Economic Forum. Retrieved 1 February 2024 from https://www.weforum.org/press/2020/01/half-of-world-s-gdp-moderately-or-highly-dependent-on-nature-says-new-report/.

[12] The concept of ascribing financial values to ecosystems and ecosystem services can be controversial. See "Natural capital – an actuarial perspective" for a more in-depth discussion, available at https://www.actuaries.org.uk/system/files/field/document/Biodiversity_NatCap_Sessional.pdf.

[13] NGFS (September 2023). Nature-Related Financial Risks: A Conceptual Framework to Guide Action by Central Banks and Supervisors. Retrieved 1 February 2024 from https://www.ngfs.net/sites/default/files/medias/documents/ngfs_conceptual-framework-on-nature-related-risks.pdf.

[14] CISL (2021). Handbook for Nature-Related Financial Risks. Retrieved 1 February 2024 from https://www.cisl.cam.ac.uk/system/files/documents/handbook-for-nature-related-financial.pdf.

TYPES AND DRIVERS OF NATURE-RELATED RISKS

The Cambridge Institute for Sustainability Leadership (CISL) Handbook for Nature-Related Financial Risks identifies five direct drivers of physical biodiversity loss—climate change, land-use change (e.g., deforestation), overexploitation of natural resources (e.g., overfishing, top-soil depletion), pollution (air, land and water) and invasive species. Our economic activity significantly accelerates the first four drivers, with invasive species typically arising from human interactions and climate change.[15]

As nature declines the direct physical losses in biodiversity impair the ecosystem services based on them, leading to direct and indirect financial consequences. Further financial consequences arise from shifts in policy, regulation, consumer demand and litigation. Similar to the now familiar framework for climate-related risks, we can consider biodiversity and nature-related risks divided between these physical, and transition and legal liability, risks:

Physical risks: Ecosystem services depend on robust natural systems that typically need the environment's stability, including climate and ecosystem equilibria, such as soil quality or biome ecology. Physical risks can be event-driven (extreme weather, fire) or longer-term trends (temperature, rainfall).

Transition and legal liability risks: Investments can be impacted by regulatory changes or shifts in consumer demands to address environmental harms. This can have abrupt or disorderly impacts on business lines, supply chains and profitability, and even lead to stranded assets. The risks of business activities that lead to biodiversity losses, or infringements of regulations, can lead to legal liabilities or, at the very least, reputational damages.

A better appreciation of these risks could lead to a nature positive economy as shown in Figure 2.[16]

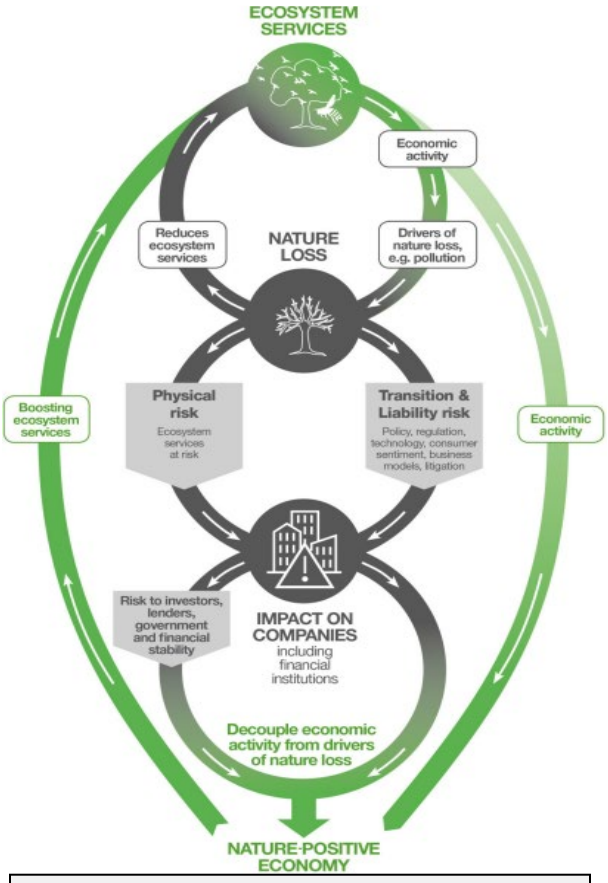


FIGURE 2: CONNECTIONS BETWEEN ECONOMIC ACTIVITY, NATURE, AND FINANCIAL RISK
Source: CISL Handbook for Nature-related Financial Risk

