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# Biodiversity and the Economy

Birds of a Feather

OCTOBER 2024

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**REPORT** - October 2024

# **Biodiversity and the Economy**

Birds of a Feather



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This report is based on a twofold observation: the rapid collapse of biodiversity due to human activities, and the chronic underestimation of the effects of this collapse on the resilience of societies.

Marked by mass species extinction, a reduction in genetic diversity, and the degradation of ecosystems, the accelerating erosion of biodiversity is primarily due to five human-driven pressures: changes in land use, over-exploitation of resources, pollution, climate change, and invasive alien species. These pressures, and the resulting decline in biodiversity, ultimately threaten the Earth's habitability for the human species.

While 50% of the world's GDP directly depends on biodiversity, the significance of its erosion remains poorly understood. Furthermore, it is often overshadowed by the climate crisis, which is better recognized due to the existence of aggregate indicators to quantify it. The overrepresentation of climate issues in public debate sometimes leads to an underestimation of the efforts needed to preserve biodiversity. The fight against climate change can, in fact, lead to the implementation of solutions that inadvertently harm biodiversity, further hindering the crucial role biodiversity plays in regulating the climate, such as mitigation and adaptation solutions to climate change, including carbon sequestration, reduction of drought and erosion risks, etc.

This underestimation is due to conceptual and methodological challenges. On a conceptual level, the notion of human beings as living in an urban environment, entirely separate from the ecosystems from which they exploit resources and derive benefits, reduces nature to a disembodied concept, and fosters various social and political fantasies. From a methodological perspective, the difficulty in defining aggregate indicators to quantify the services provided by nature, as well as the positive or negative impacts of human activities, has contributed to inaction or fragmented efforts, hindering effective and efficient action.

A collective awareness, shared by businesses and citizens alike, is essential to implementing solutions that reconcile climate and biodiversity. Constraint and setting examples have fed improvement. Non-financial reporting was a first step toward integrating biodiversity into strategic planning. The second step involves building indicators, although the complexity inherent to living systems makes the creation of a single indicator, similar to CO<sub>2</sub>-equivalent metrics, unrealistic. However, some indicators have been developed to help companies measure their biodiversity footprint in order to set a path for reducing pressures. The third step involves integrating biodiversity into private sector decision-making. This requires mapping the issues, dependencies, and risks involved for businesses. Indeed, the ecosystem services that biodiversity provides for free today are largely overlooked, be it economically or in the social consciousness.

Although biodiversity preservation is mainly perceived as a constraint, it can quickly become an opportunity for economic development, one that economic players need only seize and capitalize on. Mechanisms and initiatives designed to manage resources sustainably, such as payments for environmental services or the development of nature-based solutions, must, however, be further explored and complemented.

Recent legislative developments, such as the entry into force of the CSRD, should allow for an initial analysis of the risks, opportunities and impacts across the entire value chain of human activities.

The consequences of biodiversity decline on food, health, and industrial sovereignty also argue in favor of strengthening biodiversity-related criteria in trade agreements, with the aim of making biodiversity a component of European extraterritoriality. The competitiveness of businesses will be dependent on biodiversity preservation, thus requiring further development of environmental and economic diplomacy. It is therefore up to the public authorities to support the changes brought about by private players, to better integrate biodiversity in their business models.

While the private sector seems increasingly committed to preserving biodiversity, it continues to struggle to highlight its actions: labels, certifications and philanthropic initiatives, all suffer from a lack of visibility and credibility. The COP15 on Biodiversity, held in Montreal at the end of 2022, marked the high point in terms of the shared responsibility of states and businesses, both of which have committed to achieving specific targets for reducing strains on biodiversity.

In the medium term, ecosystem preservation and business resilience will become imperative, calling for a coherent legislative and fiscal framework at both national and international levels. Harmonizing fiscal measures, some of which go against the objectives of the COP15 on Biodiversity and of the National Biodiversity Strategy, is a priority. To mitigate increased risks of vulnerabilities and inequities between players, it is essential to account for potential social consequences and provide targeted support for the most vulnerable regions and citizens if we are to ensure the effectiveness and social acceptability of these policies.

Aware of the challenges, difficulties and opportunities related to achieving the COP15 objectives, Institut Montaigne sought to explore the interdependencies between biodiversity and the economy. We believe these two sectors to be inextricably linked.

Based on this observation, this report recommends that the first course of action be the creation of a European biodiversity framework capable of effectively distributing responsibilities between public and private players. Such a framework would require a scientific definition of the key concepts as a starting point. This shared foundation would enable biodiversity to be considered at all necessary levels of decision-making (public authorities, private entities, citizens, etc.) and would facilitate synergies between stakeholders. Indeed, reducing strains on biodiversity, which is the ultimate goal of COP15, will require the development of stronger synergies between public and private players, particularly at the local level, through experimentation, and technical and organizational

innovation. The planetary boundaries and their application at local levels certainly illustrate the opportunities, risks, and constraints within which these players can operate and benefit from their environment, both as a living space and an economic framework.

Supporting the integration of biodiversity into resource management and economic models is the second imperative. This involves compensating for additional measures taken by businesses, including agricultural ones, in favor of biodiversity. In particular, the mechanism for payments for environmental services will need to be improved, and citizens should be encouraged to help tackle conservation challenges through the French mechanism of Real Environmental Obligations (ORE). Gradually, biodiversity preservation or restoration actions should be seen not as additional costs but as investments in natural capital, essential for the sustainability of businesses. Those who fully commit to this approach should be able to benefit from opportunities in the national market, through public procurement, and internationally, supported by ambitious commercial and economic diplomacy. Finally, the development of a voluntary biodiversity credits market deserves careful analysis to avoid the pitfalls of the voluntary carbon market.

