



A BIODIVERSITY GUIDE FOR BUSINESS

WWF is one of the world's largest and most experienced independent conservation organizations, 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 humans live in harmony with nature, by conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.

LEGAL NOTICE

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Seaweed farming in Ankilimionga
in the Mahafaly land- and seascape
in Southwest Madagascar

We are facing a global crisis. We are totally dependent upon the natural world. It supplies us with every oxygen-laden breath we take and every mouthful of food we eat.

Sir David Attenborough, in the foreword of the Dasgupta Review Executive Summary (2021)

EXECUTIVE SUMMARY

There is a growing collective awareness of the systemic crisis manifesting as climate change and biodiversity loss, and of the fact that human societies and economies are intricately linked with and dependent on nature and biodiversity.

Biodiversity is the foundation of the global economy. The World Economic Forum estimates that 44 trillion USD of value generation, representing more than 50% of global GDP, is dependent on nature, biodiversity and the services it supports (see Box 1: How biodiversity is vital for ecosystem services). Yet globally, biodiversity is in crisis. A million species may be facing extinction, with the biggest drivers of biodiversity loss being human-induced land, freshwater and sea use change, overexploitation, invasive species, pollution and climate change. Species are disappearing at tens to hundreds of times the natural rate. Between 1970 and 2016, population sizes of mammals, birds, amphibians, reptiles and fish decreased by 68% on average. 75% of the land surface area has been dramatically altered by human activity; 66% of ocean area is significantly impacted, and 85% of wetlands have been lost due to human intervention.

There is a growing consensus that there is not only a need to halt the ongoing destruction of the natural world, but also to shift our economy towards one that is “Nature-Positive” to attempt to repair damage that has already been done. While governments set the policy framework within which businesses operate, the private sector bears significant responsibility for enabling and accelerating the transformation towards a nature-positive economy.

New commitments and developments in global political and institutional frameworks like the Convention on Biological Diversity, the EU Green Deal, the Taskforce on Nature-related Financial Disclosures or the Science Based Targets Network, to name just a few, together with increasing civil society scrutiny, reflect and address the growing expectations from stakeholders that businesses act responsibly and make stronger commitments to safeguarding biodiversity.

PAVING THE WAY FOR NATURE-POSITIVE BUSINESS MODELS

Understanding biodiversity risk and opportunity – along the value chain and across different locations, using a science-driven approach – is crucial for being able to make strategic decisions that steer companies toward nature-positive business models. It is also the aspect companies need most support with as it is based on extensive and diverse data that are often

not easily accessible and on concepts that lie beyond the business context. This report sets out a proposed approach for identifying, assessing and addressing biodiversity risks and opportunities for business. Biodiversity stewardship helps companies to implement change: it aims to encourage companies to engage in safeguarding biodiversity and nature within and beyond their direct value chains, and within a larger spatial and temporal scope, by engaging with local communities and governments in the landscapes that they work in or depend on.

In the context of our Biodiversity Stewardship Programme, WWF has developed an approach to characterizing biodiversity-related risks and opportunities and a roadmap for companies to follow on their biodiversity stewardship journey. In order to support companies on this journey, WWF is developing a web-based, spatially-explicit Biodiversity Risk Filter (BRF) tool that breaks down complex biodiversity information to the company level and gives businesses practical, visually comprehensible information to aid decision-making.

WWF's Biodiversity Stewardship Programme and BRF tool are aligned and complementary to the Science-Based Target Network's guidance on setting targets for nature (SBTN, see Box 3). The BRF tool complements the SBTN process by helping companies understand their risk and prioritize where and how to act. The aim of the BRF tool is to help companies with the initial decision-making involved in engaging in the biodiversity stewardship process.

BUSINESS'S IMPACTS AND DEPENDENCIES ON BIODIVERSITY

The relationship between business and biodiversity is informed by

- (1) the ways in which businesses **depend** on biodiversity; and
- (2) the ways in which businesses **impact** biodiversity.

All businesses rely on biodiversity, be it for direct inputs (e.g., water or fibres), business-enabling ecosystem services (such as pollination, water regulation or soil fertility), or more indirectly through the dependencies of third and fourth parties in their value chains. Conversely, businesses also impact biodiversity in the places they operate in through direct or indirect exploitation, pollution, land use change (including the conversion, degradation and modification of ecosystems) etc., as well as by the upstream and downstream activities in their value chains.

BIODIVERSITY RISK

Biodiversity risks arise from a business's dependencies and impacts, in combination with the state of local and global biodiversity health. This includes the diversity and intactness of ecosystems, the diversity and abundance of species and genes, and the provision of ecosystem services. These risks may be (or become) material from a financial or environmental and social perspective. Biodiversity loss may expose a business to four primary types of risk, plus overarching transition risk.

First, **physical risk** is relevant for companies that depend on biodiversity, as biodiversity loss can expose them to resource scarcity, value chain disruptions from natural hazards, or increased operational costs when a reduction of ecosystem services must be artificially compensated. Second, the transformation to a biodiversity-preserving, nature-positive economy can present overarching transition risks for businesses if they fail to adapt in a timely manner.

Transition risk may emerge as regulatory, reputational or market risks. A company's impacts on biodiversity may translate into **regulatory risks** when environmental legislation or enforcement changes the legal operational context, and into **reputational risk** when public awareness of impacts on biodiversity or on affected communities lead to a tarnished reputation and subsequently a loss in brand value and market share. Finally, **market risk** may arise from any of these risk categories, when changing physical, regulatory and/or reputational frame conditions and stakeholder dynamics lead to resource scarcity, higher input prices or a declining value proposition relative to competitors, for example.

BIODIVERSITY OPPORTUNITIES

The biodiversity stewardship opportunities available to business reflect both the inherent risks (as described above) as well as the conditions that may allow them to respond to biodiversity threats and pressures in different ways. As such, biodiversity opportunities can go beyond common sustainable business archetypes to include actions that companies can take to influence the threats and pressures driving biodiversity loss and degradation globally, both within their value chains and in the places where they operate. Biodiversity opportunities reflect the overlap between a company's ambition to achieve a nature-positive future and its ability to take actions that support and reduce threats to nature while building coalitions with peers and stakeholders to progress further along its sustainability journey and that of the sector it represents.

There are many reasons why a company may be interested in conserving, sustainably using and restoring biodiversity, including cost savings and increases in operational efficiency; revenue streams from new business models, markets, products and services; and improved stakeholder relationships and brand value.

Biodiversity opportunities can be found where an understanding of actions that can be taken to allow biodiversity to thrive and the benefits that might result for a company contributing to these solutions intersect. Opportunities often align with risk management, especially when a company is able to identify a component of biodiversity that is highly material and not well managed. However, “opportunities” as a concept can be addressed independently from, or in addition to risk. Biodiversity opportunities for companies may fall into three broad categories as outlined below.

Scape-based opportunities are location-specific opportunities through which companies can support the conservation or restoration of specific places (sites, scapes and entire ecosystems), address specific pressures on biodiversity, or advocate for sustainable policies that facilitate business in harmony with nature. **Market-based opportunities** arise when firms develop biodiversity-friendly products and value chains to cater to the needs of existing markets and to open up new markets. **Operation-based opportunities** can emerge from changing internal practices in ways that benefit biodiversity or prevent it from being harmed further and provide companies with co-benefits such as reducing their cost of production.

WWF'S APPROACH TO CORPORATE BIODIVERSITY STEWARDSHIP

Understanding and addressing biodiversity risk and opportunities is vital for companies; however, it can be a daunting task. WWF's approach to biodiversity stewardship aims to facilitate and mainstream this process. This corporate biodiversity roadmap consists of an iterative five-step process.

1. Creating awareness and building internal engagement

Gaining understanding of a company's dependencies and impacts on biodiversity and their financial materiality at a sector level.

2. Baselineing and scoping

Detailed value chain mapping and analysis of key biodiversity risks and opportunities to further prioritize locations and actions.

3. Stewardship strategy and targets

Setting commitments, onboarding stakeholders, understanding contexts, and developing a portfolio of suitable responses for material locations and issues.

4. Implementation

Carrying out actions to work towards strategic targets and goals, including: internal capacity building (e.g., engaging and training staff, establishing accountability and oversight); internal and value-chain wide action to reduce the company's biodiversity footprint and drive positive impact; and engaging in transformative action outside the value chain (e.g., joining or establishing multi-stakeholder initiatives, advocating for biodiversity-friendly policy and regulation).

5. Monitor, communicate, iterate

Monitor impact, communicate results, and regularly review and revise strategy and targets.

THE WWF BIODIVERSITY RISK FILTER

WWF is developing a spatially-explicit Biodiversity Risk Filter (BRF) tool to support companies implementing the biodiversity stewardship approach. Based on the experience with the WWF Water Risk Filter, the BRF is designed as a corporate-level screening and prioritization tool to help companies better assess and respond to biodiversity risks and potential opportunities across their operations and value chains. Visual output from the tool supports the corporate planning and decision-making process. The BRF is being piloted with businesses in 2022 and is planned to be launched publicly in early 2023. The BRF will support companies in the initial phases of the corporate biodiversity journey through four key steps.

Inform Understand sector-level impacts and dependencies on biodiversity.

Explore Identify and focus on high-risk locations and activities to prioritize detailed value chain mapping.

Assess A detailed assessment of physical, regulatory, reputational and market risk and opportunity types across all provided company operational and value chain locations, allowing companies to prioritize locations for action.

Respond Identify appropriate corporate-level actions from the offered portfolio of response options.

The ultimate goal of each company's biodiversity journey is to protect, manage and restore biodiversity on land and in water, while simultaneously reducing their risk exposure and taking advantage of new opportunities. This will require commitment and engagement, implying internal changes to business strategies, external engagement and collective action, action on the ground and in the water, and consistent monitoring and ongoing improvement. Combined with a functional framework and extensive data on biodiversity, this will yield results that help companies, people and the planet.



Aerial view of Bornean Elephants (*Elephas maximus borneensis*) at the Sabah Softwoods plantation in Sabah, Borneo, Malaysia

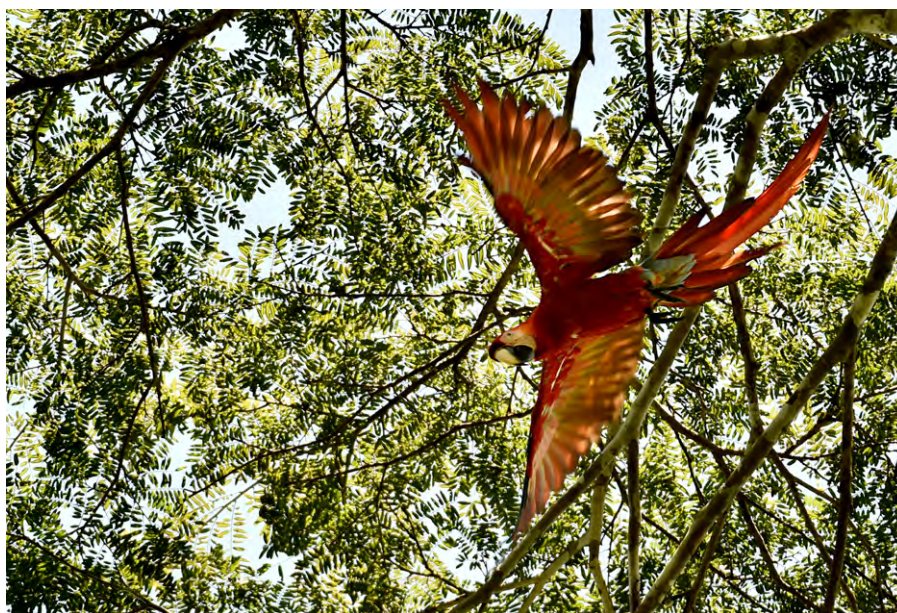
1. INTRODUCTION

The growing collective awareness of the implications of human-induced climate change and biodiversity loss, along with the emergence of zoonotic infectious diseases (such as SARS, Ebola, avian flu and COVID-19), have illustrated the fact that human societies and economies are intricately linked with and dependent on nature. Reinforcing each other in a feedback loop, climate change and biodiversity loss are manifestations of a systemic crisis driven by the profound impact human activities have on our natural environment, on people and on a vast array of economic activities.¹ This impact, in turn, leads to a myriad of obvious and less obvious consequences for human societies and economies.

1.1 BIODIVERSITY, ECOSYSTEM SERVICES AND NATURE'S CONTRIBUTIONS TO PEOPLE

Biodiversity is the natural variety of life on earth. It is the plants, animals and ecosystems that support the flow of vital ecosystem services on which we depend: to feed and clothe us, to provide us with clean water and air, to give us resilience to natural disasters and climate change, and to give us natural spaces to live in and enjoy.² For far too long, ecosystem services have been largely taken for granted and considered free and infinite.³

A scarlet macaw (*Ara macao*) at Chandless State Park in the state of Acre, Brazilian Amazon



1 McCraine et al. (2019)
2 NFCS and UNEP-WCMC (2018)
3 Science for Environment Policy (2015)

Box 1: How biodiversity is vital for ecosystem services

“Ecosystem services are the benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual, recreational, and cultural benefits; and supporting services, such as nutrient cycling, that maintain the conditions for life on Earth.”⁴

The relationship between biodiversity and ecosystem services is hard to quantify due to its holistic and systemic nature. However, research clearly suggests that high biodiversity translates into stable and sustained ecosystem services.

