SUSTAINABLE FINANCE LAB

FINDING A WAY WITH NATURE

How central banks and supervisors can start acting on nature-related risks

In this paper

The financial sector has a large, mostly negative impact, as well as a large dependency on nature. This poses considerable risks to financial institutions and the system as a whole. Urgent action is needed to halt nature degradation.

Central banks and supervisors are increasingly aware of this but effective actions to manage and limit nature-related risks and impacts are emerging too slow.

This report identifies the first steps that central banks and supervisors can now already take, as well as an agenda for the coming years that allows them to effectively limit and prepare for nature-related risks.

Gerdie Knijp, Rens van Tilburg and Aleksandar Simić

January 2024

POLICY PAPER

Colofon

Utrecht, November 2023.

The Sustainable Finance Lab (SFL) is an academic think tank whose members are mostly professors from different universities in the Netherlands. The aim of the SFL is a stable and robust financial sector that contributes to an economy that serves humanity without depleting its environment. To this end the SFL develops ideas and provides a platform to discuss them, thus bridging science and practice.
This Policy Paper has been drafted by Rens van Tilburg, Director of the Sustainable Finance Lab at Utrecht University (r.vantilburg@uu.nl), Gerdie Knijp (g.knijp@uu.nl) and Aleksandar Simić (a.simic@uu.nl), both project managers at Sustainable Finance Lab. This study is funded by the WWF-NL.

WWF is one of the world's most respected and experienced conservation organisations, with over 5 million supporters and a global network active in more than 100 countries. WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which people live in harmony with nature. Through its Greening Financial Regulation Initiative (GFRI), WWF engages specifically with central banks, financial supervisors as well as insurance regulators on the need to fully integrate climate, environmental and social risks into mandates and operations. For more information visit our website at panda.org/gfr or contact our secretariat through gfr@wwf.ch.

We thank Maud Abdelli and Christine Wortmann from WWF and Sjoerd van der Zwaag, Eva Nielsen and Carlijn Ginther from the Dutch Central Bank (DNB) for their constructive input. We also thank the people we interviewed and everyone that provided comments on an earlier version of the report (see Annex).

Policy Paper

Sustainable Finance Lab publishes different types of publications. This is a Policy Paper. Policy papers are reports produced by SFL members or employees that contain specific proposals and recommendations for the financial sector or policy makers. The views expressed in this publication are those of the authors and do not necessarily reflect those of all members of the Sustainable Finance Lab.

SUMMARY

Nature provides the healthy and well-functioning ecosystems on which all human wellbeing is based. However, nature is degrading at rates faster than ever. Urgent action is needed.

Financial institutions are impacted by nature degradation, with studies indicating significant exposure to nature-related risks, both physical and transition risks. Financial institutions also contribute to nature degradation by for example funding projects linked to deforestation and pollution. The financial sector however can also play a positive role by aligning financial flows with global biodiversity goals, such as the Global Biodiversity Framework. This alignment involves financing nature-positive initiatives and restoration projects. The financial sector thus has a critical role in addressing nature degradation. Nature degradation affects the financial sector (outside-in) and the financial sector also has an impact on nature degradation (inside-out).

Most central banks and supervisors recognise the importance of addressing climate risks. A growing group of central banks and supervisors have started to work on nature-related risks as well. However, so far this has mostly focused on increasing awareness and performing research. Concrete policies and actions for managing nature-related risks are still lacking.

Central banks and supervisors do not operate in isolation and are dependent on for example governments for policies and regulation. Therefore, collaboration and alignment between different players is key. However, there is a lot that central banks and supervisors could already do given their mandate for financial and price stability and the clear global agreements and national and regional targets and policies in place. This research focuses on how central banks and supervisors can now already integrate nature into supervisory policies and what concrete next steps they could take.

We set out four guiding principles for central bank action in this field.

- **Integrated approach**: Climate change and nature degradation are interconnected and should therefore be considered together. While there are synergies between nature conservation and climate change mitigation, there are also trade-offs, such as afforestation projects impacting native nature. The climate crisis cannot be solved without halting nature degradation.
- **Acknowledge endogenous risks**: Central banks and supervisors the inside-out perspective and thus acknowledge the endogenous risks created by the financial system. Central banks and supervisors are uniquely positioned to address the systemic nature of climate change and nature degradation.
- **Adopt a precautionary approach**: A precautionary approach is recommended, emphasising proactive measures even with imperfect data and methodologies. Cost of inaction is high and central banks and supervisors should act before it's too late and tipping points have been reached that make restoration impossible; rather to be roughly right than exactly wrong.
- **Focus on harmful activities**: Concentrate first on sectors causing the most harm. Prioritise supervisory measures on impactful sectors where data and methodologies are available, for example agriculture, forestry, mining and energy.

We identify five different topics where central banks and supervisors can make a start. These topics are all big drivers of nature degradation for which there are public goals defined, for example targets in the Global Biodiversity Framework. For these topics there are also databases and tools available to assess these activities. This means central banks and supervisors can take first action steps on nature by starting with these material topics first, being:

- deforestation
- pesticide production
- mining activities in biodiversity sensitive areas
- intensive farming
- fossil fuels

We defined the following main recommendations for central banks and supervisors to take action.

Short term (0-2 years)

Central banks own research

- Central banks and supervisors should embrace available (sub)-sector overviews providing insights in harmful (sub)sectors and agree on a (sub)sector overview with harmful activities of (sub)sectors.

Knowledge and governance of financial institutions

- Update the fit and proper assessment and assess knowledge levels specifically for nature-related risks. At least one board member should have detailed knowledge about nature.
- Monitor the governance of the organisation with respect to nature-related risks in regular supervisory practices. Monitor how often these matters are discussed in board level meetings, and how often trainings or knowledge sessions on these topics are organised.
- Share Good Practices, for example on the integration of nature-related risks in all phases of the risk management cycle, and specifically on transition plans.

Disclosure requirements and due diligence

- Mandatory disclosures of impacts, dependencies and nature-related risks following the TNFD framework. Align these requirements with developing reporting requirements such as the CSRD, SFDR and EU Taxonomy. This includes mandatory disclosures of exposures to harmful activities.
- Mandatory requirement for financial institutions to demonstrate that there are no nature crimes in their financing value chains, either through AML rules being broadened or stand-alone mechanisms.

Transition plans

- Require financial institutions to include nature in their climate transition plans, taking into account the interconnectedness of

bio-diversity loss and climate change, but also the potential trade-offs.

Medium term (2-3 years)

Transition plans

- Mandatory transition plans for nature, integrated or at least consistent with climate transition plans. This includes identifying the largest nature-related risks, defining specific nature-related target and describe actions for mitigating those.

Microprudential policy

- Integrate nature-related risk management and transition plans in existing supervisory policies. Apply stricter penalties, like capital add-ons or fines, for financial institutions that are underperforming or underestimating the risks, or in case transition plans are not credible or not sufficiently aligned with the goals.

Macroprudential policy

- Expand the economy-wide stress tests conducted by the ECB and EIOPA to include nature-related risks. Conduct a specific stress test for the insurance sector as well.
- In financial stability assessment, include indicators for measuring and monitoring levels of systemic risks specifically to nature.
- Integrate nature in existing macroprudential policies such as concentration limits and the systemic risk buffer.

Monetary policy

- Apply lessons learned from decarbonising the monetary policy instruments to nature-related risks.
- Expand ‘tilting’ in the Asset Purchasing Programme to include nature-related risk in addition to present climate considerations.
- Account for nature-related risks in the collateral framework through adjusting haircuts of the worst nature-degrading companies.

Longer term (4-5 years)

Microprudential policy

- Introduce higher capital requirements for exposures harmful to nature, by means of an adjustment factor to the models used for capital in Pillar I.
- Revisit the Pillar I framework to make it more forward looking and to allow for longer time horizons.

Monetary policy

- Design ‘nature TLTROs’ that could stimulate nature-positive bank lending.

CONTENT

1. INTRODUCTION

This research focuses on how central banks and supervisors can integrate nature into supervisory and monetary policies. Thus, it aims to inspire central banks and supervisors to take the first steps acting on nature. The research mostly focuses on the Netherlands and Europe. However, the mentioned examples and the recommendations apply to other national central banks and supervisors as well. For this research we performed a literature review and we held interviews with several experts. The annex shows an overview of the interviews.

The report is structured as follows. Chapter 2 describes why central banks and supervisors should act on nature. It summarises the urgency of acting on nature degradation, and describes the link between nature, the financial sector and the central banks and supervisors. Chapter 3 describes what central banks and supervisors can then do. It starts with an overview of guiding principles for central banks and supervisors and then summarises how nature can be integrated into supervisory and monetary policy. Chapter 4 provides practical examples on how to start with the most pressing topics. Chapter 5 concludes and provides an overview of recommendations.

2. WHY CENTRAL BANKS AND SUPERVISORS SHOULD ACT ON NATURE

Nature is degrading faster than ever

Nature refers to the natural world, emphasising the diversity of living organisms, including people, and their interactions with each other and their environment. Nature captures both the living (biotic) and non-living (abiotic) elements of our planet, including biodiversity, but also climate (NGFS, 2023). Biodiversity refers to the diversity of life, the variety of species and their ecological systems. The UN Convention on Biological Diversity (CBD) defines biodiversity 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" (United Nations, 1992).

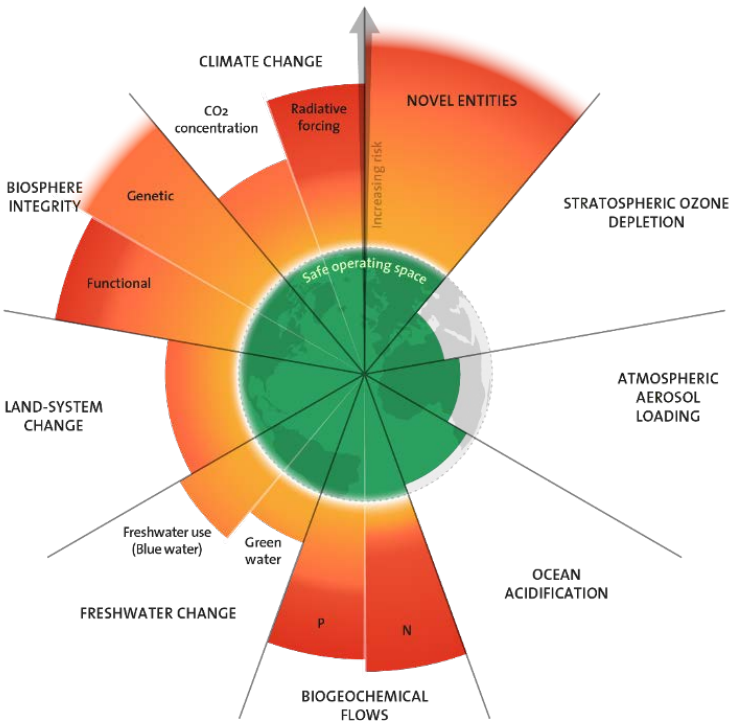
Nature has an important role in maintaining healthy and well-functioning ecosystems. Ecosystem services are nature's contribution to people, providing benefits on which we all depend. These include provisioning services (e.g. water, wood, food), regulating services (the ability to influence climate, water security), cultural services (e.g. recreation, mental and physical health) and supporting services (e.g. soil quality, water quality) (NGFS, 2023). Society and our economy could not exist without these ecosystems. The degradation of nature and its biodiversity disrupts the functioning of ecosystems and is threatening its stability and resilience. In his review, Dasgupta emphasizes non-substitutability; certain features of nature are not substitutable by other forms of nature or by for example labour or financial capital. Ecosystems are complements and need each other to fulfil the regulation and maintenance services. This puts bounds on economic possibilities (Dasgupta, 2021).

Nature is, however, degrading at a rapid rate. The rate of change of nature in the last 50 years is unprecedented in human history (IPBES, 2019). In their Global Risk Report 2023, the World Economic Forum states "Biodiversity loss and ecosystem

collapse" is viewed as one of the fastest deteriorating global risks in the next 10 years (WEF, 2023). It is estimated that there has been an average decline of 69% in monitored species population since 1970 (WWF, 2022b). Additionally, around 1 million species (25% of total species) face extinction and the rate of extinction is tens to hundreds of times higher than average of the past 10 million years (IPBES, 2019). Nature degradation is not only a risk for the extinction of certain specifies, but it can pose serious risks to humanity and can give rise to existential risks (Dasgupta, 2021).

Nature degradation could trigger tipping points with irreversible effects to ecosystems and biodiversity (Lenton, 2013). Deforestation in the Amazon is an example of such a tipping point, where more deforestation could turn the Amazon into a dry area and can affect the global carbon cycle and climate (Lovejoy & Nobre, 2019). Research shows that even if we meet the Paris goals in terms of global warming, it is likely multiple tipping points would still occur (Armstrong McKay et al., 2022). A recent study found that an ecological collapse is likely to occur earlier than previously estimated, due to incorporation of interconnected factors in the models. While the IPCC said a tipping point in the Amazon forest could occur in 2100, this study estimates it could occur several decades earlier (Willcock et al., 2023).

Figure 1. Planetary boundaries



Source: Stockholm Resilience Center (2023)

The planetary boundaries framework is a scientific framework visualising the nine boundaries in which humanity can safely operate (Stockholm Resilience Center, 2023). Crossing a boundary increases the risks of environmental damage. Six of the nine planetary boundaries are already crossed and are now exceeding the level for a safe operating space (Richardson et al., 2023). This is visualised in Figure 1. This implies the stability of the planet is at risk. The level of exceedance of biodiversity loss is significantly larger than for climate change alone, showing nature degradation is a very pressing issue.