This implies anticipating both opposition and new vulnerabilities, arbitrating as far upstream as possible the conflicts of use that will arise from a scarcity of resources, and deploying an environmental police force whose mission will be both to raise awareness among private entities and to crack down as severely as possible on environmental crime.

Such momentum cannot be sustained without the social acceptability of biodiversity protection measures. Reducing strains and promoting equity must guide public policies in this area. This requires anticipating both opposition and new vulnerabilities, arbitrating usage conflicts arising from resource scarcity as early as possible, and deploying environmental law enforcement to both raise awareness among private players and to punish severely those who commit environmental crime.

## Axis 1

Build a European framework for biodiversity that effectively allocates responsibilities between public and private stakeholders.

### RECOMMENDATION 1

**Establish scientifically based definitions of key biodiversity concepts, to build a common European framework and promote its adoption at an international level.** Drawing on the most up-to-date scientific knowledge, define concepts of “good ecosystem status,” “positive biodiversity,” “no net loss,” and “protected” and “restored” areas, at European level. This common European framework should be promoted at biodiversity COPs with a view to have it adopted at the global level. It should also highlight climate-biodiversity synergies and incorporate the application of planetary boundaries at the territorial level.

### RECOMMENDATION 2

**Coordinate the distribution of responsibilities between the public and private sectors** on an ecological territories level, by placing greater emphasis on biodiversity in local planning instruments. By leveraging existing administrative bodies and ensuring the simplification of decision-making processes and funding channels, extend the governance of public commons to include businesses and civil society.

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## Axis 2

Promote the integration of biodiversity in economic models.

### RECOMMENDATION 3

**Shift the value paradigm by introducing biodiversity as an economic driver of prosperity and by focusing on innovation.** As a factor of business resilience, biodiversity must attract greater and better-targeted public and private investments, particularly in actions that have positive joint impacts on climate, biodiversity, and the water cycle. Innovations enabled by biodiversity (nature-based solutions), aimed at alleviating strains on biodiversity or improving our understanding of it (environmental DNA), as well as those that contribute, for instance, to restoring the water cycle, offer economic opportunities that should be encouraged. At the same time, the consideration of biodiversity in corporate governance must be strengthened, within the existing framework of the CSRD and the SBTN methodology. Given France's leadership in this area, efforts should be made to ensure these standards become the global benchmark.

### RECOMMENDATION 4

**Assign financial value to commitments favoring biodiversity.** Biodiversity goes beyond simple management issues and is not limited to the activities of companies alone; it requires an integrated, collective, and large-scale response through the expansion of payments for environmental services, Real Environmental Obligations (ORE), and the development of state-backed bank loans. As a lever for promoting biodiversity and a symbol of public authorities' leadership on the matter, public procurement should specifically include a biodiversity criterion.

### Axis 3

Strengthen the social acceptability of biodiversity conservation measures.

#### RECOMMENDATION 5

**Promote fairness in biodiversity conservation measures to ensure their acceptability.** Enhance the social acceptability of biodiversity preservation by first moving away from punitive environmental policies, and then experimenting with local redistribution mechanisms to balance the disparities arising from the scarcity of resources (land, water, etc.).

#### RECOMMENDATION 6

**Raise awareness and mobilize stakeholders to preserve biodiversity.** Environmental issues are too often seen as constraints on established rights or obstacles to unrestricted consumption. A shift in collective perceptions is necessary and cannot rely solely on scientific awareness. This shift should be based on the creation of new narratives and, at the same time, help the environmental police evolve towards educating users about the strains on biodiversity.

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*“There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved.”*

Darwin, *On the Origin of Species*, 1859

The environmental crisis, with its existential threat to all human activities, has now become the paradigm within which public decisions are made. In particular, climate change, with its array of unpredictable and large-scale events, is now fully recognized as a challenge that must be collectively addressed by all governments, economic players, and citizens. International efforts, such as the Paris Agreement, provide an established institutional framework, while decisions are based on the conclusions of widely accepted scientific coalitions.

Yet, there remains a blind spot in the understanding of environmental policies: biodiversity. This may be due to the conceptual difficulty humans face in viewing themselves as just one component of a system of often invisible interdependencies. It may also be explained by methodological challenges arising from the inherent complexity of the living world. Perhaps the emphasis on the fight against climate change, which is more easily quantifiable, has contributed to this extinction of species being overlooked. Regardless, we are now paying the price for sidelining and downplaying the importance of biodiversity issues.

However, the desire to protect remarkable elements of nature, particularly landscapes, emerged as early as the mid-19th century, in connection with the rise of political ideas linked to the nation-state, which made landscapes

an essential part of national heritage, and this was reflected in specific measures.

This “nature protection” policy, aimed at safeguarding landscapes, remarkable areas, or emblematic species threatened by the Industrial Revolution, forest and mining exploitation, and the expansion of the rail network, has led to numerous initiatives and undeniable successes: species such as beavers, birds of prey, cetaceans, and certain migratory birds (storks, pink flamingos, etc.) have benefited from measures protecting or limiting the exploitation of their habitat.