For example, a high number of different species (i.e., species richness) in terrestrial, freshwater and marine ecosystems reduces nitrogen pollution in water and in the soil, underpinning the regulating service of water purification.⁵ Species richness is also positively correlated with forest biomass in both natural and managed forests, which in turn contributes to air quality regulation, water filtration and storage in the soil. More productive woodlands support a larger standing crop of timber (i.e., a provisioning service) and also provide greater flood protection and climate regulating services by capturing and storing carbon.⁶ Positive biodiversity-productivity relationships have also been observed in grasslands in Europe and even for soil ecosystems where a high diversity of soil organisms is linked to increased plant production by providing natural protection against pests and diseases, improved nutrient uptake and better soil structure, among other benefits.⁷

Pollinator diversity (mainly bees, but also many other insects, birds and bats) is crucial for maintaining pollinator services for the reproduction of many wild and crop plants

relevant for global food production. The loss of pollinator populations and diversity has been correlated with reduced crop yield for many crops around the globe; this is particularly critical for crops with a narrow range of pollinators, such as figs, vanilla or passion fruit.⁸ Yet, pollinators have been lost throughout the world mainly due to agricultural intensification (including the use of pesticides harmful to pollinating insects) and habitat decline.⁹

In the past, scientists have distinguished between ecosystem services that are a consequence of biodiversity and others such as wind or hydraulic potential, which are affected, but not generated by living organisms.¹⁰

However, newer research suggests that even complex and global processes historically labeled as “abiotic” (i.e., non-living), may in fact be much more dependent on biodiversity than previously thought. This is illustrated, for example, by the “biotic pump” model of the global water cycle, by which, scientists argue, evapotranspiration from vegetation plays a significant role as a driver of global atmospheric phenomena such as wind and rainfall patterns. This theory challenges the idea that these phenomena are abiotic, granting life a much more central role in these global processes and supporting the Gaia Theory, a view of Earth as a living, self-regulating organism.¹¹

4 Alcamo et al. (2003)

5 Science for Environment Policy (2015)

6 Science for Environment Policy (2015), Haines-Young & Potschin (2010)

7 Haines-Young & Potschin (2010)

8 Richards (2001), Klein et al. (2007)

9 Haines-Young & Potschin (2010)

10 Haines-Young & Potschin (2010), Lovelock (2003)

11 Sheil (2018), Makarieva et al. (2013)

1. INTRODUCTION

Biodiversity is the foundation of the global economy. The World Economic Forum (WEF) estimates that 44 trillion USD of value generation, representing more than 50% of global GDP, is highly or moderately dependent on nature and the services it provides.¹²

Yet globally, biodiversity is in crisis. The rapid decline of biodiversity is driven primarily by human-induced land and sea use change, overexploitation, invasive species, pollution and climate change (see Box 2: Direct drivers of biodiversity decline).¹³ A million species may be facing extinction because of human activity, some within decades, with species disappearing at tens to hundreds of times the natural rate.¹⁴ Between 1970 and 2016, population sizes of mammals, birds, amphibians, reptiles and fish have decreased by 68% on average.¹⁵ Seventy-five per cent of the land surface area has been dramatically altered by human activity; 66% of ocean area is significantly impacted; and 85% of wetlands have been lost due to human intervention.¹⁶

These losses create immense risk to the global economy and to human well-being. It is becoming increasingly clear that natural capital is finite and unless we protect them, ecosystems and the services they provide may become disastrously compromised. Since 2009, when biodiversity loss made its first appearance as a global risk in the World Economic Forum's annual Global Risk Report, its perceived significance has been steadily increasing. Biodiversity loss has ranked among the top 10 global threats since 2016.¹⁷

Flooded forest landscape
in the Mekong



12 Herweijer et al. (2020)

13 IPBES (2019)

14 IPBES (2019), Herweijer et al. (2020), WWF (2020)

15 WWF (2020)

16 IPBES (2019), WWF (2020)

17 WEF (2009 through 2022)

1. INTRODUCTION

Box 2: Direct drivers of biodiversity decline¹⁸

Anthropogenic pressures on biodiversity are a result of indirect drivers like socio-economic and demographic trends, as well as technological developments and societal drivers like culture or governance. These indirect drivers are the root cause for the five direct drivers, otherwise known as pressures on biodiversity. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) has defined five major pressures on biodiversity.

Land/water/sea-use change is the major human influence on habitats. It includes the conversion of land and wetland cover (e.g., through deforestation or mining), changes in ecosystem management (e.g., through agricultural intensification or forest harvesting) or spatial landscape changes (e.g., fragmentation of habitats by roads, dams and constructions).

Climate change is the long-term shift in average climate and weather patterns and increased variability in weather extremes. Climate change affects hydrological cycles important for sustaining life, has a direct impact on ecosystem function, can cause the extinction and migration of species, and significantly alters entire ecosystems and the services they provide. Rising CO₂ concentrations in the atmosphere lead to higher ocean temperatures, changing circulation patterns and ocean acidification. These are already having profound effects upon marine ecosystems, particularly coral reefs and other biological communities near the seafloor.

Pollution is an important driver of biodiversity and ecosystem change globally, with devastating direct effects on terrestrial, freshwater and marine habitats. Nitrogen and phosphorus pollution, primarily from fossil fuel combustion and the use of fertilizers, has been recognized as one of the major global threats to biodiversity. In lakes and ocean environments, nitrogen pollution can ultimately lead to the emergence of oxygen-depleted “dead zones” unable to support life. Plastic pollution, especially in marine and aquatic environments, continues to have devastating effects on the health of both species and ecosystems.¹⁹

Human exploitation of wildlife has led to biodiversity loss and extinctions in the past; however, we have recently seen a dramatic acceleration of the rate of loss. The most overexploited species include marine fish, invertebrates, trees, tropical vertebrates hunted for bushmeat and species harvested for the medicinal and pet trades.

Lastly, the proliferation of **invasive species** can disrupt the ecological functioning of natural systems by out-competing local and indigenous species for natural resources. Invasive species have been linked to loss of biodiversity at local and regional scale, causing significant economic damage.



Plastics in an abandoned strawberry field, Spain

¹⁸ IPBES (2019)

¹⁹ WWF-Germany (2022)

1.2 POLITICAL GROUNDWORK FOR A NATURE-POSITIVE ECONOMY

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) points out that current economic and political trajectories will fail internationally agreed goals to conserve and sustainably use nature, and that “... goals for 2030 and beyond may only be achieved through ... a fundamental, system-wide reorganization across technological, economic and social factors, including paradigms, goals and values.”²⁰ There is a growing consensus that there is not only a need to halt the ongoing destruction of the natural world, but also to shift our economy towards one that is “Nature-Positive”, to attempt to repair damage that has already been done and allow the recovery of nature. Movement towards this goal will require effective collective action across the private and public sectors. Similar views are advocated by business platforms such as the World Business Council on Sustainable Development (WBCSD), Business for Nature and the Global Commons Alliance.²¹

New targets are forthcoming in the post-2020 Global Biodiversity Framework (GBF) under the Convention on Biological Diversity (CBD), the international convention that serves as the global political platform for biodiversity issues, to be agreed at an international meeting in 2022. The first draft of the post-2020 GBF emphasizes the role of the private sector in implementing and mainstreaming global biodiversity conservation by actively “... reducing biodiversity-related risks to businesses and moving towards the full sustainability of extraction and production practices, sourcing and value chains, and use and disposal.”²² These targets will advance the significance of biodiversity issues on global political and economic agendas. This will likely lead to binding commitments and regulations at the national level (e.g., as outlined in the Biodiversity and Farm to Fork strategies of the EU Green Deal, which for example plan stricter limits to pesticide use²³) and may ultimately lead to increasing regulatory pressure on biodiversity-related issues in signatory countries.

Governments, especially under the European Green Deal in the EU, are pushing companies to make stronger commitments to protect biodiversity. Recently, the European Commission launched the development of an “EU Taxonomy”, a classification system for sustainable economic activities, in order to redirect financial flows to sustainable projects and activities, to enable the implementation of the European Green Deal and prevent

20 IPBES (2019)

21 <https://www.businessfornature.org/>, <https://www.wbcsd.org/>, <https://globalcommonsalliance.org/about/>

22 CBD (2021)

23 European Commission (2020), European Union (2020)

greenwashing. The protection and restoration of biodiversity and ecosystems is one of the six environmental objectives of the Taxonomy regulation.²⁴ Alongside the Taxonomy, the European Commission introduced the Sustainable Finance Disclosure Regulation (SFDR), under which financial market participants need to disclose information about their policies on the integration of sustainability risks in their investment decision-making processes.²⁵ Many companies operating in the EU will also soon be required to publicly disclose biodiversity-related information under the developing Corporate Sustainability Reporting Directive (CSRD).²⁶

1.3 BUSINESS AT RISK FROM BIODIVERSITY LOSS AND STAKEHOLDER PRESSURE

While the impact of business activities on the environment and biodiversity is well known, there is an increasing recognition that biodiversity loss also poses direct threats to individual businesses, and to the stability of the global economy. The financial sector is recognizing and starting to address the potential financial risks to businesses related to the environment, including declining biodiversity. Sustainable investing strategies are promoted by inter-governmental bodies, governments and the private sector alike.²⁷ The Network of Central Banks and Supervisors for Greening the Financial System (NGFS) is looking at the impact of climate change and nature loss on financial stability.²⁸ Although climate-related risks have been impacting the insurance sector for many years, climate has only recently been acknowledged to be a financial risk by broader financial sector actors, and with it is a growing awareness of environmental risks to portfolios. As a result, investors such as BlackRock, the world's biggest asset manager, are increasingly demanding that companies engage in preserving natural capital.²⁹ This new focus within the financial industry will directly impact corporates by affecting their access to capital.

Corporations are also under more and more scrutiny and pressure from many stakeholders to better manage their biodiversity risks. Millennials are increasingly looking at businesses as a force of change for reversing nature-destructive trends and are expecting to see appropriate concrete action from companies.³⁰

24 https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-taxonomy-sustainable-activities_en

25 European Union (2019), KPMG (2021)

26 <https://www.efrag.org/Activities/2010051123028442/Non-financial-reporting-standards#>

27 E.g., TNFD (2021 a), UNPRI (2020), European Commission (2019), BlackRock (2021), PwC/WWF (2020), Schelske et al. (2020)

28 <https://www.ngfs.net/en>

29 BlackRock (2021)

30 Deloitte Global (2021)

Civil society organizations have long focused campaigns on the private sector, e.g., on companies involved with palm oil plantations, toxic pollution from the textile industry or the destruction of marine ecosystems by fisheries.³¹ Initial pressure from consumers and civil society organizations has encouraged some companies to further improve disclosure and management of their environmental and social impact, and to drive change across departments through strengthened internal commitments towards greater sustainability.

To date, much of the momentum on corporate environmental issues has focused on managing climate-related risk, guided by the Task Force on Climate-related Financial Disclosures framework (TCFD). Quantifying climate impact has been somewhat more straightforward for companies thanks to CO₂-equivalents, a quantifiable and comparable metric of the global warming potential of greenhouse gas emissions. In contrast, the complexity of the impact on biodiversity makes it much more difficult to quantify³² – there is no single metric that can capture this complexity, although the GBF will adopt a suite of headline indicators against which global progress on biodiversity will be tracked.³³ Another key difference between the challenge of climate change and addressing biodiversity impacts lies in their spatial specificity. While greenhouse gas emissions in any location impact the climate on a global level, biodiversity threats and impacts are much more location-dependent and therefore require spatially-explicit identification and actions.

Despite these challenges, frameworks for biodiversity risk accounting and management are emerging, building on the growing momentum in the private sector to tackle climate risk. Among these, aligned with the TCFD, is the Taskforce on Nature-related Financial Disclosures (TNFD) that has recently been launched to provide a framework for financial institutions and corporates to identify and report on nature-related risks and impacts.³⁴

31 E.g., <https://www.greenpeace.org.uk/challenges/palm-oil/>, <https://www.ran.org/issue/the-businesses-driving-deforestation/>, <https://www.greenpeace.org/international/act/detox/>, <https://cleanclothes.org/fashions-problems/waste-and-pollution>, <https://www.worldwildlife.org/threats/overfishing>, <https://europe.oceana.org/en/our-work/stop-overfishing/overview>

32 Nauman (2020)

33 <https://www.post-2020indicators.org/>

34 <https://tnfd.global/>

1.4 EMERGING TOOLS FOR ADDRESSING BIODIVERSITY-RELATED BUSINESS RISKS AND OPPORTUNITIES

With the intention of providing a framework for addressing the impact of businesses on nature, generating positive contributions and transforming the conditions that have led to the concurrent biodiversity and climate crises, the Science Based Targets Network (SBTN) has pioneered a comprehensive five-step guide for companies to take action and set Science-Based Targets (SBTs); i.e., “measurable, actionable, and time-bound objectives, based on the best available science, that allow actors to align with Earth's limits and societal sustainability goals.”³⁵

In alignment with the SBTN framework, WWF has launched a Biodiversity Stewardship Programme which seeks to help companies understand their biodiversity-related risks and implement change within and beyond their direct value chain.³⁶ This programme also aims to support companies with the prioritization and implementation of actions to achieve their SBTs.

