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Interdisciplinary analysis of protocols and schemes for the valorization of biodiversity: the 3Bee case study

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List of important abbreviations

CBD	Convention on Biological Diversity
CDP	Carbon Disclosure Project
СОР	Conference of the Parties
CSDDD	Corporate Sustainability Due Diligence Directive
CSR	Corporate Social Responsibility
CSRD	Corporate Social Responsibility Directive
EFRAG	European Financial Reporting Advisory Group
ESRS	European Sustainability Reporting Standard
EU	European Union
GEF	Global Environment Facility
GRI	Global Reporting Initiative
ISSB	International Sustainability Standards Board
SBTN	Science-Based Targets Network
SDG	Sustainable Development Goal
TCFD	Taskforce on Climate-related Financial Disclosures
TNFD	Taskforce on Nature-related Financial Disclosures
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme

Abstract

The research aimed to critically study the different protocols, schemes, and frameworks for biodiversity valorization within companies. The analysis was conducted through a multidisciplinary approach highlighting all the critical points related to such a significant issue. The first chapter laid the basis for a global comprehension of biodiversity, and understanding its importance at social, economic, and institutional levels. It also defined the most relevant implications for us humans and framed biodiversity's current threats. Chapter two defined the legal and political infrastructure for biodiversity protection, starting from an international scale, and progressively narrowing the spectrum of analysis to the French and Italian level. The third and fourth chapters presented the main tools available for companies regarding biodiversity enhancement. We gradually got closer to exploring the implications of corporate activities on ecosystems despite the sector in which they operate. We then moved towards strategies that can be enacted and introduced the notion of Corporate Social Responsibility. Such a concept implies significant accountabilities for every action a certain company may undertake. Subsequently, the main standards (ESRS, GRI, ISSB) and frameworks (SBTN, TNFD, CDP, Natural Capital Protocol) were compared based on five characteristics, to understand their differences and similarities. Chapter five brought to our attention the relationship between finance and biodiversity; a key connection, starting with clearly defining biodiversity credits, as opposed to biodiversity offsets. The risk of greenwashing is directly linked to such issues, and it was important to discern sustainable financial activities from simple philanthropy. The chapter concludes by presenting the case study of 3Bee, a nature technology company that protects biodiversity through technology, especially focused on pollinator insects. Their everyday mission and unique protocol (Element-E) represent a great combination of business activity and biological valorization at the same time.

CHAPTER 1. General overview of biodiversity

The inaugural chapter lays the foundation for a comprehensive exploration into the intricate realm of biodiversity. Initially, we deepen the importance of biodiversity, followed by an examination of its influence on various pressing global issues. Next, we take a closer look at an assessment of the economic value of biodiversity and the imminent threats it faces today. We also briefly look at both negative and favorable developments in these areas. In conclusion, the primary objectives of this research are outlined.

1.1 What is biodiversity?

At first sight, a quick and clear interpretation of the notion of biodiversity (from "biological diversity") can be retrieved by referring to the "variety of life" that is present on our planet and within the several ecosystems it embraces (Gaston & Spicer, 2013). This preliminary interpretation does not fully express the many facets such a concept implies. More formal definitions have been proposed; among them, one of the most comprehensive was a result of the Convention on Biological Diversity (CBD)¹. This represented a significant step in the process of recognition and defense of biodiversity. More than 150 nations signed it on 5th June 1992 at the United Nations Conference on Environment and Development, held in Rio de Janeiro, and came into force approximately 18 months later. Specifically, article 2 states:

"Biological diversity" means the variability among living organisms from all sources including, *inter alia*, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems.

In more concise words, biodiversity refers to every living thing, including bacteria, plants, animals, and humans. Existing ecosystems are as complex as mysterious since millions of organisms are still to be discovered. Just think that according to scientists there are 8.7 million species of plants and animals on Earth. However, only around 1.2 million species have been identified and described so far. In addition, some areas are richer in biodiversity variety than others: for instance, warm and wet areas on the planet

¹ The Convention on Biological Biodiversity will be further described and analysed in Chapter 2.

host a multitude of plants as well as animal species. Such areas containing a significant level of biodiversity are called hotspots (National Geographic Society, 2023).

At its core, biodiversity encompasses three distinct as well as hierarchically related tiers: genes, species, and ecosystem diversity, each one playing a critical role in sustaining life. Genetic diversity, meaning the variation within species' genes, is fundamental, as it supports species' ability to adapt to changing environments. Species with low genetic diversity are more prone to extinction since they lack adaptive capabilities. Species diversity, on the other hand, refers to the variety of species in a given area. In the presence of high species diversity, the system presents redundancy that ensures ecosystem functionality even if some species cannot adapt since the presence of others carrying out similar functions guarantees the persistence of certain species. Ecosystem diversity, usually defined as "the complex of living organisms, their physical environment, and all their interrelationships in a particular unit of space" (The Editors of Encyclopaedia Britannica, 2024), further enhances biodiversity by fostering a larger variety of organisms. Increased ecosystem diversity leads to a broader range of organisms, resulting in higher levels of both species and genetic diversity. Together, these tiers are interconnected and mutually dependent: genetic diversity lays the groundwork for species diversity, which in turn supports ecosystem diversity, creating a symbiotic relationship essential for the continuation of life (Panwar, Ober, & Pinkse, 2023).



Figure 1 Three tiers of biodiversity and the primary drivers of biodiversity decline | (Panwar, Ober, & Pinkse, 2023)

The defense of biodiversity has been identified and considered as one of the main challenges of modern society. Throughout time, human actions have posed serious problems to biodiversity conservation, sometimes endangering the existence of certain species. The increasing pressure on the planet, the consumption and use of natural resources, risk upset the delicate balances among ecosystems resulting in a loss of biodiversity. The importance of preserving biodiversity will be the object of the following section.

1.2 The importance of biodiversity protection

Over the past decades, several studies have demonstrated the importance of biodiversity protection, its beneficial implications for other fields, and the dangers that humans face in threatening the livelihoods of some ecosystems. The following example is willing to demonstrate the fundamental need to preserve biodiversity; in fact, a single action can subsequently damage other layers of biodiversity by initiating a devastating and dangerous chain effect, sometimes in an irreparable way.

Recalling the threefold differentiation with reference to the classification of biodiversity seen in the previous section, this practical illustration shows how a business initiative can influence at the same time each of the three tiers. If a particular company opts to replace a primary forest, which is an ecosystem, with an oil palm plantation, the new ecosystem (in this case the plantation), is only suitable for half of the vertebrate species found in the primary forests (Fitzherbert, et al., 2008). Such reduction of biodiversity within the new ecosystem will entail the isolation of the remaining forest fragments, reducing the opportunity for genetic mixing as well as loss of genetic diversity. Moreover, if the remaining forest fragments are so small that they cannot provide anymore the necessary living conditions for species responsible for ecological functions, an ecological collapse would likely happen, together with biodiversity loss (Foster, et al., 2011).

The preservation of biodiversity is one of the fundamental global challenges that the international community seeks to address, indeed it is part of the 17 Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development set by the international community². In this respect, biodiversity and ecosystems feature

² The Sustainable Development Goals are a call for action by all countries, regardless of economic status, to pursue both prosperity and environmental preservation. They are part of the Agenda 2030 for the Sustainable Development, is an action programme for people, the planet and prosperity signed in September 2015 by the governments of the 193 UN member countries. The SDGs acknowledge that eradicating poverty requires simultaneous efforts to foster economic advancement and address various social

prominently across almost all the other SDGs and associated targets. The following statements briefly highlight the interconnection between biodiversity conservation, sustainable development, and the achievement of the various Sustainable Development Goals (SDGs).

- End poverty in all its forms everywhere (SDG 1): Biodiversity provides resources and income for rural and forest-dwelling households, contributing significantly to livelihoods, especially among the poor.
- End hunger, achieve food security and improved nutrition, and promote sustainable agriculture (SDG 2): Biodiversity is crucial for food security, providing essential ecosystem functions like pollination and soil fertility maintenance, which are central to agricultural productivity.
- Ensure healthy lives and promote well-being for all at all ages (SDG 3): Healthy ecosystems mitigate pollution, contribute to sustainable production, and provide resources for traditional medicines, thereby benefiting human health.
- Achieve gender equality and empower all women and girls (SDG 5): Recognizing women's roles as key land and natural resource managers is crucial for sustainable development. Loss of biodiversity can exacerbate gender inequalities by increasing the burden on women and children in resource collection.
- Ensure the availability and sustainable management of water and sanitation for all (SDG 6): Ecosystems play a vital role in maintaining water supply, and quality, and guarding against water-related hazards, offering cost-effective solutions compared to build technologies.
- Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all (SDG 8): Biodiversity supports various economic activities, including agriculture, forestry, fisheries, and tourism, leading to higher productivity and resource efficiency.
- Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation (SDG 9): Healthy ecosystems provide natural infrastructure,

necessities such as education, healthcare, social welfare, and employment opportunities. Additionally, they emphasize the importance of addressing climate change and safeguarding the environment in these efforts.

protecting against climate change impacts, and reducing pollution, often more cost-effectively than built infrastructure.

- Make cities and human settlements inclusive, safe, resilient, and sustainable (SDG 11): Ecosystems provide essential services for urban centers, such as food, building materials, and medicines, promoting sustainable and healthy human settlements.
- Ensure sustainable consumption and production patterns (SDG 12): Unsustainable consumption and production patterns impact biodiversity. Cleaner and resource-efficient approaches can benefit both biodiversity and quality of life.
- Take urgent action to combat climate change and its impacts (SDG 13): Conservation and sustainable use of ecosystems help mitigate climate change, preserve carbon stores, and enhance adaptation to climate change impacts.
- Conserve and sustainably use the oceans, seas, and marine resources for sustainable development (SDG 14): Biodiversity conservation is essential for marine and coastal ecosystems, supporting fishing, aquaculture, and other activities.
- Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation, and halt biodiversity loss (SDG 15): Conservation, restoration, and sustainable management of terrestrial ecosystems are crucial for sustainable development.
- Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels (SDG 16): Addressing environmental degradation and resource conflicts is vital for building inclusive societies based on justice.
- Strengthen the means of implementation and revitalize the global partnership for sustainable development (SDG 17): Biodiversity initiatives provide opportunities for global partnership, technology dissemination, and capacity-building, crucial for achieving the 2030 Agenda.

Overall, these statements underline the importance of biodiversity conservation and sustainable use in achieving SDGs and promoting systematic sustainable development (Secretariat of the Convention on Biological Diversity, 2018). The implications that biodiversity integrity would imply to multiple sectors are clearly stated: protection of

natural ecosystems has significant implications for practically all other sectors. Nevertheless, its importance has often been undermined and threatened, especially by the activities of companies motivated by profit objectives, as described in the example at the beginning of this paragraph. At the same time, international awareness has increased, and a growing number of initiatives have been implemented to promote sustainable development which gives strong consideration to the promotion and protection of biological diversity.

1.3 The economic value of biodiversity

The previous paragraph has shown how biodiversity permeates every other field of our society, particularly when dealing with global and current challenges. Contextually, it would be interesting to look at how biodiversity's protection and valorization generate economic benefits.

Changes in biodiversity can influence human well-being through either direct or indirect economic value (Bartkowski, 2017). Individuals value biodiversity for various reasons, both for direct use, like recreational activities and for non-use reasons, such as knowing species exist even if they never see them. Preferences for conservation efforts vary based on factors such as species rarity and conservation methods. Furthermore, biodiversity can have an economic value in providing services when consumers prefer species diversity. On the other hand, biodiversity contributes to ecosystem functioning, which in turn provides ecosystem services that benefit people, whether through market-valued outputs (e.g. agricultural crops) or non-market values (e.g. wildflowers). Biodiversity provides indirect value by reducing risks to commercial outputs and enhancing ecosystem resilience, but its impact on economic values varies and can involve trade-offs. Increases in biodiversity, especially due to invasive species, may lead to reduced agricultural and forest outputs and losses in biodiversity values (Hanley & Perrings, 2019).

Preserving biodiversity has a crucial role in enabling industries such as agriculture, forestry, and tourism and contributing to human health and well-being through functions like organic waste disposal, pest control, and pharmaceuticals. The intricate balance among ecosystems, species, and genes results in vital services essential for both society and the economy, significantly contributing to the global GDP. For example, pollinators such as bees play a critical role in supporting over 75% of food crops, while natural

ecosystems annually sequester one-third of global greenhouse gas emissions. However, the comprehensive range and importance of ecosystem services, including fundamental functions like soil formation and water regulation, often go unnoticed. Research estimates the combined annual value of ecosystem services at over \$150 trillion, nearly twice the global GDP (Kurth, Wübbels, Portafaix, Meyer zum Felde, & Zielcke, 2021). While assessing the intrinsic value of certain services remains challenging, acknowledging and understanding the various dimensions of biodiversity's value is crucial for effective conservation efforts.

1.4 The current state of the art concerning biodiversity loss

The current state of biodiversity loss is alarming, with species disappearing at a rate much faster than the natural background rate of extinction. The WWF's Living Planet Report 2022 reveals that wildlife populations have declined by an average of 69% between 1970 and 2018 (Whiting, 2022). This decline is particularly severe in certain areas of the globe, such as in Latin America, where there has been a 94% drop in average wildlife population size. The main drivers of biodiversity loss include habitat loss, degradation, and fragmentation, driven by factors like industrial activities, farming, and climate change. Human activities have transformed 75% of ice-free land and 63% of oceans, leading to extensive destruction of habitats like wetlands and tropical rainforests. Climate change is also a significant contributor to biodiversity loss, affecting ecosystems like coral reefs and causing disruptions in species interactions (LSE, 2022).





Economic expansion and the accumulation of resources are outpacing population growth, with 74% of the excess material usage (i.e., resource consumption beyond equitable shares) being monopolized by only 16% of the world's population, predominantly residing in affluent nations. Recent evidence suggests that individual material consumption levels have the most profound impact on humanity's ecological footprint, surpassing the influence of the total global population, which has been the predominant focus until now. This distinction delineates the contrast between the primary stakeholders in biodiversity conservation: the Global South, where the bulk of intact and diverse biodiversity remains and thus bears the primary burden of proposed conservation efforts, and the Global North, whose consumption patterns have fueled the global decline in biodiversity (Obura, 2023).

Despite the alarming numbers and the speed at which they continue to increase, it is important to emphasize that the international community, businesses, and organizations are increasingly committed to making a positive and effective contribution to the cause of sustainable development. The following chapters will be devoted to an analysis of the frameworks and schemes that the international community has put in place to enhance biodiversity, especially from a business perspective. A closer look will be taken at the tools in the hands of companies, to understand their evolution within the broader scenario of sustainable and nature-related disclosure processes. In this regard, efforts to address biodiversity loss are crucial to prevent further extinctions and ecosystem degradation. Conservation initiatives have shown success in saving species from extinction, such as the Iberian lynx, Przewalski's horse, and the Puerto Rican Amazon parrot (Greenfield, 2022). It is essential to adopt a nature-positive approach by actively restoring the planet's living species to combat the ongoing biodiversity crisis. By understanding the extent and causes of biodiversity loss and taking decisive actions to protect ecosystems and species, each subject can contribute towards a more sustainable future for all life on Earth.

1.5 Objectives of the research

The study delves into the intricate relationship between businesses and biodiversity, emphasizing the significant impact that companies, regardless of their sector and dimension, have on environmental conservation. It highlights how business actions imply societal repercussions, showcasing the interconnectedness of economic activities and environmental preservation efforts. The research scrutinizes companies' role in influencing and being influenced by biodiversity, illustrating the comprehensive nature of their engagement in conservation endeavors.

Furthermore, the study aims to evaluate the effectiveness of existing frameworks and mechanisms available to companies for promoting biodiversity conservation, sustainable practices, and fair benefit sharing. By critically analyzing these tools, the research seeks to assess their ability to foster conservation efforts and sustainable business practices.

The European landscape is predominantly characterized by a normative regulatory system. In contrast, the USA employs an incentive-based system³. Some argue that Europe's ecological transition is slowing down due to overregulation from the ambitious Green Deal and insufficient incentives to meet the targets set. Conversely, the ecological transition in the US is accelerating because of fewer regulations and well-designed incentives that make investment more attractive (La Posta, 2024). Economic incentives or market-based policies use market forces to correct behavior. Examples include marketable permit systems, which allow trading of emission allowances (e.g., cap-and-

³ In Chapter 5 we will devote particular attention to the European system of incentives and how the Union finances biodiversity and sustainable practices within companies.

trade). Emission taxes, fees, and charges impose per-unit costs on emissions to reduce the overall quantity. Subsidies provide financial support for environmentally friendly practices. Tax-subsidy combinations combine taxes with subsidies, such as deposit-refund systems (EPA, 2023).

The critical analysis in the study aims to demonstrate that imposing stricter and more binding regulations on the market is more effective than relying solely on companies to adhere to behavioral standards. Additionally, it seeks to determine whether stricter regulations are more effective than incentive-based approaches in ensuring meaningful biodiversity protection and sustainable practices across industries. This dissertation emphasizes the need for robust, coherent, and coordinated regulatory measures to ensure effective biodiversity protection and sustainability in various industries.

CHAPTER 2. Political and Legal Framework for Defense and Valorization of Biodiversity

Given that biodiversity poses significant challenges and opportunities for contemporary societies, it is imperative to grasp the political and legal structures that have been gradually erected around this topic. Our review will progress from an accurate exploration of the global landscape to a focus on the European context. Ultimately, we will offer a brief comparative assessment in terms of biodiversity protection initiatives between Italy and France, two key actors within the European sphere.

2.1 International context

Over the past five decades, unprecedented technological progress has fueled vast economic expansion, improving the quality of life for many. However, this surge has also led to amplified levels of production and consumption, compounded by systemic inefficiencies, and poor allocation of resources and waste, resulting in a rapid and extensive depletion of biodiversity. As previously seen, biodiversity plays a pivotal role in providing numerous ecosystem services essential for basic life-support functions within society such as the provision of food, fuel, and clean water, as well as nutrient cycling, pollination services, and climate regulation (OECD, 2019).

In recent years, the international community has undertaken various initiatives for the protection and enhancement of biodiversity, with consequent improvement. As highlighted in the "Global Risks Report 2024", policymakers identify biodiversity loss and ecosystem collapse as the twentieth most significant short-term risk to society. However, when looking at long-term threats, biodiversity loss is currently the third most serious risk (WEF, 2024). Thus, stopping biodiversity loss and restoring degraded ecosystems remains a crucial element of sustainable development pathways. Failure to enhance efforts to address biodiversity loss will carry substantial economic and trade consequences, along with broader implications for human well-being.