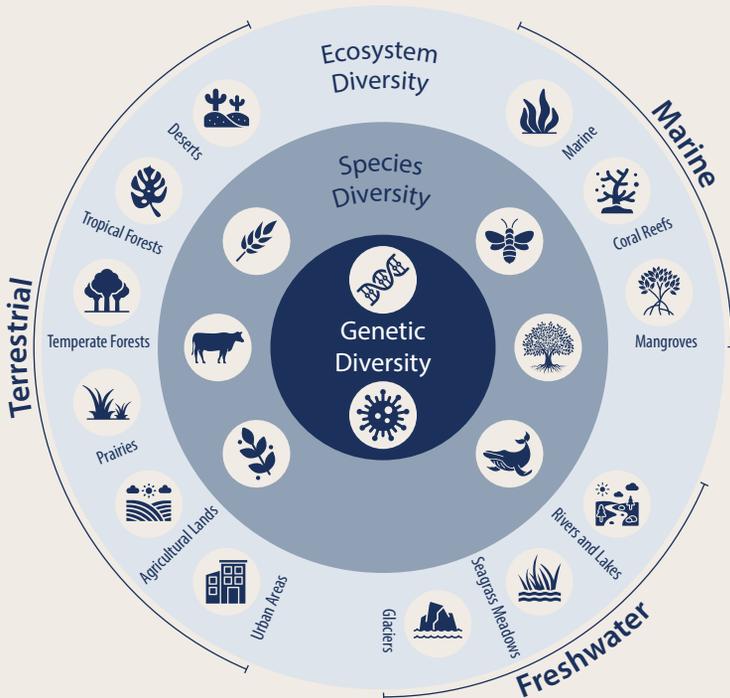
In relation to this dynamic, the introduction of the notion of “biodiversity” is relatively recent, as this technical term only appeared at the end of the 1980s. Coined by Walter Rosen in 1985 during the preparation of the National Forum on Biological Diversity, it was first used in a 1988 publication to report on the conclusions of this summit. This more striking term was preferred over “biological diversity,” coined by Thomas Lovejoy in 1980, and was adopted at the Rio Earth Summit in 1992.<sup>1</sup> In domestic law, it only appeared in legislative texts in the 21st century. In France, it wasn’t until the enactment of Law 2016-1087 on August 8, 2016, that this concept and its definition were definitively integrated into the Environmental Code.<sup>2</sup>

Biodiversity is defined as the entire fabric of living organisms and is characterized by the diversity of species (interspecific biodiversity), genetic diversity within species (or intraspecific biodiversity), and the diversity of ecosystems themselves. Biodiversity, which is deeply influenced by the interdependencies between species, must also be viewed as dynamic and constantly evolving.

<sup>1</sup> Broswimmer F., 2010, “Une brève histoire de l’extinction en masse des espèces”, *Agone*.

<sup>2</sup> Article L. 110-1 of the French Environment Code states that: “Biodiversity, or biological diversity, means the variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species, of ecosystems and of interactions between living organisms.”

Figure 1: Biodiversity



Source: Edited by Rodwell Christine and Vaillant David, *Biodiversity: A Call for Decisive Action*, HEC Alumni, Paris, 2022.

Beyond its mere semantic significance, the emergence of the concept of biodiversity reflects the introduction of new ideas linked to the evolution of knowledge and the recognition of the limitations of the “traditional” approach to nature conservation. The first major shift pertains to the extent of our lack of understanding with regards to the diversity of living things. By the mid-20th century, it was believed that a significant

portion of the inventory of living species had been recorded (leading to a declining interest in the field of natural history), it became clear that most of this inventory remained unfinished. Furthermore, the visible portion of this diversity represented only a tiny fraction of the living world, both in terms of diversity and the sheer quantity of living matter, as well as its role in the functioning of the biosphere. Transitioning from managing known entities to preserving an ensemble that remains largely unknown, reliant on ordinary or overlooked species, thus became necessary.

The second major shift involves fully embracing the concepts of evolutionary biology. While the living entities present at any given moment deserve our attention, they must be viewed as expressions of an “evolutionary system” made up of numerous interactions between these more or less transient entities. Therefore, it is this system and its evolutionary capacities that must be preserved, with particular care taken not to disrupt these essential and often imperceptible connections.

The third major shift concerns the areas involved. With the strategy of protected areas, only those territories were considered to be “high stakes” for biodiversity, often due to “remarkable biodiversity,” usually the presence of notable species. The “ordinary” biodiversity of regions where most human activities take place was not seen as carrying such importance.<sup>3</sup> This new understanding of biodiversity requires an acknowledgment that all areas are now considered “high stakes,” which can prove relatively challenging for public policy and action.

Finally, as a corollary, this expansion of the areas of interest requires the involvement of all stakeholders. Although private initiatives for nature conservation have existed since the early 20th century,<sup>4</sup> nature

<sup>3</sup> *The land sparing/land sharing conflict is still very much alive, as demonstrated by the “Nature needs Half” coalition.*

<sup>4</sup> *The Sept-Iles private reserve was created in 1912 to protect puffins in particular, or the Camargue zoological and botanical reserve in 1927.*

protection in Europe has primarily been a matter of public policy. In contrast, the importance of biodiversity now requires all players whose activities impact the dynamics of life to reflect on their role and, more importantly, to take action.