In order to apply these emerging frameworks and meet growing stakeholder expectations, businesses need accessible data and approaches to help them understand and manage their biodiversity-related risks and opportunities. They will need tools to help them understand their impacts and dependencies on nature, to identify the issues that are material to their business, to understand key risks and opportunities, to prioritize the places and activities on which they should focus their efforts to best manage their risks, and to provide the greatest benefits to nature.

This report sets out a proposed approach for identifying, assessing and addressing biodiversity risks and opportunities for business. It identifies the ways in which biodiversity-related risks and opportunities may manifest for corporate actors. Introducing the WWF Biodiversity Risk Filter tool, it then describes how this process could and should be undertaken using a spatially-explicit approach.

³⁵ <https://sciencebasedtargetsnetwork.org/how-it-works/what-are-sbts/>

³⁶ This publication adopts the United Nation's (2012) definition of a value chain: A business enterprise's value chain encompasses the activities that convert input into output by adding value. It includes entities with which it has a direct or indirect business relationship and which either (a) supply products or services that contribute to the enterprise's own products or services, or (b) receive products or services from the enterprise.
Note: The value chain includes the supply chain.

1. INTRODUCTION

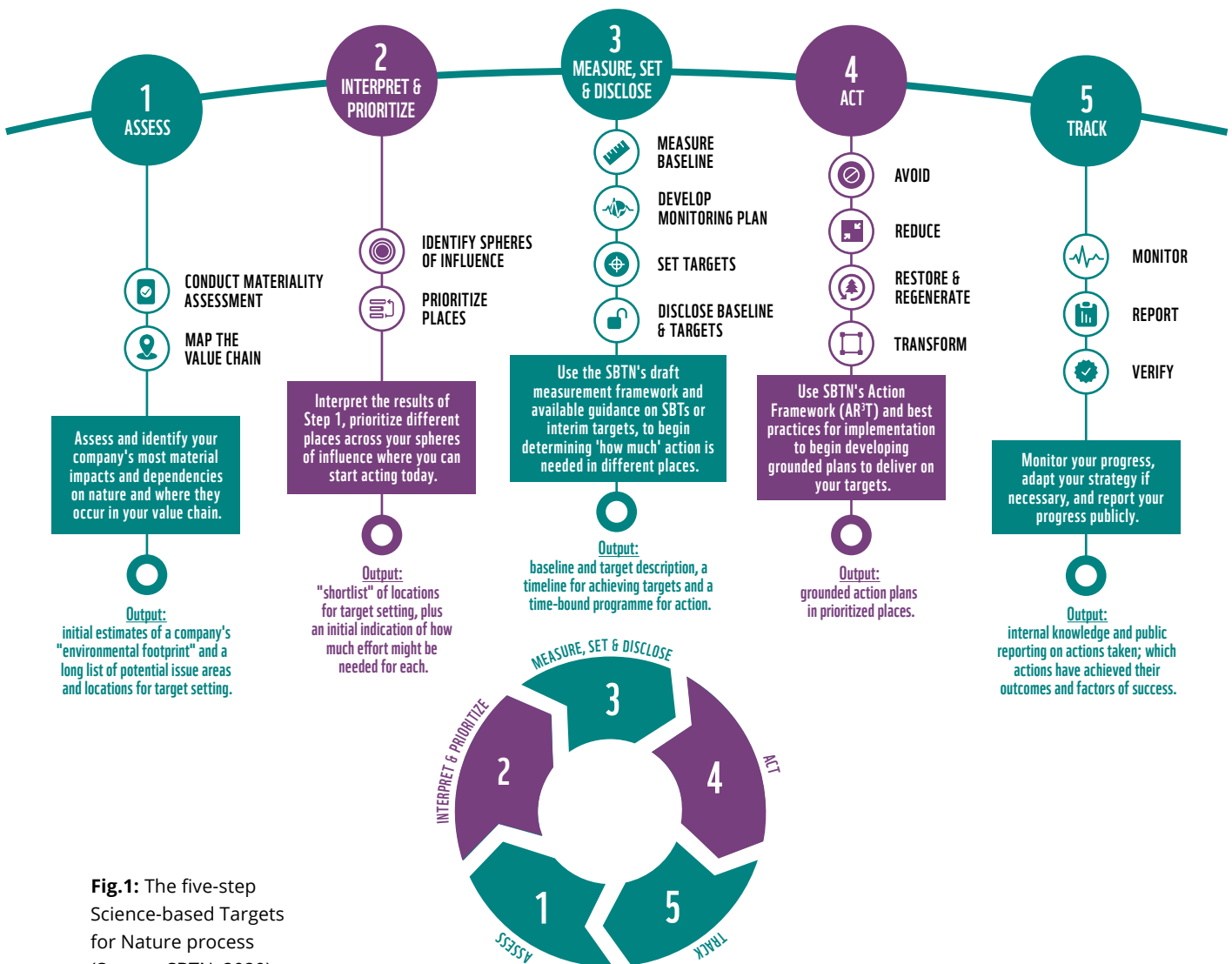
Box 3: The SBTN guidance for companies to address impacts on nature

The Science Based Targets Network (SBTN) is a collaboration of leading global non-profit and mission-driven organizations, and together with the Science Based Targets Initiative (SBTi) will equip companies as well as cities with the guidance needed to set science-based targets for climate and nature. Its goal is for the world's major companies and cities to have adopted SBTs and taken action for climate, water, land, ocean, and biodiversity by 2025. This will form a key element of progress towards Sustainable

Development Goals (SDGs) and global policy milestones.³⁷ In its initial guidance for businesses, SBTN lays out a five-step process for proactively addressing their impacts on nature, which includes:

1. **assessment;**
2. **interpretation and prioritization;**
3. **measurement and disclosure;**
4. **action and**
5. **tracking.**³⁸

5-STEP PROCESS OF SCIENCE-BASED TARGETS FOR NATURE



37 <https://sciencebasedtargets.org/about-us/sbtn>

38 SBTN (2020)



A group of European spoonbills (*Platalea leucorodia*) on a Cork oak tree (*Quercus suber*), a typical scene in Coto Doñana National Park, Andalusia, Spain

2. BUSINESS'S IMPACTS AND DEPENDENCIES ON BIODIVERSITY

The complex relationship between business and biodiversity is informed by (1) the ways in which businesses depend on biodiversity, and (2) the ways in which businesses impact biodiversity.

All businesses rely on biodiversity, be it for direct inputs (e.g., water or fibers), by relying on business-enabling ecosystem services such as pollination, water regulation or soil fertility, or more indirectly yet through the dependencies of third and fourth parties in their value chains. Conversely, businesses also impact biodiversity in the places where they operate through direct or indirect exploitation, pollution, land use change (including the conversion, degradation and modification of ecosystems), etc., as well as by the upstream and downstream activities in their value chains.^{39, 40}

The subsequent sections highlight the impacts and dependencies of the primary industries that have the most severe effect on nature and biodiversity (although many other sectors also have a significant impact). The impacts of secondary and tertiary sectors (e.g., manufacturing, retail, services) largely depend on their dependencies on the primary sectors within their value chains.

2.1 AGRICULTURE

The agriculture sector is marked by strong impacts and dependencies on biodiversity. While pressures on agriculture are rising due to a growing global population and increasing demands for animal protein, the advancing degradation of nature and a changing climate are posing great challenges to this sector. Food production is directly dependent on a number of ecosystem services supported by biodiversity, including fertile soils, clean water and pollination services, climate regulation and erosion control.

Agriculture's impacts on biodiversity are equally high, be it through deforestation/conversion and fragmentation of natural habitats, soil and water pollution from runoff, soil disturbance and compaction, or by reduction of genetic diversity through monoculture plantations.⁴¹ The current agricultural system is at the heart of the 68% average decline in

39 WWF (2019), Herweijer et al. (2020)

40 All information on impacts and dependencies for the sectors presented, unless otherwise referenced, from <https://encore.naturalcapital.finance/en> and Schelske et al. (2020).

41 Lin (2011)

2. BUSINESS'S IMPACTS AND DEPENDENCIES ON BIODIVERSITY

vertebrate species populations since 1970. Occupying half of Earth's habitable land, agriculture is the largest driver of deforestation and loss of habitats such as wetlands. It is also the largest freshwater user and polluter, responsible for 92% of the global water footprint.⁴² Eighty-five per cent of the world's arable land today is threatened by erosion, salinization, soil compaction and/or pollution.⁴³

Globally, 100 crops deliver 90% of humanity's nutrition. Seventy-one per cent of those are pollinated by bees and other pollinating animals.⁴⁴ At the same time, the world has seen a decline in pollinating insects due to intensive agricultural chemical use.⁴⁵ As the use of traditional seeds declines, 60% of all calories consumed are from only three plants – rice, maize and wheat.⁴⁶ With the focus on very few commercially grown crop species and varieties, genetic variability is dwindling, reducing their resilience to pests, diseases and a changing environment.⁴⁷

History repeating itself: Dependencies may translate into business loss in the face of biodiversity depletion

Genetic diversity is a core component of biodiversity. The diversity in the genetic makeup of a population determines the capacity of the population to adapt to changing environments and conditions. For agricultural crops, genetic diversity plays a vital role in disease and pest resistance.⁴⁸

Ireland's famous potato famine in the mid-1800s was caused by a fungus that wiped out Ireland's entire potato crop, which at the time was made up of a single potato plant variety.⁴⁹ A current example of how genetic impoverishment can spell disaster for an entire sector is provided by the banana industry. Ninety-nine per cent of all bananas exported worldwide are of the Cavendish variety, as it is easy to grow in large quantities.

Cavendish bananas cannot reproduce sexually due to their (desired) absence of seeds and are therefore propagated by cloning from cuttings, leading to a lack of genetic variability. In 2013, Panama disease, a fungus lethal to banana plants, started to spread around the globe from Asia. Having no "genetic defenses", every single banana plant is vulnerable to the disease, which has had devastating consequences for the banana industry and led Colombia to declare a national state of emergency in August 2019. Similar trends of falling genetic biodiversity are seen in livestock, aquaculture and almost all commercial crop varieties.⁵⁰ Experts advocate the diversification of the banana industry and see the banana example as a warning for all monoculture agriculture systems.⁵¹

42 Mekonnen & Hoekstra (2011)

43 PwC/WWF (2020)

44 PwC/WWF (2020)

45 IPBES (2016), WWF-Norway (2021)

46 FAO (1999)

47 PwC/WWF (2020)

48 Landry (2015), Lin (2011)

49 Landry (2015)

50 FAO (2019)

51 Kambhampaty (2019), Gray (2020), Thompson (2019), Lin (2011)

2. BUSINESS'S IMPACTS AND DEPENDENCIES ON BIODIVERSITY

Meanwhile, the agricultural sector's impacts on biodiversity can also harm businesses, as the example of IOI, a large Malaysian palm oil producer, illustrates. In March 2016, the Roundtable on Sustainable Palm Oil (RSPO), the world's largest association for sustainable palm oil production, suspended IOI Corporation, owing to illegal deforestation of 11,750 hectares in Indonesia. IOI subsequently lost its licence to sell certified sustainable palm oil (CSPO).⁵² As a result, IOI's share price fell approximately 18% and 26 corporations, including some of the world's largest consumer goods companies, stopped buying from IOI resulting in the company incurring a net loss of 14.8 million USD in the second quarter of 2016. IOI has since committed to implementing best-practice peatland management and undertaking third party verification of their policy compliance.⁵³

While many of agriculture's impacts are negative, there are also examples of the opposite – much European biodiversity actually results from livestock grazing, hay mowing for winter fodder, traditional management of cork oak woodlands, etc. The main threat to biodiversity here is often the abandonment of these traditional management practises.

2.2 FISHERIES AND AQUACULTURE

Between 1999 and 2019, capture fisheries and aquaculture production increased by 0.66 MT and 79 MT, respectively.⁵⁴ Aquaculture's increase over the past decade was nearly 120 times that of capture fisheries, primarily a result of a bleak outlook for the potential to increase wild fish stocks. This is happening at a time when ocean and freshwater ecosystems are changing at an unprecedented rate due to human intervention. Ocean warming, acidification, eutrophication, overfishing, as well as plastic and other debris pollution are among the top threats to life in the oceans.⁵⁵

Apart from the primary input (i.e., the animals that are harvested), fisheries rely on healthy ocean environments and nursery habitat to maintain global fish stocks. Fisheries are a renewable resource as well as a component of the planet's biodiversity. To maintain a healthy fishery biomass, fishing must not exceed sustainable limits and fish habitats must not be degraded so as to negatively affect recruitment and growth. Aquaculture depends on multiple components of biodiversity to generate the resources needed to farm fish and other aquatic organisms – for example, aquaculture relies on 20% of marine fisheries as an ingredient in feed. While aquaculture utilizes

52 Mongabay (2016)

53 Thoumi (2017)

54 FAO (2021)

55 Bindoff et al. (2019)

2. BUSINESS'S IMPACTS AND DEPENDENCIES ON BIODIVERSITY

land, water, energy and wild fish for production, capture fishing extracts the biodiversity itself from the planet. As larger fish species are being captured for human consumption, smaller species are being harvested for aquaculture feed as well as pet foods. Aquaculture and agriculture are more similar than aquaculture and capture fisheries, as fishing is biodiversity extraction and aquaculture and agriculture are natural resource users.