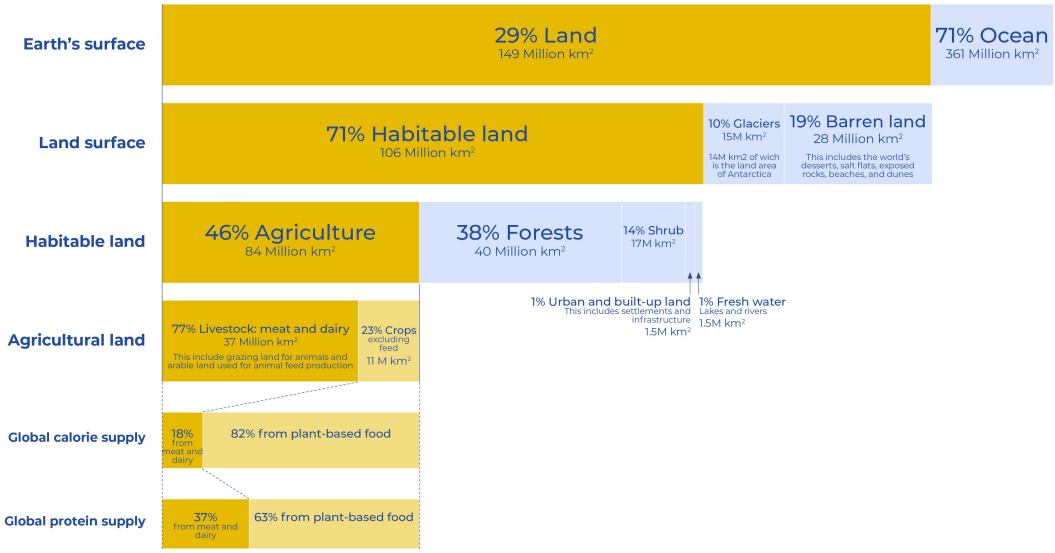
Nature degradation is primarily driven by human activity

Nature degradation is primarily driven by human activity. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) summarises five main drivers for nature degradation:

1. Changes in land and sea use
2. Direct exploitation of organisms
3. Climate change
4. Pollution
5. Invasive alien species

The biggest driver of nature degradation is the way we use the land and sea; how we produce our food, how and where we harvest materials and minerals, and how we build. An important example of changes in land use is deforestation. Much of it is caused by the production of commodities like soy and palm oil and the expansion of pasture for beef production. Direct exploitation of organisms refers to how we exploit animals and plants, overfishing is an example. Climate change is an important driver for nature degradation as well; changing weather patterns and the acidification of oceans have a large impact on ecosystems. Examples of pollution are chemical pollution in rivers, plastic pollution or the use of fertilizers or pesticides in agriculture. Lastly, invasive species can destruct ecosystems. Japanese knotweed (‘japanse duizendknoop’) is an example of an invasive plant type which is supressing other native plant species and is damaging buildings and infra-structure. More indirect drivers of nature degradation are consumption and production patterns.

Figure 2. Global land use for food production



Source: Ritchie & Roser (2019)

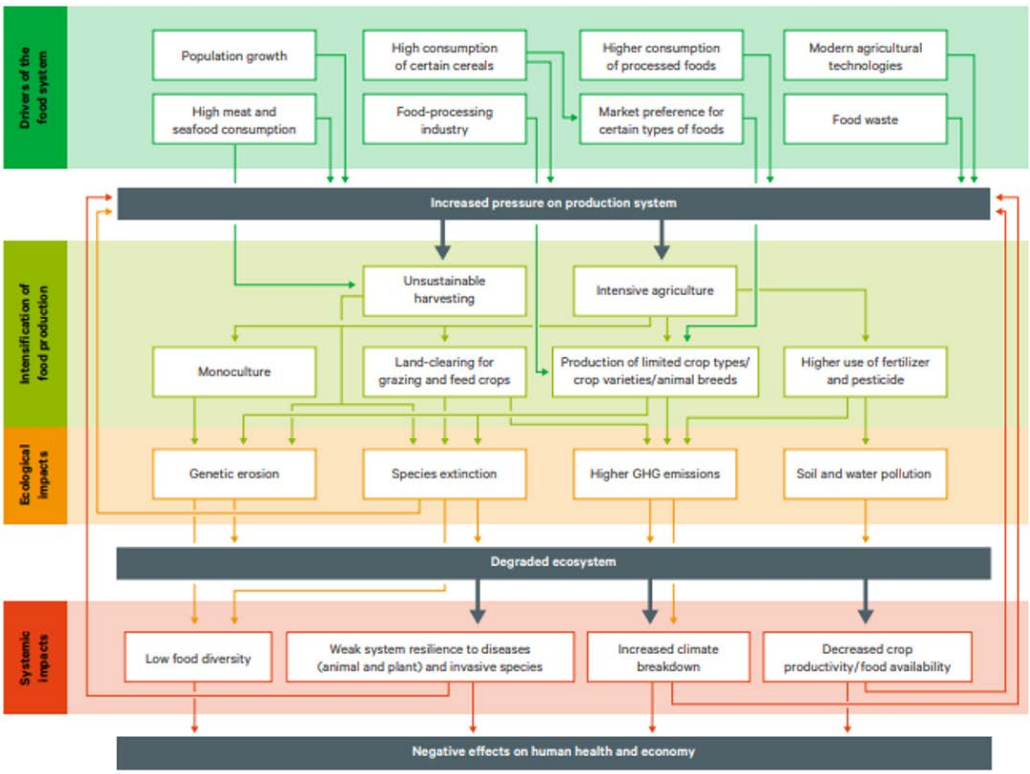
Our food system

Land use change has the largest global impact, to a large extent driven by agricultural expansion (IPBES, 2019). Almost half of the world's habitable land is used for agriculture. Of this area, 77% is used for livestock, this includes land for grazing and land to grow crops to feed animals. However, it only leads to 18% of the global calorie supply. This is shown in Figure 2. This suggests our current diet is not very effective in terms of land use. If the world population would adopt a diet similar to the average person in the Netherlands, 99,9% of the global habitable land would be needed for agriculture (Ritchie, 2017).

Agriculture production is a major driver in destabilizing the planetary boundaries and accounts for 80% of the global land use change (Campbell et al., 2017). It is the largest driver of deforestation. Of the 28,000 species on the IUCN Red List, agriculture is marked as a threat for 24,000 of them (Ritchie & Roser, 2019). Using land for agriculture results in a loss of shelter and food that wildlife is dependent on. Moreover, the intensive use of pesticides and fertilizers have an impact on water quality, nitrogen and emissions. Pesticides and fertilizers use is also the main pressure for bird population declines (Rigal et al., 2023). In marine systems, current forms of fishing have a large impact on nature, leading to a decline is fish in the oceans (IPBES, 2019). The current food system also drives climate change, mostly through emissions from production and land use change, for example deforestation (Benton et al., 2021). Figure 3 visualises a combination of factors in the current food system driving nature degradation.

Nature degradation will only accelerate, unless we change our food system. This means global dietary patterns need to shift to more plant-based diets, more land needs to be set aside for nature and agricultural activities need to be performed more nature inclusive (Benton et al., 2021). The EAT-Lancet Commission conducted a scientific review and proposed a healthy more plant-based diet from a sustainable food system within planetary boundaries (Willett et al., 2019). A recent study shows that if circular principles are adopted in the food system, land use for agriculture could reduce by 71% and emissions per capita in the agriculture sector could reduce by 29%, while still producing enough healthy food for Europe (Van Zanten et al., 2023).

Figure 3. Factors in the food system driving nature degradation



Source: Benton et al. (2021)

The complexities of nature

Measuring nature degradation is complex. Nature degradation cannot be narrowed down to one measure like CO2 for climate, nature degradation can arise from different sources (such as pollution, deforestation, droughts) and nature degradation is location-specific. Tools and indicators are still under development. Measuring natural capital, referring to the stock of natural assets providing ecosystem services, and ecosystem services itself, is also difficult.

Natural capital and ecosystem services are complex to grasp as they are mostly intangible and the natural environment deals with complex interactions. Nature and the inter-relationships between its different elements is often not well understood. There is also a lack of understanding in the interlinkages between climate and biodiversity, particularly when it comes to scenario analysis (NGFS-INSPIRE, 2022a). The technological and political developments and societal preferences are also unpredictable (Kedward et al., 2021). In general, nature degradation comes with large uncertainty. There is uncertainty around the tipping points, nature degradation results in both local and global impacts and there are indirect impacts such as socioeconomic interactions.

The solutions are also complex. For climate change we more or less know what needs to happen to stay within 1.5 degree Celsius temperature increase. Although we are lagging behind, there are promising technological developments around for example renewable energy, batteries and carbon capture. The solutions to halt nature degradation are less defined yet, while more complex interactions need to be understood and more fundamental system transformations are needed. This makes nature degradation a pressing issue to act upon.

Though we may not be able to measure nature degradation yet in concrete and widely accessible ways, we understand the major drivers of nature degradation and the key business activities and sectors contributing to this. As solutions to simplify the complexity of nature develop, action can be taken now to address the known drivers and adopt a precautionary approach to protect nature.

The link with climate change: climate-nature nexus

The various dimensions of nature such as biodiversity loss and climate are closely connected. Fossil fuel exploitation and deforestation are for example activities harmful to both climate and biodiversity. Climate change and biodiversity loss also reinforce each other. As mentioned before, climate change is an important driver for biodiversity loss. Climate change impacts such as higher temperatures, extreme weather events and the acidification of the oceans put stress on eco-systems (IPBES, 2019). Biodiversity loss is also a driver for climate change, for example through changes in the carbon, nitrogen and water cycles and through reduced carbon storage (Pörtner et al., 2021). We cannot reach the climate goals without protecting nature. Research shows that deforestation in the Amazon could lead to a tipping point turning the Amazon into a savannah, which has an effect on the regional climate (Lovejoy & Nobre, 2019). Biodiversity loss also affects the resilience to climate change, as natural infrastructure can protect against heat or floods. Biodiversity is therefore not only critical for climate change mitigation, but also for climate change adaptation. The synergies provide opportunities for combined solutions.

However, there are also trade-offs between climate change and biodiversity loss. Climate change mitigation strategies could negatively impact biodiversity, for example through planting monoculture forests for carbon storage. Potential problems of afforestation projects include reduction of native biodiversity due to the destruction of the original (non-forest) ecosystem, increases of invasive species, reduction of pollination, reduction of the provision of fresh water and a reduction of cropland threatening food security (Di Sacco et al., 2021; Doelman et al., 2020; Xiao et al., 2020). Another example of a trade-off is mining activity to extract raw materials needed for renewable energy and battery technology, which can also have negative effects for local communities. Research shows that mining activities negatively impact ecosystems on land and sea and impact protected areas, and this is likely to increase with the increased demand for raw materials (Levin et al., 2020; Sonter et al., 2020). Also the expansion of bioenergy, which is currently included in the Paris aligned scenario to limit global warming to 2 or even 1.5 degrees Celsius, is negatively affecting biodiversity (Hof et al., 2018). In some climate scenarios that allow for significant fossil fuel emissions but aim to limit temperature increases to 1,5 or 2 degrees Celsius, the required land for growing bioenergy may be up to 500 million hectares, 1,5 times the size of India. If not managed well, this has negative consequences for biodiversity and food security. The use of fertilizers and pesticides for bioenergy crops could negatively affect biodiversity as well, for example through water pollution or soil degradation (Pörtner et al., 2021).

Overall, literature suggests that there are more synergistic benefits between biodiversity and climate change mitigation actions than trade-offs (Pörtner et al., 2021). However, climate mitigation actions need to be considered carefully and should also consider potential threats to biodiversity. In addition, many trade-offs are addressed by nature-based solutions. This calls for an integrated approach towards biodiversity and climate.

Halting nature degradation requires urgent action

Halting nature degradation requires societal transformations across all sectors (Chan et al., 2020; PBL, 2022). An IIASA-led study shows that, in order to “bend the curve” towards the 2050 goal to live in harmony with nature, large-scale conversation and restoration efforts and transformations in sustainable production and consumption are needed (Leclère et al., 2020).

Policymakers and public authorities can play a large role in setting rules and defining regulation. There are several initiatives and frameworks already aiming to halt nature degradation. The Global Biodiversity Framework (GBF) was agreed upon in the 15th Conference of Parties to the UN Convention on Biological Diversity (CBD) which was held in Montreal in 2022. It consists of four main goals to be reached by 2050 and 23 underlying targets to be achieved by 2030. By 2030, 30%

of degraded ecosystems should be under restoration and 30% of the land and sea is to be conserved. One of the goals in the GBF is to align financial flows with the 2050 vision of the framework and to close the biodiversity finance gap of $700 billion per year (CBD, 2022). Other targets specifically relevant for the financial sector include: alignment of all public and private finance with the framework (target 14), implementation of policies to ensure financial institutions manage the risks associated with biodiversity loss (target 15) and the increase of financial resources to mobilise $200 billion per year by 2030 (CBD, 2022).

There are other guidance and standards as well, requiring companies to start reporting and acting on nature. Table 2 presents an overview of relevant (mostly EU focused) legislations and proposals related to nature.