However, while the concept of biodiversity has led to an evolution in our approach to and relationship with “nature,” the discussion surrounding its collapse, also known as the sixth mass extinction,<sup>5</sup> remained largely confined to the scientific community for a long time. This biodiversity crisis, with species disappearing at a rate 100 to 1,000 times the natural extinction rate,<sup>6</sup> only occasionally surfaced in public debate, usually during specific events, and mainly focused on the preservation – partly guilt-driven, partly entertaining – of distant, exotic species chosen primarily for their strong appeal and popularity.

**First and foremost, because the preservation of life is a necessary condition for human survival and the continued pursuit of human activities.**

The classic slogan “Protect the Planet” is misleading: what is truly at stake is the very survival of the human species. Beyond providing essential raw materials, such as food, clean water, textile fibers, and active ingredients for many medications, biodiversity plays a crucial role in regulating environmental processes that make Earth habitable, such as climate regulation and the mitigation of extreme events. It thus directly contributes to maintaining Earth’s viability for human life.

<sup>5</sup> “Mass extinctions must be reinterpreted, by four criteria, as ruptures rather than culminations of ongoing processes. They are more frequent, more rapid, more profound (in numbers of species and environments eliminated), and more varied in effects than in normal times.” Jay Gould S., 1985, “The Flamingo’s Smile: Reflections in Natural History”, WW Norton quoted by Broswimmer F., 2010, “Une brève histoire de l’extinction en masse des espèces”, Agone.

<sup>6</sup> 69% of species disappeared between 1970 and 2018, according to the WWF’s Living Planet Index. For the record, the natural extinction rate is equivalent to one species per million per year.

Nature also provides crucial ecosystem services with significant economic, social, and cultural value. The economic approach to valuing nature and its services is not aimed at commodifying it but rather at establishing a common unit of measurement. Nonetheless, it is worth noting that the OECD estimates these services to be valued at between \$125 trillion and \$140 trillion,<sup>7</sup> which is roughly one and a half times the global GDP. Additionally, the poorest populations are particularly dependent on ecosystem services and other non-market goods.<sup>8</sup> The economic stakes alone fully justify the integration of biodiversity into the key decision-making processes of both private and public players.

The preservation of biodiversity cannot be reduced to a secondary objective, by which various stakeholders would seek to ease their conscience. It holds an existential significance that should not be underestimated.

**Secondly, the preservation of biodiversity presents an opportunity to increase the resilience of institutions and societies.** The common approach to environmental issues often involves viewing humans as external to a system on which they primarily have a harmful impact. In practice, this mindset leads to regulating and restricting human activities, focusing on limiting usage and enjoyment, some economic agents

<sup>7</sup> OECD, *Financing Biodiversity: Action for the Economy and Business, Summary and Synthesis Prepared for the French G7 Presidency and the G7 Environment Ministers' Meeting, May 5-6, 2019*. <https://www.oecd.org/environment/resources/biodiversity/Resume-et-Synthese-Rapport-G7-financer-la-biodiversite-agir-pour-l'economie-et%20les-entreprises.pdf>. The economic valuation of these services takes into account adjusted market value (crops, livestock, and forests), production function estimation (maintenance of beneficial species, agricultural production, and flood control), revealed preferences (water quality, tranquility, recreation, and amenities), stated preferences (water and air quality, species conservation, non-use values), and subjective well-being (air and water quality, species conservation based on available indicators). The valuation of ecosystem services remains a “complex undertaking at the edge of knowledge.” This exercise provides a general idea, with the OECD questioning “whether the valuations found in the literature adequately reflect the importance of ecosystem assets and biodiversity.” In: OECD (2019), *Cost-Benefit Analysis and the Environment: Recent Developments and Policy Use*, OECD Publishing. <https://doi.org/10.1787/9789264300453-en>.

<sup>8</sup> TEEB, 2010, “The Economics of Ecosystems and Biodiversity: Mainstreaming the economics of nature,” a synthesis of the approach, conclusions and recommendations, <https://www.teebweb.org>.

consider this a degrowth approach. While this damage-focused approach can be valuable for educational purposes, it is both limiting and unrealistic in addressing environmental challenges, which require everyone to be involved and take responsibility.

On one hand, biodiversity represents an invaluable reservoir of scientific wealth, with hundreds of thousands of species yet to be discovered. The oceans remain largely uncharted, and roughly one million insect species in tropical rainforests are still unknown.<sup>9</sup> The molecules and opportunities they hold are therefore only imperfectly understood. On the other hand, biomimicry has often been a driver of innovation, and developing new, more resilient modes of production and organization is essential for adapting to climate change. Nature-based solutions, which leverage natural resources to preserve, enhance, and even restore ecosystems, are a prime example. Companies that fail to incorporate biodiversity-related risks and dependencies into their analysis, or to recognize the potential opportunities, risk stagnation and detrimental inertia.

**Thirdly, despite a certain retreat from environmental commitments, biodiversity remains a major concern for civil society.** Aligning short-term economic solutions with long-term commitment to environmental preservation is a core concern.

This increasing awareness must be more clearly understood by businesses. Firstly, because companies, including SMEs, are seen as having both a negative impact on biodiversity and the capacity for effective action.

Secondly, because the consumer behaviors of informed citizens will increasingly influence companies' production processes, favoring those with better environmental practices.

<sup>9</sup> Muséum national d'histoire naturelle, March 2022. "Les forêts tropicales: leur rôle pour le climat et la biodiversité". <https://www.mnhn.fr/fr/les-forets-tropicales-leur-role-pour-le-climat-et-la-biodiversite>.

Thirdly, because employee expectations are changing, making the adoption of a positive stance on biodiversity an asset for the employer-brand to attract and retain talent within the company.