As with agriculture, both fishing and aquaculture heavily impact the biodiversity and resources they require, primarily by poor fisheries management and inappropriate aquaculture practices, thereby jeopardizing their own foundation and having a devastating impact on co-occurring biodiversity. For example bycatch – the incidental capture of marine species in fishing gear – is the leading driver of mortality for many species; 300,000 whales, dolphins and porpoises die in fishing gear each year.⁵⁶ Ocean pollution from chemicals, noise and plastic and other debris pollution additionally impact marine and freshwater environments, and may turn into a legal liability.

As noted, aquaculture's primary inputs are land, water and energy at the farm level, and land, water, energy and wild fish embedded in aquaculture feeds. The local impact of specific aquaculture operations can be significant. Because half of all aquaculture takes place in freshwater environments, cages in lakes and reservoirs as well as constructed ponds are often used. The creation of ponds or reservoirs to enable aquaculture can lead to habitat degradation or conversion in freshwater ecosystems. Additionally, cage culture of marine and brackish water aquatic organisms is increasing and coastal zones are experiencing greater assimilation capacity pressures from increased nutrient pollution from aquaculture. Numerous examples exist where fish kills have occurred because of cumulative nutrient loads in estuaries. Of course, global aquaculture production is primarily composed of aquatic plants and molluscs (44%) and provides some ecosystem services to the waters where those species are raised. Nevertheless, land subsidence from aquifer depletion in Taiwan, eutrophication in Tasmania, escapes in the US, and illegal chemicals in India are all due to the impact of aquaculture and need to be mitigated. Escaped non-native aquaculture species may turn invasive or alter the genetic makeup of local wild populations of the same species.⁵⁷ The spread of pathogens and/or antibiotics may impact local aquatic life.⁵⁸ Indirectly, aquaculture also impacts forests due to dependency on soy for feed, which is a driver for deforestation in Amazonian rainforests.⁵⁹

⁵⁶ Read et al. (2006)

⁵⁷ Orsini (2016)

⁵⁸ Orsini (2016)

⁵⁹ Jackson (2021)

2.3 PAPER AND FOREST PRODUCTS

Forests fulfill crucial ecosystem functions that all life depends on, such as maintenance of the water cycle, carbon sequestration and fire regulation; and are home to an estimated 80% of terrestrial biodiversity.⁶⁰ Every year, species new to science are discovered in the world's forests.⁶¹

The forestry sector provides more than 13.2 million jobs worldwide.⁶² At the same time, global forest cover continues to decline, particularly in the tropics, where forests are routinely cleared to make space for cattle pastures and soy or oil palm plantations. The impact of forestry activities, especially from clear-cutting and unsustainable logging, and monoculture plantations, diminishes biodiversity and can make forests more vulnerable to fires, disease, and may decrease the soil's water retention capacity. Additionally, pulp and paper production require large volumes of water and can increase pollution through discharge of chemicals used for pulping and bleaching.⁶³

Risk for business operations may arise from these impacts when they lead to forest/plantation loss or water depletion. The large quantities of water required for paper production furthermore make paper-producing companies susceptible to tightening laws governing water use or pollution or changes in water pricing. Forestry companies can also be vulnerable to changing laws and public awareness. In Brazil, for example, in two separate lawsuits, the Indigenous Karipuna people and a coalition of NGOs are suing the government for alleged complicity in failing to stop illegal logging, invasions and land grabbing in their territory, constituting “active negligence to protect the Amazon and the people of Brazil.”⁶⁴

Consumer preferences and growing consumer awareness of poor practices (such as clear-cutting) are a real threat and reputational risk which can jeopardize sales. Already in 1997, Greenpeace created a public pressure campaign against the British Columbia forestry industry, led by MacMillan Bloedel, Inc., over clear-cutting logging in the old-growth rainforests of the province. As a result, the company found itself in a predicament, as environmental groups pressed for a boycott of old-growth forest products by consumers and corporate buyers in North America and Europe.⁶⁵

60 FAO (2020b)

61 E.g., <https://news.mongabay.com/list/new-species/>

62 PwC/WWF (2020)

63 Singh & Chandra (2019)

64 Hanbury (2021), Greenpeace International (2020)

65 Stanbury & Vertinsky (1997)

2.4 EXTRACTIVE INDUSTRIES

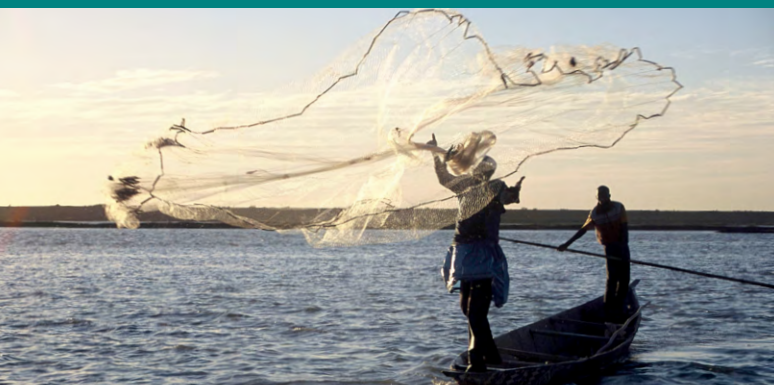
Extractive industries are businesses that mine raw materials, such as oil, coal, gas, metals and other minerals, from the earth and the seafloor. The processes used to extract oil, gas, minerals or metals include drilling and pumping, quarrying, and mining. These processes are highly dependent on water availability in large and reliable quantities, for example for cooling machines, dust suppression, fracking and ore processing. The related environmental impact can be tremendous: habitat destruction and fragmentation, water use, water, air, soil and noise pollution, among others. With rising pressure from local stakeholders (e.g., water users in the same basin, and governments becoming increasingly aware of the detrimental and far-reaching environmental impact of unregulated mining and extraction activities), some governments are increasingly tightening regulatory requirements and enforcement actions. Without proactive and forward-looking management of potential risk arising from changing legislation, extractives companies may find operating licenses revoked or not granted, or face substantial fines.

Changing environmental regulation may lead to delayed operations and financial losses

Mining operations in Peru have experienced delays in government approval due to potential water conflicts with local users. These had to be proactively addressed by the company, requiring stakeholder involvement and significant investment, before securing both the legal and the social license to operate. In Costa Rica mining licenses have been withdrawn over concerns about the impact on endangered species, agriculture and forests.⁶⁶

In a recent example, Canadian Trans Mountain Corp was ordered to put the construction of an oil pipeline in British Columbia on hold in April until at least August 2021, due to the presence and nesting season of migratory birds in the construction area, among them a species of hummingbird. While not an endangered species, Anna's hummingbird is protected under Canadian federal law.⁶⁷

In February 2021, the UK Supreme Court ruled that Nigerian farmers and fishermen can sue Royal Dutch Shell in English courts after years of oil spills in the Niger Delta contaminated land and groundwater. This ruling was the second judgement against Shell this year regarding claims against its Nigerian operations, after a Dutch appeals court held Shell responsible for multiple oil pipeline leaks in the Niger Delta and ordered it to pay damages to farmers.



66 TBC (2017), ACCA, FFI & KPMG (2012)

67 Cecco (2021), Williams (2021)

2.5 LAND DEVELOPMENT AND INFRASTRUCTURE

The day-to-day lives of most humans today take place in and around built environments: we live and sleep in houses, we travel on roads, we shop and socialize in buildings. While construction depends on raw material inputs such as sand, cement, water and energy (both for transport and for construction activities) and on many other enabling and regulating ecosystem services, its negative impact on the natural environment can be tremendous. Apart from causing habitat degradation, fragmentation and loss for plants and animals, construction also causes soil sealing, which reduces the soil's capability to absorb water, disrupts natural water regimes and can lead to flooding. To make things more complex, initial construction is not always the core impact on biodiversity. Significant biodiversity loss can occur when new territories are expanded into (for example, for mining), which then indirectly facilitates additional access or development in the area.

Ecosystem destruction is especially contentious in coastal regions, where communities struggle to find the balance between conserving the nature coastal economies depend on (e.g., coral reefs, coastal fisheries, mangroves) and the construction of infrastructure. In coastal areas, replacing green infrastructure (mangroves, salt marshes, etc.) with grey infrastructure (seawalls, buildings, etc.) initiates a feedback loop that decreases biodiversity and then coastal resilience and thereby can also drastically increase climate impact risk.

In dry coastal regions or on islands, providing tourists with swimming pools, showers and drinking water can pose major challenges to sustainable and equitable water resources management. In the future, growing environmental awareness of policymakers and civil society may represent a significant risk for construction businesses, especially for large-scale development projects.

Examples of infrastructure and construction projects halted or stopped due to environmental concerns can be found all over the globe from America through Europe to Asia.⁶⁸ Some of these concerns are interlinked with other social, cultural or environmental justice issues, such as a highway expansion project in Texas that involved the displacement of minority communities.⁶⁹

68 Kiganda (2016), Oltermann (2020), Reuters (2020), Than & Hlaing (2016)

69 Uteuva (2021)

2.6 ENERGY PRODUCTION

Modern society depends on the production of large quantities of energy. Even as the global economy is trying to find ways out of its fossil fuel dependence and technologies and incentives for regenerative energy generation are advancing, the construction of new coal-fired and nuclear power plants is still planned and approved all over the world, to meet the steadily growing demand for electricity.⁷⁰

Whether renewable or conventional energy, power lines needed to distribute electricity contribute to habitat fragmentation. Both thermal (e.g., coal-fired) and nuclear power plants need large quantities of fresh water for cooling. This results in increased levels of water abstraction on the basin level. Companies are exposed to decreased water availability, which may also threaten business when regulations change or conflicts with other water users ensue. As thermal power stations that use fossil fuel combustion emit large amounts of CO₂ and other greenhouse gases, the conventional energy sector is particularly vulnerable to tightening environmental regulations relating to greenhouse gas emissions and climate change. Nuclear power stations produce hazardous nuclear waste. Changing legislation and public awareness regarding the treatment and storage of this waste poses a constant risk to the nuclear energy sector.

Regenerative electricity production, having a much smaller GHG footprint than conventional electricity production, is central to addressing the climate crisis. It nevertheless comes with environmental baggage as it too uses natural resources (including mined rare earth elements and minerals), water for cooling, and space. Producing energy from biomass requires large amounts of combustible plant material as an input. Hydropower production, using water as the primary input, inherently has a large water footprint which can negatively affect entire basins by significantly changing the flow regime or fragmenting the connectivity of the system. Geothermal, biomass and some solar thermal power plants need large quantities of water for cooling purposes. Hydroelectric dam, onshore wind farm as well as solar power plant construction (if not built on already degraded land) all modify habitats and can lead to the displacement of terrestrial plants and animals, loss of connectivity, and direct mortality. Hydropower plants have been particularly controversial because of their adverse impact on habitats, particularly the connectivity of river systems (see below). Evolving climate change-related regulations can pose a risk or an opportunity for companies in the renewable energy sector.

⁷⁰ <https://www.carbonbrief.org/mapped-worlds-coal-power-plants>,
<https://www.world-nuclear.org/information-library/current-and-future-generation/plans-for-new-reactors-worldwide.aspx>



Wind turbines located in Cartago Province, Costa Rica

Risk for renewable energy generation companies

The environmental impact of the renewable energy sector is ambiguous: on the one hand, it plays an increasingly central role in the global energy supply, particularly in view of the necessary decarbonization of our economy. On the other hand, there is often opposition from local communities regarding the direct environmental impact of wind turbines, solar power plants and hydroelectric dams, and regarding upstream impact from mining and other kinds of inputs. These protests, in some cases, receive substantial media coverage, which can impact a company's operations at site level or damage its reputation and even jeopardize the reputation of the entire sector.

This has long been the case with large hydroelectric dam projects. In the Indian state of Arunachal Pradesh, for example, most of the dams with 56,000 MW cumulative capacity have been stalled for more than 10 years due to community protests over the impact on biodiversity, loss of fishers' livelihoods and potential inefficiencies due to siltation.⁷¹

In Canada, operating licenses for two wind parks were retroactively revoked and significantly altered (respectively) after the Environmental Review Tribunal found that the previously granted authorizations were insufficient to prevent serious and irreversible harm to affected at-risk species of turtles and bats.⁷²

71 WWF-India (2019)

72 Environmental Commissioner of Ontario (2017)



Wildlife corridor restored through an industrial tree plantation in Sabah, Malaysia, providing connectivity for elephants, orangutans and a host of other species

3. RISK AND OPPORTUNITY

As the need to safeguard nature is becoming stronger, businesses need to evaluate how they can better align with nature-positive business models. Businesses that do not consider their dependencies and impacts on nature are likely to face rising costs and will forfeit new opportunities presented by a new nature-positive paradigm.⁷³

3.1 HOW DO BIODIVERSITY-RELATED RISKS ARISE?

For a risk to arise and to become material for a business, depends on three factors:

- the likelihood of **threats** emerging
- the degree of a business's **exposure** to these threats
- the **vulnerability** of the business to the threat⁷⁴

Biodiversity risks, more specifically, are risks to businesses that arise from the state of local and global biodiversity health (threat), a company's dependencies and impacts on biodiversity (exposure) and its ability to adapt (vulnerability).