2.1.1 The Convention on Biological Diversity (CBD)

The Earth's biological resources are crucial for humanity's economic and social progress, recognized as a valuable global asset for both present and future generations. In response to the threats to species and ecosystems, the United Nations Environment Programme (UNEP) initiated discussions in 1988 for an international convention on biological diversity. By May 1989, an Ad Hoc Working Group was established to develop a legal instrument for the conservation and sustainable use of biological diversity. This effort evolved into the Intergovernmental Negotiating Committee, leading to the adoption of the CBD in May 1992. Opened for signature at the Rio "Earth Summit" in June 1992, the Convention became effective on December 29, 1993, signaling a significant advancement in global commitment to sustainable development setting three primary objectives for the international community, embodied in Articles 6 to 20 (CBD, 2024):

- 1. Preserving biological diversity.
- 2. Sustainable use of elements of biological diversity.
- Ensuring fair and equitable sharing of benefits derived from the utilization of genetic resources.

The effectiveness of the Convention hinges on the collaborative endeavors of nations worldwide. The duty to execute the Convention rests with individual countries, and its adherence largely relies on enlightened self-interest and peer influence from other nations, as well as public sentiment. The Convention has established an international platform – comprising a sequence of gatherings – where governments, non-governmental organizations, scholars, the private sector, and other concerned parties exchange ideas and evaluate tactics (CBD Sustaining Life on Earth, 2000).

The CBD established institutional arrangements including the Conference of the Parties (COP), the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA), and the Secretariat. Additionally, it sets up financial and clearinghouse mechanisms and empowers the COP to establish additional subsidiary bodies as needed. The following sections provide an overview of the Convention's institutional structure, its mandates, operations, and program of work.

2.1.1.1 Institutional organization

The highest governing body of the Convention is the Conference of the Parties (COP), comprising all ratified governments (and regional economic integration organizations) and tasked with reviewing implementation and guiding development under Article 23. Its functions include budget adoption, consideration of national reports, and protocol adoption. COP meetings are held biennially, with one extraordinary meeting convened in 1999 to finalize the Cartagena Protocol on Biosafety. The COP has addressed numerous agenda items and adopted over 175 decisions. It established multi-year programs of work, emphasizing the ecosystem approach as a primary framework (CBD Handbook (3rd edition), 2005).

Article 25 establishes SBSTTA as a scientific advisory body to guide the COP on biodiversity matters. It assesses biodiversity status, evaluates measures, identifies technologies, advises on programs, and responds to technical queries. SBSTTA has had nine meetings, with two more in 2005. Its recommendations go to the COP for consideration, often partially or wholly endorsed. Operational procedures involve expert groups and technical meetings for documentation preparation and review.

Article 24 of the Convention establishes a Secretariat, housed by UNEP in Montreal, Canada. Its primary roles include servicing COP and subsidiary body meetings, coordinating with other international bodies, and offering administrative support. The Secretariat organizes Convention meetings, prepares background documents, and aids in coordinating with other institutions and conventions. Parties contribute to trust funds to cover administrative costs, adhering to financial rules set by the COP (COP 3 Decision III/1, 1996).

Article 21 sets up a financial mechanism to aid developing countries in meeting Convention obligations. Developed nations pledge to furnish new and additional funds for this purpose. The GEF is appointed through Article 39 to manage this mechanism temporarily, answerable to the COP. The COP decides on policy, priorities, and eligibility criteria for accessing funds. Comprehensive guidance for the financial mechanism was adopted at COP 1 and refined in subsequent meetings (COP 1 Decision I/2, 1994). The GEF reports its implementation to the COP. GEF projects involve Convention Parties and Implementing Agencies: UNEP, UNDP, and the World Bank.

Figure 3 Programmatic Structure of the Secretariat | Source: CBD Handbook (the 3rd Edition)



Paragraph 3 of Article 18 creates a Clearing-House Mechanism (CHM) for technical and scientific cooperation. Initially managed by the Secretariat, it became independent in 1998 after a pilot phase. COP 5 endorsed a strategic plan and long-term program of work for the CHM (UNEP/CBD/COP/5/INF/2, 1999), while COP 7 focused on technology transfer and cooperation, emphasizing information systems development and the CHM's role in facilitating exchange.

Finally, the COP has established several subsidiary bodies with specific mandates, such as the Biosafety Working Group, and the Access and Benefit Sharing Working Group rather than the Protected Areas Working Group. These organs are tasked with offering advice and recommendations on particular matters. The COP determines the terms of reference for each body and guides its composition.

Figure 4 Structure of the COP | CBD Handbook (the 3rd Edition)



2.1.1.2 Convention's Protocols: Cartagena and Nagoya

The Cartagena Protocol on Biosafety is an international treaty under the CBD. It was adopted on 29 January 2000 and entered into force on 11 September 2003. It aims to ensure the safe handling, transport, and use of living-modified organisms (LMOs) resulting from modern biotechnology that may have adverse effects on biological diversity, taking into account risks to human health. Key provisions include the Advance Informed Agreement (AIA) procedure, which requires exporting countries to notify and obtain consent from importing countries before exporting LMOs.

Another important commitment of the Convention is the Nagoya Protocol⁴. It is a supplementary agreement to the CBD, addressing access to genetic resources and the fair and equitable sharing of benefits arising from their utilization. It aims to create greater legal certainty and transparency for both providers and users of genetic resources. The protocol includes provisions on prior informed consent (PIC) and mutually agreed terms (MAT) for accessing genetic resources, as well as benefit-sharing mechanisms to ensure that the benefits derived from the use of genetic resources are fairly and equitably shared with the countries and communities that provide them (CBD, 2015).

2.1.2 Kunming-Montreal Global Biodiversity Framework

On the occasion of COP 15, the Kunming-Montreal Global Biodiversity Framework (GBF) was adopted, after four years of consultation and negotiation. The GBF aims to halt and reverse the dramatic nature loss trend. It includes twenty-three global targets to be achieved by 2030⁵ and four overarching goals for 2050. These goals aim to halt human-induced species extinction, ensure the sustainable use of biodiversity, promote the equitable sharing of benefits, and address implementation and finance, which includes closing the \$700 billion per year biodiversity finance gap (CBD, 2022).

⁴ The extended title of the protocol is: "Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization (ABS)".

⁵ These targets are designed to tackle immediate biodiversity challenges. They encompass a wide range of actions, such as reducing pollution, restoring ecosystems, protecting critical habitats, and integrating biodiversity considerations into all sectors of the economy.

The framework emphasizes the importance of cooperation among countries, organizations, and stakeholders to achieve these targets. It calls for the integration of biodiversity considerations into national policies, plans, and programs. A critical aspect of the GBF is addressing the financial needs required to implement the targets and goals. This includes mobilizing public and private resources, international funding, and innovative financial mechanisms to bridge the significant financial gap.

2.1.3 Other International Conventions

In addition to the CBD, several international treaties focus on specific species or habitats: the Ramsar Convention on Wetlands, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Bonn Convention on the Conservation of Migratory Species of Wild Animals (CMS), and the Berne Convention on the Conservation of Wildlife and Natural Habitats in Europe. Additionally, the Global Biodiversity Information Facility (GBIF) offers open access to data on all life forms on Earth.

2.2 European context

The European Union (EU) has a long history of efforts aimed at conserving biodiversity, marked by the adoption of key policies and strategies over the decades. In the 1970s and 1980s, the foundations of nature conservation were laid with the 1979 adoption of the Birds Directive (BIS Europe, s.d.), the EU's first major piece of nature conservation legislation, which aimed to protect all wild bird species naturally occurring in the EU and established Special Protection Areas (SPAs) for threatened and migratory birds.

The 1990s saw the establishment of comprehensive frameworks with the 1992 adoption of the Habitats Directive (92/43/EEC). The Directive aimed to protect a wide range of rare, threatened, or endemic animal and plant species, leading to the creation of the Natura 2000 network of protected areas. In 1993, the LIFE Programme was launched as a financial instrument to support environmental and nature conservation projects throughout the EU. Since its establishment, it has co-financed thousands of projects that protect the environment, conserve nature, and mitigate climate change (European Climate, 2022).

At the beginning of the new millennium, the EU strengthened its biodiversity commitments with the 2001 adoption of the EU Biodiversity Action Plan aimed at halting biodiversity loss by 2010, laying out a strategic framework to conserve biodiversity across various sectors. Despite not fully achieving the 2010 targets, the EU renewed its commitment in 2006, focusing on integrating biodiversity into other policy areas like agriculture and fisheries.

The 2010s saw enhanced strategic approaches with the 2010 EU Biodiversity Strategy to 2020, setting new goals to halt the loss of biodiversity and ecosystem services by 2020, including targets for habitat restoration, combating invasive species, and expanding Natura 2000 areas. The formal adoption of the strategy in 2011 aligned with global targets set by the CBD during the Nagoya conference (EEA, 2024).

In the 2020s, the EU took on a global leadership role in biodiversity conservation by introducing very ambitious goals. The European Green Deal, introduced in 2020, aimed to transform the EU into a modern, resource-efficient, and competitive economy with biodiversity as a crucial component. The Biodiversity Strategy for 2030, announced as part of the Green Deal, aimed to ensure Europe's biodiversity is on the path to recovery by 2030, with actions including expanding protected areas, restoring degraded ecosystems, and reducing pesticide use (EC, Biodiversity strategy for 2030, s.d.). In 2022, the EU proposed the Nature Restoration Law focused on the large-scale restoration of damaged ecosystems and played a significant role in the global discussions leading to the adoption of the Kunming-Montreal GBF, which sets targets by 2050.

Ongoing efforts include the continued implementation of the Green Deal, integrating biodiversity considerations into the EU's economic, agricultural, and environmental policies, enhanced monitoring and reporting on the state of ecosystems, habitats, and species, and increased funding and financial instruments dedicated to biodiversity conservation, with significant portions of the EU budget and recovery plans allocated towards green projects. Through these efforts, the EU has progressively built a robust framework for biodiversity conservation, integrating it into broader policy agendas and committing to ambitious targets for the future.

In the upcoming sections, some of the most significant European initiatives will be highlighted and further analyzed.

2.2.1 The EU Biodiversity Strategy for 2030

As comprehended from the previous paragraph, the EU and its member states have committed themselves to biodiversity defense, setting clear goals not only at the continental level (EC, 2011). The opportunities for biodiversity conservation have been particularly reinforced with the EU Biodiversity Strategy for 2030, aiming at "Bringing nature back into our lives" (EC, 2020). The Strategy is built around three key pillars: (i) enhancing the protection and restoration of nature within the EU by creating a cohesive and effective network of protected areas and rehabilitating degraded habitats; (ii) establishing a new governance framework to ensure shared responsibility and ownership among all relevant stakeholders in achieving biodiversity goals, which includes developing new financial opportunities; and (iii) adopting a global biodiversity agenda to bolster the EU's role in stopping global biodiversity loss and reducing the negative impacts of EU resource use and consumption on biodiversity-rich regions around the world" (EC, 2020).

In addition, the EU has made available two online tools that allow real-time monitoring of the implementation of the strategy⁶. To date, of the more than 100 actions planned, 49 have been completed, 47 are underway and 8 are behind schedule (Garzarella, Scavone, & Sini, 2023).

2.2.1.1 Evaluation of EU Biodiversity Strategy

Setting ambitious goals requires adequate planning, enforcement, and governance (Guidetti, et al., 2008). The Biodiversity Strategy for 2030 certainly needs to learn from the successes and failures of past EU biodiversity policies, to adjust the scope and respect the ambitious goals it aims to reach. Four key aspect aspects can be taken into consideration for effective policy implementation: (i) coordination among and within the EU Member States, (ii) integration of biodiversity conservation into different sectors, (iii) adequacy and sufficiency of funds, and (iv) governance and stakeholder participation. The evaluation of these aspects will be crucial for effective conservation and, thus the implementation and success of the Strategy for 2030. At the same time, the potential

⁶ The EU Biodiversity Action Tracker is a tool designed to track the progress of the planned (https://dopa.jrc.ec.europa.eu/kcbd/actions-tracker/?etrans=it).

success of conservation policy in the EU has implications beyond achieving continental objectives. It could serve as a model for conservation strategies globally (Campagnaro, et al., 2019), aiding in the alignment of efforts with similar initiatives and conservation goals worldwide.



<u>Figure 5</u> The strengths and weaknesses of past conservation policies and practices in the European Union, along with opportunities and challenges for conservation in the coming decade. | (Hermoso, et al., 2022)

When dealing with coordination, it is imperative to refer to the Natura 2000 (N2K) network which represents a significant opportunity for biodiversity management. This network not only protects species and habitats listed in the Nature Directives but also many other co-occurring threatened species (Hermoso, et al., 2019). It offers a platform to extend management efforts to these additional species and habitats. The Biodiversity Strategy for 2030 aims to expand the network to cover at least 30% of the EU's terrestrial and marine territories, with strict protection for one-third of that area and improve biodiversity management both inside and outside protected areas (EC, 2020).

The new biodiversity conservation policy context in the EU, led by the Green Deal and Biodiversity Strategy for 2030, facilitates the integration of biodiversity conservation into other sectoral policies, particularly in agriculture and maritime activities. The Farm to Fork Strategy⁷ and the new Common Agricultural Policy (CAP) promote sustainable

⁷ The Farm to Fork Strategy, part of the European Green Deal, aims to create a fair, healthy, and environmentally friendly food system in the EU. Its key goals include 1) reducing environmental impact

farming practices, while the Maritime Spatial Planning Framework Directive focuses on spatially optimized national maritime plans that balance conservation with resource exploitation (Hermoso, et al., 2022).

Governance and stakeholder participation are crucial elements of the Biodiversity Strategy for 2030. The strategy aims to establish a new governance framework that ensures co-responsibility and co-ownership of biodiversity commitments among all relevant actors (EC, 2020). This includes building administrative capacity, fostering transparency, encouraging stakeholder dialogue, and promoting participatory governance at different levels. Public participation in protected area management can lead to increased environmental stewardship and improved environmental outcomes through well-designed citizen science programs and enhanced stakeholder communication (Bennet, et al., 2018).

Funding opportunities for biodiversity conservation and habitat restoration are also highlighted in the strategy. The EU aims to unlock at least €20 billion per year for nature conservation through public investment and private sector contributions (EC, 2020). Funding mechanisms such as Payments for Ecosystem Services are proposed, alongside incentives for nature-based solutions and green economy initiatives. The NextGenerationEU Recovery Plan will also support the implementation of the EU Green Deal, providing additional financial resources for biodiversity conservation (EC, 2019).

These comprehensive efforts aim to establish a robust framework for biodiversity management by integrating conservation goals into broader policy agendas and addressing global challenges. It is crucial for the effective implementation of the

by cutting greenhouse gas emissions, decreasing pesticide and fertilizer use, and promoting organic farming. It also focuses on 2) producing sustainable food by enhancing biodiversity, improving animal welfare, and ensuring sustainable fishing practices. Additionally, the strategy aims to 3) provide healthy and affordable food by encouraging healthier diets, reducing food waste, and ensuring food affordability. Furthermore, it seeks to act as a 4) global point of reference by promoting sustainability standards worldwide and supporting developing countries in achieving sustainable food systems. The strategy involves various stakeholders across the food supply chain and emphasizes integrating these goals into EU policies.

Biodiversity Strategy for 2030 involves recognizing the strengths and weaknesses of past biodiversity management experiences, identifying gaps, and building on previous efforts.

2.2.2 Nature Restoration Law

Habitat loss, over-exploitation, climate change, pollution, and invasive alien species all contribute to biodiversity loss. The European Environment Agency has estimated that around 81% of habitats, 39% of bird species, and 63% of other species in the EU are facing precarious conditions (EEA, 2020). Furthermore, it has been demonstrated that every euro invested in the restoration of the environment generates a benefit ranging from 8 to 38 euros, underlining the huge positive externalities that justify investing in natural capital restoration practices (European Union, 2023).

Restoring different ecosystems and species is the goal of the Commission's proposal for a Nature Restoration Law, as part of the EU Biodiversity Strategy⁸. It expects targets to restore degraded ecosystems, focusing particularly on those with the highest potential for carbon capture and storage, and on mitigating the impacts of natural disasters. (EC, Nature Restoration Law, s.d.)

The Law was first proposed on 22 June 2022 aiming to achieve the long-term recovery of nature in the EU's land and sea areas through binding restoration targets for specific habitats and species. By 2030, at least 20% of the EU's land and sea areas should be covered, with the goal of restoring all ecosystems in need by 2050. The specific objectives of the proposal are set out below:

- the continuous, long-term, and sustainable recovery of biodiversity and nature resilience in the Union's terrestrial and marine areas through the restoration of ecosystems;
- reversal of the decline of pollination populations by 2030, with constant monitoring;
- strengthening forest ecosystems;
- the elimination of losses of green urban space by 2030 and the overall increase of the area by 2040, with a target of 10% of the urban area covered by trees;

⁸ See paragraph 2.3.1.

- improvement of agricultural ecosystems;
- improving marine ecosystems, including efforts to mitigate the effects of climate change
- restoring the habitats of marine species such as dolphins, sharks, and seabirds and restoring marine flora and seabed;
- identification and removal of barriers to surface water connectivity, to restore at least 25000 km of rivers by 2030.

EU Member States are expected to submit their National Restoration Plans to the Commission within two years from the entry into force of the Regulation. These plans will outline their strategies for achieving the objectives, together with mandatory monitoring and progress reporting. However, the process has encountered more obstacles than expected. The new text of the Nature Restoration Act was approved by the EU on 27 February and in March, a minority of EU members, including Italy and Hungary, prevented the adoption, withdrawing their support (O'Carroll, 2024). The final green light regarding the law has been postponed to a later date. The subject will not be discussed as planned at the next Environment Council, due to a lack of broad consensus.

In this regard, WWF Italy has launched the appeal "A yes for the Nature Restoration Law is a yes also for the safety of all European citizens" asking the Italian Government to review its position and to ensure that the EU Council adopts the recommendations of the European Parliament, scientists and civil society (WWF, Un Appello per la Nature Restoration Law, 2024). The failure to implement such Regulation not only undermines the European commitment to environmental protection but also puts at risk the decisionmaking processes of the European Union on other crucial dossiers, including the achievement of its ambitious climate targets and its ability to address increasingly frequent climate disasters.