Finally, because biodiversity is becoming a criterion for attracting capital. Driven by new regulations– from the European taxonomy and the CSRD directive, to the SFDR and Article 29 of the French Energy-Climate Law – investors are increasingly concerned by this issue, viewing it as a key component of business resilience.<sup>10, 11, 12</sup>

With this in mind, this report aims to achieve three objectives:

- Mobilize scientific knowledge on biodiversity loss and the essential services it provides to humanity, for the benefit of both decision-makers and the general public.
- Promote actions already undertaken by companies most committed to preserving and restoring ecosystems, fostering a sense of shared responsibility and mutual incentives.
- Formulate recommendations to accelerate the necessary transitions by improving communication between public, private and civic entities, particularly at the local level.

To this end, the report was developed using a collaborative approach. Over 100 interviews were conducted with business leaders, environmental or CSR managers, entrepreneurs, engineers, scientists, insurers, public officials, civil servants, national and local representatives, and civil society stakeholders. These interviews helped identify the challenges faced by field players, sector by sector, as well as the solutions already implemented within their organizations.

<sup>10</sup> *The Corporate Sustainability Reporting Directive, which came into force on 1 January 2024, sets new standards for non-financial reporting at European level.*

<sup>11</sup> *The Sustainable Finance Disclosure Regulation, which came into force in 2021, is one aspect of the sustainable finance regulations.*

<sup>12</sup> *This article defines the new reporting obligations for investors managing more than €500 million in the areas of climate and biodiversity. They must explain the strategy for taking these risks into account in their portfolio.*

Thus, the first part of this study reviews the scientific findings on the biodiversity crisis. The second part focuses on the underestimation of biodiversity dependence in economic analysis, partly due to the difficulty inherent to reducing living systems to a single metric. The third part highlights both the increasing engagement of economic players, facilitated by shared action frameworks, as well as the opportunities that biodiversity provides. Finally, the last part seeks to define the role of public authorities within this specific context.

# 1 Biodiversity Is Under Threat

## 1.1. FRAMEWORK 1: THE FIVE PRESSURES ON BIODIVERSITY

*"Nature is declining globally at rates unprecedented in human history – and the rate of species extinctions is accelerating, with grave impacts on people around the world now likely."*

*The Intergovernmental Science-Policy Platform  
on Biodiversity and Ecosystem Services (IPBES), May 2019*

To quote Franz Broswimmer, "extinction is the ultimate fate of every species". However, the current rate of extinction – at least 100 species every day – is unprecedented.<sup>13</sup> These figures are all the more staggering when you consider that random extinctions have occurred at a rate of one species disappearing every five years over the past 500 million years.<sup>14</sup> The extinction of a species may be due to its population or isolated sub-populations falling below a minimum threshold, which prevents the genetic diversity necessary for its survival and adaptability (resistance to pathogens, predators, environmental changes, etc.).

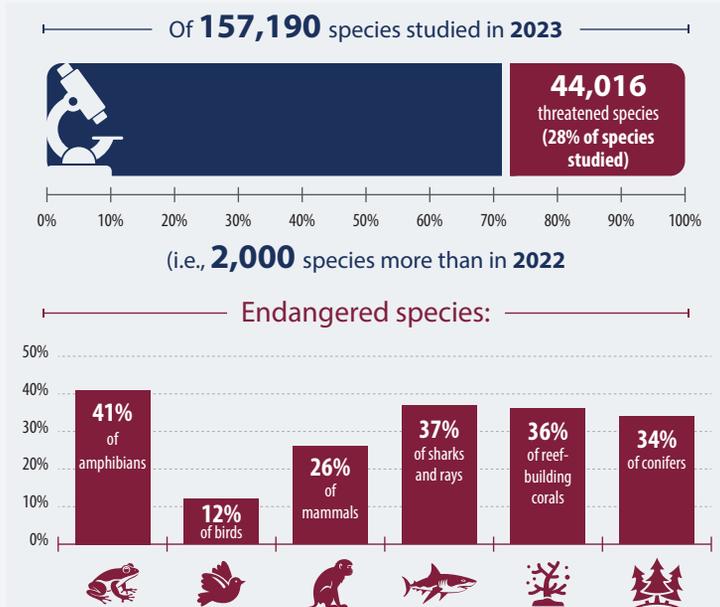
Of the 8 million known species on Earth, plus up to 12 million species that have not yet been described, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) – the biodiversity equivalent of the IPCC for climate – estimates that one million species are at risk of extinction in the coming decades. The WWF, through its Living

<sup>13</sup> This article defines the new reporting obligations for investors managing more than €500 million in the areas of climate and biodiversity. They must explain the strategy for taking these risks into account in their portfolio.

<sup>14</sup> *Ibid.*

Planet Index, estimates that two-thirds of vertebrate species and 83% of freshwater species have disappeared since 1970.<sup>15</sup>

Figure 2: Biodiversity Loss



Source: <https://uicn.fr/liste-rouge-mondiale/>.

<sup>15</sup> Ayres E., September-October 1998, "The Fastest Mass Extinction in Earth's History", *Worldwatch*, No. 11 quoted by Brosimmer F., 20, "Une brève histoire de l'extinction en masse des espèces", *Agone*.

Faced with a loss of biodiversity that is both individually felt and scientifically observed, the research community has taken an interest in the reasons for these declines in abundance, but also in the richness and health of ecosystems. The IPBES has identified five major issues, all man-made.