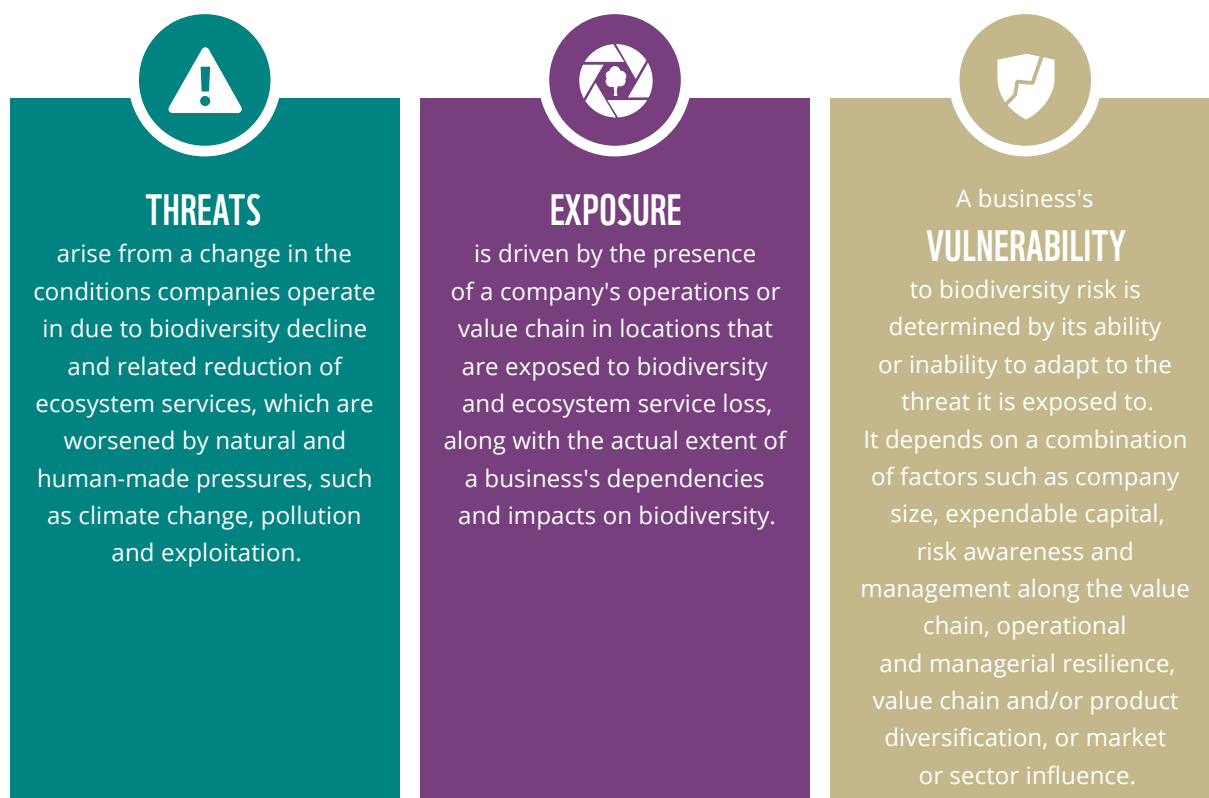


Fig. 2:
Threat, exposure and vulnerability combine to give rise to risk

73 Herweijer et al. (2020)

74 WWF (2019)

3. RISK AND OPPORTUNITY



The probability of a risk materializing is informed by current and potential future threats, while the severity of a risk is informed by a combination of both exposure and vulnerability. When these factors come together, a biodiversity risk can materialize and lead to consequences for businesses, their financiers, the economy, and people.

3.2 CLASSIFYING BIODIVERSITY-RELATED RISKS

Driven by both impacts and dependencies, biodiversity loss and ecosystem service decline, along with society's transition to a nature-positive economy, may expose a business to four general types of risk. Each of the four risk types can be further subcategorized to specify the underlying threats or drivers, e.g., a declining ecosystem service that a company depends on. Annex 1 provides a detailed list of risk categories, risk factors and drivers.

First, **physical risk** is relevant for companies that directly depend on biodiversity and ecosystem services. Physical risk is generally location-specific and may emerge from a decline of ecosystem services in several ways, exemplified in Table 1. Second, a company's impacts on biodiversity may translate into **regulatory risk** when environmental legislation or enforcement changes the legal operational context. Third, biodiversity impacts can result in **reputational risk**. This manifests in the form of negative publicity concerning a company's actual or perceived

environmental or social sustainability performance, including its local economic impact. Businesses with no direct public exposure may be put in the spotlight by downstream companies. Fourth, **market risk** may arise from any of these risk categories, as a result of changing physical, regulatory and/or reputational frame conditions and stakeholder dynamics. Market risk may emerge as a result of input price increases or from changes in the competitive landscape that influence brand value.

The transformation to a biodiversity-preserving, nature-positive economy can present **transition risk** for businesses when these do not adapt in due time. Transition risk may emerge as regulatory, reputational or market risks. For example, innovations that lead to more sustainable technologies may have implications for the processes of sectors and industries that rely on less sustainable technologies. This could create market transition risk in the form of stranded assets. Changing investor and consumer preferences towards sustainability conscious products may also pose a market transition risk. Becoming acutely aware of the financial implications of biodiversity loss for their business, financial institutions are increasingly implementing policies that limit involvement with biodiversity damaging projects. Regulatory changes may limit access to land or resources, produce new value chain regulations (e.g., conversion-free), new quotas or thresholds, disclosure requirements, compensation costs, rising taxes or even lead to the revocation of licenses. New commitments under the CBD will likely drive changes to the regulatory frameworks of signatory countries, which may put companies that do not prepare well at risk due to increased regulatory pressure. Reputational risk arises with changing public sentiment and stakeholder scrutiny accompanying the transition to a biodiversity-preserving economy and a company is perceived negatively with respect to its attitude towards and impact on biodiversity conservation.⁷⁵

Beyond the individual asset or company level, biodiversity and ecosystem service loss can result in systemic risks. For example, an individual company might not face significant risks from a particular impact in the short term, or may find their risks manageable, but aggregated impact can result in severe consequences for a broad array of stakeholders. This can include the collapse of critical natural systems, unacceptable portfolio-level risk and system-wide risks to financial stability.⁷⁶ Awareness of risks beyond physical and transition risks facing an individual company are also key to mobilize scape-based solutions, improved governance and collective action.

⁷⁵ PwC/WWF (2020), WWF (2019)

⁷⁶ TNFD (2021b)

3. RISK AND OPPORTUNITY

Table 1 presents the four risk types in terms of financial business impact. Annex I provides a more detailed overview.

Table 1: The four biodiversity risk types

Risk type	Examples of business effects with a financial impact	Primarily dependence- or impact-driven
<p>Physical risk can result in cost increases or loss of revenue due to acute hazards and lack of production factors, arising from the decline of nature and ecosystem services</p>	<p>... reduced productivity (e.g., lack of fertile soils and pollination)</p> <p>... increased cost of inputs (e.g., scarcity of feed, natural fibers or genetic material)</p> <p>... disruption of operations (e.g., from floods or landslides)</p> <p>... loss of tourism business or asset values due to decline of attractiveness of land-, basin- or seascapes (e.g., ecosystem degradation and/or species decline)</p>	<p>Dependence</p>
<p>Regulatory risk can lead to cost increases or disruptions caused by restrictions and requirements due to compliance challenges with existing and/or future biodiversity laws</p>	<p>... loss of license to operate at sites of high biodiversity or high community interest</p> <p>... litigation and fines due to direct impact of projects (e.g., habitat fragmentation)</p> <p>... production cost increases due to new standards (e.g., thresholds on use of fertilizer)</p>	<p>Impact</p>
<p>Reputational risk can result in loss of revenue or brand value due to biodiversity-related misconduct (or lack of transparency) in the eyes of the public or other stakeholders</p>	<p>... damage to the corporate brand and sales declines</p> <p>... investor scrutiny and a declining share price</p> <p>... a damaged 'social license to operate' (e.g., followed by local protests)</p>	<p>Impact</p>
<p>Market Risk can lead to cost increases or loss of revenue due to changing dynamics in overall markets that arise from a company's impact or dependency on biodiversity</p>	<p>... cost increases due to sourcing restrictions (e.g., conversion-free sourcing) or global resource scarcity</p> <p>... sales declines due to inability to keep up with competitors (e.g., circular fashion or building materials)</p> <p>... worse access to funding compared to competitors (e.g., from governments, banks, investors, etc.)</p>	<p>Mixed</p>

3.3 BIODIVERSITY-RELATED OPPORTUNITIES

There are significant business opportunities in conserving, sustainably using and restoring biodiversity, including cost savings and increases in operational efficiency; revenue streams from new business models, and access to new markets, products and services; and better stakeholder relationships and company image.⁷⁷ The WEF (2020) identified business opportunities adding up to 10.1 trillion USD per year by 2030 from engaging in nature-positive business models. Payback periods for some of these investments may extend over a decade or more, requiring companies to consider longer time horizons than for current business models. Such models include innovative technologies that attract private capital, from artificial intelligence to circular economies, including waste saving technologies. Other paths include land conservation and restoration, sustainable agriculture and fisheries improvement projects, currently sought by impact-oriented investors, biodiversity-positive social enterprises and blended finance.⁷⁸

Approaches on larger scales include nature-based solutions (NbS). These are actions to protect, sustainably manage, and restore ecosystems, while addressing societal challenges, thereby providing human well-being and biodiversity benefits.⁷⁹ NbS are attracting interest from large corporations but will require policy and regulatory development for effective upscaling.⁸⁰ Avoiding and/or reversing severe environmental changes, in many cases, has the combined effect of mitigating climate risks. In Amazonia, for example, stopping and reversing deforestation could break the feedback loop leading to ever reducing rainfall patterns.⁸¹

In 2019, a report by the Food and Land Use Coalition found that by 2030, apart from helping to bring climate change under control and safeguarding biodiversity, the transformation of land use and food systems alone can create annual business value of 4.5 trillion USD. Responses may include natural habitat restoration (e.g., grasslands, wetlands and forests), sustainable aquaculture, plant-based meat alternatives, precision and agroecology, and reducing food waste.⁸²

77 OECD (2019)

78 Blended finance is the strategic use of development finance for the mobilisation of additional finance towards sustainable development in developing countries. (<https://www.oecd.org/dac/financing-sustainable-development/blended-finance-principles/>)

79 <https://www.iucn.org/commissions/commission-ecosystem-management/our-work/nature-based-solutions>

80 Khatri et al. (2020)

81 Planet Tracker (2021)

82 FOLU (2019)

3. RISK AND OPPORTUNITY

While business opportunities arise from restoring and mitigating existing damage, it is crucial to highlight that business options avoiding or minimizing negative impacts on biodiversity and the climate should always be prioritized over reconstructive or compensatory measures. The mitigation hierarchy illustrates this prioritization. The SBTN's (see Box 3) extended mitigation hierarchy, or AR3T framework, includes transformative action, which covers the possible contribution of companies to systemic change inside and outside their value chains (see Figure 3).

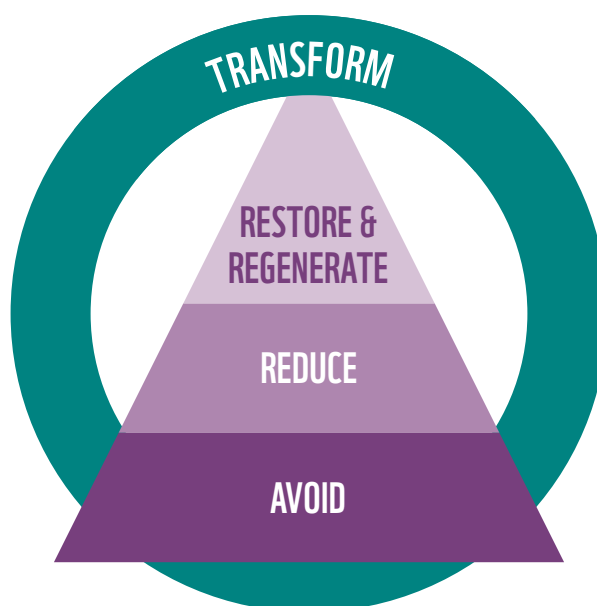


Fig. 3: The SBTN AR3T Action Framework mitigation hierarchy (Source: SBTN, 2020)

Weed to wealth: Furniture production from invasive weeds⁸³

Lantana camara, a flowering woody shrub native to South America, has become one of the most invasive weeds worldwide. In the Western Ghats in India, it thrives mainly in degraded ecosystems. Lantana has been invading numerous protected areas in India, including tiger habitat, where it alters the landscape to such a degree that it severely limits animal movement, jeopardizing the survival of tigers and their ungulate prey species. Indigenous communities, their livelihoods largely depending on the collection of NTFP (non-timber forest products, such as herbs) from surrounding

woodlands, are also negatively affected by the Lantana invasion. Since 2015, under the Lantana Project in the Western Ghats in Southwest India, Indigenous tribal people have been making a living from removing Lantana from surrounding woodlands and building furniture out of the woody branches. These are woven and worked into chairs, baskets and shelves in much the same way as rattan or bamboo. The project thus improves tribal livelihoods while promoting forest biodiversity and conservation through the removal of the invasive weed.

83 Katoch (2017), Venkataraman (2015), www.thelantanacollective.org

3.4 CLASSIFYING BIODIVERSITY OPPORTUNITIES

Identifying biodiversity-related opportunities will require a scientific understanding of “what nature needs” and an honest assessment of a company's objectives when investing in biodiversity. Biodiversity opportunities reflect the place where a company's ambition for a nature-positive future overlaps with its ability to undertake actions that support and reduce threats to nature, and to build coalitions of peers and stakeholders to progress along its sustainability journey and that of the sector it represents. Developing company-wide awareness of impacts and dependencies on biodiversity, understanding the physical and value chain contexts, fostering internal engagement, and building capacity are crucial to seizing opportunities and sparking internal transformation that will credibly reflect in a company's external actions on nature.