Transmission of physical and transition risks into the financial markets

CISL's Handbook for Nature-related Financial Risks (2021)[17] identifies six transmission channels whereby these biodiversity risks can become financial risks:

1. **Disruption of activities or the value chain:** From changes in costs, demands, business interruption and productivity shifts.
2. **Raw materiality price volatility:** Variability in pricing, for example from poor and variable harvests or from the increases in pest and other biological hazards.
3. **Pricing externalities:** The increase of regulation to price the economic, social and/or environmental impacts, for example water or nitrogen fertiliser taxes.
4. **Stranded assets:** While most stranded asset work has focused on climate change impacts, the same principles apply to biodiversity. For example, they could arise from restrictions on freshwater usage.
5. **Adjustment or relocation of activities:** Reflecting longer-term shifts in profitability and competitive advantage in particular jurisdictions or locations.
6. **Capital destruction:** Direct physical losses, for example loss of soil fertility from seawater flooding.

An increased focus on pricing externalities, along with increased regulation and shifts in consumer demand, is increasing the transition risks associated with biodiversity loss. As awareness and understanding of the risks associated with biodiversity loss grows, and as

[15] Ibid.
[16] Ibid.
[17] Ibid.

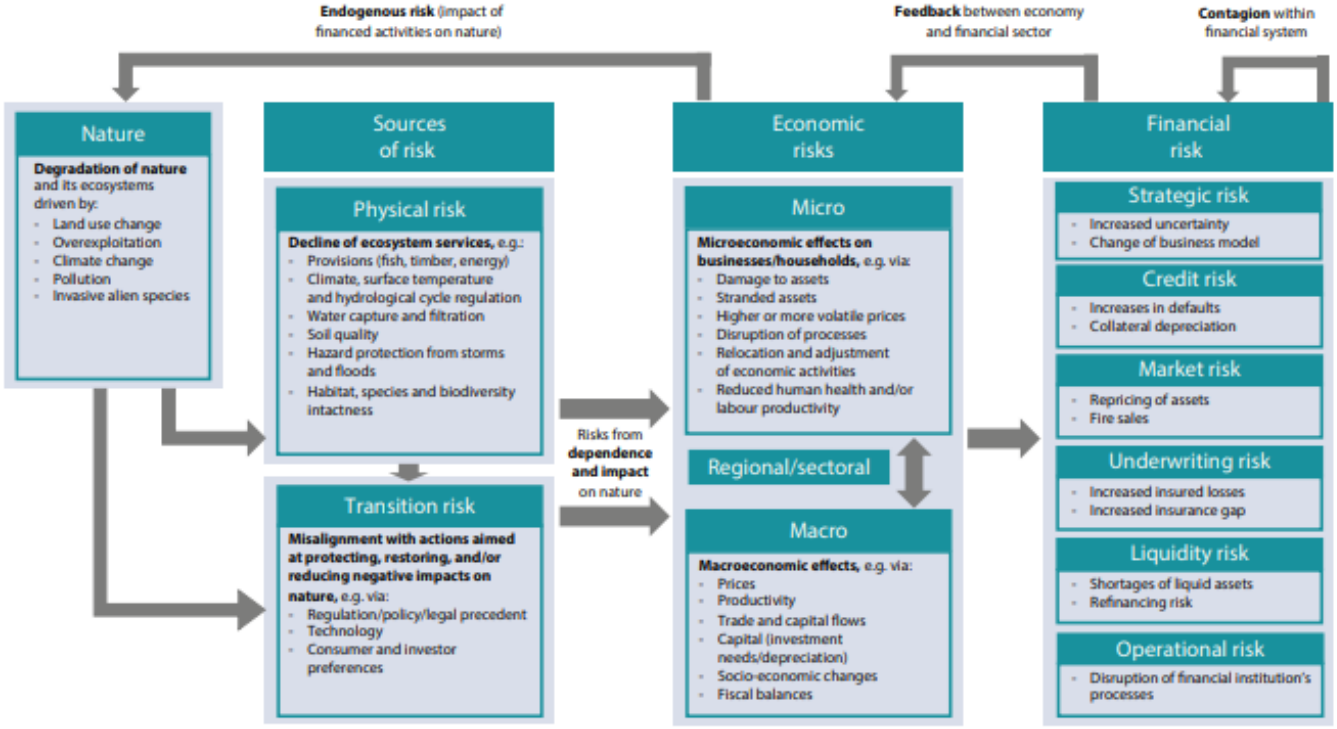
new technologies are developed, public sentiment and regulation is likely to shift and adapt. This is likely to lead to reduced returns for firms which have high impacts on nature, such as links to deforestation. These reduced returns could manifest through increased costs, reduced demand, reputational damage or legal liabilities. The need for corporates to manage biodiversity risks and support nature-positive outcomes is emerging as best practice for responsible businesses. Initiatives such as the Science-Based Targets Network (SBTN)[18] and the Taskforce on Nature-related Financial Disclosures (TNFD) are creating frameworks for companies to develop science-based targets and disclose their nature-related risks. Investors and financial institutions are increasingly looking at their business and investment risk exposures, representing 33% of the initial TNFD signatories.[19]