On 17 June 2024, the regulation was finally adopted by the Council, after a stalemate due to the European elections. Italy confirmed its opposition by voting against the regulation, along with Hungary, the Netherlands, Poland, Finland, and Sweden, highlighting the division within the EU on such important environmental issues. Such opposition had so far failed to exceed the 65% consensus required to pass the law: however, thanks to Austria, which after an initial opposition changed its position at the last minute, the law

got 66% of the votes and passed. It will be published in the EU's Official Journal and enter into force. It will become directly applicable in all member states.

2.2.3 Pollinators Initiative

In recent decades, the abundance and diversity of wild-insect pollinators like bees, butterflies, hoverflies, and moths have significantly decreased in Europe. Many species are nearing extinction: 1 in 3 bee, butterfly, and hoverfly species is declining, 1 in 10 bee and butterfly species is at risk of extinction, and approximately 80% of crop and wild flowering plant species rely on animal pollination (EC, Pollinators, s.d.).

In 2018, the Commission adopted the first-ever framework to address the decline of pollinators – the Pollinators Initiative as part of the EU Biodiversity Strategy (EC, 2018). The initiative set objectives to be reached and commitments to be taken by Member States and aimed to improve knowledge on pollinator decline, tackle the causes of their decline, and raise awareness and engage society. The Commission revised the Pollinators Initiative in January 2023 (EC, 2023).

This revision represents a significant contribution to the objectives of the Green Deal, in particular the Biodiversity and the Farm to Fork Strategies. There is no alternative to halting and reversing the decline of wild pollinators if the EU is to preserve biodiversity, which is fundamental to human wellbeing.

2.3 National context: deep-dive into Italian and French frameworks

Together with international and Communitarian initiatives, single states are called to act following the commitments they have undertaken and develop their national strategies and plans to face the threats of climate change, more precisely relating to biodiversity safeguarding. The following paragraphs aim to understand more clearly the commitments of two major eurozone countries: France and Italy.

2.3.1 France's commitment to biodiversity conservation

As we have seen in the precedent paragraphs, biodiversity is a key focus of the UN 2030 Agenda for Sustainable Development, directly addressed by SDGs 14 and 15⁹. Its preservation and restoration are essential to achieving all other goals, making it an urgent global issue. France is actively engaged both nationally and internationally to prioritize biodiversity protection in public policies and international cooperation. It has made biodiversity a priority in its diplomatic efforts, exemplified by hosting the IUCN World Conservation Congress¹⁰ in 2021. At the same time, France's National Plan for Biodiversity, published in 2018, emphasizes making biodiversity an environmental priority in its diplomacy to achieve significant outcomes at CBD COP15. More recently, in November 2023, the French government launched the National Biodiversity Strategy (SNB) for 2030, and the French Biodiversity Agency (OFB) will mobilize its forces to ensure the success of this strategy. The ambitious text contains 200 actions divided into four axes (Gouvernement, 2023):

- Reduce Pressures on Biodiversity: Implement Zero Net Artificialization, create a 12th national park for wetlands, introduce the TracNat¹¹ tool to combat illegal natural resource trade, and organize operations to control invasive species.
- 2. Restore Biodiversity: Plant a billion climate-adapted trees, restore 50,000 hectares of wetlands, and launch a grassland plan.
- 3. Mobilize Stakeholders: Involve the state, create biodiversity atlases, support ecological engineering, and engage businesses and youth.
- 4. Guarantee Resources: Allocate over a billion euros and 141 new jobs for biodiversity, and plan to phase out harmful subsidies by 2024.

⁹ SDG14 aims to preserve marine ecosystems for sustainable development while SDG 15 focuses on the terrestrial ones.

¹⁰ Held every four years, the IUCN World Conservation Congress is the world's largest conservation event. It gathers thousands of leaders and decision-makers from government, civil society, indigenous communities, business, and academia to focus on conserving the environment and leveraging nature-based solutions for global challenges.

¹¹ TracNat is a national service created to improve the control of trade in endangered species, minerals imported from conflict zones and the fight against imported deforestation.

Leveraging its strong scientific expertise and biologically diverse territory, France participates in numerous initiatives addressing various issues such as ocean preservation, deforestation, desertification, land degradation, illegal wildlife trade, environmental crime, fishing, agriculture, and the protection of protected areas and species (MEAE, 2020).

2.3.2 Italy's commitment to biodiversity conservation

Looking at the other country in question, Italy's biodiversity protection laws are comprehensive and largely based on international agreements like the Convention on Biological Diversity and EU directives. A significant advancement was made in 2022 with a constitutional reform including environmental and biodiversity protection. The National Biodiversity Strategy for 2030, published in 2021, aligns with global goals to restore and protect ecosystems by 2050. This strategy targets biodiversity loss through two strategic objectives and eight intervention areas, focusing on expanding protected areas, restoring ecosystems, strengthening legislation, mobilizing funding, promoting sustainable practices, and engaging society in biodiversity efforts.

The Strategic Objective A of Italy's National Biodiversity Strategy 2030 focuses on creating a cohesive network of terrestrial and marine protected areas. It includes protecting at least 30% of land and sea areas, ensuring the conservation of one-third of legally protected areas, promoting connectivity among protected areas at various levels, implementing effective conservation measures, and securing adequate funding. The second one, Strategic Objective B aims to restore marine and terrestrial ecosystems through seven intervention areas. Goals include achieving satisfactory conservation status for 30% of protected species and habitats by 2030, preventing ecosystem degradation, reducing invasive species impacts, reversing pollinator decline, promoting sustainable agriculture, and conserving urban and marine ecosystems (Garzarella, Scavone, & Sini, 2023). Key laws supporting this strategy include:

- Law 394/1991: establishes a framework for protected areas.
- Legislative Decree 152/2006: unifies environmental legislation, including water, soil protection, and waste management.
- Law 194/2015: focuses on agricultural biodiversity, establishing a national system to protect genetic resources.

Biodiversity is more and more at the core of general debate, due to its fundamental implications, and many businesses (both state and private) are devolving increasing attention to the cause. For instance, public administrations look to integrate biodiversity in spatial planning processes at different scales. The focus of green plans is generally oriented to preserve existing biodiverse urban areas (Lazzarini, Mahmoud, & Pastore, 2024). With one of the highest numbers of animal and plant species and the range of habitats in Europe, Italy is a true biodiversity hub, and the country is particularly affected by the topic.

2.4 Conclusions

The international community shows a strong, ongoing commitment to biodiversity conservation, led by the EU through various strategies. Italy and France support these efforts with national strategies based on international agreements. Italy's recent constitutional amendment highlights its significant legal commitment. Both countries allocate substantial resources and involve multiple stakeholders, with France focusing more on integrating biodiversity into public policy and international diplomacy. The next chapter will examine how businesses contribute to biodiversity protection and the tools they use.

CHAPTER 3. Companies Tools for the Valorization of Biodiversity

From this moment, we enter the core of the research. The previous chapters aimed at setting the foundations in order to fully understand the political frameworks, as well as the dynamics in terms of biodiversity protection. The section will focus on companies, and in particular, we will try to understand their importance in enhancing biodiversity by analyzing the available tools.

3.1 How companies contribute to biodiversity loss

As Figure 1 shows, it is possible to identify five main causes of biodiversity loss: land use change, pollution, introduction of invasive species, overexploitation of natural resources, and climate change. Companies across different sectors contribute to these underlying factors. It is therefore necessary to further investigate how business activities relate to these factors to facilitate the development of effective biodiversity protection strategies.

3.1.1 Land use change

Land use change can be interpreted as any way in which humans modify the natural landscape. Those changes can be permanent, such as urban expansion, resulting in ecosystem disruption and the displacement or extinction of many species. Others, such as abandonment of farmland and restoration of forests, may attempt to repair previous damages (Viglione, 2021).

The food, forestry, and real estate Industries are the primary drivers of land use change and the resulting habitat destruction. This is due to the extensive areas these industries require globally to satisfy human demands for food, fiber, and shelter. However, nearly all industries contribute to biodiversity loss through land use changes. For instance, the retail sector is responsible when a new shopping center and its parking lot are developed. Similarly, a software development company is accountable when an office complex is constructed in a previously undeveloped area (Panwar, Ober, & Pinkse, 2023).

3.1.2 Pollution

Pollution is another significant cause of biodiversity degradation, and its main channels of diffusion are air, water, and soil. The energy, agriculture, and mining sectors are the main creators of pollutants through the aforementioned channels. Power plants' emissions adversely affect species and ecosystems when they are deposited in water, on vegetation, or on soils as acid rain. The agriculture sector is often characterized by an extensive use of fertilizers and pesticides which can alter the biotic conditions of soils becoming unsuitable for many organisms (Panwar, Ober, & Pinkse, 2023). Mining is extensively destructive to biodiversity when a mining site is within or near a biodiversity hotspot, as demonstrated by the open-pit mining of ironstone that has endangered the entire Canga ecosystem in Brazil (Salles, do Carmo, & Jacobi, 2018).

3.1.3 Invasive species introduction

The third significant driver of biodiversity loss is the introduction of invasive species. Companies may intentionally or accidentally introduce a specific species into a region and, if this species finds suitable conditions, it may proliferate, thus threatening the native species that occur naturally there.

Agroforestry, biomass production for biofuel, commercial forestry, and ornamental horticulture frequently introduce invasive species by selecting plants with traits that facilitate invasiveness, such as high reproductive rates and rapid growth. In addition to intentional introductions, unintentional introductions occur via international trade, with species like rats being transported in shipping containers and threatening local wildlife. Overall, agriculture, horticulture, forestry, and aquaculture are the primary sectors responsible for introducing invasive species (Panwar, Ober, & Pinkse, 2023).

3.1.4 Resources overexploitation

Overexploitation happens when human activities like hunting or harvesting take place at rates that prevent populations from recovering adequately. This is another major cause of biodiversity loss. The fishing industry exemplifies biodiversity loss through overexploitation, with overharvesting reducing the genetic diversity of many marine fish species and their ability to adapt to changing ocean conditions (Pinsky & Palumbi, 2014).
Similarly, the forestry industry contributes to biodiversity decline by overharvesting native tree species, leading to habitat destruction (Panwar, Ober, & Pinkse, 2023).

3.1.5 Climate change

Finally, although extensively considered in the sustainability literature for companies, climate change is often forgotten when dealing with corporate biodiversity strategies. Human activities are altering the earth's atmosphere, hydrosphere, lithosphere, and biosphere, exacerbating biodiversity loss from other threats. Climate change reduces genetic diversity by favoring only those gene variants that are adaptive under new conditions, leading to the loss of others. As climatic conditions shift, species may fail to find necessary resources, resulting eventually in species extinctions (Panwar, Ober, & Pinkse, 2023). Altered temperature and rainfall patterns are likely to transform entire ecosystems, such as rainforests becoming savannahs or boreal forests turning into tundra, with significant impacts on biodiversity (Bellard, Bertelsmeiner, Leadley, Thuiller, & Courchamp, 2012). While almost all industries contribute to climate change, the primary sectors driving biodiversity loss through this pathway are energy, agriculture, forestry, and transportation

In summary, there is no doubt that every company contributes directly or indirectly to the loss of biodiversity. Consequently, increasing attention has been paid to this issue and scholars are reflecting on the importance of companies adopting biodiversity-related initiatives. The next sections will attempt to explore the position of companies and the strategies they can adopt.

3.2 The role of companies in biodiversity protection

Previous chapters have provided insight into the current state of global biodiversity loss, highlighting its far-reaching implications and challenges. With half of the world's GDP relying on nature to some extent (Steiner & Rosito, 2024), the decline in biodiversity poses significant threats to human health, food security, and rural communities. In response, the international community and national governments are working to develop scalable policies for implementation at all levels. These policies necessitate efforts and commitment from corporations as well; they must actively engage in biodiversity conservation and promotion. For example, Target 15 of the GBF specifically calls on large

multinational companies and financial institutions to take comprehensive actions to conserve and enhance biodiversity (Panwar, Lieb, Federman, & Betts, 2024).

Companies are under pressure from the imminent call to action to stem the biodiversity crisis. At the same time, they identify several compelling reasons for acting. Firstly, political pressures quickly translate into social and consumer expectations, making biodiversity conservation a crucial element of companies' environmental reputation¹². Second, many industries depend on ecosystem functions (Mace, Norris, & Fitter, 2012) such as pollination and flood control, which in turn depend on maintaining biodiversity and ecosystem processes. Therefore, the loss of biodiversity presents a tangible operational risk to these industries. Third, central banks and financial institutions increasingly see biodiversity loss as a systemic risk for financial systems. Investors and shareholders are also realizing that biodiversity loss is one of the fastest-growing issues in ESG¹³ investments and disclosures (Agnew, 2022). Managing biodiversity risks effectively has become an imperative in the financial market too.

The upcoming sub-paragraphs will provide theoretical insight into how companies can comply with their duty of valorizing biodiversity.

3.2.1 Theoretical frameworks for corporate biodiversity strategies

Companies can respond to biodiversity loss in a variety of ways. The literature has analyzed a vast array of corporate strategies, and a widely recognized tool is the mitigation hierarchy. It is usually applied at a project or landscape level to structure decisions about how the impacts of proposed activities on biodiversity and the environment might be mitigated. The hierarchy involves three fundamental steps, and eventually a fourth one (The Biodiversity Consultancy, s.d.):

¹² This is part of the Corporate Social Responsibility (CSR) hemisphere which will be further discussed in paragraph 3.3.

¹³ The acronym ESG represents the three key factors of a sustainability report: Environmental, Social, and Governance. "Environmental" involves protecting the environment and biodiversity, reducing CO₂ emissions, and managing waste and toxic substances. "Social" focuses on the well-being of workers, including health and safety, medical care, education and training, and fair working hours and wages. "Governance" encompasses regulatory compliance and corporate ethics, such as anti-corruption measures, fair competition, corporate governance, and ensuring equal opportunities.

- 1. Avoidance: the initial step in the mitigation hierarchy involves taking measures to avoid environmental impacts from the start. This includes strategically locating infrastructure and scheduling construction to minimize disturbance. Examples include routing roads away from rare habitats or key breeding areas and timing seismic operations to avoid periods when whales are present. Avoidance is often the simplest, most cost-effective, and efficient method for mitigating negative impacts, but it necessitates considering biodiversity early in the project planning process.
- Minimization: those measures aim to reduce the duration, intensity, and extent of unavoidable impacts. Effective strategies can mitigate some negative effects, such as reducing noise and pollution, designing powerlines to prevent bird electrocutions, and constructing wildlife crossings on roads.
- 3. Rehabilitation/restoration: this step focuses on improving ecosystems degraded or removed by unavoidable impacts. Restoration seeks to return an area to its original state, while rehabilitation aims to restore basic ecological functions and services, such as planting trees to stabilize soil. Both are often needed at the end of a project's life cycle but can sometimes be implemented during operation.

Collectively, avoidance, minimization, and rehabilitation/restoration aim to reduce a project's residual impacts on biodiversity as much as possible. However, even with the effective application of these measures, further steps are often necessary to achieve no overall negative impact or net gain for biodiversity.

4. Offset: offsetting compensates for any remaining adverse impacts after the previous three mitigation steps have been fully applied. There are two main types of biodiversity offsets: "restoration offsets", which aim to rehabilitate or restore degraded habitats, and "averted loss offsets", which aim to prevent biodiversity loss in at-risk areas. Offsetting can be complex and costly, so prioritizing earlier steps in the mitigation hierarchy is usually more efficient and preferable

The steps are sequenced by environmental preference, with avoiding impacts being more reliable and desirable than attempting to restore damaged habitats later. This approach can be scaled up for large projects or entire sectors. The conservation hierarchy can be seen as an evolution of the previous one; it adopts a proactive approach, identifying where and how impacts should be mitigated before development activities, thus ensuring systematic, landscape-level mitigation (Sinclair, et al.).

	The Reactive Impact The Proactive Mitigation Hierarchy Conservation Hierarc		The Proactive Conservation Hierarchy	
Avoid	Retain woodland patches on project site		Identify areas for protected area expansion	
Minimise	Reduce pollutant runoff		Collectively manage polluters to prevent habitat degredation	
Restore	Regenerate habitat impacted during construction		Actively restore degraded habitat areas	
Offset	Restore and protect habitat offsite	Restore and protect habitat offsite Fund conservation activities in othe nations		

<u>Figure 6</u> Examples demonstrate how the mitigation hierarchy addresses issues reactively, while the conservation hierarchy addresses them proactively. | (Sinclair, et al.)

The mitigation hierarchy Is notably effective, particularly In project-level applications aiming for No Net Loss (NNL) or Net Gain (NG) of biodiversity relative to a baseline. This requires that all activities across each stage collectively offset all impacts, and for NG, result in an improved environmental state. On the other side, the conservation hierarchy treasures such strengths, adding its versatility and scalability. It can be applied to any context and at any level, with each layer of resolution fitting within broader levels. Additionally, it is highly flexible; similar to the widely used impact mitigation hierarchy, the conservation hierarchy can be adapted to various global contexts.

3.2.2 Four strategies

Scholars have developed various approaches to define corporate biodiversity protection strategies. In the following section, we will have a look at a specific framework developed by Panwar, Ober, and Pinkse, which takes into account two key factors: time and space.

The temporal dimension addresses when initiatives are undertaken, either proactively to prevent biodiversity loss or reactively after the loss has occurred. The spatial dimension pertains to where interventions happen, either on-site or off-site. These dimensions combine to form four main strategies: conservation, restoration, compensation, and reparation. In subsequent sections, we delve into each strategy, highlighting their distinct underlying principles for biodiversity protection.



<u>Figure 7</u> A classification of corporate biodiversity strategies that includes temporal (timing) and spatial (location) dimensions | (Panwar, Ober, & Pinkse, 2023)

3.2.2.1 Conservation

Conservation strategies aim to prevent biodiversity loss by integrating sustainable practices into business operations, driven by regulatory and market pressures. Various industries are innovating: apparel companies use sustainable fibers and waterless dyeing, real estate adopts biodiversity benchmarks, and urban ecology projects promote sustainability. However, evidence of these strategies' effectiveness is limited, with studies showing that certifications in forestry, soy, palm oil, and cocoa have not significantly prevented biodiversity loss (van der Ven, Rothacker, & Cashore, 2018). While conservation is ideal, it is often impractical for industries like mining and fishing, where preventing biodiversity loss would require drastic reductions or cessation of operations.

3.2.2.2 Restoration

Restoration is an on-site, post-loss strategy aimed at restoring ecosystems after commercial activities, acknowledging that some biodiversity loss is inevitable. Unlike conservation, which seeks to prevent loss, restoration aims to return ecosystems to their pre-disturbed states, though this is often unrealistic due to incomplete information and challenges in recreating original conditions (Moerke & Lamberti, 2004).