### a. Changes in Use of Land and Sea

The first pressure, the change in use of land and sea (i.e., changes in occupation, land use and resources), often leads to the artificialization, reduction and fragmentation of natural habitats. This change in use affects all natural environments. According to the 2019 IPBES report, 75% of Earth's surface has been significantly altered, 66% of the oceans are experiencing increasingly significant cumulative impacts, and 85% of wetland areas have disappeared.<sup>16</sup> More than a third of Earth's surface is used for crops and livestock, with the agri-food system responsible for 80% of land-use changes alone.<sup>17</sup>

This change in land use affects all terrestrial ecosystems (forests, meadows, peat bogs, etc.) and has accompanied the development of human societies, particularly with a view to meeting their food requirements. For example, the clearing of land for agricultural purposes, which coincided with population growth, began as early as the Bronze Age (between the 4th and 2nd millennia BC) and led to a 46% reduction in forest area. Forest

<sup>16</sup> *IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services) is an international group of biodiversity experts established in 1992 by 92 governments to advance the science of biodiversity and ecosystem services and to inform public policy. The 2019 report provides a comprehensive analysis of how biodiversity has changed over the past 50 years and the consequences that such changes may have for human societies. IPBES, (2019), Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. E. S. Brondizio, J. Settele, S. Díaz, and H. T. Ngo (editors). The executive summary of this report is available at: [https://www.ipbes.net/sites/default/files/2020-02/ipbes\\_global\\_assessment\\_report\\_summary\\_for\\_policymakers\\_fr.pdf](https://www.ipbes.net/sites/default/files/2020-02/ipbes_global_assessment_report_summary_for_policymakers_fr.pdf).*

<sup>17</sup> Vonlanthen M., 2023, "La biodiversité, l'autre crise écologique", Savoir Suisse, Presses Polytechniques et Universitaires.

cover remained fairly stable for two millennia before deforestation accelerated in the 1980s. The absence of environmental regulations combined with the rise in power of multinationals exporting agricultural products were factors in explaining this intensification of deforestation.<sup>18</sup> Today, forests cover around 30% of Earth's surface and deforestation remains closely linked to the pace of demographic transition.

However, according to NASA, the global vegetated area has increased by 5% since 2010, mainly due to very proactive policies in India and China. But while this is a sign that the trend can be reversed relatively quickly, it must be remembered that the biodiversity of primary forests, which are currently experiencing the greatest pressure, is much greater than that of reforested forests.

In addition to deforestation, another issue is the degradation of forest environments. It is currently estimated that 20% of remaining forests are degraded, i.e., they have been subjected to human disturbance linked to occasional logging, fire, small-scale farming and unsuitable extractive methods. According to a report presented to the 16th session of the UN Human Rights Council in 2011, more than 200,000 square kilometers of arable land are artificialized every year, while 100,000 square kilometers of arable land disappear due to soil decay and exhaustion.<sup>19</sup>

Finally, maritime and coastal areas are also affected. 40% of coastal ocean shelves, where many species feed and reproduce, are severely damaged: offshore, due to fishing methods such as deep-water trawling, and in coastal wetlands, due to the artificialization of these areas.

<sup>18</sup> Gilbert P., 2020, "Géomimétisme, réguler le changement climatique grâce à la nature", *Les Petits Matins*.

<sup>19</sup> De Schutter O., 2011, "Agroecology and the right to food", *Report presented to the 16th session of the UN Human Rights Council*.

In addition to the disappearance in surface, the fragmentation, mainly due to the development of infrastructure, particularly roads, leads to a loss of connectivity between habitats, which in effect become separate islands. In the short term, this fragmentation hampers access to food and/or breeding sites. A 2020 meta-study also concluded that more than 200 million animals (birds and mammals) were the direct victims of collisions every year in Europe.<sup>20</sup> In the medium and long term, the isolation of populations limits metapopulation exchanges,<sup>21</sup> which could lead to their disappearance.

As well as having a significant impact on the ability of species to evolve and maintain sufficient genetic diversity, land-use change also contributes to the degradation of the services provided by these ecosystems (see below), which have become less functional as a result. According to a 2014 study conducted under Costanza's direction, between 1997 and 2011, as a result of land use change and the subsequent degradation of ecosystem services,<sup>22</sup> the world lost between 4,000 and 20,000 billion dollars per year in the value of these services.<sup>23</sup>

<sup>20</sup> Grilo C., Koroleva E., Andrášik R., Bíl M., González-Suárez M., (August 2020), "Roadkill risk and population vulnerability in European birds and mammals", *Frontiers in Ecology and the Environment*, vol. 18, no. 6. <https://esajournals.onlinelibrary.wiley.com/doi/abs/10.1002/fee.2216>.

<sup>21</sup> In ecology, a population is a group of individuals of the same species living at a given time in a given area. A metapopulation is therefore built around the interactions between populations of the same species living in different given areas.

<sup>22</sup> Costanza R., de Groot R., Sutton P., van der Ploeg S., J. Andersson S., Kubiszewskia I., Farber, S, Turner R.K., may 2014, "Changes in the global value of ecosystem services", *Global Environmental Change*, Vol 26, Elsevier (Ed). <https://www.sciencedirect.com/science/article/abs/pii/S0959378014000685?via%3Dihub>.