Furthermore, a systems perspective can help understand the broader macroeconomic impacts that these disruptions can lead to, particularly from severe, acute events such as:

- Biodiversity losses magnifying the effects of extreme weather events, reducing ecosystem services from food, hazard protection and recreational services.
- Price inflation leading to cost-of-living crises, creating broader social and geopolitical tensions.
- Health impacts from disease-bearing invasive species or novel zoonotic pathogens crossing into human populations.
- Potential for tipping points, for example Amazon rainforest dieback, with significant local and global impacts.[20]

These transmissions from nature loss drivers, through physical and transition risks into the economy and financial markets, were summarised by the Network of Central Banks and Supervisors for Greening the Financial System (NGFS) in the diagram in Figure 3.[21]

FIGURE 3: TRANSMISSION CHANNELS



Source: NGFS. Adapted from Swartzman, R. et. al. (2021). A "Silent Spring" for the Financial System? Exploring Biodiversity-Related Financial Risks in France.

Similar to climate change, this illustrates how nature loss interacts with the traditional risk types that financial institutions are exposed to, from strategic and asset risk through to underwriting and operational risks.

[18] See https://sciencebasedtargetsnetwork.org/.

[19] TNFD (16 January 2024). 320 companies and financial institutions to start TNFD nature-related corporate reporting. Press release. Retrieved 1 February 2024 from https://tnfd.global/wp-content/uploads/2024/01/TNFD-Early-Adopters_Press-release-final.pdf.

[20] University of Exeter (2023). Global Tipping Points Report 2023: 2.2.3.1 Amazon dieback. Retrieved 1 February 2024 from https://global-tipping-points.org/section2/2-tipping-point-impacts/2-2-assessing-impacts-of-earth-system-tipping-points-on-human-societies/2-2-3-impacts-of-biosphere-tipping-points/2-2-3-1-amazon-dieback/.

[21] NGFS (September 2023), Nature-Related Financial Risks, op cit.