Restoration has limitations since fully restoring ecosystems is nearly impossible; some biodiversity loss is inevitable, so companies may lack effective restoration knowledge, and the original sites may not always be available for restoration.

3.2.2.3 Compensation

Compensation is a preventative strategy that accepts on-site biodiversity loss while offsetting it elsewhere to achieve No Net Loss (NNL) or Net Gain (NG). It balances conservation with economic development through spatial separation and can involve in-kind or out-of-kind offsets¹⁴ within or across biogeographical regions (Panwar, Ober, & Pinkse, 2023).

Critics of compensation point out issues like confusion over offsets, ambiguous measurements, unclear time frames, and management uncertainties. Although compensation is meant to be a last resort in the mitigation hierarchy¹⁵, many companies prefer it to avoid the challenges of conservation or restoration efforts.

3.2.2.4 Reparation

Reparation is a post-damage compensation strategy aimed at addressing biodiversity loss after it has occurred. Companies adopt reparation due to regulatory requirements, such as in-lieu fee (ILF) mitigation¹⁶ (Wilkinson, 2009) under the U.S. Clean Water Act, and voluntary commitments, like carbon offset programs. Those are recently emerging as a

¹⁴ Offsetting may be "in-kind", whereby the new habitat is like that lost, or "out-of-kind", whereby the new habitat is different.

¹⁵ As you can see in paragraph 3.2.1.

¹⁶ In-lieu fee (ILF) mitigation is a method for offsetting unavoidable impacts to wetlands. Instead of conducting their own mitigation or purchasing credits from a mitigation bank, a permittee pays a fee to a third party. This fee represents the cost of replacing the lost or degraded wetland functions.

new industry. However, reparation is less effective in mitigating biodiversity loss due to the time and space gaps between damage and restoration, conflicting with biodiversity's place-specific nature. Concerns include corruption, double counting in developing countries, and issues of equivalency in offsets. Reparation projects can also harm biodiversity, as practices like monocropping may reduce biodiversity while claiming to protect it (Panwar, Ober, & Pinkse, 2023).

As the authors say, the four strategies—conservation, restoration, compensation, and reparation—should not be viewed as rigid choices. Companies can innovate and differentiate within these strategies, exploring diverse and innovative approaches to protect biodiversity.

3.3 Responsibility of a Companies

Having clearly understood the strategies that companies can undertake to cope with the loss of biodiversity, another significant aspect of our analysis, and closely related to the previous paragraphs, concerns the responsibility of a company. Every action has consequences, and every consequence must be borne by someone. Companies, as individuals, face the positive and negative consequences of their actions and must respect them.

First, it is important to define what is corporate responsibility. Corporate responsibility encompasses the policies that companies implement to support sustainable development principles. This means that companies aim to be economically viable and profitable while also committing to positively impacting society and respecting and preserving the environment.

From an institutional perspective, in 2001, the European Commission published a "Green Paper" titled "Promoting a European Framework for CSR", defining Corporate Social Responsibility (CSR) as:

"The voluntary integration by companies of social and environmental concerns into their business activities and their relations with stakeholders. Being socially responsible means not only fully satisfying the applicable legal obligations but also going beyond and investing 'more' in human capital, the environment, and stakeholder relations" (European Commission, 2004). Another definition comes from the International Organization for Standardization (ISO), an international standard-setting body. Through its ISO 26000 standards on Corporate Social Responsibility, it provides the following definition of CSR:

"The responsibility of an organization for the impacts of its decisions and activities on society and the environment, resulting in ethical behavior and transparency which contributes to sustainable development, including the health and well-being of society; takes into account the expectations of stakeholders; complies with current laws and is consistent with international standards of behavior; and is integrated throughout the organization and implemented in its relations" (ISO, 2010).

Despite its recent popularity, CSR is not a new concept; it voluntarily extends the company's traditional responsibilities. The modern concept of CSR originated in the 1950s, first emerging in the United States. Most theorists identify three main periods of CSR development from the 1950s to the 2000s, which will be discussed in the following section.

3.3.1 Birth and evolution of CSR

The social component in corporate behavior dates to ancient Roman laws, with institutions like asylums and hospitals (Chaffee, 2017). This tradition continued through the Middle Ages with English law and expanded under the English Crown in the sixteenth and seventeenth centuries, eventually reaching the American colonies. In the eighteenth and nineteenth centuries, Christian philosophy influenced social reforms and Victorian philanthropy, addressing issues like poverty and labor conditions. In the late 1800s and early 1900s, companies adopted paternalistic approaches to improve employees' quality of life. Urbanization and industrialization brought new labor challenges, prompting business leaders to promote better working conditions. By the 1920s and 1930s, managers balanced profit with the needs of clients, employees, and the community, assuming social responsibilities. This view evolved further during World War II, leading to broader discussions on corporate social responsibilities (Latapí Agudelo, Jóhannsdóttir, & Davídsdóttir, 2019).

Therefore, it is possible to state that the discipline of Corporate Social Responsibility (CSR) traces its origins back to philanthropy, since until the 1950s, major companies primarily engaged in charitable activities. During the 1950-1960 decade, debates about the company's mission emerged, marking the "awareness era", where entrepreneurs recognized their firms' societal implications. Howard Bowen, often associated with CSR's birth, contributed significantly with his work, "Social Responsibilities of the Businessman", defining CSR as the obligation of businessmen to pursue objectives aligned with societal values (Bowen, 1953). A normative and philosophical approach to CSR characterized this period.

In the subsequent decade, CSR evolved into a more managerial and pragmatic concept, emphasizing economic responsibility. The rise of social movements and ecological criticism, notably the Meadows Report of 1972¹⁷, highlighted the environmental impact of human activities. Scholars began to view CSR as a win-win strategy, where companies could enhance profitability through social involvement. Academic publications provided companies with an approach that investigated how to comply with the new responsibilities that have been given to them by the new legislation that now covered environmental aspects as well as product safety, and labor rights (Latapí Agudelo, Jóhannsdóttir, & Davídsdóttir, 2019). Therefore, CSR extended into various fields, including employee health, working conditions, public policies, and philanthropic actions.

The 1980s saw the emergence of new societal concerns: the creation of the European Commission's Environment Directorate-General (1981), the establishment of the World Commission on Environment and Development chaired by the Norwegian Prime Minister Gro Harlem Brundtland (1983), the Chernobyl nuclear disaster (1986), the publication of the report *Our Common Future* presented by the Brundtland Commission which defined sustainable development (1987), the United Nations (UN) adoption of the Montreal Protocol (1987), and the creation of the Intergovernmental Panel on Climate Change

¹⁷ The Limits to Development Report was published in 1972 by Donella Meadows, Dennis Meadows, Jørgen Randers, and William W. Behrens III. The Report emphasized the incompatibility between exponential economic and population growth in industrial societies and the finiteness of the earth's resources.

(IPCC) (1988). Even when these events did not relate directly to CSR, they reflected a growing sense of awareness of the international community about environmental protection and sustainable development, and indirectly to corporate behavior. Civil society became more vigilant about corporate behavior beyond economic activities (Latapí Agudelo, Jóhannsdóttir, & Davídsdóttir, 2019).

The stakeholder theory, proposed by Freeman In 1984, became particularly Influential, suggesting an organization, to be truly accountable, must be able to integrate all the expectations of the different stakeholders that revolve around it (Freeman, 1994). It should meet the needs of all stakeholders, with profit being a consequence rather than the primary goal. Stakeholders had diverse expectations concerning CSR's economic, social, and environmental aspects. From 1990 onwards, companies began to promote CSR through new communication channels. NGOs played a crucial role in using the web to highlight irresponsible corporate actions. This era marked the anticipation of consumer demand, where companies, to avoid boycotts and reputational damage, adopted CSR as a survival strategy.

In the year 2000, the adoption of the Millennium Development Goals (MDGs) and the creation of the United Nations Global Compact (UNGC) expanded the scope of CSR to include human and labor rights, environmental protection, anti-corruption, and sustainable development. This shift encouraged international institutions, such as the European Commission, to view CSR to address new corporate challenges, leading to broader recognition of CSR in the early 21st century.

The definitions of CSR in the 2000s emphasized the need for corporations to be responsive to social expectations and motivated by sustainability, necessitating strategic decision-making (Husted & Allen, 2007) (Werther Jr. & Chandler, 2005). This era highlighted the benefits of strategic CSR, suggesting that companies could generate shared value and improve competitiveness through a holistic approach.

In the 2010s, the Paris Agreement and the Sustainable SDGs of 2015 underscored a new social contract, expecting corporations to play a significant role in achieving the SDGs. The literature on CSR has since focused on its implementation and impact, particularly concerning the SDGs, with a continued emphasis on generating shared value (Latapí Agudelo, Jóhannsdóttir, & Davídsdóttir, 2019).

Looking ahead, the Corporate Sustainability Reporting Directive (CSRD) will further shape CSR by mandating comprehensive sustainability reporting, and ensuring transparency, and accountability in corporate contributions to sustainable development.

3.3.1.1 Corporate Social Reporting Directive (CSRD)

On 5 January 2023, the Corporate Sustainability Reporting Directive (CSRD) entered into force. It modernizes and strengthens the rules concerning the social and environmental information that companies must report. A broader set of large companies and listed SMEs will now be required to report on sustainability. Some non-EU companies will also have to report if they generate over EUR 150 million on the EU market (EC, s.d.).

The new rules will ensure that Investors and other stakeholders have access to the information they need to assess the impact of companies on people and the environment and that investors can evaluate the financial risks and opportunities arising from climate change and other sustainability issues. Finally, reporting costs will be reduced for companies over the medium to long term by harmonizing the information to be provided.

The first companies will have to apply the new rules for the first time in the 2024 financial year, for reports published in 2025. The CSRD stipulates a phased implementation of sustainability reporting obligations as follows:

- Starting from January 1, 2024, these obligations will apply to large companies and parent companies of large groups with over 500 employees that are public interest entities already required to prepare a "non-financial statement".
- Beginning January 1, 2025, the obligations will extend to all other large companies and parent companies of large groups not covered in the previous point.
- From January 1, 2026, small and medium-sized companies with listed financial instruments on regulated markets, small and non-complex credit institutions, and captive insurance and reinsurance companies will be included.
- Finally, from January 1, 2028, the requirements will also apply to third-country companies.

The main changes introduced by the CSRD are five:

- dual materiality analysis¹⁸;
- placement of the document in the Management Report;
- assurance obligation extended to the European perimeter;
- format of the document, which must be drawn up in a single electronic format (XHTML), to be made public and accessible to stakeholders;
- integration of the value chain within the reporting.

Furthermore, the reporting standards to be referred to are the new European Sustainability Reporting Standards (ESRS)¹⁹: through these standards, EFRAG (European Financial Reporting Advisory Group) introduces the criteria for analyzing and reporting ESG data.

In this way, companies must ensure consistency and comparability with others: the CSRD places a constraint on the choice of framework for drawing up sustainability reports, requiring all companies to comply with the new European guidelines.

3.3.1.2 CSRD and biodiversity reporting

The CSRD introduces new mandatory standards across various sustainability domains. These standards, known as ESRS, have been developed to ensure comprehensive reporting. The first set includes 12 standards, with ESRS E4 specifically addressing biodiversity. ESRS E4 (EFRAG, 2022) outlines disclosure requirements regarding impacts and interdependencies related to terrestrial and aquatic ecosystems (freshwater and marine), species (fauna and flora), and biodiversity within and between ecosystems and species.

By 2030, all companies must measure and report their impact on biodiversity. Large companies with 500 or more employees will start this reporting from the financial year 2024, while SMEs will begin in the financial year 2028. This expansion in reporting scope necessitates changes in sustainability reports, with standards like the Global Reporting

¹⁸ Materiality analysis in sustainability reports identifies key issues affecting a company's impact on the planet and society. The CSRD mandates "dual materiality", requiring companies to assess both the impact materiality (information on the company's effects on people and the environment) and the financial materiality (information on risks and opportunities affecting the company's financial health). Companies must evaluate and report on both dimensions, following EFRAG guidelines to ensure uniformity.

¹⁹ This topic will be further discussed in section 3.4.1.

Initiative (GRI)²⁰ and the Eco-Management and Audit Scheme (EMAS)²¹ updating their requirements, accordingly, influenced by COP15 agreements.

The CSRD's emphasis on biodiversity highlights the crucial role companies play in supporting biodiversity protection and restoration. To comply, businesses must adapt their strategies and models to operate within planetary boundaries and positively impact biodiversity.



Figure 8 This infographic shows the background of the CSRD and ESRS | (O'Connell, 2023)

²⁰ This topic will be further discussed in section 3.4.2.

²¹ Eco-Management and Audit Scheme (EMAS) is a key instrument within the European Green Deal, aiming to guide organizations towards circularity and minimize their environmental impact. It enhances the overall environmental performance of organizations, with improvements regularly verified through the EMAS (EC, s.d.).

3.3.2. Notion of Due Diligence

The notion of due diligence for companies encompasses a thorough process of assessing risks and opportunities generally associated with proposed transactions, extending beyond mere auditing to ensure informed decision-making. It has two primary definitions. Firstly, it involves assessing the risks and opportunities of a proposed transaction, beyond just conducting an audit. Secondly, it refers to the standard of care necessary during a transaction, especially beforehand. In both cases, it entails verifying the accuracy of information related to a potential investment or business decision and evaluating the future potential of the transaction's subject matter (Uludag, 2013).

Due diligence plays a critical role in CSR. By rigorously evaluating the environmental, social, and governance (ESG) aspects of potential investments or business decisions, companies can identify and mitigate negative impacts, align their operations with sustainable practices, and ensure compliance with ethical standards. This proactive approach not only enhances corporate accountability and transparency but also fosters long-term value creation and trust among stakeholders, reinforcing the company's commitment to responsible and sustainable business conduct.

Corporations have increasingly committed to improving people's lives in recent years, integrating environmental and social issues into their business policies. This shift has led to a broader approach to due diligence in mergers and acquisitions, focusing on socially responsible aspects such as environmental, human rights, and reputational risks. Environmental due diligence, driven by investor concerns and public awareness, addresses compliance with regulations and the impact on long-term financial performance. Carbon due diligence, motivated by climate change concerns and regulatory measures like carbon trading, aims to reduce carbon footprints and associated risks. Human rights have also become a critical CSR issue, with companies adopting UN Guiding Principles to prevent abuses and maintain commercial and reputational success. Overall, socially responsible due diligence helps companies mitigate risks, enhance reputation, and ensure sustainable business practices (Uludag, 2013).

3.3.2.1 Corporate Sustainability Due Diligence Directive (CSDDD)

The European Commission's Directive on corporate sustainability due diligence approved on 24 May 2024, aims to ensure companies address human rights and environmental impacts within their operations and value chains. The benefits include better protection of human rights and the environment, increased trust in businesses, and improved access to justice for citizens. Companies will benefit from a harmonized legal framework, greater customer trust, and better risk management. For developing countries, the Directive promises better protection of human rights, sustainable investment, and improved living conditions (EC, s.d.).

The Directive requires companies to identify and address both potential and actual adverse impacts on human rights and the environment in their operations and value chains. Large companies are also required to develop transition plans for climate change mitigation that align with the 2050 climate neutrality target. These rules apply to large EU companies with over 1,000 employees and EUR 450 million in turnover, as well as large non-EU companies with equivalent turnover within the EU. While SMEs are not directly included, they will benefit from support and protective measures.

The EU rules will establish a uniform legal framework to enhance international competitiveness, stimulate innovation, and ensure legal certainty. The Directive seeks to establish a global benchmark for mandatory environmental and human rights due diligence. Member States will have two years to integrate the Directive into their national legislation, followed by a 3 to 5-year phase-in period for companies. The European Commission will provide guidelines to assist companies in conducting due diligence.

3.4 Evolution of Standard Reporting

Following the discourse initiated in section 3.3.1.1, we will now have a closer look and deeper understanding of what standard reporting means to companies. First, it is important to distinguish that the sustainability landscape can be broadly categorized into two main groups: those organizations that publish standards and those that issue

frameworks or guiding principles²². However, this distinction is not absolute, as some organizations engage in both activities.



Figure 9 This shows the different organizations and bodies involved in issuing standards rather than frameworks | (GRI, 2022)

Standards represent the agreed-upon quality requirements that reporting entities are expected to meet. They outline specific and detailed criteria or metrics for "what" should be reported on each topic. Generally, corporate reporting standards share common features: a focus on public interest, independence, adherence to due process, and incorporation of public consultation. These elements collectively provide a stronger foundation for the requested information (GRI, 2022).

The evolution of standard reporting for companies has seen significant methodological and conceptual advancements, particularly in nature-related issues. Initially focused on financial metrics, reporting standards have expanded to include comprehensive environmental, social, and governance (ESG) criteria. Key trends include the integration of biodiversity and ecosystem impacts into reporting frameworks, as seen in the development of the European Sustainability Reporting Standards (ESRS) and the Global Reporting Initiative (GRI). These standards emphasize transparency, accountability, and the interdependence of economic activities and natural ecosystems, encouraging companies to adopt sustainable practices and disclose their environmental impact comprehensively.

²² Frameworks will be further discussed in chapter 4.

In recent years, the regulatory landscape for climate and nature-related disclosures has evolved significantly. There is a growing recognition that climate risks are linked with broader environmental risks, as highlighted by the Taskforce on Climate-related Financial Disclosures (TCFD) and the Network for Greening the Financial System (NGFS). New frameworks such as the Taskforce on Nature-related Financial Disclosures (TNFD) and the Science-Based Targets Network (SBTN) have emerged to address nature-related issues. The ISSB has released standards for sustainability disclosures, which are being adopted by various countries. Regional efforts include the EU's Sustainable Finance Disclosure Regulation (SFDR) and CSRD (UNEP-WCMC & UNEP FI, 2024).

The Kunming-Montreal GBF adopted at COP15 is driving further national regulations on biodiversity disclosures, with many countries expected to introduce related regulations by 2024. The landscape of private sector assessment and disclosure on nature will continue to evolve, with updates to standards and frameworks anticipated. The transition from voluntary to mandatory disclosure requirements is likely to continue and be observed in an increasing number of countries, fostering a more standardized and comprehensive approach to sustainability reporting worldwide.