Table 1. Selection of relevant legislations for nature

Initiative	Description	Status
European legislations		
CSRD	The Corporate Sustainability Reporting Directive (CSRD), mandatory reporting as of 2024. It includes a double materiality approach. ESRS E4 summarises disclosure requirements for biodiversity and eco-systems (EFRAG, 2022). Closely linked are ESRS E2 on pollution and ESRS E4 on water and marine resources. If biodiversity is considered a material topics, companies and financial institutions are required to report on their dependencies and impact on nature.	Established
EU Taxonomy	A classification system for environmentally sustainable economic activities (Regulation (EU) 2020/852, 2020). The EU Taxonomy is already into effect. The screening criteria for environmental objectives other than climate change mitigation and climate change adaptation (e.g., sustainable use and protection of	Established, almost final

	water and marine resources, pollution prevention and control, protection and restoration biodiversity and ecosystems) are nearly final. For some sectors bio-diversity related screening criteria are proposed. All organisations in scope of the CSRD have to at least show they "do no significant harm" to biodiversity.	
SFDR	Sustainable Finance Disclosure Regulation (SFDR) for investors, already into force. It includes Principle Adverse Indicators (PAIs) for biodiversity. There is one mandatory PAI related to biodiversity which is 'activities negatively affecting biodiversity-sensitive areas'. In addition, there are a number of voluntary PAIs for biodiversity (Regulation (EU) 2019/2088, 2019; Commission Delegated Regulation (EU) 2022/1288, 2022).	Established
UN Conservation and Sustainable Use of High Seas Biodiversity	Agreement for conservations and sustainable use of biodiversity in 2/3 of the ocean (United Nations, 2023).	Established
The EU Deforestation Regulation	Requires companies trading in specific commodities (cattle, cacao, coffee, oil, palm, rubber, soya and wood) and their derived products to conduct extensive due diligence on the value chain. Into force since June 2023 (Regulation (EU) 2023/1115, 2023).	Established
EU Nature restoration law	Proposal for a law to restore ecosystems (European Commission, 2022b). The European Parliament has adopted the proposal. Passed trialogue negotiations, upcoming Member State endorsement and EP votes.	Under development

CSDDD	Corporate Sustainability Due Diligence Directive (CSDDD). Due diligence regulation includes an obligation on biodiversity impacts. Still under development (European Commission, 2022a).	Under development
Voluntary initiatives		
TNFD	The Taskforce of Nature-related Financial Disclosures (TNFD), a voluntary risk management and disclosure framework for organisations and financial institutions to report and act on evolving nature-related risks. The final version was published in September 2023 (TNFD, 2023d).	Established
SBTN	The Science Based Target Network (SBTN) is developing science-based targets for nature. It released the first part of its work in 2023, which includes interim targets and the first part of its methodology to set Land and Freshwater targets for companies.	Under development

Source: Sustainable Finance Lab (2023)

Nature degradation and the financial sector

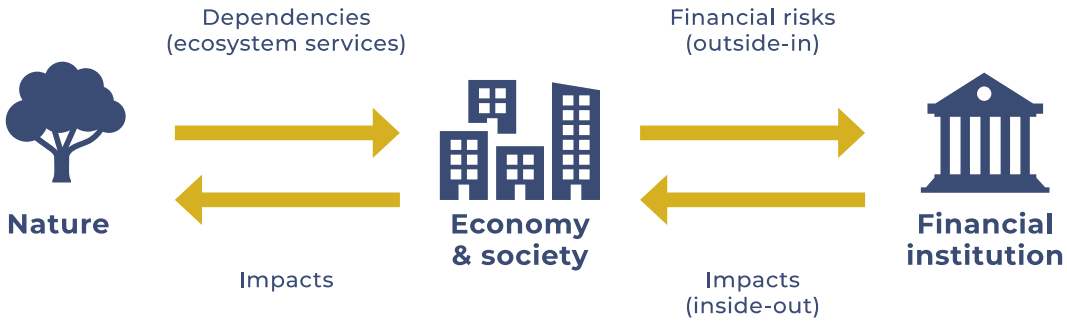
The financial sector, based on its expectations about the future, decides on allocations and decides which companies or projects get funding under what conditions and which ones not. They therefore are crucial in determining the shape of our economy. Its models, assumptions and expectations are to a large extent self-fulfilling prophecies (Perez, 2003; Soros, 2009). The primary responsibility of the financial sector is to assess financial risks and returns. But more and more the financial sector itself recognises that to do this well, it needs to take into account developments in social and ecological systems as well (Schoenmaker & Schramade, 2019, 2023).

In addition to climate risks, the financial sector is now starting to recognise nature-related risks as well, and starts to analyse their portfolios and develop reports.

Double materiality

Financial institutions are both impacted by nature degradation (outside-in) and contribute to nature degradation (inside-out). This is also referred to as the 'double materiality' concept, where both the financial materiality (outside-in) and environmental materiality (inside-out) are considered. This concept is well-known in literature and central in the European sustainability reporting regulations (Adams et al., 2021; Boissinot et al., 2022; Directive (EU) 2022/2464, 2022). Figure 4 provides a visualisation of this concept. The interaction between nature and the financial sector works through their counterparties, for example their borrowers or investees.

Figure 4. Simple visualisation of the interaction between nature and the financial sector



Source: Sustainable Finance Lab (2023)

Outside-in: Nature degradation affecting financial and price stability

Nature degradation is affecting our economy and the financial system and is thereby a threat to financial stability. The interaction between the economy and nature can be described by impacts and dependencies. Impacts are the positive or negative changes in the state of nature which may be a result of an organisation's or another player's action. Dependencies are defined as ecosystem services an organisation relies on (TNFD, 2023d).

Monetary valuation of nature

There is some criticism on the concept of ecosystem services and giving nature a monetised value. Some of the points critique are: the exclusion of the intrinsic value of nature, the dominance of the human-nature relationship, the economic valuation of nature and the commodification of nature, i.e. the assumption that payments for nature will ensure their provision (Schröter et al., 2014). Although the ecosystem service framework is useful to assess dependencies on nature, it is worth taking some of the criticisms seriously.

> For example, to consider the intrinsic value of nature (part of the cultural category of ecosystem services) which is more difficult to value. And to acknowledge the limitations to monetising nature, such as the absence of market prices and a discount value (Victor, 2020). Moreover, many parts of nature are simply not measurable, tipping points are uncertain, and the sum of different parts does not capture the interconnections and holism of nature. Monetised values should be used with caution in decision making and policy making, and should be used as complements and not as the one source of the truth. In policy making, these uncertainties should be addressed and a precautionary principle can be adopted (Victor, 2020).

A recent preliminary ECB study looked at more than 4.2 million companies covering € 4.2 trillion corporate loans. First results show that 75% of the bank loans in the Euro region are highly dependent on at least one ecosystem service (Boldrini et al., 2023)). Earlier assessment of the Dutch Central Bank (DNB) showed that the Dutch financial sector has a € 510 billion exposure to nature-related risk (DNB & PBL, 2020). This study only looked at first order dependencies, and did not consider the supply chains, meaning that the more accurate value is almost certainly higher. In terms of impact, the study estimated that the biodiversity footprint of the Dutch financial sector equals the loss of an area of pristine nature which is 1.7 times the size of the Netherlands. Similarly, the Banque de France concluded that 42% of the securities held by French financial institutions is issued by companies that are dependent on at least one ecosystem service (Svartzman, Espagne, et al., 2021). Similar studies with similar results have been conducted in Malaysia, Brazil and Mexico (NGFS-INSPIRE, 2022a).

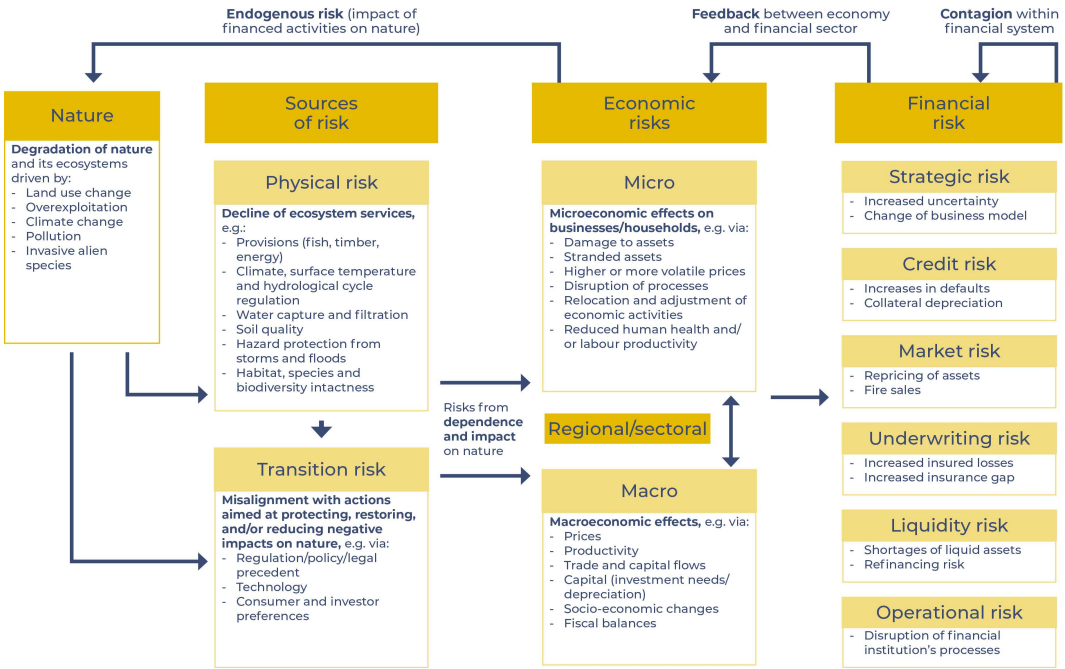
Resulting in nature-related risks

These impacts and dependencies give rise to financial risks. From now on we use the term “nature-related risks“ which capture the full spectrum of climate and environmental risks.

Climate risk are considered to be part of nature-related risks (NGFS, 2023). Nature-related risks can be categorised into physical and transition risks. Physical risks are risks resulting from the degradation of nature, including its biodiversity, and the loss of ecosystem services that flow from it (NGFS, 2023). Examples are reduction of pollinator species affecting crop yields, diseases affecting harvests, or damage as a result from climate disasters such as heatwaves or floods. Transition risks result from the misalignment of economic actors with actions aimed at protecting, restoring, and/or reducing negative impacts on nature (NGFS, 2023). These risks are mostly related to impacts on nature. Examples of nature-related transition risks are the risks that soy or palm oil producers, who contribute to deforestation, face in relation to deforestation moratoria and regulation, or the

nitrogen crisis in the agricultural sector currently happening in the Netherlands. These physical and transition risks can result into financial risks through certain transmission channels, for example stranded assets, lower profitability, liquidity difficulties or legal costs. This can affect traditional financial risks for financial institutions such as credit and market risks, or can give rise to systemic risks. The below figure provides a summary overview of how nature-degradation can lead to financial risks for financial institutions. Financial institutions need to assess and mitigate these nature-related risks. The supervisory framework for assessing nature-related risks published by OECD provides relevant steps to assess nature-related risks, and includes useful examples and frameworks such as an economic risk assessment for direct and indirect economic impacts and an overview of financial risk transmission channels to different types of financial risks (OECD, 2023).

Figure 5. Schematic overview of nature-related financial risks



Source: NGFS (2023)

Nature-related risks are compounding through complex interactions (Crona et al., 2021; Keys et al., 2019). Physical and transition risks can for example reinforce each other. For example the agricultural sector is dependent on nature (e.g. pollination animals and a healthy soil) but is also negatively impacting nature (through its contribution to deforestation or the use of fertilizers) (NGFS-INSPIRE, 2022a). These multiple transmission channels and loops make analysing nature-related risks complex.

Although the current research on nature-related risks and the effect on price stability are currently limited, parallels can be drawn with climate risks. In the short term environmental events could impact inflation (Almeida et al., 2022; NGFS-INSPIRE, 2022b). For example, risks to the food system affecting global food security could potentially impact food prices. In the long term, gradual nature degradation could affect the growth of the economy. A deterioration and decline of nature capital reduces economic supply. This can affect other forms of capital such as human capital. This affects supply chains and therefore inflation. From a transition risk perspective, policy responses to tackle biodiversity loss could also impact price stability, for example if the government implements pricing policies such as the pricing of externalities (NGFS-INSPIRE, 2022a).

Inside-out: Financial sector driving nature degradation or part of the solution?

Economic activities pose pressures on nature. The financial sector is financing economic activities and is thereby indirectly contributing to nature degradation, for example through financing companies, projects or activities linked to deforestation, exploitation and pollution. Financial institutions have an important role to play to prevent nature-related risks are built up in the wider financial system. At the same time, it can make a positive contribution to nature by redirecting financial flows in line with the Global Biodiversity Framework. The financial sector can for example contribute to finance nature-positive initiatives and nature restoration projects.

Nature degradation and central banks and supervisors

Central banks and supervisors have acknowledged that climate risks are drivers of financial risks, and that these risks fall within their mandate, as they are affecting price stability. As a result, they have started to consider these risks in supervisory practices and monetary policy. On the monetary side, the ECB has pledged to account for climate risk in its asset purchasing programmes and the collateral framework (ECB, 2022e).