<sup>23</sup> More specifically, between 1997 and 2011, changes in land cover generated a loss in the value of ecosystem services estimated at between 4,000 and 20,000 billion dollars. To this must be added between 6,000 and 11,000 billion dollars per year in losses of ecosystem services due to land degradation. OECD, *Financer la biodiversité, agir pour l'économie et les entreprises, résumé et synthèse préparés pour la Présidence française du G7 et la réunion of G7 Environment Ministers on 5 and 6 May 2019.*

## **b. Pollution**

The second pressure on biodiversity comes from pollution. This issue is the direct and exclusive consequence of human activities and affects all environments. A few examples of chemical pollution of aquatic environments, soils, air, marine environments and living organisms, will be presented, and the consequences of noise and light pollution on biodiversity will also be briefly discussed.

Nitrogen and phosphorus pollution, leading to eutrophication, is a prime example. An excess of nutrients from fertilizers or agricultural soil leaching, but also from wastewater, leads to a proliferation of aquatic plants (algae, for example) or cyanobacteria.<sup>24</sup> The decomposition of these algal blooms degrades water quality, notably by reducing the amount of oxygen available and producing sulfurous gases. This leads to the creation of “dead zones,” such as the Velje Fjord in Denmark, which has been considered as such since April 2024.<sup>25</sup> Cyanobacteria can also produce certain toxins that are dangerous to human and animal health. Green algae, the result of this anthropogenic over-fertilization of the environment, therefore has a major impact on ecosystems and health.

Excessive agricultural inputs also have a major impact on soils. The massive use of pesticides, a corollary of industrial production and monocultures, is drastically reducing the living population (organisms and micro-organisms) in the soil. While biodiversity and crop rotation help to break the reproduction cycles of pests, the use of pesticides hampers natural regulatory functions, increasing the use of inputs in a vicious circle. In addition to reducing soil fertility, toxic substances can contaminate water resources and accumulate throughout the food chain. Rachel

<sup>24</sup> *Unicellular or filamentous micro-organisms capable of photosynthesis. Definition taken from the Encyclopedia Universalis. <https://www.universalis.fr/encyclopédie/cyanobacteries-cyanophycees-algues-bleues/>.*

<sup>25</sup> *17% of the surface area of mainland Denmark is affected by this deoxygenation of the water, Danish Environment Agency.*

Carson, in her 1962 book *Silent Spring*, was one of the first to highlight the consequences of pesticide use on biodiversity and human health. DDT, an organochlorine insecticide, played a significant role in the massive decline of the peregrine falcon in North America between 1950 and 1960. At the top of the food chain, these birds of prey, were contaminated by their prey, accumulated large quantities of DDT, which interfered with their ability to fix the calcium essential for the synthesis of their eggshells. As a result, the females laid eggs with thinner shells that could not withstand the weight of the parents during incubation.<sup>26</sup>

In addition, acidification phenomena (a decrease in the pH of an environment), with variable causes, are multiplying and affecting a large number of environments and species, particularly oceanic ones. Ocean acidification is caused by an increase in the level of CO<sub>2</sub> in the water and has a significant impact on the construction and maintenance of the skeletons and calcareous shells of marine animals.<sup>27</sup> Once in contact with water, the CO<sub>2</sub> molecule is transformed into carbonic acid. Slower growth, thinner shells, reduced skeletal density – these are the consequences of ocean acidification. Taken to extremes, like white vinegar on limestone, this phenomenon can even lead to the dissolution of shells and other calcareous structures. In addition to its direct impact in terms of the decline or disappearance of a number of species, this acidification threatens marine biodiversity by destabilizing food chains. This disruption of marine ecological functions will have an impact on the food security of human communities. Finally, this decline in marine biodiversity is having an impact on climate change. Living organisms capture CO<sub>2</sub> when they build up their shells, which is then stored in anthozoans such as corals or sea anemones, or during the sedimentation of shells. However, when the shells

<sup>26</sup> *In addition to Rachel Carson's Silent Spring, Alan's travelogue is a good read. Tennant, In Flight, published by Gallmeister. He follows the migration of peregrine falcons from the Gulf of Mexico to the Arctic Circle, initially as part of a scientific program.*

<sup>27</sup> *Once in contact with water, the CO<sub>2</sub> molecule transforms and reduces the content of carbonate, which is essential for building the skeletal structures and shells of corals, mollusks and certain plankton.*

dissolve, they release the CO<sub>2</sub> that they had captured, meaning that the oceans no longer play their role as carbon sinks

Furthermore, the release of various molecules into the atmosphere leads to the acidification of rain and its deposition on the ground. Sulphur dioxide, mainly produced by the combustion of fossil fuels, nitrogen oxides, produced by high-temperature industrial combustion processes, and ammonia, produced by livestock farming, are the main culprits. Rain-fall acidifies aquatic and terrestrial ecosystems, reducing the capacity of plants to photosynthesize and of soils to absorb mineral salts. Sulphur dioxide also plays a role in the formation of fine particles, reducing air quality. Nitrogen oxides contribute to smog, the eutrophication of waterways and the formation of ground-level ozone. This powerful greenhouse gas accelerates climate change and also degrades air quality. Ammonia also contributes to the aforementioned eutrophication.