3.4.1 European Sustainability Reporting Standard (ESRS)

In July 2023, the European Commission adopted the European Sustainability Reporting Standards (ESRS) for use by all companies subject to the EU CSRD. The subject companies will have to report environmental, social, and governance sustainability-related information according to the ESRS. Reporting will be mandatory for the first group of companies in the financial year 2024²³. The ESRSs comprise the General requirements (ESRS 1), General disclosures (ESRS E2), as well as topical standards focusing on environmental (ESRS E1–E5), social (ESRS S1–S4), and governance (ESRS G1) related disclosures²⁴ (UNEP-WCMC & UNEP FI, 2024).

²³ Companies previously subject to the EU Non-Financial Reporting Directive (NFRD) and large non-EU listed companies with over 500 employees will begin reporting under the ESRS starting in the financial year 2024. The standard will extend to large non-listed companies in 2025, with additional types of companies becoming subject to the CSRD in subsequent years.

²⁴ See Figure 8.

As seen in section 3.3.1.2, the ESRS E4 specifically addresses biodiversity and ecosystem services, emphasizing their critical role in corporate sustainability reporting. This standard offers insights into the factors leading to biodiversity loss, impacts on species, and their ecosystem connections. The ESRS E4 mandates companies to disclose their strategic plans publicly, ensuring their business models align with three key targets: no net biodiversity loss by 2030, net biodiversity gain by 2030, and full biodiversity recovery by 2050.

Companies will be required to publicly disclose all policies related to biodiversity and ecosystems to ensure effective protection and proper monitoring and management of these policies. Additionally, they must implement transparency policies regarding the strategies and actions taken to achieve biodiversity conservation goals. Disclosures should also include information on how corporate policies align with global objectives and agreements, such as the SDGs, the GBF, and the European Green Deal.

3.4.2 Global Reporting Initiative (GRI)

The Global Reporting Initiative (GRI) is an independent international organization that assists businesses and other entities in reporting their impacts. The GRI Standards are a modular system consisting of interconnected standards: the GRI Universal Standards (GRI 1–3), the GRI Sector Standards (GRI 11–18), and the GRI Topic Standards (GRI 201–207, 301–308, 401–418). The Universal Standards apply to all companies, while the Sector Standards and Topic Standards are specific to certain sectors and relevant topics when they are material (UNEP-WCMC & UNEP FI, 2024).

The GRI has announced the release of a new biodiversity standard, GRI 101: Biodiversity 2024, which will replace GRI 304: Biodiversity 2016 and take effect in 2026. This global standard enables companies worldwide to comprehensively and transparently disclose their biodiversity impacts throughout their supply chains, including site-specific impacts. Its primary objective is to ensure full transparency on biodiversity impacts, particularly during procurement stages where such impacts are often hard to identify. Additionally, the standard mandates location-specific impact reporting, providing detailed information on countries, jurisdictions, and the size of operational sites. GRI 101: Biodiversity 2024 was developed through a multi-stakeholder process, involving experts from various industries, organizations, and investors.

GRI 101: Biodiversity 2024 is structured into two main sections: Topic Management Disclosure and Topic Disclosure. Topic Management Disclosure includes:

- 101-1: Policies to halt and reverse biodiversity loss
- 101-2: Managing impacts on biodiversity
- 101-3: Access and benefit sharing.

Topic Disclosure consists of:

- 101-4: Identification of biodiversity impacts
- 101-5: Sites with biodiversity impacts
- 101-6: Direct drivers of biodiversity loss
- 101-7: Changes in biodiversity status
- 101-8: Ecosystem services.

The GRI Biodiversity Standard offers new insights into the direct causes of biodiversity loss, including land use changes, climate change, overexploitation, pollution, and invasive species. It mandates reporting on societal impacts, particularly on communities and indigenous peoples, and encourages organizations to engage with local groups in ecosystem restoration efforts. GRI Standard 101 aligns with global biodiversity initiatives like the United Nations GBF, the SBTN, and the TNFD. This standard's release is crucial, given the current biodiversity crisis.

Comparing the two previous standards, ESRS E4 and GRI 101, the first one is mandatory for companies subject to CSRD, which must therefore use this standard as a reference, while the second remains voluntary. Both standards have materiality²⁵: ESG E4 has a double relevance while GRI 101 has an Inside Out relevance. Furthermore, both take into account impacts on the entire value chain and link with other international initiatives.

²⁵ The definition of materiality differs across the approaches. Some prescribe financial materiality or environmental and social materiality, while others are flexible in their requirements and guidance. There are also differences in the guidance provided on how companies should identify nature-related issues that are material to assess or disclose (UNEP-WCMC & UNEP FI, 2024).

3.4.3 International Sustainability Standards Board (ISSB) Standards

The International Sustainability Standards Board (ISSB) was established in November 2021 by the International Financial Reporting Standards (IFRS) Foundation to create global accounting and sustainability disclosure standards. In 2022, the IFRS Foundation integrated the Sustainability Accounting Standards Board (SASB) and the Climate Disclosure Standards Board (CDSB). By June 2023, the ISSB released two sustainability standards based on exposure drafts, consultations, and public feedback: IFRS S1, General Requirements for Disclosure of Sustainability-related Financial Information, and IFRS S2, Climate-related Disclosures. Although IFRS S1 and S2 are currently voluntary, they are anticipated to become mandatory in various jurisdictions over time (UNEP-WCMC & UNEP FI, 2024).

The ISSB standards represent standards for sustainability-related financial disclosures. They are voluntary²⁶ and they cover nature and other sustainability issues, including dedicated climate standards. The ISSB's main priority for the next two years will be implementing the inaugural standards, IFRS S1 and IFRS S2. Additionally, the ISSB will focus on two new research projects and improving the SASB Standards. Based on market feedback, the ISSB decided not to pursue projects related to human rights risks and opportunities – except for those of a company's workforce and workers in its value chain – or integration in reporting at this time. However, they will monitor developments in these areas and may consider them in future consultations (IFRS, 2024).

In June, the ISSB plans to release a summary of the feedback received during its agenda consultation, along with its response and work plan for the next two years.

Characteristics	ESRS	GRI	ISSB	
Scope and	Primarily focused on	Global applicability;	Global	
Coverage	European Union	comprehensive	applicability;	
	regulations;	coverage of ESG	aimed at providing	
	comprehensive		high-quality,	

Table 1 Summary of the main approaches analyzed in Chapter 3

²⁶ ISSB Standards are expected to be mandated in different jurisdictions, similarly to the IFRS Accounting Standards.

	coverage of ESG	aspects with sector-	transparent,
	aspects specific standards		reliable, and
			comparable
			sustainability
			information
Reporting	Mandatory for	Voluntary, widely	Still under
Requirements	companies within the	adopted; offers	development,
	EU under the CSRD;	flexible, principle-	expected to
	detailed and	based reporting	integrate with IFRS
	prescriptive	guidelines that can	standards for a
		be tailored by	unified financial
		organizations	and sustainability
			reporting approach
Target	Regulators, investors,	Wide range of	Investors and
Audience	and other	stakeholders	financial market
	stakeholders within	including investors,	participants
	the EU	regulators, civil	globally
		society, and	
		consumers	
Regulatory	Aligned with EU	Independent, non-	Established by the
Context	policies and	profit organization;	IFRS Foundation;
	regulations; aims to	widely recognized	aims to provide a
	support the EU Green	and used by	globally consistent
	Deal and other	companies globally	and comparable
	sustainability	for voluntary	sustainability
	initiatives	reporting	reporting
			framework
Focus Areas	Emphasis on double	Focus on materiality	Primarily focuses
	materiality,	from a broad	on investor needs;
	considering both the	stakeholder	aims to capture
	impact of	perspective,	information

	sustainability on the	considering impacts	relevant to financial
	company and the	on the environment,	performance and
	company's impact on	society, and the	enterprise value
	sustainability	economy	

3.5 Conclusions

This chapter has demonstrated the importance of firms for biodiversity, both in negative terms considering the five main causes of biodiversity loss seen in section 3.1, and in positive terms with the strategies that farms can implement, including the mitigation hierarchy. We have seen standards. We then saw what is meant by standard reporting and some of the main: ESRS, GRI, and ISSB are disclosure standards, each of them with specific advantages and differences. The next chapter will intend to focus more on frameworks issued by organizations; we will understand the differences and their added value towards corporate strategies.

CHAPTER4.Nature-RelatedDisclosureApproaches Entailed by Companies

The fourth chapter of our analysis will be devoted to understanding the contexts within which companies can operate in the process of enhancing biodiversity. We will then look at the transformation of companies' business models over the years, focusing on the current landscape. Finally, we will examine situations in which companies agree on certain standards, and principles anticipating the arrival of the standard itself.

4.1 Transformation of business models

Biodiversity loss translates into a 69% species loss since 1970. Although the number of direct biodiversity initiatives is limited, companies are already tackling biodiversity challenges indirectly by addressing key drivers of biodiversity loss, such as climate change, pollution, and resource overexploitation, particularly water (SDGs 13, 12, and 6). The next step for the private sector is to broaden and integrate their sustainability strategies to more directly target nature and biodiversity loss (Scalvini & Zollo, 2023).

The research underscores the critical importance of sustainable practices, particularly emphasizing corporate biodiversity conservation. It highlights that businesses, regardless of size, must adopt transformative practices to impact biodiversity valorization significantly. However, the current sustainability discourse is overly focused on carbon emissions, often neglecting other crucial environmental issues. According to a KPMG survey (2022), less than 50% of 5800 large companies reported on biodiversity issues. Therefore, it is essential to give biodiversity equal importance to carbon emissions in sustainability efforts. The business community has been slow to expand its sustainability vision beyond the "carbon tunnel", resulting in an excessive focus on carbon emissions at the expense of other environmental issues, including biodiversity loss (Panwar, 2023).

The question Is how companies can be incentivized to protect biodiversity. An interesting research, conducted by Panwar, presents five potential strategies for internal transformative changes (Panwar, 2023). Businesses can be incentivized to protect biodiversity by:

- making biodiversity protection every business's business;
- giving biodiversity a central stage in the corporate sustainability discourse;
- holding companies accountable for biodiversity impacts across their entire supply chains;
- developing biodiversity-friendly organizational cultures;
- and creating third-party certifications to benchmark and evaluate biodiversityfriendly business practices.

These strategies illustrate the need for voluntary initiatives to be supplemented by regulations. Hybrid corporate responsibility and sustainability models offer innovative solutions that bridge the gap between regulations and voluntary actions, which are often seen as mutually exclusive and conflicting. These models combine voluntary corporate commitments with regulatory support and enhancement (Panwar, Pandey, Suddaby, & Vidal, 2023). The demand for such hybrid approaches in biodiversity conservation is clear, as they ensure businesses can voluntarily engage in conservation efforts while being guided and reinforced by regulatory frameworks.

These hybrid solutions would probably need collaboration between the public and private sectors to ensure that economic systems and activities are compatible with biodiversity. Markets can provide signals about risks investors and consumers are unwilling to take, guiding government regulations. Indeed, transformative change requires tangible policy measures combined with structural changes in values and institutions cannot (Turnhout, et al., 2021).

In the previous chapter, we analyzed the protocols that companies adopt in order to enhance biodiversity within them. In the next sections instead, we will deal with frameworks. Those on the other hand provide the "frame" to contextualize information. Frameworks are those that are normally put into practice in the absence of well-defined standards. A framework allows for flexibility in defining the direction, but not the method itself (GRI, 2022). A framework can be thought of as a set of principles providing guidance and shaping people's thoughts on how to think about a certain topic but miss a defined reporting obligation.

4.1.1 Science-Based Targets Network (SBTN)

The Science-Based Targets Network (SBTN) is a civil society and science-led initiative founded in 2019. It is a collaborative effort to assist companies and cities in establishing targets and addressing their impacts on the environment. Similar to the Science Based Targets initiative (SBTi) that focuses on greenhouse gas emissions, SBTN aims to ensure that actions taken by businesses and urban areas are aligned with the latest scientific understanding of what is needed to sustain life on Earth, including the preservation of biodiversity, land, water, oceans, and climate systems.

It Is fundamental to define what are science-based targets for nature (SBTs). SBTs are 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. By setting SBTs for nature, companies and cities can align their actions to both the scientific boundaries that define a safe and just operating space for humanity in terms of Earth's limits and the societal sustainability goals that set out global objectives for equitable human development (SBTN, s.d.).

The Initiative is supported by several key organizations like the Carbon Disclosure Project (CDP), the World Resources Institute (WRI), the Worldwide Fund for Nature (WWF), and the United Nations Global Compact (UNGC). These organizations provide guidance, tools, and resources to help companies navigate the process of setting and achieving science-based targets.

To set and act on Science-Based Targets (SBTs) for nature, companies must adhere to a five-step process:

- 1. Assess environmental impacts: Evaluate the company's environmental footprint to understand its effects on nature.
- 2. Interpret and prioritize: Analyze pressure and state of nature data to identify and prioritize key locations for intervention.
- 3. Collect baseline data, set targets, and disclose: Gather initial data, establish targets based on scientific benchmarks, and publicly disclose these targets.
- 4. Implement actions: Take concrete steps to achieve the set targets.

5. Monitor, verify, and report: Continuously track progress, verify outcomes, and report on achievements over time.



Figure 100 The Science-Based Target-setting process | (Science Based Targets Network, 2023)

The first release of the Science-Based Targets Network (SBTN) methods includes technical guidance for three steps: assessing environmental impacts (Step 1), interpreting and prioritizing data (Step 2), and measuring, setting, and disclosing targets for land and freshwater (Step 3). This guidance is supplemented by a paper on including biodiversity in these steps and an upcoming detailed analysis of biodiversity (UNEP-WCMC & UNEP FI, 2024).

Steps 1 and 2 offer a foundational framework for all companies to start their journey with the Science-Based Targets Network (SBTN). This involves assessing and quantifying pressures on biodiversity across land, freshwater, oceans, and climate. To validate their science-based targets for nature, companies must perform an environmental and societal materiality screening and justify any exclusions made during target-setting. They also need to prioritize locations for targets based on the needs of nature and biodiversity as outlined in Step 2 (Science Based Targets Network, 2023a). In Step 3, companies establish and validate targets for land and freshwater by utilizing data and insights from Steps 1 and 2, along with additional local ecological and social information. The current Step 3 methods tackle major human-induced pressures on biodiversity, such as land use changes, resource exploitation, and pollution. Some methods, like the freshwater quantity target and landscape engagement target, are widely applicable across various sectors. Other targets, such as those for water quality and land footprint reduction, are more specific to certain sectors. These methodologies guide companies in managing key pressures within their value chains (Science Based Targets Network, 2023).

The SBTN Is crucial for several reasons. First and foremost, in terms of CSR: by setting science-based targets, companies can demonstrate their commitment to sustainability. This not only enhances their reputations but also helps them mitigate risks associated with environmental degradation. Adopting these targets showcases a company's dedication to responsible and sustainable practices, which can attract eco-conscious consumers and investors. Next, the SBTN promotes practices that help preserve vital ecosystems. By following SBTN guidelines, organizations contribute to long-term ecological balance and resilience. This is essential for maintaining the health of natural systems on which all life depends. Effective environmental stewardship ensures that natural resources are available for future generations. Finally, as governments increasingly adopt stringent environmental regulations, organizations that align with SBTN guidance are better prepared to comply with new laws and policies. Being proactive in setting science-based targets can help companies avoid penalties, reduce regulatory risks, and position themselves as leaders in sustainability.

4.1.2 Taskforce on Nature-related Financial Disclosures (TNFD)

Established in 2021, the Taskforce on Nature-related Financial Disclosures (TNFD) is a global, market-driven initiative. Its mission is to create and provide a risk management and disclosure framework that organizations of all sizes and across all jurisdictions can use to identify, assess, manage, and disclose their nature-related dependencies, impacts, risks, and opportunities. The aim is to redirect global financial flows from nature-negative to nature-positive outcomes. As a voluntary framework, TNFD offers recommendations and guidance relevant to a broad spectrum of market participants, including financial institutions, corporations, and various business organizations.



<u>Figure 11</u> Where TNFD fits in the global sustainability reporting landscape | (Centre for Climate Engagement Climate Governance Initiative, 2023)

The TNFD was developed to be market-usable, directly valuable to corporations and financial institutions, and grounded in scientific evidence. It focuses on nature-related dependencies, impacts, risks, and opportunities, encouraging organizations to take prompt action. The framework integrates seamlessly with existing risk management processes, highlights the interconnectedness of climate and nature challenges, and promotes nature-based solutions. Additionally, it ensures global inclusivity, making the framework relevant, accessible, and affordable worldwide, including in both emerging and developed markets (TNFD, 2024).

In September 2023, TNFD released Version 1.0 of its framework for market adoption, accompanied by the Guidance on the Identification and Assessment of Nature-related Issues: the LEAP Approach. This approach is a core component of its framework, designed to guide organizations through the process of identifying, assessing, and managing nature-related risks and opportunities. LEAP stands for Locate, Evaluate, Assess, and Prepare:

1. Locate: This step involves identifying the geographic locations of an organization's assets, operations, and supply chains that interact with nature. It

focuses on pinpointing areas where nature-related dependencies and impacts are most significant.

- 2. Evaluate: In this phase, organizations evaluate their interactions with nature in the identified locations. This includes understanding the dependencies on natural resources and the impacts of their operations on biodiversity and ecosystems.
- 3. Assess: Organizations then assess the risks and opportunities arising from these dependencies and impacts. This step includes analyzing how changes in the natural environment, such as degradation or restoration, could affect the organization's operations and financial performance.
- 4. Prepare: The final step is to prepare for managing these nature-related risks and opportunities. Organizations develop strategies and action plans to mitigate risks, capitalize on opportunities, and integrate nature considerations into their overall risk management and decision-making processes.

The LEAP approach is designed to be iterative and adaptive, allowing organizations to refine their assessments and actions over time as new data and insights become available (TNFD, 2023).

The TNFD framework fulfills the material information needs of capital providers in alignment with the ISSB's IFRS Standards and addresses the broader material information needs of stakeholders concerned with impacts, following an approach that aligns with both ISSB and GRI standards. Additionally, the ISSB intends to utilize the work of TNFD when developing specific nature-related disclosure standards. Furthermore, the TNFD is aligned with the GBF goals and targets established by 196 governments at the CBD COP15 in December 2022. GBF's Target 15²⁷ mandates governments to implement corporate reporting requirements for nature-related risks, dependencies, and impacts by 2030. The TNFD's alignment with the GBF's four goals and 23 targets²⁸ is designed to support governments in achieving Target 15.

²⁷ Target 15 urges large multinational companies and financial institutions to take extensive measures to conserve and enhance biodiversity.

 $^{^{28}}$ We have referred to them in paragraph 2.1.2.