GROWING REGULATION: KUNMING-MONTREAL 2022 GLOBAL BIODIVERSITY FRAMEWORK, TNFD AND BEYOND

This economic imperative to protect biodiversity is initiating responses from policymakers. In 2022, the UN convened global governments across two conferences to create and agree the Kunming-Montreal 2022 Global Biodiversity Framework (GBF).[22] The agreement sets out four key goals: (1) maintain, enhance and restore ecosystems; (2) support sustainable use of ecosystem services; (3) ensure benefits are shared fairly and equitably, particularly with indigenous peoples and local communities; and (4) ensure adequate financial resources are made available.

Twenty-three targets underpin these goals. They include the 30x30 target of protecting at least 30% of global land and 30% of the oceans by 2030. There are also three targets for the financial sector which promote the integration of biodiversity into investment decision-making (#14), the disclosure of nature-related dependencies, impacts, risks and opportunities, in particular by large companies and financial institutions (#15) and increasing private sector investment in support of biodiversity (#19).

Increasingly regulatory bodies have sought ways to increase the commercial and financial sector engagement with biodiversity and nature-related risks and opportunities. Examples include:

- EU Deforestation Regulation, June 2023,[23] which ensures that products consumed by EU citizens do not contribute to deforestation or forest degradation worldwide.
- NGFS paper "Nature-Related Financial Risks: A Conceptual Framework to Guide Action by Central Banks and Supervisors," September 2023[24]; recommendations toward the development of scenarios for assessing nature-related economic and financial risks, December 2023[25]; and "The Green Scorpion: The Macro-Criticality of Nature for Finance,[26] all of which provide guidance to the financial sector on engaging with biodiversity and nature-related risks.
- "Mobilising Green Investment: 2023 Green Finance Strategy," March 2023),[27] which sets out a UK framework to encourage investment in technologies to support net-zero and environmental objectives.
- TNFD final recommendations, September 2023, and its discussion paper on conducting advanced scenario analysis, [28] December 2023. (See "The Taskforce for Nature-Related Financial Disclosures" below.)

These are alongside broader sustainability efforts such as UK and EU green taxonomies,[29] Sustainability Disclosure Requirements (SDR) [30] /Sustainable Finance Disclosures Regulation (SFDR)[31] and reporting requirements such as the EU's Corporate Sustainability Reporting Directive (CSRD).[32] Undoubtedly, the efforts and expectations of investors, the requirements from them and the companies they invest in will all grow.

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[22] UN. Kunming-Montreal Global Biodiversity Framework. Retrieved 1 February 2024 from https://unctad.org/topic/trade-and-environment/biotrade/kunming-montreal-global-biodiversity-framework#:~:text=A%20landmark%20deal%20for%20biodiversity,the%20Convention%20on%20Biological%20Diversity.

[23] European Commission. Regulation on Deforestation-free Products. Retrieved 1 February 2024 from https://environment.ec.europa.eu/topics/forests/deforestation/regulation-deforestation-free-products_en.

[24] NGFS (September 2023), Nature-Related Financial Risks, op cit.

[25] NGFS (13 December 2023). NGFS publishes a Technical Document providing recommendations for the development of nature-related scenarios. Press release. Retrieved 1 February 2024 from https://www.ngfs.net/en/communique-de-presse/ngfs-publishes-technical-document-providing-recommendations-development-nature-related-scenarios.

[26] Ranger, N. et al. (13 December 2023). The Green Scorpion: The Macro-Criticality of Nature for Finance. NGFS Occasional Paper. Retrieved 1 February 2024 from https://www.ngfs.net/sites/default/files/medias/documents/ngfs_occasional_paper_green-scorpion_macrocriticality_nature_for_finance.pdf.

[27] HM Government (March 2023). Mobilising Green Investment: 2023 Green Finance Strategy. Retrieved 1 February 2024 from https://assets.publishing.service.gov.uk/media/643583fb877741001368d815/mobilising-green-investment-2023-green-finance-strategy.pdf.