On the supervisory side, central banks and supervisors increasingly recognise that, in addition to climate risk, nature degradation should be on their agenda as well. The NGFS recommends central banks and supervisors to recognise these risks, to analyse the exposure and to explore supervisory actions (NGFS, 2023). The NGFS, however, doesn't yet recommend any concrete policy proposals to mitigate these risks. Action on nature-related risks falls behind climate risks, both on the policy side as within the financial sector itself.

The Dutch central bank (DNB) was one of the first to publish a report exploring nature-related risks for the Dutch financial sector (DNB & PBL, 2020). With the Sustainable Finance Platform, the DNB is also contributing to capacity building.

As mentioned before, also the ECB has also published research to assess dependencies and impacts on nature (Boldrini et al., 2023).

Additionally, the ECB conducted economy wide climate risk stress tests in 2021 and 2023 (Alogoskoufis et al., 2021; Emambakhsh et al., 2023). The objective was to assess the resilience of euro zone banks to different climate scenarios. The European Insurance and Occupational Pensions Authority (EIOPA) conducted a stress test as well, the 2022 Institutions for Occupational Retirement Provision (IORP) stress test, to gain insights in climate risks in the pension fund sector (EIOPA, 2022a). In 2022 the ECB conducted a climate risk stress aiming to assess the climate risk stress-testing capabilities of banks in scope. This exercise was seen as a learning exercise to also test the alignment on specific recommendations of the ECB Guide on climate-related and environmental (C&E) risks (ECB, 2020, 2022a).

This ECB Guide defines supervisory recommendations on the management of C&E risks. The ECB asked banks to perform a self-assessment against these recommendations and to draft a roadmap for implementation. The ECB did announce they expect all banks prepare a materiality assessment by March 2023 and to meet the supervisory recommendations by 2024 (ECB, 2022c). With on-sites and thematic reviews, the ECB is closely monitoring progress. The ECB stated that banks are currently underestimating these risks and that progress is lagging behind (ECB, 2022b, 2023a; Elderson, 2023).

For banks, nature-related risks are announced to be part of the yearly Supervisory Review and Evaluation Process (SREP), part of the Pillar II supervisory review process of the Basel Framework. The 2022 SREP cycle did lead to qualitative measures for climate and environmental risk for financial institutions, but did not affect capital add-ons (ECB, 2023b). The ECB has announced to take action in the future if necessary (ECB, 2023e). This indicates fines or Pillar II capital add-ons can be expected (ECB, 2022c).

The DNB published a Guide to managing climate and environmental risks, specifically focused on pension funds, insurers, premium pension institutions, investment firms and institutions, and electronic money and payment institutions (DNB, 2023b). This guide provides tools and practices for the management of nature-related risks. Although not (yet) mandatory, the DNB has asked the relevant institutions to perform a self-assessment and is planning to include this in supervision. After this self-assessment, DNB will announce in 2024 when to include this in supervision and if and how to use supervisory instruments (DNB, 2023d). DNB also published several Good Practices for the insurance and pension fund sector, for example on the integration of climate risks in the Own Risk and Solvency Assessment (ORSA), the management of C&E risks for investment firms and

institutions and on ESG risk management for the pension fund sector (DNB, 2019, 2021a, 2022a).

Insurance companies are expected to integrate climate change in their Own Risk and Solvency Assessment (ORSA) as part of Pillar II (EIOPA, 2022b). However, also here, no capital add-ons or other penalties are given yet. Similarly for pension funds, ESG risks are required to be included in the own risk assessment (ORA) (Directive (EU) 2016/2341, 2016). A recent review of EIOPA concluded that only 16% of pension funds are using scenario analysis in their ORA to manage ESG risks (EIOPA, 2023).

DNB has several instruments for the supervision of pension funds and insurance companies. This is done risk based, meaning that the intensity of supervision increases when larger risks for the sector are observed. On-site supervision is one of the supervisory instruments. This is an in-depth investigation focused on specific topics or themes. This results in a report from the supervisor including identified shortcomings (findings) (DNB, 2023c). This can result in an increased risk score, leading to more supervisory attention, a supervisory conversation on risk mitigation, or more formal penalties such as fines (DNB, 2020).

WWF's SUSREG Framework

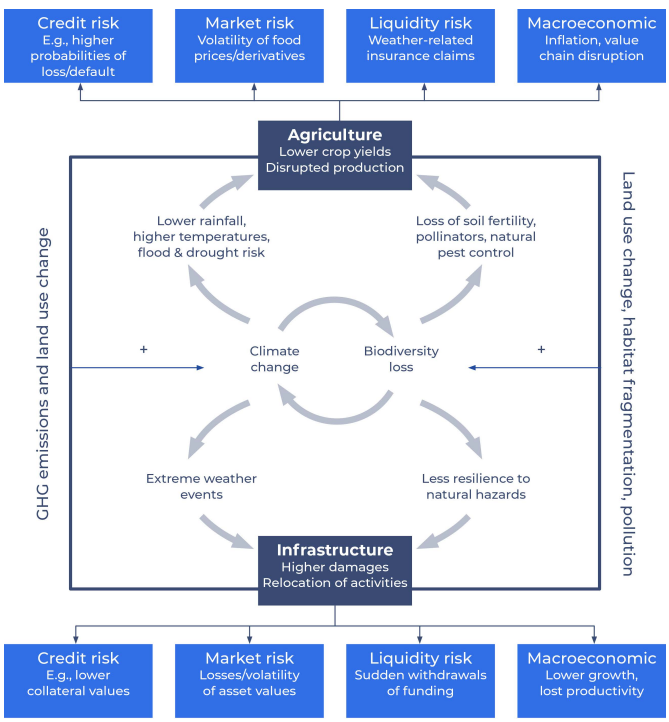
The WWF SUSREG 2023 Assessment reveals a predominant emphasis on climate-related aspects within the current financial supervision policies across the globe. In contrast, broader environmental issues, such as bio-diversity loss, deforestation, and other nature-related risks, are being inade-quately addressed. Both banking and insurance supervision, across nearly all countries, are failing to adequately address nature-related risks. This deficiency results in significant exposure to and impact on nature, including those of the world's most megadiverse countries. For a full assessment and a detailed list of best practices on the integration of nature-related risks into the mandates and supervisory practices of central banks and financial regulators, please refer to the WWF SUSREG 2023 annual report and tracker tool.

Given the urgency as described before, central banks and supervisors need to step up on nature-related risks, and mitigate the financial risks posed by nature degradation including climate change. In the next chapter we highlight what central banks and supervisors can do.

3. WHAT CENTRAL BANKS AND SUPERVISORS CAN DO

As ECB-board member Frank Elderson mentioned about nature related risks in a recent interview: “some banks would say it’s very difficult and claim that they can’t really do anything because they lack the data. But it is also true that the risks don’t become smaller just because they are difficult to measure. There is still a lot you can do short of perfection” (ECB, 2023c). This reasoning obviously also holds for central banks and supervisors themselves.

Figure 6. Compounding effects of climate and other nature-related risks



Source: Kedward et al. (2022)

Guiding principles for central banks and supervisors to integrate nature

This section sets out four guiding principles for central banks and supervisors to integrate nature.

Integrated approach to climate and biodiversity is needed

As described earlier, climate change and biodiversity loss are interlinked. Therefore, climate change and biodiversity loss need to be considered together to cover all interconnected dimensions of nature. This is recognised by the NGFS as well (NGFS, 2023). Only acting on climate will not do enough to halt nature degradation. Considering climate risk and other nature-related risks separately may lead to blind spots and an underestimation of the financial risks. Figure 6 provides an overview of how the physical climate and other nature-related risks can be compounding for the agriculture and infrastructure sector.

Acknowledge before endogenous risks

As illustrated, financial institutions are both impacted by nature degradation (outside-in) and contribute to nature degradation (inside-out), the so-called double materiality concept. The outside-in perspective links to the management of nature-related risks and clearly falls within the mandate of central banks and supervisors. The inside-out perspective is less recognised yet by central banks and supervisors but equally relevant for the risks that in the end the financial sector is exposed to in the future. For that reason it is important to assess the impact as well, as it is linked to the risk perspective (Boissinot et al., 2022). Firstly, the financing of harmful activities can result in transition risks, for example since these activities are more sensitive to future regulations to reduce pressure on nature. Some academic papers suggest that the impact of a financial institution could be a proxy for nature-related transition risks (Svartzman, Espagne, et al., 2021). Secondly, there is a systemic risk component. Financing harmful activities results in the build-up of future physical risks and in turn can affect individual financial institutions again. These risks can become irreversible if tipping points occur. These activities contribute endogenously to nature-related risks. This is also recognised by the NGFS (NGFS, 2023). The updated DNB sustainable finance strategy acknowledges systemic risks as well (DNB, 2023d).

A recent working paper series from the ECB also highlights the need for supervisors to consider the role of the finance-economy-climate feedback loop, and to look into macroprudential tools for climate risks. They looked into climate scenarios and found that a disorderly transition results in more financial instability for the financial system compared to an orderly transition (Gourdel et al., 2022). Climate stress tests conducted so far come to the same conclusion: losses for financial institutions are the smallest in an 'orderly transition' or ‘accelerated transition’

scenario and the highest in a 'hot house world' or ‘delayed transition’ scenario (ECB, 2022a; Emambakhsh et al., 2023).

Central banks and supervisors need to understand these systemic risks better and take measures in order to prevent more drastic environmental outcomes. In this approach, there is no need to calculate robust numbers of nature-related risks. There is sufficient scientific knowledge, such as from the IPCC and IPBES that should convince central banks and supervisors to move financial allocations away from harmful activities (Chenet, 2021). Macroprudential policy can provide a solution here, but also transition plans for nature degradation. This is further discussed in the next chapter.

Adopt a precautionary approach: act with imperfect data and methodologies

Frameworks for measuring and understanding nature-related risks are not very advanced yet. The lack of data and methodologies and the uncertainty around the dynamics in nature make it a complex exercise and can result in an under-estimation of the risks. Forward looking scenarios that are currently considered cannot quantify all possible outcomes (Chenet et al., 2021, 2022; Kedward et al., 2022; Svartzman, Bolton, et al., 2021). For example, researchers found that climate models underestimate food security risks from compounding extreme weather events (Kornhuber et al., 2023). In addition, NGFS scenarios used by central banks and the broader financial system are fundamentally based on integrated assess-ment models. This group of models integrates economic activities with their impacts on the broader environment. However, as these models are still in relatively early stages of development, they yield inaccurate and unlikely results based on our scientific understanding of impacts of climate change. This most prominently includes very low, single-digit, projected global GDP loss for rather high temperature increases of three-plus degrees Celsius (Keen, 2021; Monasterolo et al., 2023; Simić, 2023; Trust et al., 2023). These results raise questions to what extent these models and scenarios are fit for purpose in the financial sector.

Central banks and supervisors are busy trying to assess and map nature-related risks, but face several challenges, like the lack of granular data, challenges in linking environmental parameters to prudential parameters, challenges in construction scenario analysis and challenges in the estimation of losses (EBA, 2023; NGFS-INSPIRE, 2022a). However, we cannot wait for the relevant knowledge and the complex methodologies to be built up before actions are implemented. For climate risks for example, it has been ten years of discussions and research already, and still no capital add-ons in Pillar II have been imposed. As described before, nature is a very pressing issue where we already crossed the planetary boundaries and with tipping points waiting to happen there is no time to wait for the perfect data. Moreover, nature-related risks come with radical uncertainty

where future outcomes and the variables determining them are unknown (Chenet et al., 2021; Kedward et al., 2022).

Next to that, central banks (and other policymakers) are currently in the mindset of waiting for nature-related risks or shocks to occur, and then mostly taking reactive action in response to the event (ex-post). This approach is futile when considering the worst risks (e.g. tipping points) because once the shock occurs, there is no guarantee we will return to a historically similar baseline. In the event of tipping points, biophysical and socioeconomic systems are more likely to be pushed into a new equilibrium state. The most prudent action to manage these risks is to prevent them from happening in the first place – i.e., preventative action before an event occurs (ex-ante).

Central banks and supervisors might therefore adopt a precautionary approach; work proactively and act with incomplete information (WWF, 2022a). They could therefore focus on taking pre-emptive, proactive measures which effectively contribute to reducing harm to ecosystems as well as recovering and restoring nature as fast as required. In addition, their efforts might be focused firstly on the highest emitting sectors, companies, and economic activities which are associated with the highest financial risks and, secondly, utilize the array of tools at their disposal to encourage the transition to a nature positive[1] economy. The EU legislature is supportive in this course of action, with the Article 191(2) stating: "It [EU policy on the environment] shall be based on the precautionary principle and on the principles that preventive action should be taken, that environmental damage should as a priority be rectified at source and that the polluter should pay".[2] As Christine Lagarde put it in a recent speech: "we cannot wait for the parameters of this new environment to become entirely clear before we act. We have to form a view of the future and act in a forward-looking way" (ECB, 2023d).