There are many reasons why a company may be interested in conserving, sustainably using, and restoring biodiversity. These can include cost savings and increases in operational efficiency; revenue streams from new business models, markets, products and services; and improved stakeholder relationships and brand value. From a corporate perspective any of these reasons must be justified by their financial relevance and some form of return on investment.

Opportunities often align with risk management, especially where a company can identify a component of biodiversity that is highly material and not well managed. Why a company may pursue actions to support biodiversity will vary, but the actions that they take ideally go beyond pure risk reduction and contribute to a nature-positive future. As such, biodiversity opportunities can exceed common sustainable business archetypes to also include the range of conditions within which companies can act on and influence the threats and pressures that drive biodiversity loss and degradation globally, within and outside of their value chains.

In other words, the difference between biodiversity opportunities and biodiversity risks is that opportunities should be transformational. Here, the objective is not simply to remedy oversights, fill gaps, and maintain the very systems that have led to the existing biodiversity and climate crises, but to seek sustainable ways to alter these systems for the benefit of companies and nature in tandem. Where solutions present themselves and contribute to what nature needs while delivering benefits to companies – these are biodiversity opportunities. They fall into three broad categories, as outlined below.

3. RISK AND OPPORTUNITY

Figure 4 illustrates how knowledge of risk and opportunities translates into taking appropriate action.

Fig. 4:
How biodiversity
risk and opportunities
translate into
responses



Scape-based opportunities are location-specific and can support the protection, management, or restoration of specific places (e.g., land-/basin-/seascapes, habitats, and entire ecosystems). These actions have high potential for reducing the impact on nature and improving the extent and condition of ecosystems. Importantly, these opportunities are not confined only to natural ecosystems and are plentiful within working lands/seas and degraded ecosystems, which represent the largest areas of potential impact and intervention for companies.

These opportunities are necessarily place-based and dependent on an understanding of the capacity of a place to respond to company actions, the influence a company can have at such spatial scales, and the partnerships and cooperation necessary to build and maintain momentum in places. This means that companies may address specific pressures on biodiversity by identifying and avoiding or reducing sources of threat (e.g., conversion, invasive species, overexploitation). At a local and/or regional level, businesses can support institutional arrangements and advocate for policies that are aligned with a nature-positive future.

Scape-based opportunities convey powerful narratives regarding transformational change and corporate stewardship as well as the stories of people, cultures, species, and the places they live and thrive. Successful engagement in scape-based opportunities can help build goodwill and local relationships, secure resources, develop stability, and transform degraded or neglected areas from liabilities to assets. Benefits can include continued authorization to operate at local sites (e.g., concessions), verified CSR stories, marketable credits or tax benefits for certified projects (e.g., payments for ecosystem services such as carbon sequestration),

3. RISK AND OPPORTUNITY

or the local application of a company's own products and services. The benefits of scape-based opportunities provide additional input into the other types of biodiversity opportunities by providing companies with a first-hand understanding of the role that places and their people can have in scaling up other types of biodiversity opportunities.

Cacao harvested in the Amazon by Indigenous communities using agro-forestry approaches – the cacao grows under the shade of native trees, which prevents deforestation and produces a bean with exceptional aroma and flavour



Reframing marine reserves as “fish banks”: A business opportunity⁸⁴

Relative to their unprotected counterparts, marine reserves result in an average increase of 446% in fish biomass within a decade. The Spanish Medes Islands Marine Reserve lies in the Mediterranean Sea, the most overfished sea on the planet, where over three-quarters of fisheries have collapsed. Since its establishment in 1983, it has grown to support a significant diving tourism industry and has benefitted local fisheries through the spillover of recovered fish populations into adjacent fishing areas. Scientists have modeled a pro forma business plan for the marine reserve involving private investment by the tourism industry and local

management. Their model suggests that total annual profit rose from 254,000 EUR before the reserve (from fishing) to 3.3 million EUR (from fishing and tourism) in just eight years after the creation of the reserve.

Management costs of the reserve and fisheries losses due to the reduction of fishing grounds are offset by the positive effects of the protected area (i.e., higher tourist numbers and higher catches in the areas surrounding the marine reserve). Short-term losses for fisheries can be compensated through directing a share of the tourist access fees to them.

84 Sala et al. (2016)

3. RISK AND OPPORTUNITY

Market-based opportunities arise when firms recognize the value proposition, creation, or delivery from actions that can protect, manage, or restore biodiversity. Unlike scape-based opportunities that rely on the context of places, market-based biodiversity opportunities are more the product of the free market, regulation, and corporate ingenuity in the face of both. This can include developing biodiversity-friendly products and services as substitutes within existing markets. Developing and understanding such opportunities can result in new revenue streams. First, new eco-friendly business models can be developed by providing products and services that help transform existing value chains to make them eco-efficient and circular. Examples include resource-efficient consumer offerings such as Software-as-a-Service models and meat alternatives, but also business products such as energy-efficient production systems. Second, companies can develop product and service innovations that serve as enablers of biodiversity-safe business. Enablers are products and services such as precision farming tools that help reduce the biodiversity impact of other sectors. Third, companies can offer biodiversity-positive products and services. Examples range from soil-replenishing seeds via targeted pest control to restoration services. Many public-facing companies have also capitalized on repurposing to support global sustainability and to encourage sufficiency where they believe it aligns with the market.

Public-private sector partnerships to tackle marine plastic pollution in support of a circular economy⁸⁵

Single use plastics, such as straws, bags and bottles, are pervasive in our oceans and pose a serious threat to marine life. The financial impact of marine plastic pollution on tourism, fishing and shipping amounts to billions. In 2020, the IFC (International Finance Corporation of the World Bank Group) granted the first “Blue Loan” to a plastic resin company, Indorama Ventures, to help it achieve the goal of recycling 50 billion plastic bottles by 2025. The company aims to divert plastic waste away from landfills and oceans in five countries (Thailand, Indonesia, the Philippines, India and Brazil) that are struggling with waste management and plastic pollution in their ocean environment. The loan will also

support investment in renewable energy and resource efficiency projects. The 150 million USD loan is matched by an equal loan from the ADB (Asian Development Bank) and DEG (Deutsche Investitions-und Entwicklungsgesellschaft).



85 IFC (2020), Kemper & Pathak (2021)

Operation-based opportunities generally refer to the actions a company can take within its own operations and value chain to avoid or reduce its impacts on nature. While many of these actions can overlap with both market-based and scope-based opportunities, they refer to changes a company can make regarding its own internal practices in ways that benefit or prevent harm to biodiversity and provide companies with co-benefits such as reducing their cost of production. For example, integrating eco-efficient and circular production systems (such as the application of Integrated Pest Management practices) will lead to significant improvements in natural resource use, emissions, pollution, and waste for existing products, effectively reducing production costs.

Biodiversity in the spotlight: The Fashion Pact

The Fashion Pact was established in 2020 as a CEO-led coalition of over 60 global fashion and textile companies and manufacturers representing one-third of the global fashion industry by volume. The inception of the Fashion Pact manifests the fashion industry's acknowledgment of its dependencies on nature (e.g., natural fibers such as cotton or wood for viscose) and its global environmental impact. It is also a testament to the sector's assumption of responsibility for bringing about change

towards sustainable practices across value chains. Signatories subscribe to key environmental goals in three areas: stopping global warming, restoring biodiversity and protecting the oceans.⁸⁶ Biodiversity targets include "Wildlife Friendly" approaches to agriculture, mining and forestry that promote the conservation of key species.⁸⁷ This adoption has opened up possibilities for developing and certifying "Wildlife Friendly" wool and cashmere.⁸⁸

The exploration of biodiversity opportunities for companies can include any of the three broad types of opportunities outlined above. Companies should be able to identify several effective responses within each type and should be able to communicate how their combinations across landscapes, markets, and operations lead to transformational change in the relationship between business and nature.

The table in Annex II gives a more detailed overview over how biodiversity needs match with potential business benefits.

86 <https://thefashionpact.org/wp-content/uploads/2020/10/038906e111abca13dce4c77d419e4f21.pdf>

87 https://www.inditex.com/documents/10279/304402/Fashion+Pact_G7_EN.pdf/5db5ef9e-f959-d1df-b966-0f7808049307

88 <https://wildlifefriendly.org/buy-wild/>



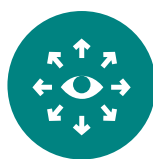
A mist covers the Aldeia Jamari in the Uru-Eu-Wau-Wau Indigenous land, Rondônia

4. WWF'S BIODIVERSITY STEWARDSHIP APPROACH

Understanding and addressing biodiversity risk and opportunities is vital for companies; however, it can be a daunting task. Frameworks like the Science Based Target Network (SBTN, see Box 3) and the WWF biodiversity stewardship approach aim to facilitate and mainstream the process by providing roadmaps with step-by-step guidance.

4.1 WHERE TO START? IDENTIFYING, ASSESSING AND ADDRESSING BIODIVERSITY RISK

While SBTN supports companies in setting science-based targets,⁸⁹ WWF's approach to biodiversity stewardship can help companies to find meaningful ways of achieving those targets. The corporate biodiversity roadmap that acts as the foundation of WWF's Biodiversity Stewardship Programme consists of an iterative five-step process.



1. Creating awareness and building internal engagement

As a first step, a company needs to foster an internal understanding and awareness of how biodiversity might be relevant to its business. This may include identifying its general dependencies and impacts on biodiversity (at a sector level) and developing a high-level view of their materiality. This will result in an initial appraisal of potential biodiversity risk factors for the company and help in engaging management and employees for biodiversity stewardship. Here companies will also outline their objectives for addressing biodiversity risk and the types of corporate biodiversity benefits they would like to see from their engagement. This step aligns with SBTN step 1 (assessment).



2. Baselining and scoping

The next step consists of a detailed analysis to identify areas for action. Companies must map their value chain and analyze impacts and dependencies in each step and across different geographic locations. This will enable them to identify their own key biodiversity issues (for example, regions, products, or commodities with a high degree of biodiversity risk). Subsequently, a quantitative assessment of risks and opportunities for each location (informed by impacts and dependencies) allows to further prioritize locations and thereby determine where a company should start its efforts. This step aligns with SBTN steps 1 and 2 (assessment, interpretation and prioritization).

89 SBTN (2020)



3. Stewardship strategy and targets

The third step consists of helping companies to set commitments, onboard investors and set measurable, time-bound and science-based targets for the respective locations and issues (see Box 3: The SBTN guidance for companies to address nature risk). In the absence of final target setting-guidance from SBTN, WWF will help corporate partners set meaningful interim contextual targets. A portfolio of appropriate response options is then identified at an issue-specific level. This step aligns with SBTN step 3 (measurement, target setting and disclosure).



4. Implementation

Several key actions within this step allow a company to make progress towards reaching their strategic targets and goals. Internal capacity building (e.g., establishing accountability and oversight, setting up systems to track progress, engaging and training staff) is a critical element that sets the groundwork for taking internal and value chain-wide action. Implementation of responses aims not only at reducing the company's biodiversity impact and risk, but to go beyond a net-zero goal to drive positive impact. It may involve avoiding and reducing the company's contribution to threats to biodiversity, restoring ecosystems, and transforming value chains (which can involve substantial opportunity as outlined in Chapter 3.3). Companies can also harness their successes to mobilize peers. Collaboration is essential given the complex interactions between different actors in landscapes where activities take place.⁹⁰ Multi-stakeholder initiatives can be joined/established and peers can be supported by sharing knowledge and data. Moreover, companies can advocate for biodiversity-friendly regulation and policy, and work to educate and engage consumers. This step is aligned with SBTN step 4 (action).



5. Monitor, communicate, iterate

The impact and outcomes of a company's biodiversity efforts should be monitored, tracked and evaluated in order to ensure that progress is being made towards goals and targets. This review is meant to foster continuous improvement and encourage the adjustment of strategy and targets where necessary. Ongoing and transparent reporting on both the measures implemented and the ultimate biodiversity impact of those efforts will be needed both internally and externally. This step is aligned with SBTN step 5 (tracking).

90 SBTN (2020)



WWF ground support: The EDEKA Citrus Project

The appraisal of biodiversity risk and opportunities along a company's value chain forms the basis for developing appropriate responses and putting them into action on the ground. In the Spanish province of Andalucia, WWF has partnered with German retailer Edeka to promote more sustainable practices in conventional agriculture with Edeka suppliers. About 80% of the oranges and mandarins sold in Germany by Edeka come from Andalucia⁹¹.

Andalucia is one of Europe's food production centres. As such, it has been marked by increasing agricultural intensification, which has led to a number of pressures on nature and biodiversity, including soil erosion, habitat loss, and over-use of water resources.⁹²

In 2015, the Citrus Project was launched by EDEKA, WWF and a distributor in the Guadalquivir River basin. Through this project, measures were

implemented on 15 citrus farms with a total cultivation area of 1,136 hectares, with the aim of implementing sustainable water use on farm and river basin levels, reducing pesticide application, improving soil fertility and efficient fertilization and protecting and enhancing biodiversity. Preliminary outcomes include over 200 million litres of water saved on the pilot finca (Spanish for farm/ranch) Iberesparragal in just one season and a total of 1,824 million litres of water saved on 15 project fincas. Biodiversity has also recovered, with 114 different key species observed in the plantation's surroundings; this is likely a direct result of having reduced the toxic load per hectare by 79%.⁹³

Annex III provides a more detailed overview over how the project aligned threats (which translate into risk) and opportunities to actions and presents preliminary outcomes.