4.1.3 CDP disclosure system

CDP (formally known as Carbon Disclosure Project) runs the largest global disclosure system. By providing a voluntary disclosure framework through its three different questionnaires on climate change, forests, and water security, CDP helps companies, investors, and cities disclose and manage their environmental impact, using the data used by banks, investors, governments, and other companies. Specifically to questionnaires, they adopt a double materiality perspective. This approach includes information crucial for understanding the company's impact on the environment ("inside-out") and information necessary for assessing the company's position, performance, and development concerning climate change and environmental degradation ("outside-in") (UNEP-WCMC & UNEP FI, 2024).

CDP is dedicated to maximizing the impact of current and future regulations by establishing High-Quality Mandatory Disclosure (HQMD) Principles. These principles guide policymakers and financial regulators in creating effective and comprehensive mandatory environmental disclosure policies. Although primarily focused on environmental disclosures, the principles are also applicable to broader sustainability disclosure policies. The HQMD Principles aim to inspire jurisdictions to develop robust environmental disclosure regulations that enhance transparency, improve risk management, and drive economic contributions towards global environmental goals, including those outlined in the Paris Agreement, the SDGs, and the Global Biodiversity Framework (Carbon Disclosure Project, 2023a). These principles are listed below:

- 1. Uphold environmental integrity by addressing risks, opportunities, dependencies, and impacts on both people and the planet through a comprehensive environmental approach.
- 2. Promote consistency and interoperability of disclosure regimes across jurisdictions by building on global baseline standards.
- 3. Ensure coherence in disclosure requirements across various policies within a single jurisdiction.
- 4. Base the policies on scientific evidence.
- 5. Include all businesses and financial institutions within the scope.

- 6. Set clear expectations for the disclosure of transition plans for climate, water, and nature.
- 7. Ensure the quality and reliability of disclosures, with expectations for external assurance.
- 8. Implement a mechanism for enforcement.
- 9. Enhance the role of corporate governance bodies.
- 10. Foster an environment that encourages innovation and advances the maturity of disclosures.

An interesting CDP report of 2023 about the interrelation between the private sector and water security, has shown that consistent and comparable private sector water disclosures are crucial for addressing the water and climate crises (Carbon Disclosure Project, 2023). CDP has facilitated the collection of data and, therefore, it is possible to deduct its fundamental contribution to other spheres of the climate emergency, such as biodiversity protection. In fact, through its comprehensive disclosure framework, CDP helps businesses understand and manage their biodiversity-related risks and opportunities, promoting transparency and accountability. The data collected by CDP supports the development of policies and regulations aimed at biodiversity conservation driving positive change and contributing to the preservation of the planet's natural heritage.

4.1.4 Natural Capital Protocol

To grasp the next important framework, it's essential to define capital. Traditionally seen as money, capital encompasses any resource or asset that provides value to people. Natural, social, and human capital function similarly to traditional capital: investing in them generates value while degrading them reduces their value (Capitals Coalition, s.d.). These three pillars – natural, social, and human capital – are central to the Capitals Coalition, a global collaboration aimed at redefining value to transform decision-making.

Founded in 2012, the Capitals Coalition has developed protocols that enable organizations to identify, measure, and value their direct and indirect impacts and dependencies on natural capital, social capital, and human capital. In terms of biodiversity enhancement, the natural one is certainly the most significant. Applicable within any business sector to organizations of all sizes and in all operational geographies, the Natural Capital Protocol (hereafter the "Protocol") guides companies on measuring, valuing, and

integrating natural capital impacts and dependencies into existing business processes such as risk mitigation, sourcing, supply chain management, and product design (UNEP-WCMC & UNEP FI, 2024).

Purposely flexible and broad, the Protocol applies to any sector, geography, or organizational level, allowing integration with existing processes and experimentation with various approaches. It covers all types of valuation – qualitative, quantitative, or monetary – depending on the decision at hand. We will see now the functioning of the Protocol.

FRAME Why?		SCOPE What?		MEA	SURE AND VALU How?		Al What	PPLY at next?
01 Get started	02 Define the objective	03 Scope the assessment	04 Determine the impacts and/or dependencies	05 Measure impact drivers and/o dependencie	06 Measure changes r in the state s of natural capital	07 Value impacts and/or dependencies	08 Interpret and test the results	09 Take action
Why should you conduct a natural capital assessment?	What is the objective of your assessment?	What is an appropriate scope to meet your objective?	Which impacts and/ or dependencies are material?	How can your impact drivers and/or dependencies b measured?	What are the changes in the state and trends of natural capital related to your business impacts and/or dependencies?	What is the value of your natural capital impacts and/or dependencies?	How can you interpret, validate and verify your assessment process and results?	How will you apply your results and integrate natural capital into existing processes?

Figure 12 The Natural Capital Protocol Framework | (Natural Capital Coalition, 2016)



<u>Figure 13</u> The four stages | (Natural Capital Coalition, 2016)

The Protocol Framework consists of four stages: "Why", "What", "How", and "What Next". These stages are divided into nine steps, each containing specific questions to guide a natural capital assessment. The stages and steps are iterative, meaning you may need to revisit previous steps as necessary. For instance, after identifying your most significant impacts and dependencies in Step 04, you might need to revise the objective or scope of your assessment in Steps 02 and 03. Each step follows a consistent structure, starting with the main question to be addressed and a brief introduction, followed by a detailed description of the required actions and the expected outputs (Natural Capital Coalition, 2016).

At the bottom of Figure 12, the four cardinal principles of the protocol are displayed, which should be adhered to throughout the four Stages of the Protocol to ensure your assessment results are credible and fit for purpose.

- Relevance: consideration of the most relevant issues throughout the natural capital assessment including the impacts and/or dependencies that are most material for the business and its stakeholders
- Rigor: use of technically robust (from a scientific and economic perspective) information, data, and methods that are also fit for purpose.
- Replicability: all assumptions, data, caveats, and methods used need to be transparent, traceable, fully documented, and repeatable. This allows for eventual verification or audit, as required
- Consistency: the data and methods used for an assessment are compatible with each other and with the scope of analysis, which depends on the overall objective and expected application

While the Protocol offers a standardized process, it maintains flexibility in the choice of measurement and valuation approaches. As a result, the outcomes may not be comparable across different businesses and applications.

Characteristics	SBTN	TNFD	CDP	Natural	
				Capital	
				Protocol	
Scope and	Focuses on	Focuses on	Global	Provides a	
Coverage	developing	developing	applicability;	standardized	
	science-based	and delivering	focuses on	framework for	
	targets for	a framework	environmental	businesses to	
	companies to	for	disclosure	measure and	
	align their	organizations	including	value their	
	environmental	to report and	carbon, water,	impacts and	
	impact with	act on	and forest	dependencies	
	planetary	evolving	impacts	on natural	
	boundaries	nature-related		capital	
		risks			
Reporting	Voluntary,	Voluntary,	Voluntary,	Voluntary,	
Requirements	science-based	aims to deliver	widely used;	flexible	
	targets setting;	a framework	companies	framework;	
	provides	for companies	disclose	offers a process	
	guidance and	to disclose	environmental	for companies	
	tools for	nature-related	data annually	to assess and	
	companies to	risks and	through a	integrate	
	set and achieve	opportunities	standardized	natural capital	
	targets		questionnaire	into decision-	
				making	
Target	Companies,	Companies,	Companies,	Companies,	
Audience	investors,	financial	investors,	investors,	
	policymakers,	institutions,	policymakers,	policymakers,	
	and NGOs	investors,	and other	and other	
		regulators,	stakeholders	stakeholders	

<u>Table 2</u> Summary of the main approaches analyzed in Chapter 4

		and			
		policymakers			
Regulatory	Independent,	Independent,	Independent,	Independent,	
Context	non-profit	market-led	non-profit	global	
	organization;	initiative;	organization;	collaboration;	
	aligns with	aims to align	recognized	aims to	
	global	with global	globally as a	integrate	
	environmental	sustainability	standard for	natural capital	
	goals and	reporting	environmental	into business	
	international	frameworks	disclosure	decision-	
	agreements			making	
Focus Areas	Emphasizes	Emphasizes	Emphasizes	Emphasizes	
	setting science-	risk	disclosure of	understanding,	
	based targets	management	environmental	measuring, and	
	for climate,	and disclosure	data, climate	valuing natural	
	water, land,	related to	change, water	capital impacts	
	biodiversity,	nature and	security, and	and	
	and oceans	biodiversity;	deforestation	dependencies	
		focuses on		to improve	
		integrating		decision-	
		nature-related		making	
		risks into			
		financial			
		decision-			
		making			

4.2 Companies' actions anticipating the norm

So far, we have analyzed the main frameworks that the international system, and particularly the European scene, offers to companies in terms of enhancing biodiversity. These tools provide companies with the necessary guidelines for their business, regardless

of sector and size. As we have repeatedly mentioned during the research, the issue of sustainability enters their day-to-day activities, changing them and creating new spaces for business development.

In this section, the intention will be to discover practical cases of companies that have made a commitment to the development of sustainable projects with a direct impact on biodiversity. The aim is to demonstrate that sometimes companies themselves decide to engage in projects and initiatives even before stricter constraints resulting from a possible standard can be developed.

An interesting case to examine is Metal 57, a project that involved converting and extending a historic industrial building on the banks of the Seine in Boulogne-Billancourt, southwest of Paris. Originally designed as a Renault workshop in the mid-1980s, the complex was partially converted in 2004 to create event spaces. Now serving as the headquarters of BNP Paribas Real Estate, Metal 57 integrates environmental and social concerns into its design, emphasizing a biophilic approach.

Situated amidst parks and forests, Metal 57 functions as an ecological hub, featuring a rooftop sanctuary and an urban farm that supplies its food hall. Biodiversity efforts are further supported by measures to prevent bird collisions and the use of local species in planted patios. The building includes experimental areas promoting the circular economy using upcycled and locally sourced materials. Dedicated to soft mobility, Metal 57 provides electric charging stations, shared mobility services, and a bicycle repair workshop (BNP Paribas Real Estate , 2022).

Like BNP, many large corporations have committed to sustainable practices, particularly in alignment with biodiversity efforts. One notable example of a nature-based water supply system is the one serving the New York City metropolitan area, specifically involving the Catskill Mountains and the New York City Watershed. In 1996, faced with increasing demand and ecological pressure that threatened water quality, New York City had to choose between constructing a water filtration system or protecting its watersheds. The cost of building and operating the grey infrastructure was estimated to be between USD 6 billion and 8 billion. In contrast, purchasing, protecting, and restoring the watershed lands was estimated to cost between USD 1 billion and 1.5 billion (Scalvini &
Zollo, 2023). This cost-effective and sustainable solution has inspired similar initiatives in countries such as China and Australia.

Another example comes from Germany: REWE Group, a major German retailer, has enhanced the sustainability of its operations by introducing the PRO PLANET sustainability label. Employing around 384,000 staff, REWE Group offers products and services through supermarkets, specialty stores, and the travel and tourism sector. One of REWE's key initiatives is labeling the sustainability of products and services based on scientific evidence and stakeholder perception. The PRO PLANET label identifies products that are produced in an ecologically and socially sustainable manner, with particular emphasis on biodiversity projects, such as bee- and insect-friendly cultivation methods for participating fruit and vegetable producers (REWE Group, s.d.). In terms of certifications and direct contribution to biodiversity enhancement, the 3Bee experience is significant and represents an example of a nature-oriented business. It will be better discussed during the next chapter.

For most businesses, the successful implementation of Target 15 will be a journey, and will take time to put all the necessary measures and processes in place to achieve it, but the pace of climate change does not make any discounts, therefore corporations must deal with that as soon as possible.

4.3 Conclusions

This chapter has allowed us to understand the value of frameworks and to compare the most important ones, contrasting them with the protocols, analyzed in Chapter 3. Companies are constantly updating and evolving to meet global challenges; we have seen some significant examples that illustrate this trend. Now the focus will shift to finance and biodiversity credits, uncovering the opportunities and risks of greenwashing that companies may encounter.

CHAPTER 5. Credits and compensation

This fifth chapter will explore the interrelationship between finance and biodiversity conservation. We will begin by examining the distinctions between credits and compensation. Additionally, we will address the risks of greenwashing associated with these actions, emphasizing the importance of differentiating between genuine sustainability efforts and mere philanthropy. Finally, we will focus on 3Bee, the primary case study of this research, highlighting their mission and unique protocol for monitoring biodiversity.

5.1 Financing biodiversity

As we may have understood from the previous pages of the research, the interrelationship between finance and biodiversity is increasingly recognized as vital for sustainable development. Financial investments play a crucial role in biodiversity conservation by providing the necessary resources for protecting ecosystems, restoring habitats, and promoting sustainable practices. The urgency of financing biodiversity protection to combat biodiversity loss highlights the importance of engaging the private sector in the global green transition. It underscores the potential of a nature-positive economy to generate substantial business value and job creation by 2030, driven by transforming economic systems in key sectors such as food, infrastructure, energy, and extractives (UNDP, s.d.).

Conversely, the financial sector is also impacted by biodiversity loss, as it can lead to economic instability, increased risks, and diminished returns on investments (Hudson, 2024). Therefore, integrating biodiversity considerations into financial decision-making is essential to ensure long-term ecological and economic sustainability. This integration involves innovative financial instruments, policies, and mechanisms designed to redirect capital towards nature-positive outcomes, thus supporting global efforts to halt biodiversity decline and promote environmental resilience.

The UNDP is championing three systemic changes to support biodiversity finance: redirecting public and private finance towards nature-positive investments, transforming

production and consumption practices in critical sectors, and catalyzing behavioral change through stakeholder engagement.

The UNDP's Nature Pledge²⁹ promotes an economic and financial shift towards a naturepositive economy. The Global Biodiversity Framework's financial targets aim to mobilize \$200 billion annually by 2030, increasing international financial resources, domestic resource mobilization, and leveraging private finance. Strategies include innovative financial schemes like green bonds and biodiversity offsets³⁰, enhancing co-benefits of biodiversity and climate finance, and promoting collective actions for conservation.

Some important initiatives include:

- 1. The Biodiversity Finance Initiative (BIOFIN): Supports countries in developing and implementing Biodiversity Finance Plans, with a toolkit of over 150 finance solutions.
- 2. Global Fund for Coral Reefs (GFCR): Aims to protect and restore coral reef ecosystems.
- Taskforce on Nature-related Financial Disclosures (TNFD): Establishes a reporting framework for financial institutions to account for their impact on nature.

The latter falls within the various disclosure instruments that have been analyzed in Chapters 3 and 4. They have been compared among themselves through Tables 1 and 2, and we have understood that there is a growing movement towards better biodiversity disclosure. However, some major issues in the current situation in which protocols, standards, and frameworks are used (Elliot, Jonäll, Paananen, Bebbington, & Michelon, 2024). Firstly, the EU CSRD is the only mandatory regulation, allowing firms without significant EU ties to potentially bypass biodiversity reporting. Secondly, many standards are still in development. Thirdly, the reporting requirements differ significantly among

²⁹ The UNDP's Nature Pledge is the commitment of the Programme that aims to transform global economic, financial, social, and political systems to support sustainable resource consumption. It focuses on shifting to a nature-positive economy by redirecting finance flows, implementing sustainable practices in key sectors, and fostering behavioral change and stakeholder engagement to promote biodiversity conservation. ³⁰ Biodiversity offset will be further discussed in section 5.3.

standards, lacking standardized metrics. Even the concept of materiality varies, with some standards focusing on financial materiality – how sustainability impacts future financial performance—while others emphasize impact materiality, which considers the environmental effects on stakeholders and the environment (Hudson, 2024).

Disclosing biodiversity-related information presents numerous inherent challenges. The complexity is further compounded by the involvement of multiple standard-setting bodies, each often covering different geographical regions. Now, it would be useful to have a look at the main actors in the financial sector and how they act differently according to biodiversity influence.

5.1.1 Different elements of the financial sector

5.1.1.1 Investors and investment companies

Biodiversity issues are fundamental for asset value and risk, as well as for security market investors and managers. Investment managers are encouraged to address biodiversity risks and support conservation through targeted investments, aligning with broader ESG criteria, which have been linked to positive financial performance. However, concerns about the reliability and oversight of ESG ratings persist, with criticisms regarding the classification of sustainable finance and the potential for "greenwashing"³¹.

Customer demand for sustainable investments is growing, but there are doubts about the authenticity of some sustainability claims. The EU Sustainable Finance Disclosure Regulation seeks to address this by requiring clear declarations of fund positioning relative to the EU Taxonomy for sustainable activities (Hudson, 2024).

Quantitative approaches to assessing biodiversity risk are emerging. For instance, a Bank of France study found that a significant portion of the value of securities held by French financial institutions comes from issuers highly dependent on ecosystem services (Svartzman, et al., 2021). However, valuing ecosystem services and defining biodiversity risks remain challenging.

The evolving nature of biodiversity reporting standards, which vary significantly and lack standardized metrics, complicates disclosure. Despite these challenges, empirical studies

³¹ This issue will be further discussed in section 5.4.

suggest that biodiversity risk is increasingly being considered in equity markets. Some evidence indicates that investors are starting to require risk premiums for biodiversity risk, especially following the Kunming-Montreal agreements. Nonetheless, these studies are in the early stages, and further refinements are needed to improve the reliability of biodiversity risk assessments and reporting.

International initiatives like the United Nations Principles for Responsible Investment support investment managers in addressing biodiversity risks and demonstrating commitment to sustainability (UNPRI, s.d.). These efforts reflect a growing recognition among finance professionals, regulators, and researchers of the material impact of biodiversity risks, both physical and transitional, on future financial performance and investment value.

5.1.1.2 Banks

Banks face significant biodiversity-related risks through their business activities, including credit losses and defaults from disrupted business models or supply chains, market losses from securities portfolio downgrades, increased operating costs due to changes in credit underwriting, and regulatory compliance issues. They may also need to withdraw from sectors with high biodiversity impacts. US banks have an estimated \$1.7 trillion in loans and \$300 billion in securities portfolios exposed to nature-related risks (Deloitte, 2024).

Despite these risks, banks have opportunities to fund biodiversity projects and offer specialized advisory services. The Principles for Responsible Banking (PRB), created in collaboration with the UN Environment Programme Finance Initiative, help banks manage biodiversity risks. More than 230 banks, collectively holding \$60 trillion in assets, have adopted these principles. The guidelines include identifying industries with significant biodiversity impacts, aligning business targets with global biodiversity goals, halting financing activities that harm biodiversity, implementing rigorous due diligence processes, and setting specific biodiversity targets. Banks are expected to report their progress annually, with guidance from the PRB.