Focus on harmful activities and most material sectors

As explained by WWF in the Roadmap for central banks and financial supervisors, most harmful activities and vulnerable ecosystems are concentrated in a number of sectors (WWF, 2022a). In proposing supervisory measures for nature, following a precautionary principle, we keep the following guiding principles in mind:

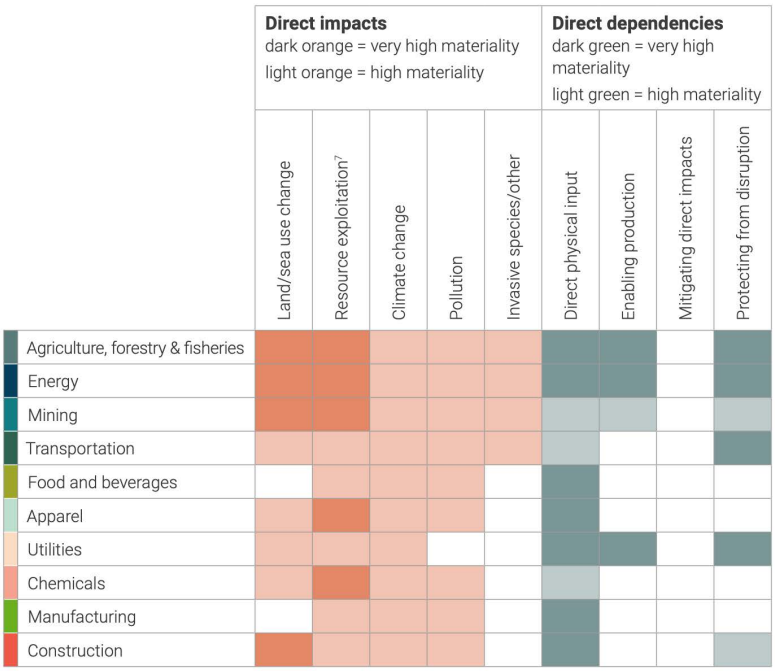
- Focus on the most impactful monetary and supervisory instruments to realise change in the real economy
- Prioritise the most material topics, sectors and geographies
- Prioritise topics for which data and methodologies are available

[1] Defined by WWF as the "need[s] to be more nature in 2030 than in 2020, that at least 30 % of land and oceans are protected, the footprint of our production and consumption is halved by 2030, and that there cannot be any offsetting" (WWF, 2022a).
[2] https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX%3A12008E191%3AEN%3AHTML

The GBF states all financial flows should be aligned with the goals and targets of the framework (CBD, 2022). The Dasgupta Review on the Economics of Biodiversity states "there is a need to identify and reduce financial flows that directly harm and deplete natural assets" (Dasgupta, 2021). These harmful activities contribute to financial risks in the system and therefore need to be mitigated. WWF also underscores this and urges central banks and supervisors to focus their policies on the most harmful sectors and activities. They have developed a reference point for an 'always environmentally harmful economic activities list' (WWF, 2022d). The EU Platform on Sustainable Finance recommended that the EU Taxonomy should be extended to classify harmful activities including those that cannot transition and where divestment is required (Platform on Sustainable Finance, 2022).

Figure 7 provides an overview of the most significant impacts and dependencies on nature, based on the ENCORE knowledge base.

Figure 7. Classification on significant impacts and dependencies on nature



Source: UNEP-WCMC (2022a)

There are currently multiple initiatives aiming to provide more granular and better supported information on harmful (sub)sectors. The SUSTAIN project aiming to update the ENCORE tool to include more value chain information, and to use a more detailed and standardised industry classification is an example of such an initiative (UNEP-WCMC, 2022b). However, even without further detailed analyses there seems to be high-level consensus which sectors include the most harmful

activities. We observe agriculture, forestry and fishery, energy and mining are the most harmful sectors. Infrastructure or distribution and chemicals are also often being mentioned.

BNP Paribas recently presented their analysis where they calculate the biodiversity footprint of their equity and fixed-income investments. This shows that consumer staples (food and beverage) has the highest biodiversity footprint, followed by materials, and consumer discretionary sectors (BNP Paribas, 2022). A pilot analysis from the Finance for Biodiversity Foundation on the biodiversity footprint of companies in the MSCI World Index also confirms that the food, beverage & tobacco sectors have the highest impact on nature. This is followed by the materials sector (including chemicals, metals & mining) and the energy sector (Finance for Biodiversity Foundation, 2023a).

Obviously, when more information on harmful sectors or nature-related issues becomes available or when data and methodologies further mature, the supervisory focus and instruments can be enhanced or expanded to a broader scope.

Integrating nature into supervision and monetary policy

This section summarises actions central banks and supervisors can already take now. It also describes how these actions can be integrated in current supervisory processes and monetary policy.

Expanding research and providing insights in nature-related risks

In order to further integrate nature-related risks into central banks' policies, central banks and supervisors need to better understand the risks themselves. Several central banks have already started with analysing impacts and dependencies in the financial system and with the quantification of nature-related risks. This should not delay action as there are actions that can be taken in parallel. We do however believe it's important that central banks and supervisors continue this journey of researching nature-related risks and gaining new insights.

Readily available data, tools and methodologies can provide a picture of nature-related risks in the financial system. Central banks and supervisors can for example build a metrics dashboard including a set of nature-related indicators, which they can use to monitor and mitigate nature-related risks (Braunschweig et al., 2022). The starting point for finding these metrics can be the overviews provided by the TNFD and Finance for Biodiversity (Finance for Biodiversity Foundation, 2022; TNFD, 2023b, 2023d). These metrics should include endogenous risks and therefore impacts need to be included as well. Both sectoral and location-specific information is important.

Currently there is no agreed overview on harmful sectors for nature. For climate, the scientifically substantiated Climate Policy Relevant Sectors (CPRS) framework, developed by a group of researches was recognised by central banks (Battiston et al., 2017; FINEXUS: Center for Financial Networks and Sustainability, 2022). The CPRS is a classification framework providing insights in activities exposed to transition risks. It can easily be linked to NACE codes the financial sector is already working with. Agreeing on something similar for nature-related risks could support the financial sector to take further steps. Sectoral pathways towards nature-positive outcomes are also not yet developed and agreed upon. Central banks and supervisors can embrace currently available research or push for additional research in this field, for example conducted by NGOs or academic researchers.

Expanding the current research, collecting the right indicators and doing more research on sectoral information should not hold central banks and supervisors back from already implementing policies. These are further summarised below.

Requiring sufficient capabilities and a strong governance within financial institutions

Financial institutions should have the right capabilities and knowledge levels to be able to assess nature-related risks. This also holds for the board and other management bodies. The fit and proper assessment assesses the capabilities of the management bodies, both management functions and supervisory functions, of an institution. In the Netherlands, DNB is responsible for the fit and proper assessments of financial institutions supervised by DNB. This includes the pension funds, insurance companies and the banks under the supervision of DNB. The ECB is responsible for the financial institutions that fall under the supervision of the ECB. The ECB published a guide describing the policy stances, supervisory practices and processes with respect to these fit and proper assessments (ECB, 2021). They acknowledge that it is essential for members of management bodies to have an adequate understanding of climate and environmental risks and include this in their fit and proper assessments. This is in line with expectation 3.2 of the ECB Guide on C&E risks: “The management body is expected to consider the knowledge, skills and experience of its members in the area of climate-related and environmental risks in its assessment of the collective suitability of such members” (ECB, 2020).

DNB mentions that they explicitly take into account the knowledge of climate and environmental risks as well (DNB, 2021b). The application form includes a question about the knowledge of climate and environmental risks[3] (DNB, 2022b). The knowledge of these risks needs to be summarised in the application form. In some cases (one out of ten) an interview is followed, and if deemed relevant for the

[3] The application form includes the following question: “What is the knowledge and experience of the candidate regarding climate-related and environmental risks? What is the overall knowledge and experience of the board regarding these risks?”

specific position the knowledge of these risks are further discussed. Typically, for applications for roles related to investment management an interview is followed. In such interview relevant regulations are discussed for example, or the knowledge about financial risks associated with climate change. Nature-related risks are part of the ECB Guide on C&E risks but compared to climate risks, less often discussed.

In order to ensure sufficient knowledge on management level, it is important to explicitly assess the knowledge of nature-related risks as well in the fit and proper assessment. In every board, at least one board member should have detailed knowledge about for example the concept of planetary boundaries, the link between biodiversity and climate and how the financial institution is affected by these risks. The other board members should have a basic understanding of nature-related risks as well to be able to link it to their field of work and act upon it. Next to that it is important to understand the concept of litigation risks in relation to nature degradation and climate change. This means keeping track of the commitments and understand what that means for the organisation.

Also, the integration of nature in the broader governance of the organisation needs to be part of the supervisory process. Governance is mentioned in the ECB Guide and also the DNB Guide on C&E risks for pension funds and insurance companies refers to the importance of good governance. It includes examples of good practices related to governance (DNB, 2023b). Next to that it needs to be ensured that management bodies put and keep nature-related risks high on the agenda.

Central banks and supervisors also have a role to play to promote and support voluntary initiatives within the financial sector. DNB for example initiated the Sustainable Finance Platform ('Platform voor Duurzame Financiering'') in 2016. Its goal is to promote sustainability in the financial sector. It is a partnership between the Dutch financial sector, the government and supervisory authorities, working together on different themes in different working groups (DNB, 2023g).

Sustainable Finance Platform, Biodiversity Working Group

The Biodiversity Working Group consists of ten Dutch organisations, eight of which are financial institutions. The Working Group has published several reports, including a roadmap to protect biodiversity, a report on deforestation and on regenerative agriculture. Moreover, it launched an e-learning on bio-diversity for the financial sector. The Working Group is still active and plans to continue to share their plans and good practices.
(DNB, 2023e)

Central banks and supervisors can also promote other initiatives such as signing the Finance for Biodiversity Pledge, participating in its working groups and joining TNFD initiatives.

Finance for Biodiversity Pledge

The Finance for Biodiversity Pledge, hosted by the Finance for Biodiversity Foundation, is a commitment of financial institutions to call on global leaders and to protect and restore biodiversity through their finance activities and investments. It describes 5 steps: (1) collaborating and sharing knowledge, (2) engaging with companies, (3) assessing impact, (4) setting targets, (5) reporting publicly on the above before 2025. Currently 153 financial institutions have signed the pledge. Members of the Finance for Biodiversity Foundation can participate in different working groups working together on for example engagement, impact measurement and data or target setting. (Finance for Biodiversity Foundation, 2023b)

There are also collective engagement initiatives which can be powerful for investors to address specific nature-related topics.

Collective engagement initiatives

Nature Action 100 is an example of a global investor engagement initiative focused on driving action to reverse nature loss and on increasing corporate ambitions. 100 systemically across several key sectors are selected. companies in key sectors are defined. The initiative coordinates engagement activities between investors and supports in defining concrete ambitious asks for these companies. There are also collective engagement initiatives focused on specific topics. Examples are the Finance Sector Deforestation Action, Investor Policy Dialogue on Deforestation and the Forest Finance Risk Consortium, focused on halting deforestation.
(Climate Champions, 2023; Nature Action 100, 2023; Tropical Forest Alliance, 2023; WBCSD, 2023)

Microprudential policy: Expanding the current recommendations on C&E risks

The ECB Guide on C&E risks includes recommendations for banks to integrate C&E risks. For insurance companies and pension funds, most supervisory recommendations come from national central banks and supervisors, although the IORP Directive includes minimum standards. DNB developed their own good practices guide for pension funds and insurance companies to integrate C&E risks.

Below we summarise some elements on which the supervisory recommendations on C&E risks can be expanded to better capture the nature-related risks. In turn, this needs to be integrated in existing supervisory practices as well.

Analysing and disclosing nature-related risks

In order to fully capture nature-related risks in the supervisory recommendations, disclosure of impacts, dependencies and the corresponding nature-related risks (e.g. in line with the TNFD framework) is required. Tools like ENCORE (for impacts and dependencies), the WWF Biodiversity Risk Filter (for nature-related risks) or the classification by UNEP (on which Figure is based) provide a useful starting point for this (ENCORE, 2023; UNEP-WCMC, 2022a; WWF, 2023b). They provide information on impact and dependencies on (sub) sector level. The TNFD LEAP framework provides relevant step-by-step guidance on how to assess these impacts and dependencies and corresponding risks (TNFD, 2023c).

Disclosures on endogenous risks

The ECB Guide on C&E risks follows a single materiality perspective. The DNB Guide on C&E risks acknowledges the double materiality concept but does not include specific recommendations on managing negative impacts. IORP II, defining minimum standards for pension funds and insurance companies is currently being reviewed, including the further integration of sustainability. The current proposals in the IORP II consultation, in contrast, specifically mention the need to adopt a double materiality approach (EIOPA, 2023). However, this proposal is still under discussion and will take a couple of years before implemented.

Mandatory disclosure of contributions to harmful activities is important (Kedward et al., 2022). This could be analysed per (sub)sector, per impact driver or on a location basis. The SBTN Sectoral Materiality Tool, Iceberg Data Lab and the Global Impact database can help analysing these negative impacts (Iceberg Data Lab, 2023; Impact Institute, 2023; SBTN, 2023c). Financial institutions should also describe the risk mitigation policies for these harmful activities or sectors they have identified. This could include limits, due diligence standards, or lending application or investment selection policies.

Current Pillar III disclosures on ESG risks for banks already include templates to report exposure towards carbon-intensive sectors (EBA, 2022a, 2022b). This could be further detailed to also include exposure to sectors with high nature-related risks. For example, the category ‘Agriculture, forestry and fishing’ can be split into sub-categories requiring banks to report on organic versus non-organic farming. Similarly for the ‘Production of chemicals, a sub-category can be defined for chemical producers which are clearly harmful to nature such as pesticide producers. For Pillar III disclosures under Solvency II, something similar could be implemented.