91 Vatter et al. (2021)

92 Massot (2016)

93 <https://www.edeka.de/nachhaltigkeit/edeka-zitrusprojekt/zitrus.jsp>

4.1 THE WWF BIODIVERSITY RISK FILTER

Since a company's biodiversity dependencies and impacts are place-based, the assessment of risks and opportunities, response options and progress need to be location-specific.⁹⁴ Without site-level data, it is difficult for companies to fully understand their biodiversity-related risks and opportunities and to prioritize where they should be acting to get the greatest risk reduction and to provide the greatest benefit to nature. This requires a tool that is able to analyze the relevant and available spatially-explicit biodiversity data. Responding to this need, WWF is in the process of developing a spatially-explicit Biodiversity Risk Filter (BRF) tool that will support companies through their biodiversity stewardship journeys. The BRF is designed as a corporate-level screening and prioritization tool to help companies better assess and respond to biodiversity risks and opportunities across their operations and value chains. To do so, the tool combines a large variety of data and will provide location- and sector-specific biodiversity risk and opportunity assessments (based on the risk and opportunities frameworks introduced in the previous chapter and presented in detail in Annexes I and II). Visual output supports the corporate planning and decision-making process for mitigating biodiversity risk and seizing opportunities.

The BRF tool will support companies in the initial steps of the corporate biodiversity journey through four key functionalities.

- **Inform** Understand sector-level impacts and dependencies.
- **Explore** The spatial component is added, and high risk and opportunity areas are shown globally. Companies can identify and focus on high-risk locations and places to prioritize parts of the value chain that will be mapped at site level.
- **Assess** Risks and opportunities are assessed across value chains and key issues and locations identified. The tool provides a detailed assessment of risk and opportunity types across all provided company locations. This will allow companies to identify high-risk and opportunity locations, investigate their underlying causes, and prioritize areas for action.
- **Respond** Identify appropriate corporate-level response options from the offered portfolio of actions. Responses are fitted to specific issues and locations (e.g., changing resource extraction or cultivation practices on the ground; engaging with suppliers; meeting certification standards; contributing to conservation, restoration, and remediation; engaging with local communities, etc.).

4. WWF'S BIODIVERSITY STEWARDSHIP APPROACH



Fig. 5: Alignment of the Biodiversity Stewardship Roadmap and the BRF tool

Biodiversity risk is a complex issue and we are aiming high by creating a tool that captures as many facets of biodiversity risk as possible in a spatially-explicit approach. The development of the BRF builds heavily on WWF's experience with the Water Risk Filter (WRF), launched in 2012 (see Box 4: The WWF Water Risk Filter). In essence, both the BRF and WRF are designed to be used by companies as corporate-level screening and prioritization tools to identify risk hotspots and opportunities across direct operations and value chains. By using spatially-explicit global data sets and similar risk assessment frameworks, both tools provide location-specific and sector-specific assessments of different physical, regulatory and reputational risks, with the objective to help companies better prioritize where and on what to focus contextual responses as well as inform their stewardship strategy and target setting.



Illegal deforestation found in the Indigenous Uru-Eu-Wau-Wau territory

4. WWF'S BIODIVERSITY STEWARDSHIP APPROACH

Box 4: The WWF Water Risk Filter

The *WWF Water Risk Filter* is a free, practical, online tool that supports companies and investors on their water stewardship journey from risk to response.

Launched in 2012 in partnership with the German Development Finance Institution DEG, the WWF Water Risk Filter was one of the first online water risk assessment tools for companies and investors. The tool is unique in its ability to assess both basin and operational water risks to identify water risk hotspots across direct operations, value chain and investments. It has become a leading water risk tool with more than 400,000 sites assessed by over 6,000 users from a broad range of sectors – including food and beverage, textile, retail, mining and finance.

Over the past nine years, the tool has continuously evolved to address private sector actor needs. It not only helps users to assess water risks using the best available data but supports them in identifying contextually-appropriate water stewardship response actions and (soon) evaluate potential financial impacts.

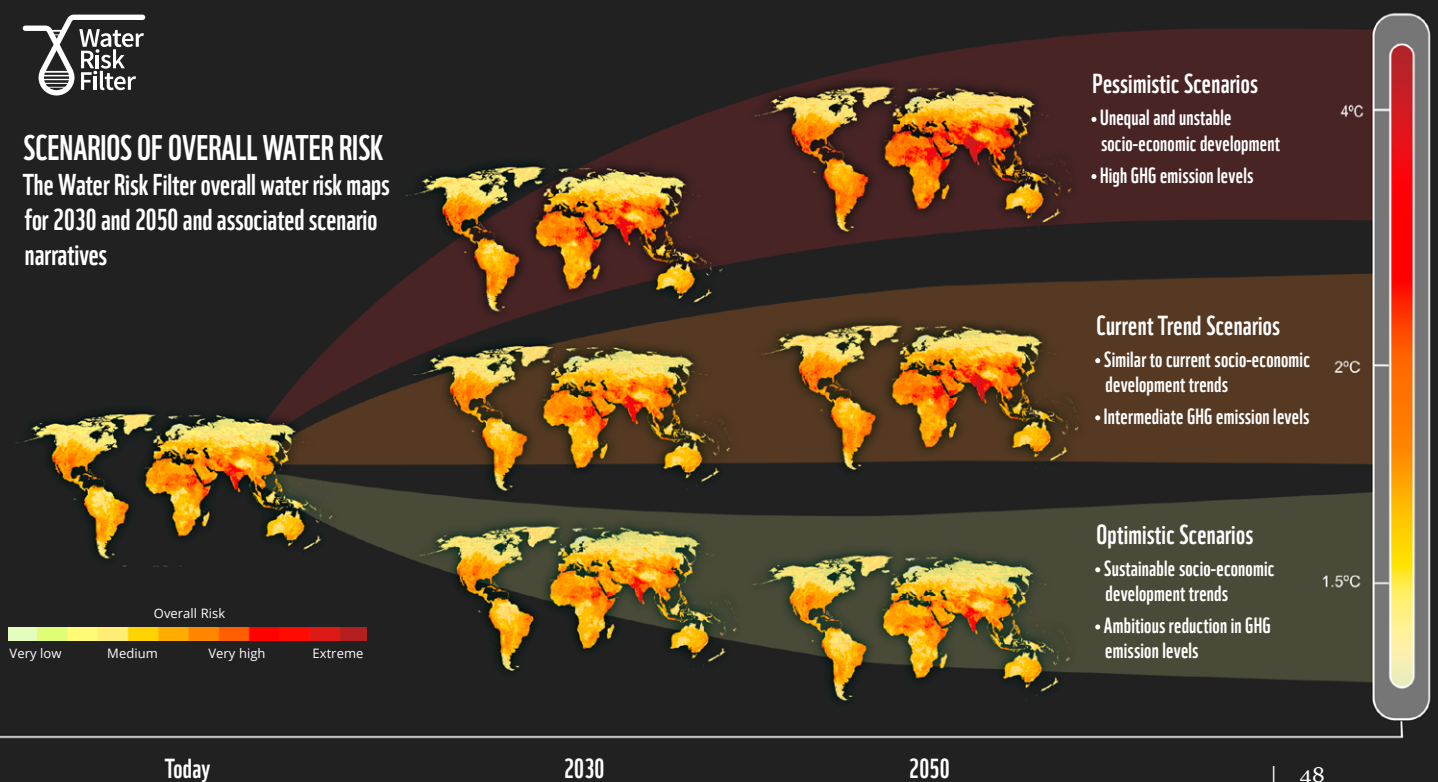
With the support of the UK Development Finance Institution CDC, the WWF Water Risk Filter tool is being enhanced even further to comprehensively integrate climate and socio-economic pathway scenarios of water risks, thus enabling users to perform scenario analysis across their portfolio of sites as recommended by the Task Force on Climate-related Financial Disclosures (TCFD). The enhanced Water Risk Filter 6.0 was released in December 2021.

The WWF Biodiversity Risk Filter covers broad aspects of biodiversity (e.g., freshwater, marine, forest, grasslands and wetlands, etc.) and includes some specific risk indicators from the WWF Water Risk Filter. While the BRF tool will provide general high-level assessment of biodiversity risk, the WWF Water Risk Filter provides a more in-depth assessment of water risks (including operational risk assessment, higher resolution data sets and scenario risk assessment) as well as water stewardship focused recommendations. Therefore, both tools are intended to be complementary and offer unique features for assessing and responding to biodiversity and water risks and opportunities.



SCENARIOS OF OVERALL WATER RISK

The Water Risk Filter overall water risk maps for 2030 and 2050 and associated scenario narratives



4. WWF'S BIODIVERSITY STEWARDSHIP APPROACH

Equally important are several bodies of existing work by other institutions, and collaboration with these organizations is a key aspect of the Biodiversity Risk Filter's approach. Specifically, WWF collaborates with ENCORE (Exploring Natural Capital Opportunities, Risks and Exposure), IBAT (the Integrated Biodiversity Assessment Tool) and RepRisk, which have accumulated a vast and valuable set of biodiversity assessment information for corporate stakeholders.⁹⁵ WWF's aim is to complement these and other existing tools, allowing users to prioritize action in the areas of their value chains that will benefit companies and nature most.

So far, a total of 45 subcategories of risk have been identified within the risk hierarchy that forms the basis for the Biodiversity Risk Filter's methodology (risk factors and drivers in Annex I). A preliminary set of over 100 metrics, indicators and proxies have been identified to give quantitative output for each of the risk categories.⁹⁶ Indicators come from a broad range of sources, including amongst others: FAO, UNEP-WCMC, CBD, NASA, the World Bank, RepRisk, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Economist Intelligence Unit, International Labour Organization, the KBA Partnership, IUCN, scientific publications, as well as WWF internal datasets. Table 2 shows a few example indicators for physical, regulatory and reputation risk.

Aerial view of a soy farm in the Cerrado, Brazil, one of the world's oldest and most diverse tropical ecosystems and one of the most endangered on the planet



⁹⁵ <https://encore.naturalcapital.finance/en/about>;
<https://www.ibat-alliance.org/>; <https://www.reprisk.com/>

⁹⁶ These preliminary datasets are contingent upon use agreements with our data partners and may be subject to change as the BRF methodology is refined.

4. WWF'S BIODIVERSITY STEWARDSHIP APPROACH

The WWF Biodiversity Risk Filter tool is being piloted with partner businesses representing key sectors in early 2022 and is planned to be launched publicly in early 2023. The tool reflects the emerging post-2020 Global Biodiversity Framework of the Convention on Biological Diversity, and is specifically designed to support and is aligned with emerging frameworks including the Science-based Targets for Nature and the Taskforce on Nature-related Financial Disclosures.

Table 2: Sample indicators and proxies to quantify risk factors and drivers (see Annex I for more detail). Note: these indicators are contingent upon use agreements with our data partners and may be subject to change as the BRF methodology is refined.

Risk type	Risk category	Risk subcategory	Risk factor and example metrics
Physical risk	INPUTS: Lack of natural inputs	Availability of wood-based fibers and timber	Mulligan (2021): Realised hard and soft commercial timber value. Model results from the Costing Nature version 3 policy support system (non-commercial use)
	DISTURBANCES: Acute disturbance of value chain or operations	Extreme temperature events	Occurrence of extreme heat or cold (Terrestrial/Marine) (NASA)
Regulatory risk	CURRENT LEGISLATION: Risk of project/ operation- specific interventions	Proximity of sites under protection	Number and size of areas under formal protection
	FUTURE LEGISLATION - SITES: Risk of new site-specific restrictions and requirements	Proximity of sites of specific designation (not yet protected)	Key Biodiversity Areas (KBA Partnership), Vulnerable Marine Ecosystems (FAO), Intact Forest Landscapes (IFL) Large Mammal Areas, Climate Stabilization Areas (Global Safety Net)
Reputational risk	ENVIRONMENTAL: Reputation damage due to environmental impact	Negative impacts on local environmental assets	PAs (UNEP-WCMC), KBAs (KBA Partnership), other areas of importance
	SOCIOECONOMIC: Reputation damage due to social impact	Potential to negatively impact local economy	Exposure to food insecurity (FAO)



A farmer preparing his fields in the dry season, Ruaha Catchment, Tanzania

5. OUTLOOK: FROM INTERNAL ACTION TO BIODIVERSITY STEWARDSHIP

Understanding biodiversity risk and opportunity – along the value chain and across different locations, using a defensible science-driven approach – is perhaps one of the most challenging aspects of developing a nature-positive business model. It is also the aspect companies need most help with as it requires extensive and diverse data that they don't necessarily have access to and concepts that are outside the business context – this is the value that tools like the BRF bring to the table. The BRF aims to break down this complex landscape to the company level and provide practical, decision-useful information in a visually comprehensible way. However, company action should not stop with this analysis.

The BRF tool will be embedded within WWF's global Biodiversity Stewardship Programme. Biodiversity stewardship goes beyond just understanding risk. It aims to encourage companies to engage in safeguarding biodiversity and nature within and beyond their direct value chains, and within a larger spatial and temporal scope, by engaging with local communities and governments in the landscapes in which they work or depend on. The aim of the BRF tool is to provide a decision-useful tool for companies as a first step to start engaging in the biodiversity stewardship process.