5.1.1.3 Insurers

The final key players in the financial sector to consider are insurers. They encounter substantial biodiversity-related risks through various types of insurance, including director & officer's, general liability, and professional indemnity insurance, which financially and reputationally expose them to the actions of the insured parties (Golnaraghi & Mellot, 2022). Traditional methods like higher premiums or exclusions might mitigate some risks but avoiding underwriting for high-impact activities (e.g., agriculture, construction, marine, and aviation) may be necessary, potentially affecting the economy (Institute and Faculty of Actuaries, 2023).

Biodiversity loss also increases pandemic risks, posing challenges for life insurers due to unexpected deaths. Regulators might need to demand higher capital requirements for insurers in biodiversity-disruptive areas, making sustainable business more attractive.

Insurers can combat biodiversity decline by restricting coverage for damaging projects or working with clients to make their activities more sustainable. They can also promote the circular economy by repairing rather than replacing insured goods and building resilience into insured properties (WWF and Deloitte, 2023). As major investors, insurers can adopt best practices to reduce biodiversity decline.

Additionally, insurers can offer products that protect natural assets, cover corporations that accidentally damage biodiversity, and issue catastrophe bonds to fund biodiversity initiatives. Examples include premium reductions for ecologically managed forests, insurance for coral reefs, and coverage for carbon-dense ecosystems like mangroves and seagrasses, which also reduce flooding risks (Hudson, 2024).

5.2 Biodiversity credits

5.2.1 Definition and history context

The Fifteenth meeting of the Conference of the Parties to the Convention on Biological Diversity (CBD COP 15) in December 2022, held in Montreal, marked a pivotal moment in the history of biodiversity protection. This event significantly emphasized the critical

role of finance in biodiversity conservation. Since then, a particular innovative financial mechanism has gained prominence in public discourse: the biodiversity credit³².

The Biodiversity Credit Alliance (BCA) offers the best definition of this instrument. Launched during the recent CBD COP 15, the BCA aims to guide the creation of a credible and scalable biodiversity credit market that can withstand scrutiny from various market participants (Biodiversity Credit Alliance, 2024). The inclusive definition is the following:

A biodiversity credit is a certificate that represents a measured and evidence-based unit of positive biodiversity outcome that is durable and additional to what would have otherwise occurred.

A biodiversity credit is directly tied to the concept of a "biodiversity outcome", which is quantified as the difference between scenarios with and without project activities. Since it is measurable, the credit represents an outcome that has already been achieved. The specific positive biodiversity outcomes are determined by the respective methodology, and these outcomes can encompass a mix of ecological and management improvements (Biodiversity Credit Alliance, 2024). A positive biodiversity outcome should be understood as the extent to which a certain decision leads to an improvement in biodiversity. This can involve a reduction in threats to biodiversity or the prevention of an anticipated decline in biodiversity measures. More precisely, this can be achieved through activities that pursue the following objectives:

- Uplift: improvement in biodiversity from interventions like ecological restoration is shown by changes in ecosystem structure, composition, function, or reduced threats.
- Avoided loss: prevention of biodiversity decline through preservation or land designation maintains ecosystem integrity and prevents increased threats, addressing imminent risks.
- Maintenance: maintenance of intact biodiversity by conservation plans, protection of Indigenous rights, and sustainable financing prevents changes in ecosystem structure and increases in threats, addressing medium- to long-term risks.

³² In the following pages, they can be referred also as biocredits or BCs.

The next section will help us better understand how these financial instruments work.

5.2.2 Mechanisms and functioning

Biodiversity credits are financial instruments designed to promote and incentivize the conservation and restoration of biodiversity. The mechanism behind biodiversity credits can be compared to carbon credits, but it presents a significant distinction.

The issue of biodiversity credit can involve non-profit organizations, governments, landowners, or companies that are focused on land conservation or restoration. So, they generate biodiversity credits or "certificates", that, for instance, represent a specific amount of land conserved or restored over a designated period. Terrasos's project in Colombia values one biodiversity credit as 10 square meters of land conserved or restored over 30 years (Galeano, 2024).

At this stage, private companies purchase these credits to fulfill biodiversity or naturebased commitments, like how they buy carbon credits for emissions reduction goals (WRI, 2024). However, here it is the significant difference, biodiversity credits aim for a net-positive impact on nature, unlike biodiversity offsets, which compensate for unavoidable negative impacts. In addition, carbon credits are created so that emitters can compensate annually. Biocredits are created to stop and reverse species loss by addressing a multitude of threats, including permanent habitat loss, in hand with local biodiversity custodians.

Another interesting case occurs in Zambia: in Tondwa Game Management Area, a Key Biodiversity Area³³ suffering from wildlife decline due to inadequate funding and law enforcement, a major biodiversity credit project is underway. The local community and Conserve Global, an environmental non-profit, have partnered with ValueNature to manage biodiversity and supply credits to private-sector buyers. This project issues "Nature Investment Certificates" (NICs), where one NIC equals a 10-year commitment to conserve or restore one hectare of land in the Tondwa reserve (IIED, s.d.).

³³ Key Biodiversity Areas (KBA) are 'sites contributing significantly to the global persistence of biodiversity', in terrestrial, freshwater, and marine ecosystems.

5.2.3 Drivers and motivations behind biocredits

BCs are becoming a crucial tool for companies aiming to address environmental sustainability and meet biodiversity goals. The impetus for restoration, conservation, and sustainable management of biodiversity stems from our heavy reliance on nature for economic well-being and our responsibility to steward it. The rapid decline in biodiversity poses significant risks, as over half of the world's GDP depends on nature and biodiversity loss is ranked among the top five global risks by the World Economic Forum (WEF, 2024).

Internally, companies are motivated by several factors to invest in biodiversity. A significant number of companies are driven by their mission, which includes an explicit commitment to biodiversity and nature. This mission-based value not only supports biodiversity but also helps attract and retain employees, especially as workforce candidates increasingly prioritize company ethics and sustainability in their employment decisions. Additionally, companies acknowledge the critical role of ecosystem services – such as pollination, climate regulation, water supply, and soil fertility – that biodiversity provides. To secure these services and minimize risks in their supply chains, businesses, especially those in downstream sectors like manufacturing and retail, invest in biodiversity improvements. For instance, a manufacturing company might fund projects that restore local ecosystems to ensure a stable water supply essential for its agricultural and mining suppliers (WEF, 2023).

Externally, the expectations and opinions of stakeholders, including regulators, local communities, investors, employees, and consumers, drive the demand for biodiversity improvements. Companies aim to stay ahead of regulations, such as the EU's Regulation on deforestation-free products and voluntary disclosure standards, which are becoming mandatory in some regions. Demonstrating good stewardship of biodiversity can attract a growing segment of consumers willing to pay a premium for green-certified products. This market differentiation is becoming more significant as consumers become more aware of greenwashing and as regulators implement standards to ensure meaningful action behind environmental claims.

Reputational factors also play a crucial role. Acting responsibly towards the environment helps maintain a company's social license to operate, particularly in sectors with a direct

biodiversity impact, such as mining, forestry, and agriculture. Even downstream sectors face scrutiny over responsible sourcing practices. Moreover, demonstrating good environmental performance may become more urgent if civil society and financial institutions increasingly expect businesses to transparently disclose impacts and contribute to global biodiversity targets.

Financial pressures further incentivize companies to improve their biodiversity performance. Financial institutions are increasingly seeking nature-friendly portfolios, and companies that enhance their environmental, social, and governance (ESG) ratings by investing in biodiversity can attract investors and lenders. This, in turn, reduces reputational and regulatory risks, thereby lowering the cost of finance.

The World Economic Forum has proposed a few potential use cases for the biodiversity credits. We will have a look at them with the following figure.



Figure 14 Use cases for biodiversity credits | (WEF, 2023)

Biodiversity credits can be used in several ways by companies to enhance their environmental impact and business operations (WEF, 2023b):

1. Enhance Carbon Credits for Better Outcomes: Companies can purchase BCs to achieve both climate and biodiversity goals, leveraging the synergies between climate regulation and biodiversity restoration.

- 2. Access Ecosystem Services: BCs can be used to secure or enhance ecosystem services within a company's supply chain, improving the sustainability of their operations.
- 3. Contribute to Nature Recovery: Companies can buy BCs to show their commitment to nature recovery beyond their direct impact. This should not replace their efforts to avoid and reduce their impacts on biodiversity.
- 4. Offer Bundled Products: Companies can bundle BCs with their products or services, promoting nature recovery as part of their offerings.
- 5. Address Unmitigated Impacts: Companies may voluntarily invest in BCs to offset their residual impacts on biodiversity. However, this use case is debated and requires a more robust market infrastructure and governance.

5.2.4 Risks and challenges

Interest in biodiversity credits is rising, drawing comparisons to the established carbon credit market. Both markets target sustainability-focused corporations, with some overlap: carbon credits often use nature-based solutions that also benefit biodiversity. However, biodiversity markets face similar challenges to carbon markets, such as accusations of "greenwashing"³⁴ due to concerns about the integrity of credits, transparency issues, and the rights of Indigenous peoples and local communities.

Biodiversity credits are inherently more complex than carbon credits because biodiversity lacks a simple, uniform metric like the "tonne is a tonne" principle³⁵ in carbon markets. Different project developers use various methods to measure and value biodiversity improvements, highlighting the need for standardized metrics, transparency, and good governance.

Biocredits aim to connect the surge in corporate interest in biodiversity with field-based conservation efforts, potentially unlocking new funding streams by reducing transaction

³⁴ Such issue will be further discussed in section 5.4.

³⁵ The phrase "a tonne is a tonne" stems from the requirement that a carbon credit must represent the reduction or removal of 1 metric tonne of carbon dioxide (or its equivalent, tCO2e) from the atmosphere. The atmosphere is indifferent to the origin or type of project responsible for the carbon mitigation or sequestration – it simply acknowledges that one tonne of carbon is either prevented from being emitted or extracted.

costs and guiding impactful investments. However, these schemes come with significant risks. One major risk is market confusion and inconsistency. The diverse approaches and objectives of current biodiversity credit schemes can create confusion among market participants. If these schemes fail to deliver tangible benefits for both biodiversity and local communities, the entire concept of biodiversity credits could be discredited, like past issues experienced with carbon credits (Starkey, 2022).

Ensuring local-scale integrity is crucial. Biodiversity gains must be real, demonstrable, and maintained in a socially equitable, rights-based manner. Rigorous local monitoring is necessary to confirm that biodiversity outcomes are being achieved and sustained. Additionally, maintaining system-scale integrity is vital. Biodiversity credits should contribute to broader societal goals and not serve as a way for companies to avoid addressing their negative impacts directly. These credits should not distract from necessary actions, such as implementing deforestation-free supply chains.

To ensure the success of biodiversity credits, several key elements need to be in place. Specifying intended outcomes is essential, informing technical design choices such as metrics and measurement approaches. Social considerations must be integrated from the beginning, emphasizing social equity and rights-based approaches to benefit local communities. Building on existing knowledge and systematically evaluating conservation outcomes is also crucial, leveraging frameworks from the SBTN to standardize and rigorously assess actions.

Despite the complexities, there is potential for more standardized metrics. While carbon credits rely on indirect measurements, the use of remote sensing technologies to monitor land use changes offers a promising approach to developing common metrics for biodiversity. Establishing such standards could help the biodiversity credit market evolve more effectively.

5.3 Biodiversity offsets

Biodiversity offsets have emerged as a conservation and business tool due to regulatory requirements in various countries, such as the USA, Brazil, and parts of Europe. These offsets involve positive, measurable actions to compensate for harmful effects caused by project development, aiming to ensure no net loss to biodiversity (Doswald, Barcellos

Harris, Jones, Pilla, & Mulder, 2012). Increasingly, businesses, including financial institutions, are adopting voluntary biodiversity offsets as part of their environmental or risk management strategies.

Despite their benefits, biodiversity offsets present several challenges, including issues with poor outcomes and metrics, design complexities, costs, timing, and sector-specific applications. However, financial institutions are motivated to engage in biodiversity offsets to demonstrate leadership, influence regulatory processes, reduce operational risks, and explore new business opportunities.

5.3.1 Key aspects

5.3.1.1 Mitigation Hierarchy

Offsetting is generally considered the final stage in a mitigation hierarchy, whereby predicted biodiversity impacts must first be avoided, minimized, and reversed by developers before any remaining impacts are offset³⁶. As we have seen, the mitigation hierarchy is typically a five-step set of principles (Doswald, Barcellos Harris, Jones, Pilla, & Mulder, 2012):

- 1. Avoid negative impacts where possible;
- 2. Minimize the negative impacts if necessary;
- 3. Restore and rehabilitate the environment from the environmental impacts;
- 4. Offset the unavoidable and necessary harms by additional compensatory conservation action. In some instances, financial compensation may be required either in lieu or in addition;
- 5. Accrue benefits to the environment.

The mitigation hierarchy serves to meet the environmental policy principle of "No Net Loss" of biodiversity alongside development. This hierarchy ensures that offsets are not used as an easy alternative to direct mitigation actions but rather as a last resort when other measures are insufficient.

³⁶ The mitigation hierarchy has been discussed in chapter 3.

5.3.1.2 Measurable Outcomes

Effective biodiversity offsets must yield quantifiable conservation outcomes that balance the biodiversity losses from development projects. These outcomes are typically measured in terms of habitat area restored, species population stabilized or increased, or ecosystem services maintained or enhanced. This quantification is crucial for ensuring that offsets deliver real, tangible benefits for biodiversity (IUCN, 2016).

5.3.1.3 Equivalency, additionality, permanence

The ecological gains from biodiversity offsets should be equivalent to the losses incurred from development activities. This means that the type and quality of biodiversity gained through offsets should match what was lost. Determining equivalency can be complex due to the unique and varied nature of ecosystems, but it is essential to ensure that offsets truly compensate for biodiversity impacts (McKenney & Kiesecker, 2009).

Biodiversity offsets must provide conservation benefits that go beyond what would have occurred without the offset. This principle of additionality ensures that offsets lead to a net positive impact on biodiversity rather than simply reclassifying existing conservation efforts. It requires that offsets result in new or enhanced conservation actions that would not have happened otherwise (IUCN, 2016).

The positive outcomes of biodiversity offsets should be long-lasting and ideally permanent. This requires secure funding, robust legal mechanisms, and effective management plans to ensure that offset sites are protected and maintained over the long term. The goal is to provide enduring conservation benefits that continue well into the future, counterbalancing the permanent losses caused by development.

5.3.2 Implementation of biodiversity offset

Biodiversity offsets can be implemented by various entities, including governments, nongovernmental organizations (NGOs), and private sector companies. These providers manage offset sites to ensure that the targeted conservation outcomes are achieved and maintained. Governments often play a critical role by establishing regulatory frameworks and overseeing compliance, while NGOs may bring expertise in conservation planning and community engagement. Private sector companies may also be involved, particularly those with large land holdings or those required to implement offsets as part of their environmental compliance.

In some regions, biodiversity offset markets have been established to facilitate the trading of offset credits. These markets operate similarly to carbon credit markets, allowing developers to purchase credits from offset providers to meet regulatory requirements or voluntary conservation commitments. The creation of such markets aims to provide a more efficient and scalable approach to implementing biodiversity offsets (Maron, et al., 2016). Offset markets can help standardize the valuation of biodiversity gains, streamline transactions, and increase transparency in the offsetting process.

Biodiversity offsets are often governed by regulatory frameworks that establish standards for their design, implementation, and monitoring. These frameworks are crucial for ensuring that offsets are effective, transparent, and accountable. They typically outline criteria for offset site selection, metrics for measuring biodiversity gains, and long-term management and monitoring protocols. Regulatory oversight helps maintain the credibility of biodiversity offsets by ensuring that they genuinely contribute to conservation goals and do not simply serve as a means for developers to bypass more stringent environmental protections (Bull, Suttle, Ascelin, Singh, & Milner-Gulland, 2013).

5.4 Greenwashing in biodiversity protection

5.4.1 Definition and basic understanding

Despite the noble objective behind the biodiversity conservation processes and projects that companies can initiate; the risk of incurring greenwashing remains unfortunately high. In the context of biodiversity protection, it refers to the deceptive practices employed by companies and organizations to present an environmentally responsible image while failing to make meaningful contributions to biodiversity conservation. As corporations increasingly adopt sustainability initiatives, there is a growing concern that some may engage in greenwashing to enhance their environmental credentials without making substantive changes or contributions.

The term "Nature Positive" has gained traction within the conservation community, paralleling the concept of "Net Zero" in climate discussions. It envisions a world where

biodiversity loss is not only halted but actively reversed, ensuring a healthy environment that supports human well-being. Over 90 world leaders and several Fortune 100 companies³⁷ have made pledges to achieve this goal by 2030 (University of Oxford, 2023). However, many of these commitments lack the scientific rigor necessary to produce real impacts, leading to concerns that they may devolve into mere greenwashing Some of the most basic, but also significant, cases/tactics that companies can use to g greenwash their environmental claims are listed below (Stone, 2023):

- Misleading claims: Companies might exaggerate the positive impact of their biodiversity projects or fail to deliver on their promises. This can include overstating the benefits of habitat restoration, species protection, or ecosystem service enhancement.
- Lack of transparency: Insufficient transparency in project design, implementation, and monitoring can obscure the real impacts of biodiversity initiatives. Companies may selectively disclose information, hiding negative outcomes or overstating success stories.
- Inadequate measurement and reporting: Biodiversity benefits are complex to measure. Without standardized metrics and rigorous reporting, verifying the authenticity and effectiveness of biodiversity projects is difficult. This can lead to the presentation of misleading data.
- Superficial commitments: Some companies may engage in token actions with minimal impact, such as planting a small number of trees or supporting a minor conservation project while continuing with environmentally harmful activities elsewhere.
- Disregard for local communities: Effective biodiversity protection often involves the cooperation and support of local communities. Ignoring the rights and needs of Indigenous peoples and local stakeholders can lead to projects that are more harmful than beneficial, despite being marketed as positive initiatives.

³⁷ The Fortune 100 is a list of the top 100 companies in the United States within the Fortune 500, a list of the 500 largest U.S. public and privately held companies published by *Fortune* magazine. The ranking is based on total revenues for the company's corresponding fiscal year (Kenton, 2024).

 Certification and accreditation issues: The proliferation of certification schemes and eco-labels can create confusion. Not all certifications are created equal, and some may have lower standards, allowing companies to claim biodiversity benefits without rigorous verification.