[28] TNFD (December 2023). Discussion paper on conducting advanced scenario analysis. Retrieved 1 February 2024 from https://tnfd.global/publication/discussion-paper-on-conducting-advanced-scenario-analysis/.

[29] European Commission. EU Taxonomy for Sustainable Activities. Retrieved 1 February 2024 from https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/eu-taxonomy-sustainable-activities_en.

[30] Financial Conduct Authority (November 2023). PS23/16: Sustainability Disclosure Requirements (SDR) and Investment Labels. Retrieved 1 February 2024 from https://www.fca.org.uk/publication/policy/ps23-16.pdf.

[31] European Commission. Sustainability-Related Disclosure in the Financial Services Sector. Retrieved 1 February 2024 from https://finance.ec.europa.eu/sustainable-finance/disclosures/sustainability-related-disclosure-financial-services-sector_en.

[32] European Commission. Corporate Sustainability Reporting. Retrieved 1 February 2024 from https://finance.ec.europa.eu/capital-markets-union-and-financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en.

THE TASKFORCE FOR NATURE-RELATED FINANCIAL DISCLOSURES

TNFD[33] will be a key driver for integrating biodiversity into decision-making, and almost certainly will be at the core of the Kunming-Montreal's push for disclosures. It follows a very similar structure to the Taskforce on Climate-Related Financial Disclosures (TCFD),[34] and outlines 14 recommended disclosures divided into four pillars - governance, strategy, risk and impact management, metrics and targets. A key distinction between TNFD and TCFD is its inclusion of impact – so that TCFD's "Risk management" pillar has been replaced by "Risk & Impact management" as well as a great focus on location which is critical in a biodiversity context.

Several corporations have voluntarily committed to these disclosures which we expect will become mandatory in the next few years.

FIGURE 4: TNFD'S FOUR PILLARS AND 14 RECOMMENDED DISCLOSURES *Source: TNFD*

Governance	Strategy	Risk & impact management	Metrics & targets
Disclose the organisation's governance of nature-related dependencies, impacts, risks and opportunities.	*Disclose the effects of nature-related dependencies, impacts, risks and opportunities on the organisation's business model, strategy and financial planning where such information is material.*	*Describe the process used by the organisation to identify, assess, prioritise and monitor nature-related dependencies, impacts, risk and opportunities.*	*Disclose the metrics and targets used to assess and manage material nature-related dependencies, impacts, risks and opportunities.*
Recommended Disclosures A. Describe the board's oversight of nature-related dependencies, impacts, risks and opportunities. B. Describe management's role in assessing and managing nature-related dependencies, impacts, risks and opportunities. C. Describe the organisation's human rights policies and engagement activities, and oversight by the board and management, with respect to Indigenous Peoples, Local Communities, affected and other stakeholders, in the organisation's assessment of, and response to, nature-related dependencies, impacts, risks and opportunities.	**Recommend Disclosures** A. Describe the nature-related dependencies, impacts, risks and opportunities the organisation has identified over the short, medium and long term. B. Describe the effect nature-related dependencies, impacts, risks and opportunities have had on the organisation's business model, value chain, strategy and financial planning, as well as any transition plans or analysis in place. C. Describe the resilience of the organisation's strategy to nature-related risks and opportunities, taking into consideration different scenarios. D. Disclose the locations of assets and/or activities in the organisation's direct operations and, where possible, upstream, and downstream value chain(s) that meet the criteria for priority locations.	**Recommended Disclosures** A1. Describe the organisation's processes for identifying, assessing and prioritising nature-related dependencies, impacts, risks and opportunities in its direct operations. A2. Describe the organisation's processes for identifying, assessing and prioritising nature-related dependencies, impacts, risks and opportunities in its upstream and downstream value chain(s). B. Describe the organisation's processes for monitoring nature-related dependencies, impacts, risks and opportunities. C. Describe the organisation's processes for monitoring nature-related dependencies, impacts, risks and opportunities.	**Recommended Disclosures** A. Disclose the metrics used by the organisation to assess and manage material nature-related risks and opportunities in line with its strategy and risk management process. B. Disclose the metrics used by the organisation to assess and manage dependencies and impacts on nature. C. Describe the targets and goals used by the organisation to manage nature-related dependencies, impacts, risks and opportunities and its performance against these.