The TNFD framework provides a comprehensive overview of disclosure requirements for nature and can be used as a guide for mandatory disclosures on nature-related risks and impacts. This is an addition to current disclosure and risk management requirements and upcoming sustainable finance reporting requirements. The CSRD for example only requires reporting on biodiversity related topics if organisations consider the topic as material. The SFDR only has one mandatory PAI for biodiversity, and the EU Taxonomy focuses mainly on 'green' financing, rather than harmful exposures.

Due diligence

Chain transparency is key to be able to assess harmful activities. Currently financial institutions and central banks and supervisors do not have a complete picture on the complete value chains of the companies financed to or invested in. Financial institutions should therefore also gather location-specific information and disclose exposures to sensitive locations, which are for example areas important for nature, or areas with high levels of nature loss (TNFD, 2023d, 2023a). Location-specific data on the origin of different products can help tracking value chain impacts. Going back to the original source can help supervisors to perform independent assessment instead of relying on modelled data or metrics. The Corporate Sustainability Due Diligence Directive (CSDDD) aims to improve due diligence requirements for negative impacts on humans and the environment (European Commission, 2023b). However, at the moment it is still unclear whether the financial sector will fall within scope of this CSDDD. Mandatory disclosure of location-specific data on value chains can bridge this gap.

A specific concern is that of nature crimes, like illegal deforestation, in the value chain. Nature crimes are in the top five most profitable criminal enterprises (Finance for Biodiversity Initiative, 2022). Existing anti-money laundering (AML) rules should be applied more intensively and can be extended to cover the wide range of nature crimes.

Adding transition plans

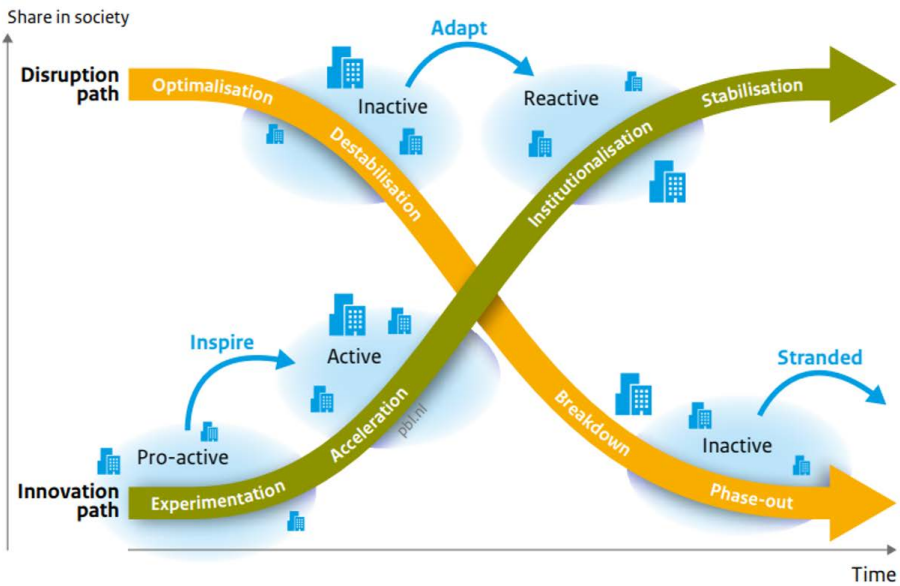
Up until now, the discussion around transition plans has been almost exclusively focused on climate. For climate, transition plans are expected to be mandated by law in the new Capital Requirements Directive (CRD IV) proposal (article 76(2)), which is part of the Banking Package 2021 (European Commission, 2021c). For insurance, climate transition plans are expected to become mandatory as well in Solvency II, although this is still uncertain. More detailed guidance for climate transition plans is expected to be prepared by the European Banking Authority (EBA) and the European Insurance and Occupational Pensions Authority (EIOPA).

The interconnectedness of climate change and biodiversity requires biodiversity to be integrated in climate transition plans. As discussed before, it will be impossible

to meet climate goals without considering biodiversity, and considering them together also provides opportunities for synergies. Also, potential trade-offs need to be considered.

Figure 8 shows the role of different companies in the transition towards a nature-positive economy (PBL, 2022). There are harmful companies that become stranded, and need to be phased out. There are new companies that need to be accelerated and there are companies which need to adapt and transition. Financial institutions should have different strategies for these different categories. This is where transition plans can play an important role. First of all, financial institutions should identify the biggest nature-related risks and show how they mitigate those, for example through engagement ('adapt' in Figure 8) or phasing-out ('stranded' in Figure 8). Secondly, they should identify the most important nature-based solutions (NBS) and see how to support those ('inspire' in Figure 8). Examples of nature-based solutions are the restoration of nature or investing in regenerative projects such as regenerative agriculture.

Figure 8. The role of companies in biodiversity transitions



Source: PBL (2022)

All of this should align with defined targets. Financial institutions should define specific nature targets for their portfolios, for the short-, medium- and long-term. For example, DCF (Deforestation and Conversion Free) or NDPE (No Deforestation, No Expansion on Peat and No Exploitation) commitments, covering cross-commodities, the reduction of water consumption and pollution, targets on eco-system protection like river connectivity, or the phase-out of finance linked to key biodiversity areas or natural areas of international importance (e.g. Ramsar sites).

These targets should be in line with global goals such as in the GBF, or regional or local governmental goals or regulations. From a supervisory perspective, misalignment with global targets can be considered an indicator for transition risks. And from a macroprudential perspective, misalignment with global targets can be used for identifying systemic risks.

For nature specifically, tools, scenarios and metrics to measure alignment are still under development. Recently, a new initiative has been launched aiming to create alignment on the term 'nature-positive'. The priority will be to define a common definition, metrics and tools and methodologies to measure and report on impact. It is a follow-up of the work around the development of a 'nature positive by 2030' goal, referring to halting and reversing biodiversity loss by 2030 from a 2020 baseline (Nature Positive, 2023). There are also developments on the target setting side. The Science Based Targets Network (SBTN) is currently working on key principles for science-based targets for financial institutions. SBTN has already published science based targets for companies on freshwater and land (SBTN, 2023b, 2023a). The Finance for Biodiversity Foundation, together with UNEP FI Principles for Responsible Banking are developing guidance and examples for target setting by the financial sector on nature.

However, given the urgency of addressing nature, and given what is already available, financial institutions should start preparing transition plans for nature and updating these plans on a regular basis. Financial institutions also have a role to play to require transition plans that include nature from their counterparties. A two-step approach can be followed (WWF, 2023a). Firstly, financial institutions should integrate biodiversity in climate transition plans, taking into account the interconnectedness of biodiversity and climate change, but also the potential trade-offs, making sure that negative impacts of climate mitigation and adaptation measures on biodiversity and nature are mitigated, and capturing the opportunities that nature-based solutions provide for climate mitigation and adaptation. The 'do no significant harm' (DNSH) criteria of the EU Taxonomy should be taken into account (European Commission, 2021a). Tools and guidelines which could in addition be used for assessing the biodiversity impact of their climate targets and actions are for example the Guidelines on Business and Key Biodiversity Areas and the WWF guidance on high-quality interventions for people, nature and climate (IUCN, 2018; WWF, 2021). The Guidance on Key Biodiversity Areas is based on the IBAT database, and includes a framework for the identification of protected and key biodiversity areas (IBAT, 2023). Financial institutions can use this to assess whether their climate actions, for example mining activities for renewable energy, are not linked to biodiversity rich areas. The WWF blueprint for high-quality interventions that work for people, nature and climate defines principles for nature based solutions for climate change mitigation, beyond the use of carbon credits. Secondly, in addition to climate targets, financial institutions should define specific

nature targets for their portfolios, for the short-, medium- and long-term and get to comprehensive transition plans for nature.

Central banks and supervisors should evaluate these transitions plans as part of their current supervisory processes. A group of researchers have developed a framework with 'red-flag' indicators to screen climate transition plans based on consistency, ambition and feasibility and credibility. A similar framework including nature-related risks could help central banks and supervisors to engage with financial institutions for which the transition plans are not up to standard. It can also be used in micro and macroprudential policy assessments for transition risk (Bingler et al., 2023).

Strict requirements of what a good (climate) transition plan entails are currently missing, although there are many reports with guidelines for climate-related transition plans, for example from the Science Based Target Initiative (SBTi), the UK Transition Plan Taskforce, the UNEP FI and UN High-Level Expert Group on the Net Zero Emissions Commitments of Non-State Entities (SBTi, 2022; TPT, 2023; UN High-Level Expert Group on the Net Zero Emissions Commitments of Non-State Entities, 2022; UNEP FI, 2021). Central banks and supervisors can use this guidance as a starting point to set clear requirements for nature-related transition plans as the generic guidelines and principles for climate transition plans apply to nature as well. However, the further detailing of transition plans specifically for nature requires for example reference to nature specific goals, different pathways and a different set of actions. Therefore, defining clear requirements for nature transition plans requires some further work. The Monetary Authority of Singapore (MAS) has issued a supervisory expectations for financial institutions on transition plans (MAS, 2023).

DNB announced they will prepare and disclose their own transition plan for climate. This includes specific ambitions in line with agreed climate objectives for their core functions and internal organisations (DNB, 2023f). Central banks and supervisors can also set an example themselves and disclose their own transition plan, including nature.

Increase capital requirements

There are currently discussions on integrating climate risk in capital requirements. Both the Basel Committee on Banking Supervision (BCBS) and the EBA are working on integrating climate-related risks and ESG risks in the prudential framework (BCBS, 2022; EBA, 2023).

In Pillar II, central banks and supervisors need to independently assess the impact, dependencies and risk assessments performed by financial institutions. This includes verifying transition plans. Central banks and supervisors should not only

look at risk management processes and policies but also the methodologies and materiality of the risks. If processes and policies are not up to standard or if the risks are underestimated, penalties or capital add-ons should apply.

The EBA published a report on the role of environmental and social risks in the prudential framework. This report addresses the potential revision of the Pillar I framework to consider more forward-looking elements, the inclusion of environmental and social risks in the Internal Rating-Based (IRB) models and the Standardised Approach (SA) and the consideration of concentration risk related metrics (EBA, 2023). One of the recommendations of EBA is to include these risks in IRB models through the Margin of Conservatism (MoC) component, the downturn component, overrides or by calibration techniques. This should be done using observed and reliable data.

In Solvency II, climate-related risks are not part of the capital requirements framework yet (EIOPA, 2022c). The current Pillar I framework under both Basel and Solvency II only looks at a one-year horizon for the most part, and the calculations are based on historical data. Nature-related risks typically have a longer horizon to materialise and historical information only will not give a complete picture. Also the current framework does not capture the non-linearity of nature-related risks and its potential tipping points (Bank of England, 2021). Therefore, it is unlikely that these risks will be properly captured in the current setup of the Pillar I framework.

Until the Pillar I framework is able to capture these risks, an adjustment factor, increasing risk weights for harmful activities, combined with specific locations relevant for nature-related risks, can be implemented. Article 459 of the CRR already allows for the override of risk weights (Regulation (EU) No 575/2013, 2013). There are more rigorous proposals as well. Finance Watch, for example, put forward the idea of a 'one-for-one rule' for the financing of new fossil fuels extraction development. It proposes a 100% capital charge (1250% risk weight) for new fossil fuel financing, implying that for each euro invested in these projects, financial institutions should put one euro aside to cover for potential losses (Finance Watch, 2021).

Macroprudential policy

Nature-related risks have a systemic dimension and may give rise to 'green swan' events: "potentially extremely financially disruptive events that could be behind the next systemic financial crisis"(Bolton et al., 2020). The European Systemic Risk Board (ESRB) calls for a forward-looking precautionary approach to deal with the radical uncertainty around climate change and acknowledges the significant systemic dimensions (ESRB, 2023). Macroprudential policy inherently takes endogenous risks into account.

Central banks and supervisors can monitor nature-related macroprudential indicators as part of their financial stability assessments. The Financial Stability Report of the DNB for example includes a qualitative indicator for nature-related risks (DNB, 2023a).

The EU's macroprudential framework is currently under review. In principle, most existing macroprudential tools can be adapted to take nature-related risks into account. The tools that stand out most are the (sectoral) systemic risk buffer (SyRB) and large exposure limits (Grunewald, 2023; Hiebert & Monnin, 2023; Schoenmaker et al., 2015). The SyRB addresses systemic risks not already addressed by other capital buffers. It can be applied on sectoral level, or for specific groups of exposures, for examples harmful activities. Large exposure limits for nature-related risks limit the exposure to harmful activities. The current large exposure requirements limit the exposure to individual counterparties or a group of connected counterparties. For nature-related risks, these limits could be applied to groups of harmful activities, sectors or geographical regions. The existing large exposure regime then needs to be adopted to account for sector activity or locations. Concentration limits can also be implemented outside the large exposure framework.

Monetary policy

Similarly to its supervisory counterpart, monetary policy as it pertains to nature is still in the developing stage. In addition, in the current environment of monetary tightening, little room is left for even the climate agenda. For instance, asset purchasing programme is being rolled back, leaving little room for the effectiveness of the green 'tilting' policy, while the climate-related haircut adjustment in the collateral framework is being put on hold (ECB, 2022f; Schnabel, 2023). The same reasoning is applied to greening the refinancing operations, with the ECB officials associating this policy with the expansionary, and not the contractionary environment we're finding ourselves in presently (Schnabel, 2023). This makes expanding the ambition to biodiversity even more challenging. Nevertheless, there are clear lessons that can be drawn from proposals on taking climate into account in the monetary policy instruments that can be used to address nature-related risks.