Some forest conservation projects aimed at protecting biodiversity have faced criticism for displacing Indigenous communities and failing to deliver the promised ecological benefits. The case of the Cordillera Azul National Park in Peru, where the Kichwa tribe faced restrictions and loss of traditional hunting grounds, exemplifies such issues. Major companies such as Shell and Total Energies have spent more than \$80 million since then buying credits in the park to counter their carbon emissions (Associated Press, 2023). Such companies have faced scrutiny for their biodiversity offset projects. Allegations include misleading accounting practices and failure to achieve claimed biodiversity outcomes, raising doubts about the credibility of their environmental commitments.

The challenge of greenwashing in biodiversity protection underscores the need for clear definitions, rigorous standards, and genuine commitments from businesses and governments. Without these, the laudable goals of achieving a "Nature Positive" world risk being undermined by superficial pledges that fail to address the urgent need for biodiversity conservation.

5.4.2 Biodiversity and sustainable finance

The European Securities and Markets Authority (ESMA) has highlighted the increasing risk of greenwashing in biodiversity protection in its "Report on Trends, Risks and Vulnerabilities, No. 2, 2023". Biodiversity is seen as a new frontier in ESG investing, emphasizing the need for effective and transparent risk assessment³⁸. The report aligns with findings from the Network for Greening the Financial System (NGFS)³⁹, which points to the significant risks to financial stability posed by biodiversity loss.

³⁸ The report contains a specific section entitled 'Biodiversity: the next frontier in ESG investing' (ESMA, 2023).

³⁹ The NGFS is a coalition of 114 central banks and financial supervisors dedicated to advancing green finance and formulating recommendations on the role of central banks in addressing climate change.

Financial markets are currently experiencing volatility due to various factors, including falling energy prices, expectations of a slowdown in monetary tightening, and the collapse of several US regional banks. ESMA warns that the overall risk level remains high, with short-term risks like volatility and inflation impacting consumers. However, there is strong growth in the EU market for ESG products and sustainable investments (ESMA, 2023).

Biodiversity is not only a crucial environmental concern but also an investment opportunity provided that companies genuinely commit to sustainable development goals to avoid greenwashing. Accurate and comparable data are essential, especially considering climate change forecasts from the IPCC AR6 report⁴⁰. The IPCC offers scientific assessments and guidance for global climate actions (IPCC, 2023).

ESMA stresses the importance of tools to understand and assess biodiversity-related financial risks, which affect global economies and specific sectors like supply chains and water availability. The Kunming-Montreal GBF, adopted at COP 15, supports sustainable development goals and aims to protect biodiversity by 2050 through various measures, including monitoring, financial resources, and scientific cooperation.

More and more companies and start-ups are contributing to this cause, putting at the center of their business the protection of biodiversity not only as a source of income but as a mission towards a planet that man is exploiting in an often-uncontrolled manner. One of these realities is undoubtedly 3bee: a dynamic Italian tech company that supports companies in adopting and improving ESG objectives through regenerative technological approaches. In the next section, we will learn more about their experience.

5.6 Conclusions

This chapter was essential for understanding the relationship between finance and biodiversity, particularly in terms of biodiversity protection. Every financial player has a crucial role to play in this process and should not be overlooked. The topic of biodiversity credits is increasingly gaining attention and being implemented. We explored their

⁴⁰ The report underscores how global warming, primarily driven by the "greenhouse effect", disrupts ecosystem balances, altering the biological cycles of organisms and affecting the availability and seasonality of resources.

potential in comparison to biodiversity offsets while also addressing the risks of greenwashing associated with them.

CHAPTER 6. The 3Bee case study: Technology and Biodiversity

This short chapter aims to discover the reality of 3Bee, an Italian company that has been committed to the protection of biodiversity for years, placing it at the center of its business model. We will get to know it in its most significant activities, in particular the technologies it has developed in the service of monitoring and regeneration.

6.1 History and Approach

3Bee is a nature tech company with a clear mission: protecting pollinating insects and preserving biodiversity. Since its founding in 2017, the company has focused on leveraging technology to better understand the complex dynamics of bees and their essential role in the ecosystem.

3Bee's first major breakthrough was the development of Hive-Tech, an innovative system designed to monitor and analyze beehive data⁴¹. Launched in 2019, this technology has made significant strides in improving the understanding and care of bees, merging advanced tech with environmental awareness. To date, it has been implemented in over 5,000 hives across 10 countries and 3 continents.

Building on this success, the "Adopt a Hive"⁴² initiative has helped 3Bee become a prominent sustainable brand in Italy, drawing the support of over 100,000 consumers. This project not only strengthened 3Bee's market position but also raised public awareness about the critical role bees play in maintaining ecological balance.

3Bee collaborates with businesses, research centers, and local communities to implement biodiversity regeneration projects, creating a positive impact on ecosystems. 3Bee also collaborates with research institutions and universities to enhance the importance of

⁴¹ It will be better defined in section 6.2.1.1.

⁴² The "Adopt a Hive" initiative is aimed at both businesses and companies. Through the 3Bee website, it is possible to select the technological hive that best suits the buyer's preferences. Each hive is monitored by sensors and microphones that collect data on the bees and their environment. The company's app allows the data from the sensors to be analyzed and the growth of the hive to be tracked. The buyer will receive photos and videos of the adopted hive and a jar of honey as a reward.

biodiversity conservation, and they have a network of beekeepers and farmers who work to promote sustainable farming practices and biodiversity protection (3Bee, s.d.).

3Bee operates through three main revenue streams: Adopt a Hive (B2C), Monitoring for Beekeepers (B2Farmers), and Biodiversity Protection with Companies (B2B). The COVID-19 pandemic accelerated 3Bee's B2C growth, driven by a surge in e-commerce and lower digital marketing costs. However, by 2023, a contraction in the B2C market led 3Bee to shift focus to the more stable B2B sector to preserve capital, ensure sustainable growth, and mitigate risks (Mazzola, 2024).

6.2 Biodiversity products and services

3Bee offers several innovative products based on objective data to assess terrestrial biodiversity in line with GRI and ESRS standards and the SBTN framework. The aim is to innovate biodiversity management by developing various tools, IoT tools, and artificial intelligence processing (3Bee, s.d.). 3Bee has refined a strategic technological portfolio focused on environmental monitoring, biodiversity regeneration, and environmental education.

6.2.1 Monitoring

3Bee's monitoring technologies collect scalable biodiversity data, focusing on pollinators and more. Their goal is to develop a global platform for biodiversity monitoring, accessible to businesses, municipalities, and universities, offering insights and tools to support ecological conservation efforts. Some of the most significant will be analyzed in the following sections.

6.2.1.1 Hive Tech

Hive Tech is an advanced monitoring system designed to ensure the health and productivity of bee colonies using IoT technology. Sensors placed inside the hive monitor crucial parameters such as temperature, humidity, hive weight, and acoustic signals. This real-time data is continuously collected and transmitted to a cloud-based platform, where machine learning algorithms analyze it to detect any anomalies, health issues, or signs of swarming. Beekeepers receive alerts and actionable insights through a mobile app or web dashboard, enabling them to take timely interventions. This system helps optimize hive management, reduce colony losses, and support sustainable beekeeping practices.

6.2.1.2 Spectrum

Spectrum is designed to detect the quantity and types of pollinators present on the site. It works as an "electronic ear" detecting the presence and diversity of pollinators by capturing the vibrations they emit during flight. This data, based on the unique sound prints of different pollinators, helps define their abundance in a specific region. The technology is used in the Element-E certification⁴³ process to assess and quantify pollinator presence, contributing to a broader understanding of biodiversity in that area.

6.2.1.3 Flora

Flora, developed by 3Bee in collaboration with the European Space Agency (ESA), is a neural network system utilizing AI and satellite imagery to analyze plant diversity and ecosystem biodiversity potential. By employing the Normalized Difference Vegetation Index (NDVI), Flora maps plant biodiversity and assesses habitat suitability for pollinators. This technology provides valuable data for biodiversity conservation, ecosystem management, and sustainability certification, supporting informed decision-making and long-term environmental monitoring.

6.2.2 Regeneration

The Biodiversity Oasis project was a key milestone for 3Bee's B2B sector in 2023, showcasing their ability to enhance biodiversity in arid regions. Each Oasis, featuring nectar-bearing trees and tailored ecological niches, is managed under five-year contracts with dedicated biodiversity cultivators. 3Bee has also increased pricing to over €13k per Oasis and extended contract durations. The initiative, applicable to corporate and third-party lands, integrates biodiversity monitoring and regeneration, paving the way for the development of Biodiversity Credits to incentivize and measure conservation efforts (Mazzola, 2024).

⁴³ See section 6.3.

6.2.3 Environmental education

3Bee's environmental outreach focuses on raising awareness about sustainability and ESG topics. The company actively engages companies, collaborators, managers, schools, universities, and research centers in promoting biodiversity and sustainability education through various CSR initiatives, leading to the creation of a network for sustainability professionals renamed "CSR Oasis". The company also launched the "Biodiversity Academy", an educational platform that emphasizes biodiversity, ecosystem regeneration, and environmental sustainability, aiming to raise awareness and knowledge among individuals and businesses about protecting natural ecosystems (Mazzola, 2024). Additionally, 3Bee organizes tailored team-building programs that involve hands-on environmental projects, fostering a stronger connection to nature and reinforcing corporate sustainability commitments. Companies can also partner with 3Bee to support environmental sustainability projects, such as adopting beehives and enhancing biodiversity, encouraging active contributions to environmental protection.

Furthermore, 3Bee is dedicated to educational initiatives within schools through its "Adopt a School" service, which enables companies to sponsor environmental education projects. This initiative promotes sustainability and biodiversity awareness among students, instilling responsibility and knowledge about environmental issues in younger generations (3Bee, s.d.). Through these initiatives, 3Bee is actively promoting corporate engagement in biodiversity conservation, environmental education, and the development of sustainable practices.

6.3 Element-E Protocol

Element-E is an advanced biodiversity assessment protocol developed by 3Bee, designed to support companies in meeting ESG requirements, particularly under European regulations like CSRD. As we have seen in Chapter 3, this latter aims to improve and standardize sustainability reporting across Europe, requiring companies to provide detailed information on how they operate and manage social and environmental challenges. Element-E likely provides a framework or set of tools that help businesses meet these stringent reporting requirements. The protocol operates through a multi-layered monitoring system. In particular, it employs two types of monitoring: the First Level concerns the site analysis via satellite, calculating the land use change, and the Pollination Abundance Index⁴⁴ over the past two years, to show nearby key biodiversity areas and endangered species; the Second Level of Monitoring assesses the presence of pollinating insects and other species through IoT sensors based on bioacoustics, with no impact on the site's operations.

The monitoring protocol provides five phases:

- Phase 1: This phase focuses on defining the boundaries of the site that need to be monitored.
- Phase 2: The First Level of Monitoring is conducted through Remote Sensing based on Satellite, in order to quantify the site's potential in terms of biodiversity.
- Phase 3: The Second Level of Monitoring is conducted through IoT sensors based on Bioacoustics, to quantify the real presence and variety of animal species.
- Phase 4: The protocol applicant receives the report with results to plan specific solutions for the site.
- Phase 5: This is the phase of externalization of results both through the landing page and the label.

Upon completing the process, the applicant receives three critical insights about their site: a comprehensive report detailing the site's biodiversity, an evaluation of its biological health, and a strategic plan for long-term revaluation. Additionally, they gain access to a project page for externally communicating the results of their biodiversity protection efforts, and a certification label that can be used on the company's products, confirming compliance with the Element-E biodiversity protocol (3Bee, s.d.).

6.4 Revenue model

3Bee is shifting its strategic focus towards the B2B sector, moving from online B2C adoption models to offering biodiversity-related services to companies. These services will include, as seen before:

⁴⁴ The Pollination Abundance Index is a metric used to assess the abundance and activity of pollinators in a given area. It relies on technology such as IoT devices and sensors to capture and analyze the vibrations and sounds produced by pollinators during their flight.

- Monitoring: Software-based and hardware-enhanced site-specific biodiversity monitoring.
- Regeneration: Corporate adoptions of oases, hives, and forests.
- Education: Training programs through the 3Bee Academy, sustainability networks, team-building activities, and corporate gifts.

This shift aims to boost revenue, with a strong focus on high-margin services, crossselling, and upselling to attract and retain B2B clients, while maintaining a reduced presence in the B2C market (Mazzola, 2024).

6.5 Conclusions

In this short concluding chapter, we have examined the 3Bee experience, highlighting the strong commitment to enhancing biodiversity, exemplifying the successful integration of a business model with the conservation of biological diversity. 3Bee aims to position itself as Europe's leading climate-technology company for the protection of biodiversity through three fundamental pillars: Monitoring, Regeneration and Education, through an Element-E certified protocol. Their testimony, together with the previous theoretical chapter we have seen, allows us to fully understand how the protection of biodiversity and therefore its enhancement is essential for the current and future development of society.

Final considerations

In this research, we delved into the intriguing world of biodiversity from various critical perspectives, adopting an interdisciplinary approach that highlights its social, economic, political, and environmental dimensions. The study investigated the relationship between businesses and biodiversity, emphasizing the substantial impact companies have on environmental conservation across different sectors. It also examined how businesses both influence and are influenced by biodiversity while assessing the effectiveness of existing frameworks designed to promote conservation and sustainable practices. The study has briefly compared Europe's regulatory system with the USA's incentive-based approach, noting that Europe may experience slower ecological progress due to overregulation, while the US benefits from fewer regulations and attractive incentives. It argued that stricter regulations are more effective than voluntary compliance or incentives for achieving meaningful biodiversity protection and emphasized the need for coordinated regulatory measures for effective conservation.

We will begin our final considerations by reviewing what the previous chapters have offered us and then try to draw some comments and thoughts on the current situation and, why not, on the future that awaits biodiversity.

The inaugural chapter delved into biodiversity, starting with its definition as the variety of life on Earth. It discussed biodiversity's crucial role in sustaining life through genetic, species, and ecosystem diversity. The importance of protecting biodiversity was emphasized, showing how human activities threaten ecosystems and species, which in turn undermines global efforts toward sustainable development. The chapter also highlighted the economic value of biodiversity, emphasizing its contribution to global GDP and ecosystem services. Finally, it outlined the alarming current state of biodiversity loss and its global implications, setting the stage for the exploration of international and business frameworks for biodiversity protection in subsequent chapters.

The second chapter provided an overview of the international and European contexts of biodiversity conservation. It began with the CBD, detailing its goals of conserving biodiversity, promoting sustainable use, and ensuring equitable sharing of genetic resources, alongside its institutional structure and protocols like the Cartagena and Nagoya Protocols. The chapter then discussed the Kunming-Montreal GBF, which outlines future conservation goals and briefly mentions other international conventions that influence biodiversity policies. Looking at the European context, we have seen that the Union has developed key systems for biodiversity evaluation and valorization: the EU Biodiversity Strategy for 2030, as well as the Nature Restoration Law, which establishes legally binding targets for ecosystem restoration, and highlights specific strategies aimed at protecting pollinators, vital for both ecosystem health and agriculture. An in-depth study of the national contexts of France and Italy was carried out in terms of their biodiversity commitments, to evaluate the similarities and differences.

Chapters three and four represented the core of the research. The main protocols, schemes, and frameworks were presented and compared from a business perspective. The third has started analyzing the causes of biodiversity loss such as land use change, pollution, introduction of invasive species, exploitation of resources, and climate change. Those are either directly or indirectly a consequence of corporate activity. Connected to that, it examined strategies and actions companies can take to mitigate their impact on biodiversity. It highlighted case studies of companies successfully implementing biodiversity-friendly practices, emphasizing the role of innovation and collaboration in achieving sustainability goals. The issue of CSR has been introduced and detailed with great accuracy, understanding its importance and implications in society. Finally, some practical instruments have been selected, particularly the evolution of standard reporting for companies. Standards like ESRS, GRI, and ISSB were compared using five characteristics: scope and coverage, reporting requirements, target audience, regulatory context, and focus areas. The same dimensions were used to compare the main frameworks in chapter four. The latter covered the evolution of nature-related disclosure processes and the growing importance of integrating biodiversity into corporate sustainability practices. It emphasized how initiatives like TNFD, SBTN, and others guide companies in assessing, reporting, and reducing their impacts on biodiversity. These frameworks are becoming crucial as businesses recognize the direct link between biodiversity loss and financial risk.

The fifth and final chapter of the dissertation has brought to our attention the interrelation between biodiversity and finance. The main actors of the scene like investors, banks, and insurers have all the potential to influence the process of biodiversity protection. Subsequently, biodiversity credits were added to the analysis, a fast-growing approach to conservation that creates financial incentives for protecting and restoring ecosystems. Like carbon credits, they allow companies to offset their environmental impact by investing in projects that enhance biodiversity. Their analysis allowed us to say that while they hold great potential for channeling private sector resources into conservation efforts, the effectiveness of biodiversity credits depends on rigorous standards, transparency, and careful monitoring to ensure that these investments lead to genuine and measurable ecological benefits rather than merely serving as a tool for greenwashing. This last issue needs to be taken into consideration as an important warning for all companies that decide to undertake green initiatives in support of any type of SDG of the Agenda 2030.

The research has shown that the tools available to companies in terms of enhancing biodiversity within them are numerous. Chapters 3 and 4 have enabled us to learn about them in detail, and what we can take from their examination is that without a doubt, they place stakes in the activity of the companies in some respects, while in others they make it more defined and with a clear purpose. Companies such as 3Bee, which place biodiversity as the foundational and fundamental center of their business activities, are testimony to a growing awareness of the critical state in which biodiversity finds itself today. However, some form of direction and sometimes compulsory imposition by the international community, research shows are essential and functional to achieve its goals.

The challenges that daily put pressure on our society force us to react, both as companies and as individuals: cities eating more and more green, fossil fuel industries steadily increasing their profit, and airlines that show no signs of traffic abating, are just a few examples of a trend of unsustainable development. In this context, regeneration, efficiency projects, and the search for new smart and green solutions end up being essential and necessary. Corporate social responsibility, ESG, sustainable finance, as well as the various protocols and frameworks that we have analyzed, will be increasingly essential within company strategies, and professional figures such as the Chief Sustainability Officer will gain centrality in decision-making. The driving force for a change within a company will come when it realizes that its profit is directly dependent on the risk of biodiversity loss, as the latter directly or indirectly impacts a company's entire value chain, whether it focuses on biodiversity protection (see 3Bee) or on pharmaceuticals, rather than food, transportation or any other sector of our boiling society.

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