TNFD's overarching goals are to be science-based and aligned to global sustainability standards and policy goals whilst being flexible to different approaches to materiality across the world and acknowledging the challenges in metrics. To aid this, the taskforce also developed a locate, evaluate, assess and prepare (LEAP) framework to help companies identify and evaluate the key elements of their assessment and reporting:

There is also specific TNFD guidance for the financial sector, recognising that quantitative disclosures are hard without consistent data from their underlying investments. The guidance includes recommendations for global metrics, including greenhouse gas emissions, pollution, water usage and changes in land use. For sectors, it recommends calculating exposures to companies in high-risk sectors or locations. Additional metrics may include assessments of individual companies' risk policies and practices, although the guidance recognises that typically this information is not easily available.

[33] See https://tnfd.global/.

[34] See https://www.fsb-tcfd.org/.

INTERSECTIONALITIES: CLIMATE CHANGE AND BEYOND

Biodiversity intersects with many other sustainability risks, especially climate change. Climate change and biodiversity are essentially twin crises which are inexorably intertwined and interrelated. Biodiversity loss is impacted and accelerated by climate change. Climate change is magnified by biodiversity loss. It is inconceivable that we can halt and reverse the damage from climate change without being nature-positive. The impact on, and co-relationships with, climate change offer a practical lens to consider and prioritise biodiversity actions. Actions that reduce climate change should also consider biodiversity impacts and their potential for biodiversity improvements.

The social implications and interactions are also critical. Firstly, there is the need for economic activity. Rural communities directly depend on ecosystem services, which need to be developed sustainably to provide for their long-term economic future. Furthermore, whilst indigenous peoples are only 6% of the global population, they conserve 80% of the world's remaining biodiversity. Supporting their land rights, livelihoods and local stewardship is critical to preserving our remaining biodiversity. More broadly, this reflects the need for a just nature transition[35] that reflects different needs from social, climate and biodiversity perspectives (see "A Just Nature Transition" below for details).

A JUST NATURE TRANSITION

Muller and Robins define a just nature transition as "one delivering decent work, social inclusion and the eradication of poverty in the shift to a net zero and climate-resilient economy that simultaneously delivers biodiversity goals in agriculture, forestry, land-use and the oceans."

They highlight that, beyond the energy system transformations, the net-zero goals of the 2015 Paris Agreement require attention to impacts and dependencies on nature: "the imperative of decent work and social inclusion applies equally to the transformations that lie ahead to deliver net zero in terms of agriculture, forests and land-use, and for strengthening the conservation of biodiversity."

Muller and Robins make five recommendations for the financial sector to support a just nature transition:

1. Include just transition principles in their own plans for net zero, nature and biodiversity.
2. Set just transition expectations of the businesses they lend to and invest in.
3. Channel finance to companies making progress to a just nature transition for their workers, suppliers, communities and consumers.
4. Engage with policymakers to reform agricultural, forestry and nature policies in line with a just transition.
5. Include social and just transition factors in reporting and transparency frameworks.