As already mentioned, the ECB had already committed to decarbonizing its asset purchasing portfolio and the collateral framework. This entails that, for the collateral framework, the ECB announced introducing higher haircuts for the assets issued by high-emissions companies (ECB, 2022d). This shift could be very impactful, as the collateral framework sits at the core of the ECB's monetary policy and has a strong signalling role for the financial sector more broadly.

The ECB has also decided to purchase fewer bonds of high-emitting companies and more of the low-emission ones ("tilting"). However, this instrument currently

has little broader impact as in this phase of monetary tightening the ECB is winding down its asset purchase portfolio (ECB, 2023g). Although reinvigorating this policy through greening the stock of existing assets (as opposed to only the flow of the new purchases, which is being stopped with) in the portfolio is apparently still on the table (Schnabel, 2023). In any case, its climate commitment could prompt the ECB to maintain and promote the green 'tilt' as a structural feature of its policy, thus taking into account any future expansion of the asset purchases, rather than a one-time commitment.

Next to the collateral framework and the asset purchasing programme, a proposal to decarbonize a third large instrument of the ECB, the targeted longer term refinancing operations (TLTRO), has been put on the table (van 't Klooster & van Tilburg, 2020). This would, effectively, stimulate bank lending for sustainable investments and could potentially offset negative effects of current monetary policy tightening on green energy sectors (Van Tilburg, 2023). This policy proposal has not been implemented by the ECB, but appears to be still under consideration (Randow & Horobin, 2022). The green credit facility has already been rolled out by the People's Bank of China and the Bank of Japan, and considered by the central banks of Brazil and Korea (Eames & Barmes, 2022). An alternative approach here could be to exclude the most harmful sorts of lending from a general TLTRO.

These three approaches to decarbonization could be relatively straightforwardly transposed onto the nature-related considerations. In that sense, companies that have negative impacts on nature could be disfavoured in the asset purchases and collateral framework, whereas nature-positive activities could be stimulated. Central banks could play an even larger role in this by bringing all the climate and environmental assessments on the quality of the collateral in-house, rather than relying on third-party, private agencies (Abdelli & Batsaikhan, 2022). Refinancing operations could be similarly modified to stimulate more nature-positive bank lending (Monnin, 2022).

Supervisory and monetary policy can have a synergetic effect in this area. For instance, credible, science-based transition plans, mainly discussed in the context of financial supervision, could also be used to inform monetary policy. For instance, the ECB has already announced its three-step scoring card for issuers that would determine their 'greenness' and the corresponding weighting of the 'tilt' of its asset purchasing programme (ECB, 2022e). It is likely that transition plans of issuers could be used as a factor in this scoring system, with more credible and favourable plans receiving more preferential treatment in the policy operations.

4. MAKING IT PRACTICAL: REDUCING EXPOSURES TO HARMFUL ACTIVITIES

Harmful activities that financial institutions invest in are both a source of transition risks and contribute to the build-up of physical risks in the system. Therefore, these harmful activities need to be mitigated. A precautionary approach is needed as measuring these negative impacts is complex and existing tools and databases have their limitations. However, there is still much that can and should already be done. The current exceedance of the planetary boundaries confirms the need for system-wide action. Central banks and supervisors can take action already today. This section describes what could be the first steps that central banks take.

Guiding goals

In defining criteria for harmful activities, we focus on the sectors and topics which have the largest negative impact on nature. Additionally, we look into topics where data is already available and for which a guiding goal is defined. These guiding goals, for example the targets included in the GBF, can give rise to transition risks when implemented in local regulations. There are also other goals for nature, for example mentioned in the Green Deal. These goals do not only relate to transition risks, but they also point towards the topics and areas where the largest physical risks are expected. Therefore, these public targets are considered a starting point for defining criteria for central banks and supervisors.

Table 2 presents some concrete public (global and European) goals for nature in 2030. We selected the guiding goals related to underlying pressures and activities as these can more directly be linked to supervisory instruments compared to the goals focused on outcomes. Once these guiding goals are translated into national policies, central banks and supervisors can refer to and align with those as well.

Table 2. Global and European guiding goals for 2030

Goals for 2030	Source	Current status[4]
Protection: 30% of land and sea is legally protected of which 1/3 under strict protection	GBF, target 3 EU Global biodiversity strategy, target 1 and 2 (CBD, 2022)	Protected land: 26% Protected sea: 12% Strict protection no indicator yet
Restoration: Conservation measures for at least 30% of habitats not in good condition	GBF, target 2 Nature restoration law, Article 4.1 and 5.1 EU Global biodiversity strategy, target 4 (CBD, 2022)	No indicator yet
Restoration: No net loss of green urban space by 2030, and an increase in the total area covered by green urban space by 2040 (4%) and 2050 (5%)	Nature restoration law, Article 6.1 and 6.2 (European Commission, 2022b)	
Agriculture: The risk from chemical pesticides and highly hazardous pesticides is reduced by 50%	GBF, target 7 EU Global biodiversity strategy, target 6 Farm to Fork strategy (CBD, 2022; European Commission, 2020)	No indicator yet
Agriculture: 20% reduction of the use of fertilizers	GBF, target 7 EU Global biodiversity strategy, target 13 Farm to Fork strategy (CBD, 2022; European Commission, 2020)	No indicator yet
Agriculture: At least 10% of agricultural area is under high-diversity landscape features	EU biodiversity strategy, target 7 (European Commission, 2023a)	No indicator yet

[4] From: EU Biodiversity Strategy Dashboard (europa.eu)

Agriculture: At least 25% of agricultural land is under organic farming management	EU biodiversity strategy, target 8 Farm to Fork strategy (European Commission, 2020, 2023a)	Organic farming: 9%
Deforestation: Three billion additional trees are planted in the EU	EU biodiversity strategy, target 9 (European Commission, 2023a)	Trees planted as part of the pledge: 1,1 billion
Deforestation: Specific commodities and derived products produced in and exported from the EU have not led to deforestation.	EU Deforestation Regulation (Regulation (EU) 2023/1115, 2023)	
Deforestation: Eliminate forest loss by 2030	Glasgow Leaders' Declaration on Forests and Land Use (a political declaration signed by 145 countries, covering 90% of forests) (UN climate change conference UK 2021, 2021)	
Water: At least 25,000 km of free-flowing rivers are restored	EU biodiversity strategy, target 11 (European Commission, 2023a)	No indicator yet
Food waste: Sustainable consumption choices are enabled, and food waste reduced by half	GBF, target 16 (CBD, 2022)	
Incentives: Reduce harmful incentives by at least $500 billion per year	GBF, target 18 (CBD, 2022)	

Source: Sustainable Finance Lab (2023)

Material topics

Below we summarise topics related to the most harmful activities or sectors, for which there is a public guiding goal available and for which there are data sources readily available which can be used for supervisory instruments.

Deforestation and conversion

Introduction

Forests and other natural ecosystems provide important services to humans. They are a source of livelihood for humans and are key to meet climate goals through the carbon they sequestrate. However, forests are degrading and disappearing at an alarming rate. The world has lost one third of its forests already. Moreover, in only the last 100 years the world has lost as much forest as in the previous 9000 years (Ritchie, 2021). 17% of the entire Amazon and 20% of the Brazilian Amazon are already lost. Further deforestation in the Amazon could trigger tipping points beyond which restauration is no longer feasible (Lovejoy & Nobre, 2019). Agriculture and forestry are responsible for over 80% of deforestation worldwide. This is mostly driven by the cattle, soy, palm oil and timber commodities (CDP, 2020).

Guiding goals

The EU Deforestation Regulation came into force this year and requires companies trading in specific commodities (cattle, cacao, coffee, oil, palm, rubber, soya and wood) and their derived products to conduct extensive due diligence on the value chain. The financial sector itself is not included in the EU Deforestation Regulation. Nevertheless, the financial sector plays a key role in financing deforestation and will be impacted by this regulation through its clients. Moreover, in the Glasgow Leaders' Declaration on Forests and Land Use countries declared to end forest loss by 2030. The EU Biodiversity Strategy includes a target to plant three million additional trees in the EU by 2030 (European Commission, 2023a; UN climate change conference UK 2021, 2021). The world is currently off track to meet the 2030 goals of halting and reserving deforestation (Forest Declaration Assessment, 2023).

Frameworks and databases

There are several frameworks available for financial institutions to assess the risks around deforestation. Examples are the Accountability Framework, guidance outlined in the Global Canopy Deforestation-Free Finance Roadmap and a practical guide from WWF on deforestation risks (Accountability Framework Initiative, 2023; Global Canopy, 2021; WWF, 2022c). Dutch central bank also published guidelines for risk mitigation for deforestation (Sustainable Finance Platform, 2020) Central banks and supervisors can use these frameworks. In addition, several useful databases are identified for central banks and supervisors to gain insights in the financial risks associated with deforestation. These are summarised in Table 3.

Table 3. Selection of relevant databases for deforestation

Database	Description	Can be used for
Global forest watch	Uses geospatial data to monitor forests worldwide.	Assessing performance of companies on their imple-mentation of commitments to deforestation
Trase	Follows trade flows and maps companies in supply chains linked to deforestation; linking countries, traders and production places.	Identifying which companies are exposed to high-risk regions and commodities
Forest and Finance database	It assesses the financing of 300 companies in supply chains of commodities linked to deforestation. It also evaluates the policies of these financial institutions. Used in the Global Witness Report. (Forest and Finance, 2023; Global Witness, 2021)	Identifying the quality of the financing and investment policies of financial institutions to deforestation-risk commodity sectors in tropical regions.
Forest 500 (Global Canopy)	Identifies 350 corporates and 150 financial institutions with the largest exposure to deforestation	Identifying the commitments and actions that companies and financial institutions undertake for addressing deforestation risks in global supply chains.
Forest IQ	New database providing insights for financial institutions on exposures linked to deforestation. Combines amongst others, Forest 500, Trase and the Accountability Framework	Identifies exposure to de-forestation of companies, their financial materiality and their performance on reporting.

Satelligence	Uses satellite images and Artificial Intelligence (AI) to provide insights in global performance and risks in agricultural production.	Identifying high-risk areas

Source: Sustainable Finance Lab (2023)

Even though most of the tools for operationalization only refer to deforestation, conversion of other ecosystems should not be overlooked or underestimated. Some tools do include indicators on conversion within their methodology, such as Forest500.

Pesticide production

Introduction

Pesticides are a significant contributor to nature degradation and play a large role in our food production system. Pesticides contribute to land use change and pollution. The use of pesticides have a negative impact on the variety of insects, bird populations, the quality of the soil and freshwater and marine ecosystems. They also enable intensive farming which is harmful to nature on itself (ShareAction, 2023b). To halt nature degradation the use of pesticides needs to be significantly reduced.

Guiding goals

The GBF and the EU Biodiversity Strategy aim to reduce in 2030 the risk of chemical and of highly hazardous pesticides by 50% (CBD, 2022; European Commission, 2023a). This is aligned with the Farm to Fork Strategy and with the list of Highly Hazardous Pesticides from Pesticide Action Network (European Commission, 2020; Pesticide Action Network International, 2022). The EU Biodiversity Strategy also includes as one of its targets to have at least 25% of agricultural land under organic farming management in 2030.

Frameworks and databases

Over 80% of the global pesticide market is dominated by six companies, and many financial institutions invest in these companies (ShareAction, 2023a). Financial institutions should identify pesticide producers and the companies making use of pesticides in their value chain. Engagement strategies or exclusion policies could then apply. Central banks and supervisors can monitor the list of dominant pesticide producers. ShareAction has used publicly available data from annual and reports to identify the six largest pesticide producers.
Pesticide producers fall into the WWF 'Always harmful subsector category' Fertilizers & Agricultural Chemicals (GICS Code: 15101030) (WWF, 2022d).

Mining activities in biodiversity sensitive areas

Introduction

Mining activities pose threats to nature. It is expected that mining activities will only increase as we move to a low carbon economy with more renewable energy. Research shows that global mining potential overlaps with 7% of the protected areas, 7% of the key biodiversity areas and 16% of the remaining wilderness. Mining areas mostly target materials for the energy transition (Sonter et al., 2020). The increased need for these materials poses serious threats for nature. With the GBF goals for the increase in global protected and restored land and sea this might lead to land use conflicts and thereby transition risks.

Guiding goals

In 2030, 30% of land and sea is legally protected of which one third under strict protection (CBD, 2022).

Frameworks and databases

To analyse the potential transition risks related to mining activities and biodiversity sensitive areas, data on both potential mining activities with biodiversity sensitive areas is needed. These maps can then be combined.

Sonter et al. (2020) performed an analysis on mining activities in biodiversity sensitive areas. The included scope was materials needed for wind turbine manufacturing, solar photovoltaic installations and storage batteries for electric vehicles, and some other technologies e.g., carbon capture and storage installations, nuclear electricity generation installations, LED manufacturing, electric vehicle manufacturing, and lithium-Ion batteries. They used data from S&P Global Market Intelligence for locations of mining properties worldwide (Sonter et al., 2020). The IBAT data base can be used for data on protected areas and biodiversity sensitive areas as it includes data on Protected Areas, IUCN Red List of Threatened Species, and the World Database of Key Biodiversity Areas. The four twenty-seven database is able to link protected areas to financial exposures.