The ultimate goal of each company's biodiversity journey, the BRF tool and WWF's Biodiversity Stewardship Programme is to protect and restore global biodiversity on the ground and in the water, while allowing businesses to reduce their risk and take advantage of new opportunities. Our efforts are not a mere paper exercise but are meant to translate into company actions towards biodiversity benefit and support the transition towards a nature-positive economy. This will require true commitment and engagement, implying internal changes to business models, external engagement and collective action, action on the ground and consistent monitoring and adjustment of actions and outcomes. We thereby seek to actively support the implementation of the CBD's 2050 Vision for Biodiversity, which is a world of “Living in harmony with nature” in which “by 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people.”⁹⁷

97 CBD (2018)

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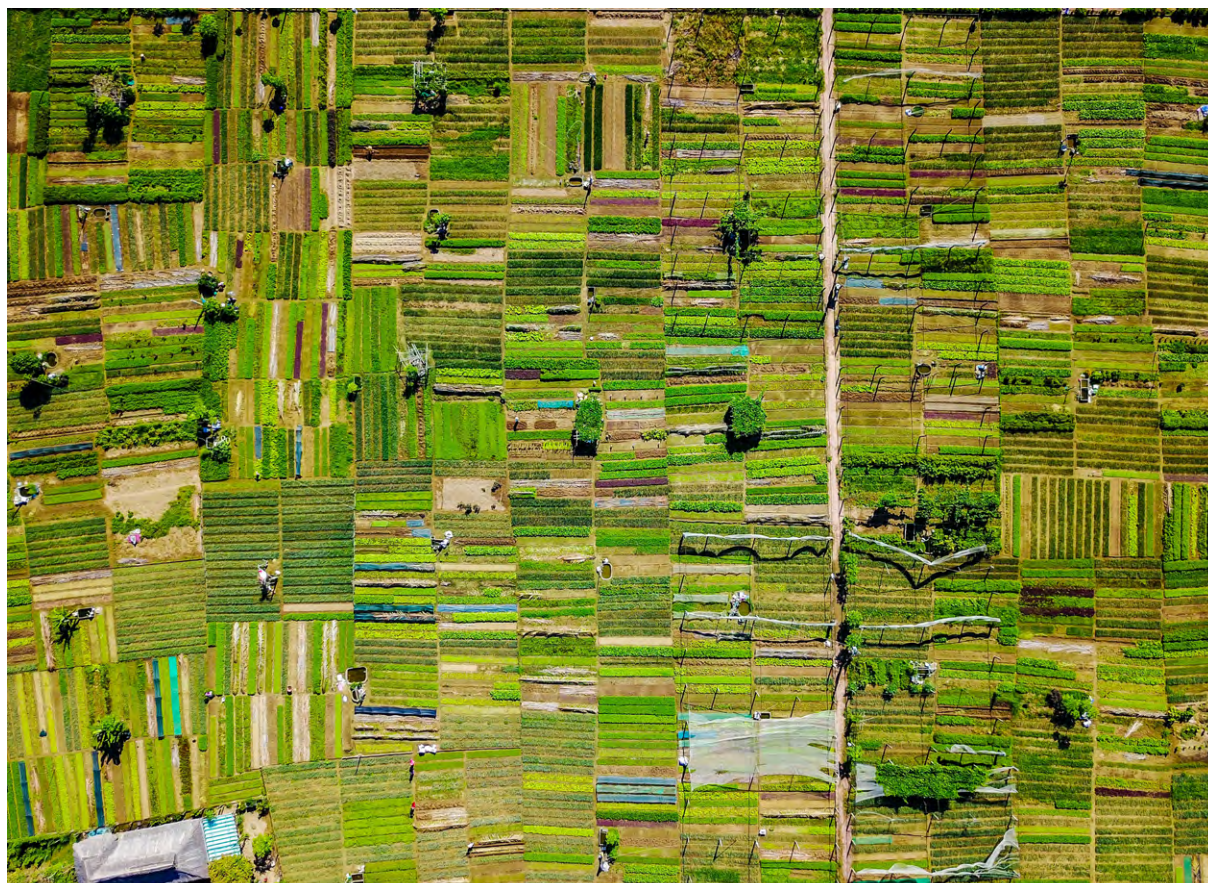
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ANNEXES

ANNEX 1: OVERVIEW OF RISK TYPES, CATEGORIES AND DRIVERS

The following hierarchy classifies the four risk types described above, and subdivides each of these into risk categories, which are linked to underlying threats, e.g., a declining ecosystem service that a company depends on. The individual factors that affect the manifestation of each risk category are framed as risk factors and drivers.

Risk type	Risk category
Physical risk	INPUTS: Lack of natural inputs Production inputs extracted from nature (including feed, raw materials, and genetic material) become locally scarce or inaccessible
	ENABLERS: Lack of natural enablers of business productivity Lack of ecosystem services as enablers of production processes, including cultivation of crops or breeding of animals but also access to extraction sites
	DISTURBANCES: Acute disturbance of value chain or operations Natural hazards disrupting projects, operations, or entire value chains
	ATTRACTIVENESS: Decline in attractiveness of land-/basin-/seascapes or specific sites Landscapes or specific sites that companies depend on (e.g., for tourism or education) become increasingly unattractive
	VULNERABILITY: Increasing vulnerability of ecosystems to the effects of business activities Land, basin, and seascapes become increasingly unable to remediate adverse effects from business activities (e.g., effects on nutrient balances) and may potentially require further interference to stay productive
Regulatory risk	CURRENT LEGISLATION: Risk of project/operation-specific interventions Risk of current legislation leading to restriction of operations at certain sites of operation, requirements or delays to specific projects, litigation, and/or fines
	FUTURE LEGISLATION – SITES: Risk of new site-specific restrictions and requirements Risk of forthcoming regulation leading to stranded assets or restricted operations, e.g., due to additional areas being designated as protected or conserved
	FUTURE LEGISLATION – ACTIVITIES: Risk of new activity-specific restrictions and requirements Risk of forthcoming regulation leading to new mandatory standards (e.g., thresholds, taxation, prohibition) on resource extraction, cultivation, or production processes that cause non-compliant firms to face restrictions or miss out on subsidies

Risk type	Risk category
<p>Reputational risk</p>	<p>ENVIRONMENTAL: Reputation damage due to environmental impact Negative publicity concerning company's environmental sustainability performance (impact on environmental assets), causing direct brand damage, loss of consumer demand and investor scrutiny</p>
	<p>SOCIAL: Reputation damage due to social impact Negative publicity concerning company's social sustainability performance impact on social assets, causing direct brand damage, loss of consumer demand, investor scrutiny and social unrest</p>
	<p>ECONOMIC: Reputation damage due to impact on local economic capabilities Negative publicity concerning company's impact on the economic capabilities and development of a region, causing direct brand damage, loss of consumer demand, investor scrutiny and social unrest</p>
<p>Market risk</p>	<p>INPUTS: Input price increases Risk of production cost increases due to restrictions on sourcing or use of certain resources, or decline of global abundance of a resource</p>
	<p>COMPETITION: Declining brand and value proposition (relative to competitors) Companies are perceived to perform worse on biodiversity than direct competitors and lose market share and investor goodwill</p>

ANNEX II: OVERVIEW OF OPPORTUNITY TYPES

Opportunity type	Response option category – what does nature need?	Potential benefits for businesses
<p>Scape-based opportunities: Allowing firms to realize benefits by supporting the preservation or restoration of specific places</p>	<p>Conservation: Businesses can directly support the conservation of specific sites, land-/basin-/seascapes, or entire ecosystems through instruments like funding or technical assistance</p>	<ul style="list-style-type: none"> • Permission to operate at local sites (e.g., mining concessions) • CSR stories and materials based on verified contributions • Marketable credits for certified projects (e.g., PES = Payment for Ecosystem Services) • New revenue streams from commercialization of nature-based products • Local use of own products and services
	<p>Addressing pressures: Businesses can help combat specific pressures on biodiversity by</p> <ul style="list-style-type: none"> • Eliminating sources of pressure (e.g., poaching) • Mitigation of impact (e.g., removing invasives) 	<ul style="list-style-type: none"> • Permission to operate at local sites (e.g., mining concessions) • CSR stories and materials based on verified contributions • Local use of own products and services • New revenue streams from commercialization of nature-based products
	<p>Restoration: Businesses can support the restoration of habitats and entire ecosystems</p>	<ul style="list-style-type: none"> • Permission to operate at local sites (e.g., mining concessions) • CSR stories and materials based on verified contributions • Marketable credits for certified projects (PES = Payment for Ecosystem Services) • New revenue streams from commercialization of nature-based products • Local use of own products and services
	<p>Sustainable policies: Businesses can advocate for policy changes that facilitate business in harmony with nature</p>	<ul style="list-style-type: none"> • Permission to operate at local sites (e.g., mining concessions) • Local use of own products and services
<p>Market-based opportunities: Allowing firms to realize benefits by catering to market participants' needs or desires for biodiversity-friendly products and value chains</p>	<p>Efficient and circular production systems: Create and support sustainable, eco-efficient and circular value chains through significant improvements in natural resource use, emissions, and waste for existing products</p>	<ul style="list-style-type: none"> • Reduced production costs • Enhanced brand image to consumers, investors and in recruiting
	<p>New resource-efficient business models: Create and support eco-efficient and circular value chains through consumer end products and services that radically reduce biodiversity impact (e.g., Product-as-a-Service models)</p>	<ul style="list-style-type: none"> • Enhanced brand image and specifically value proposition to consumers
	<p>Enablers of biodiversity-safe business: Develop product and service innovations that reduce the biodiversity impact of other sectors, especially in resource extraction and cultivation (e.g., precision farming tools)</p>	<ul style="list-style-type: none"> • Opportunity to capture B2B demand for such products and services • Enhanced brand image to consumers, investors, and in recruiting

Opportunity type	Response option category – what does nature need?	Potential benefits for businesses
<p>Market-based opportunities: Allowing firms to realize benefits by catering to market participants' needs or desires for biodiversity-friendly products and value chains</p>	<p>Biodiversity-positive products: Develop product and service innovations that benefit biodiversity (e.g., soil-replenishing seeds, targeted pest control)</p>	<ul style="list-style-type: none"> • Opportunity to capture B2B/B2P/B2C demand for such solutions • Enhanced brand image to consumers, investors, and in recruiting
<p>Operation-based opportunities: Allowing firms to realize benefits by changing practices in ways that benefit or prevent harm to biodiversity</p>	<p>Integrate improved production systems: Significant improvements in natural resource use, emissions, pollution, and waste for existing products</p>	<ul style="list-style-type: none"> • Reduced production costs • Enhanced brand image • Enhanced value proposition to consumers

ANNEX III: THE EDEKA CITRUS PROJECT

This table illustrates how the Edeka Citrus Project described in Chapter 4 aligned threats (which translate into risk) and opportunities to actions, and presents preliminary outcomes of the project.

Threats	Opportunities	Actions	Outcomes (as of the end of 2020)
Sinking groundwater levels and drought as a consequence of climate change and water depletion due to agricultural intensification in the region	Sustainable water management to secure livelihoods of people and biodiversity	<ul style="list-style-type: none"> • Drip irrigation of trees and installation of soil moisture probes 	<ul style="list-style-type: none"> • Over 200 million litres of water saved on the pilot finca Iberesparragal in just one season • A total of 1,824 million litres of water saved on 15 project fincas
	Basin-wide engagement and advocacy through collective action	<ul style="list-style-type: none"> • Joint workshop with relevant regional stakeholders such as the local irrigation community responsible for the allocation and quantity of water use rights • Joint waste collection campaign on a bank of the Guadalquivir River 	
	Future objective: Contribute to the protection of the Coto de Doñana National Park, located at the end of the river basin and one of the few remaining biodiversity hotspots in the area.		
Biodiversity depletion	Restore, maintain and foster biodiversity	<ul style="list-style-type: none"> • Creation of new biotopes and protection of existing biotopes on farms • Hedge planting • Building nesting sites and perches for native and partly endangered bird species • Use of protection protocols for specific species 	<ul style="list-style-type: none"> • 114 different key species observed in the plantation surroundings: 90 bird species, 10 mammal species and 14 reptile and amphibian species • Among them were rare animals such as badger, otter, mongoose, garden dormouse and mouse weasel, and the strictly protected pearl lizard • The number of ladybird species has increased almost fivefold to 25
Soil and water pollution from pesticides	Improve and restore soil health and productivity	<ul style="list-style-type: none"> • Optimization and reduction of crop protection products, particularly harmful ones • Use of beneficial organisms such as ladybirds for pest control 	<ul style="list-style-type: none"> • Reduced toxic load per hectare by 79%, saved 7,000 litres of pesticides

Threats	Opportunities	Actions	Outcomes (as of the end of 2020)
<p>Nitrate pollution from fertilizers</p>	<p>Improve and restore soil health and productivity</p>	<p>New guidelines for responsible fertilization, including:</p> <ul style="list-style-type: none"> • Compliance with fertilizer use limits • Optimized fertilizer use through analysis of soil conditions, irrigation water quality, leaf and root structure, etc. • Mandatory documentation of fertilizer use 	<ul style="list-style-type: none"> • Water and nutrients are better stored and less mineral fertilizer needs to be applied



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