BIODIVERSITY: HEALTH AND LONGEVITY

Biodiversity links both directly and indirectly to health and longevity. Direct impacts include the roles of vector-borne diseases, sanitation and mental health. Invasive species can disrupt local ecosystems and bring vector-borne diseases. Climate change is shifting the domains of vector-borne diseases such as malaria, dengue fever and Lyme disease.[36]

Human activity is increasing biodiversity loss, disrupting wildlife populations and increasing human and wild animal interactions. This increases the risk of infectious disease emergence, noting that 65% of emerging infectious diseases and almost all pandemics are animal-originated (zoonotic diseases).[37]

Indirect health impacts include those on nutrition—both the quality of food produced and food insecurity from higher prices or lack of availability. Beyond nutrition impacts, higher food prices can also add strains to social welfare systems and provision of public healthcare, further magnifying health impacts. A separate impact arises from the development of therapeutic drugs. Many therapeutics

[35] Muller, S. & Robins, N. (2022). Just Nature: How Finance Can Support a Just Transition at the Interface of Action on Climate and Biodiversity. London: Grantham Research Institute on Climate Change and the Environment and Centre for Climate Change Economics and Policy, London School of Economics and Political Science.

[36] Wellcome. How climate change affects vector-borne diseases. Retrieved 1 February 2024 from https://wellcome.org/news/how-climate-change-affects-vector-borne-diseases.

[37] Ibid.

are derived from plants and animals, including 70% of cancer drugs and 75% of antimicrobials.[38] A further health impact arises from excessive antimicrobial use in humans and livestock farming, which is creating significant risks from antimicrobial resistance.[39]

The "One Health" perspective recognises that the health of humans, domestic and wild animals, plants and the wider environment (including ecosystems) are closely linked and interdependent. We need to protect nature and animal health to support human health.[40]

OPPORTUNITIES IN NATURE AND NATURE-BASED SOLUTIONS[41]

Whilst risks to the economy, our food systems and society are manifold, transitioning to a just, nature-positive economy also creates investment and business opportunities.

- Better aligned, purposeful business can gain from an enhanced reputation with consumers and employees.
- Business opportunities can be created through new product lines and extensions into new markets. For example, extensions in weather insurance might include nature restoration, consumer products may promote "green" replacements, new saving products could focus on nature-based solutions and microinsurance, which helps insured crops or livestock.
- Multiple levels of investment opportunities can be used in saving products or as long-term asset holdings:
  - "Core" or direct investing in nature: From sustainable approaches to agriculture and forestry, to new innovations in nature-based solutions providing infrastructure, broader ecosystem services and financed conservation.
  - "Technology": Providing innovations that support biodiversity such as Food Tech or Smart Agriculture that better deploys resources.
  - "Enablers": Providing the services and equipment that support nature, for example water treatment, circular economy or packaging alternatives.
- Beyond the new investment opportunities, there are opportunities for stewardship and engagement with existing investments. Encouraging the adoption of TNFD for not only improved transparency but as a management tool to engage investee companies in their biodiversity risks and opportunities. This can both increase returns and reduce the risks of these investments.

INTEGRATING BIODIVERSITY INTO CLIMATE AND SUSTAINABILITY SCENARIOS

All the core net-zero pathways assume a net positive nature outcome with nature providing net negative greenhouse gas (GHG) emissions. Yet the most commonly used climate scenarios, NGFS and the International Energy Agency (IEA), do not consider biodiversity impacts.

The "Green Scorpion" report[42] demonstrates the macro-criticality of nature-related risks. The reports estimates water-related risks to be 7% to 9% of global GDP (5% value at risk [VaR]), with significant impacts on the manufacturing sector. It also estimates that 14% to 18% of agricultural output is subject to water-related risks, with 12% output at risk from pollinator decline. These direct impacts could be amplified by cascading feedback loops with inflation, migration and geopolitical conflicts. Thus, these estimates should be considered lower bounds, especially as the report only considered five ecosystem services.