A similar study was conducted for fossil fuel projects in relation to biodiversity sensitive areas. RepRisk performed an analysis and concluded 73% of oil and gas projects are close to biodiversity sensitive areas. Here, ESG data from RepRisk was combined with IBAT data on biodiversity sensitive areas (RepRisk, 2022).

Intensive farming

Introduction

Intensive farming is amongst the largest drivers of nature degradation. Intensive farming for example degrades the quality and biodiversity of the soil, reduces habitat and population sizes, contributes to pollution of natural resources, compromises ecosystem services like carbon storage and pollination and is

the largest water using sector. Although not the only solution, more organic farming practices can be part of the solution. The European Commission recognises this and states that organic farming opens the way towards more green agriculture, the integration of circular concepts, increased animal welfare and a better income for farmers (European Commission, 2021b).

Guiding goals

The EU Biodiversity Strategy states by 2030 at least 25% of agricultural land is under organic farming management. In the Netherland specific measures apply to reduce nitrogen levels as well.

Frameworks and databases

Central banks and supervisors could request data from financial institutions on total hectares organic and non-organic farmers in the portfolio or number of organic and non-organic farmers financed. This data can then be further expanded to also include the broader value chain (e.g., supermarkets).

Fossil fuels

Introduction

Fossil fuels directly contribute to nature degradation, through climate change but also pollution and the destruction of habitats.

Guiding goals

The global Paris agreement aims to limit global warming to 1,5 degrees Celsius above pre-industrial levels. Local governments have their own targets and plans in line with the global target. In the Netherlands the target is to reduce emissions by 50% with an aim to reduce by 60%. The International Energy Agency has warned that exploitation and development of new oil and gas fields must stop immediately in order to stay within the global climate goal of 1,5 degrees Celsius.

Frameworks and databases

On (sub)sector level, central banks and supervisors have insights in the exposures to Climate Policy Relevant Sectors (CPRS) or the carbon-intensive sectors summarised in Pillar III reports prepared by financial institutions themselves (Battiston et al., 2017; FINEXUS: Center for Financial Networks and Sustainability, 2022).

Next to that there are a number of sources providing overviews with harmful oil and gas companies. There is the Global oil exit List from Urgewald, which is a list of companies expanding oil & gas production. This list is being expanded with expansion plans (Urgewald, 2022). The Carbon Underground 200 identifies the top 100 coal and top 100 oil & gas reserve holders (Fossil Free Funds, 2023).
The Net Zero Tracker monitors how companies are doing in terms of net zero ambitions (Net Zero Tracker, 2023). Oil and Gas Policy Tracker monitors climate

transition plans of financial institutions (Oil and Gas Policy Tracker, 2023). The earlier mentioned “red-flag” indicators can also be used to screen climate transition plans of financial institutions (Bingler et al., 2023).

The WWF always harmful list includes a list of always harmful subsectors related to fossil fuels, being: Oil & Gas Drilling (GICS Code: 10101010), Integrated Oil & Gas (GICS Code: 10102010), Oil & Gas Exploration & Production (GICS Code: 10102020), Oil & Gas Refining & Marketing (GICS Code: 10102030), Oil & Gas Storage & Transportation (GICS Code: 10102040), Coal & Consumable Fuels (GICS Code: 10102050), Gas Utilities (GICS Code: 55102010), Electric Utilities (GICS Code: 55101010), Multi-Utilities (GICS Code: 55103010) in so far as it relates to electric and/or gas utilities (not water utilities), Independent Power Producers & Energy Traders (GICS Code: 55105010), Steel (GICS 15104050) in so far as it relates to metallurgical (coking) coal mining used for steel production (not steel production itself) (WWF, 2022d). This includes power generation from fossil fuels and thermal coal mining and peat extraction (Platform on Sustainable Finance, 2022). And companies that are expanding coal production or expanding oil and gas production (WWF, 2022c).

How central banks and supervisors could use this

First of all, central banks and supervisors could take topics like these into account into the supervisory practices (e.g., Pillar II). This means reviewing the extent to which financial institutions finance specific high-risk companies (e.g., deforestation-linked companies, largest pesticide producers, harmful oil and gas companies), high-risk subsectors (e.g. Fertilizers & Agricultural Chemicals or fossil fuel sectors) or high-risk activities (e.g. finance mining activities in biodiversity sensitive areas or intensive farming). They should also assess the reported risk levels against their own risk management estimations. Central banks and supervisors should require capital add-ons or other penalties in case risks are underestimated. Additionally, central banks and supervisors can request higher capital charges because of stranded asset risk by means of an adjustment factor. And concentration limits can be introduced to limit exposures to these companies, sectors or activities because of increased systemic physical risks.

When it comes to transition plans, central banks and supervisors can require financial institutions to consider the abovementioned topics in their transition plans and to include short-term targets on these topics. They can check alignment of the transition plans with GBF targets or other relevant guiding goals. If there is no alignment, then higher capital ratios should apply to compensate for the higher transition risk as well as the contribution to the systemic risk. Also, climate transition plans could be reviewed and compared against reported exposure to fossil fuels and broader carbon-intensive sectors and the lists of harmful oil and gas companies. Tools like the Net Zero Tracker, the Oil and Gas Policy Tracker and the “red flag” indicators can support the supervisory review of transition plans.

5. CONCLUSION AND RECOMMENDATIONS

There is an urgent need for central banks and supervisors to integrate nature-related risks. This means adopting an integrated approach to climate and nature, acknowledge endogenous risks, adopt a precautionary approach, focus on harmful activities, and continuously evaluate and adjust their strategies based on evolving data and methodologies. This cannot wait, and central banks also need not wait given the clarity policymakers have given on the targets and policies as well as the data and methodologies available. This report sets out concrete recommendations for central banks and supervisors to integrate nature-related risks and provides concrete examples.

Guiding principles

- **Integrated approach:** Climate change and nature degradation are inter-connected and should therefore be considered together. While there are synergies between nature conservation and climate change mitigation, there are also trade-offs, such as afforestation projects impacting native nature. The climate crisis cannot be solved without halting nature degradation.
- **Acknowledge endogenous risks:** Central banks and supervisors are urged to acknowledge both the outside-in perspective and the inside-out perspective and thus acknowledge the endogenous risks created by the financial system. Central banks and supervisors are uniquely positioned to address the systemic nature of climate change and nature degradation.
- **Adopt a precautionary approach:** A precautionary approach is recommended, emphasising proactive measures even with imperfect data and methodologies. Central banks and supervisors should act before it's too late and tipping points have been reached that make restoration impossible; rather to be roughly right than exactly wrong.

- **Focus on harmful activities:** Concentrate first on sectors causing the most harm. Prioritise supervisory measures on impactful sectors where data and methodologies are available, for example agriculture, forestry, mining and energy.

We identify five different topics where central banks and supervisors can make a start: deforestation, pesticide production, mining activities in biodiversity sensitive areas, intensive farming and fossil fuels. These topics are all big drivers of nature degradation for which guiding goals are defined, for example targets in the GBF. For these topics there are also databases and tools available to assess these activities. Central banks can take first action steps on nature by starting with these material topics first, being deforestation, pesticide production, mining activities in biodiversity sensitive areas, intensive farming and fossil fuels. They can for example consider these topics in existing supervisory practices and in transition plans.

We have identified the following recommendations for central banks and supervisors:

Short term (0-2 years)

Central banks own research

- Central banks and supervisors should embrace available (sub)sector overviews providing insights in harmful (sub)sectors and agree on a (sub)sector overview with harmful activities of (sub)sectors.
- Push for or contribute to research into sectoral transition pathways towards a nature-positive economy. Until that is available work with the most pressing issues for which guiding goals are already defined yet, providing insights in the required transition.
- In parallel, expand research on nature-related risks an indicators, using available tools and databases. Both to inform and mobilise the financial sector, but also to be able to monitor and supervise these financial institutions. Expand current benchmarking dashboards used to monitor risk management processes of financial institutions with nature-related data.
- Research the effects of nature-related risk on price stability.

Knowledge and governance of financial institutions

- Update the fit and proper assessment of the DNB and ECB and assess knowledge levels specifically for nature-related risks. In every board, at least one board member should have detailed knowledge about nature. The question on climate and environmental risks can be made more specific to also test the understanding of planetary boundaries, how nature degradation interacts with climate change and could impact their portfolio and the concept of endogenous risks.

- Monitor the governance of the organisation with respect to nature-related risks in regular supervisory practices and specific on-sites. Monitor how often these matters are discussed in board level meetings, and how often trainings or knowledge sessions on these topics are organised.
- Promote and facilitate voluntary initiatives within the financial sector around knowledge sharing, collective engagement activities (like Nature Action 100, Finance Sector Deforestation Action, Investor Policy Dialogue on Deforestation) and pledges like the Finance for Biodiversity Pledge.
- Share Good Practices, for example on the integration of nature-related risks in all phases of the risk management cycle, and specifically on transition plans.

Disclosure requirements and due diligence

- Mandatory disclosures of impacts, dependencies and nature-related risks following the TNFD framework. Align these requirements with developing reporting requirements such as the CSRD, SFDR and EU Taxonomy. This includes mandatory disclosures of exposures to harmful activities.
- Require chain transparency on the origin of different products. Mandatory disclosure of location-specific data to be able to assess the value chain impacts, starting with the most harmful sectors or activities.
- Mandatory requirement for financial institutions to demonstrate that there are no nature crimes in their financing value chains, either through AML rules being broadened or stand-alone mechanisms.

Transition plans

- Require financial institutions to include nature in their climate transition plans, taking into account the interconnectedness of biodiversity and climate change, but also the potential trade-offs.

Microprudential policy

- Develop supervisory recommendations for pension funds and insurance companies to integrate climate and nature-related risks.
- Include nature-related risks in the ORSA for insurance companies.
- Require financial institutions to perform a self-assessment on supervisory recommendations and prepare plans. Conduct on-site investigations on nature-related risks.

Medium term (2-3 years)

Transition plans

- Require transition plans for nature-related risks, integrated or at least consistent with climate transition plans. This includes identifying the largest nature-related risks and describe actions for mitigating those. It also includes actions to identify the most important nature-based solutions. Start

with the most harmful sectors and sectors for which the (qualitative) transition pathways are more or less clear. A two-step approach can be followed. First integrating the interaction with nature into existing climate transition plans, taking into account the interconnectedness of biodiversity and climate change, but also the potential trade-offs. Then including specific nature-related targets and actions.
- Define supervisory expectations for transition plans or support the development of industry standards for credible nature-related transition plans.
- Set an example and prepare and disclose a nature-related transition plan for the central bank itself.

Microprudential policy

- Integrate nature-related risk management and transition plans in existing supervisory policies such as on-sites. Apply stricter penalties, like capital add-ons or fines, for financial institutions that are underperforming or underestimating the risks, or in case transition plans are not credible or not sufficiently aligned with the goals. Central banks and supervisors can independently verify the risk and alignment levels themselves.

Macroprudential policy

- Expand the economy-wide stress tests conducted by the ECB and EIOPA to include nature-related risks. Conduct a specific stress test for the insurance sector as well.
- In financial stability assessment, include indicators for measuring and monitoring levels of systemic risks specifically to nature.
- Integrate nature in existing macroprudential policies such as concentration limits and the systemic risk buffer.

Longer term (4-5 years)

Microprudential policy

- Introduce higher capital requirements for exposures harmful to nature, by means of an adjustment factor to the models used for capital in Pillar I.
- Revisit the Pillar I framework to make it more forward looking and to allow for longer time horizons.

Monetary policy

- Apply lessons learned from decarbonising the monetary policy instruments to nature-related risks.
- Look for synergies between supervisory policies on nature-related risks and monetary policies and make them consistent, for example in the use of transition plans.

ANNEX: OVERVIEW CONTRIBUTORS

Interviews

- Isobel Allen, ShareAction
- Jeff Althouse, Banque de France
- Geraldine Ang, OECD
- Sebastian Becker, UNEP-WCMC
- Jeroen Candel, Wageningen University & Research
- Chiara Colesanti Senni, University of Zurich
- Jaap Dahmeijer, DNB
- Ewald Engelen, University of Amsterdam and SFL-member
- Eve Gleeson, ShareAction
- Miriam van Gool, SBTN
- Linda van Goor, independent consultant
- Anita de Horde, Finance for Biodiversity Foundation
- Sem Houben, DNB
- Heleen van den Hombergh, IUCN
- Katie Kedward, UCL
- Arthur van Mansvelt, Achmea Investment Management
- Robin Millington, Planet Tracker
- Roel Nozeman, ASN
- Mark van Oorschot, PBL
- Lucian Peppelenbos, Robeco
- Julja Prodani, DNB
- Hans Schenk, Utrecht University and SFL-member
- Tim Steinweg, PRI
- Romain Svartzman, Banque de France
- Thessa Vasudhevan, LSE
- Bodo Verberkt, DNB
- John Willis, Planet Tracker
- Simon Zadek, Nature Finance

Reviews

- Maud Abdelli, WWF
- Chiara Colesanti Senni, University of Zurich
- Eve Gleeson, ShareAction
- Anne Gram, ABP and SPIL-member
- Seraina Grünewald, Radboud University Nijmegen and SFL-member
- Anita de Horde, Finance for Biodiversity Foundation
- Dirk Schoenmaker, Erasmus University Rotterdam and SFL-member
- Christine Wortmann, WWF
- Simon Zadek, Nature Finance
- Sjoerd van der Zwaag, DNB

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