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[38] Daszak, P., Amuasi, J., das Neves, C. G., Hayman, D., Kuiken, T., Roche, B., Zambrana Torrelio, C., Buss, P., Dundarova, H., Feferholtz, Y., Földvári, G., Igbinosa, E., Junglen, S., Liu, Q., Suzan, G., Uhart, M., Wannous, C., Woolaston, K., Mosig Reidl, P., O'Brien, K., Pascual, U., Stoett, P., Li, H., & Ngo, H. T. (2020). Workshop Report on Biodiversity and Pandemics of the Intergovernmental Platform on Biodiversity and Ecosystem Services. IPBES secretariat, Bonn, Germany. DOI:10.5281/zenodo.4147317.

[39] UN (7 February 2023). Bracing for Superbugs: Strengthening Environmental Action in the One Health Response to Antimicrobial Resistance. Retrieved 1 February 2024 from https://www.unep.org/resources/superbugs/environmental-action.

[40] Adisasmito, W.B. et al. (23 June 2022). One Health: A new definition for a sustainable and healthy future. PLOS Pathogens. Retrieved 1 February 2024 from https://doi.org/10.1371/journal.ppat.1010537.

[41] For further details on investment opportunities and stewardship see 'Managing Nature Risks and Investing in The Opportunities: Top Tips For Pension Fund Chairs And Trustees', Accounting for Sustainability. Retrieved 1 February 2024 from https://www.accountingforsustainability.org/content/dam/a4s/corporate/home/KnowledgeHub/Guide-pdf/Nature%20Top%20Tips%20for%20Pension%20Fund%20Chairs%20and%20Trustees.pdf.downloadasset.pdf.

[42] Ranger, N. et al. (December 2023). The Green Scorpion: The Macro-Criticality of Nature for Finance. Oxford-NGFS Occasional Paper. Retrieved 1 February 2024 from https://www.eci.ox.ac.uk/sites/default/files/2023-12/INCAF-MacroCriticality_of_Nature-December2023.pdf.

This report, combined with the TNFD discussion paper on conducting advanced scenario analysis[43] and the Forecast Policy Scenario + Nature (FPS + Nature) scenario[44] of the Inevitable Policy Response (IPR) show the emerging engagement with integrating biodiversity into climate scenarios. Whilst at a nascent stage, these studies are illustrating the material impacts—both on physical and transition costs as well as the likely emergent transition policy pathways. For example, the IPR FPS + Nature scenario projects a significant decline in demand for ruminant meat to support a reduced deforestation target.

EMBEDDED IN NATURE: THE RISKS OF INACTION AND THE BENEFITS OF ACTION

Our economy and our society are embedded in nature. If we fail to recognise and prioritise the importance of nature, and to address these intersecting needs, then we will likely face significant and debilitating impacts from its loss. The macroeconomic consequences of increased food and water insecurity are likely to led to inflation and increased societal tensions. Migration and conflict will impact long-term prosperity and market returns. Financial institutions face risks to individual investments as well as from these broader systemic issues.

We also have much to gain from the benefits of reducing harm, to growing investment and business opportunities within the just nature transition. Engaging with these benefits can also provide a boost from enhanced reputation, new products and markets. Financial institutions which consider biodiversity are not only acting in their long-term self-interests of a productive economy and society, they are also likely to be on the front foot for regulations. These regulations will not only cover disclosures but also the shifts in demands and requirements that are likely from more direct policy interventions.

Whilst these efforts are at an early stage, financial institutions that start early engagement with biodiversity and nature-related risks will not only help manage these risks but may gain from first mover advantages and opportunities. They will also better protect their reputational risk as well as potentially enhancing their brand value and improving alignment with their corporate and employee values.

[43] TNFD (December 2023). Discussion Paper on Conducting Advanced Scenario Analysis. Retrieved 1 February 2024 from https://tnfd.global/wp-content/uploads/2023/12/TNFD_Discussion_paper_on_conducting_advanced_scenario_analysis_2023.pdf?v=1701692155.

[44] PRI (9 January 2023). IPR Forecast Policy Scenario + Nature. Retrieved 1 February 2024 from https://www.unpri.org/inevitable-policy-response/ipr-forecast-policy-scenario--nature/10966.article.

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