The ecotoxicity of substances reflects the overall harm and imbalances caused to ecosystems by the presence of heavy metals, pesticides such as neonicotinoids, industrial chemicals, and persistent organic pollutants (POPs), which include PFAS.<sup>28</sup> Often, these pollutants “degrade,” but POPs and PFAS, for example, persist in the environment, frequently combining low biodegradability with a high capacity for bioaccumulation. They are also capable of long-range dispersion in the environment.<sup>29</sup> The phenomenon of bioaccumulation is a major issue for biodiversity. A study carried out by the University of Aarhus on killer whales looked at concentrations of PCBs,<sup>30</sup> chemical compounds used as cooling fluids, lubricants for

<sup>28</sup> PFAS: *Per and Polyfluoroalkyl Substances. These are a family of synthetic chemical compounds containing carbon and fluorine molecules. These substances are chemically very stable, Polyfluoroalkyl. This is a family of synthetic chemical compounds containing fluorine and carbon. These substances, which are chemically very stable, have the following properties hydrophobic and lipophobic, which explains their common use in industrial products (clothing, cosmetics, kitchen utensils, etc.) from the 1940s onwards. The Stockholm Convention on POPs, adopted on 22 May 2001, does not classify all PFAS as POP.*

<sup>29</sup> *Bioaccumulation (progressive accumulation of toxic substances in organisms) and long distribution in the environment are the criteria used by the Convention. Stockholm Convention on POPs.*

electrical equipment or coatings for ships that were either banned or particularly regulated in the 1970s and 1980s. Even years later, PCBs are still found in the bodies of killer whales. Above a certain threshold, they affect their fertility. In some individuals, levels of up to 25 times this threshold have been found, with females contaminating their calves during gestation and suckling.<sup>31</sup> This study highlights the fact that secondary consumers, at the top of the food chain, including humans, accumulate very high levels of POPs, with risks for their health, their reproductive capacity and ultimately the survival of the species. The long-term persistence of these substances in the environment is also a cause for concern.

Finally, disturbances such as light and noise pollution can disrupt the natural functioning of ecosystems. The circadian cycle is a major marker for species as it regulates physiological functions such as sleep, feeding, and reproduction. Behaviors can also be altered: prey hidden in darkness become vulnerable in environments that are illuminated most of the time. Everyone has observed the attraction artificial light has on insects. An increased mortality rate of this essential link in the food chain and pollination process has significant consequences, including for humans. Light pollution also directly impacts orientation, and therefore the survival of species. For example, young turtles struggle to reach the sea when beaches are illuminated. Artificial lighting can divert migratory birds from their paths or lead to collisions with buildings.

In 2017, nearly 400 migratory birds were blinded by the lights on the tallest building in the city of Galveston, Texas, and died after colliding with it. Since then, a campaign called "Lights Out Texas" has been promoting a reduction or switching off of building lights during migration periods.

<sup>30</sup> PCB: polychlorinated biphenyls. This is a group of synthetic chemical compounds that have a similar structure but different degrees of chlorination. They are insoluble in water, colorless or yellowish, with a strong aromatic odor, highly stable to heat and inert chemically, making them less sensitive to acids, bases and oxidants.

<sup>31</sup> Desforges J-P., et al., "Predicting global killer whale population collapse from PCB pollution.", *Science*, no. 361. <https://www.science.org/doi/10.1126/science.aat1953>.

As for plants, their growth and/or reproduction often depend on natural light cycles and can be affected by light pollution.

A similar argument could be made as to the consequences of noise pollution on marine species. Physiological reactions have been observed in the form of delayed growth, increased stress levels and respiration rates, reactions due to acoustic masking resulting in an inability to communicate with conspecifics, disorientation of individuals and an inability to locate prey. Behavioral reactions, such as changes in migratory trajectory and temporary physiological damage (reduced hearing capacity, for example) or permanent damage, generally resulting in the death of the animal, have also been observed.

Therefore pollution, which affects all ecosystems, has an impact on biodiversity, much of which has yet to be studied further.

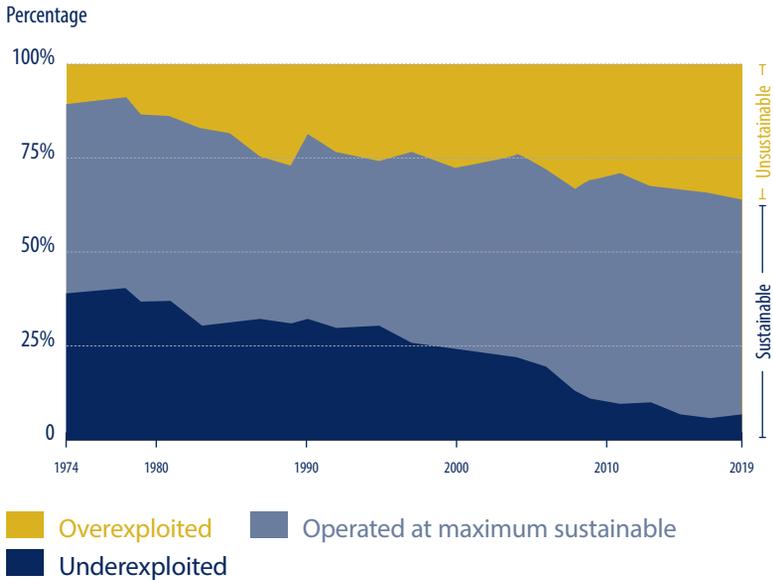
### c. Overexploited Resources

The third pressure comes from the overexploitation of resources, which destroys certain ecosystems and/or leads to competition between humans and other living organisms for access to resources. The concept of resource exploitation, which reflects the direct exploitation of living organisms, encompasses the harvesting of animals, plants and other organisms (e.g., collecting, logging, hunting and fishing). Living resources are, by definition, renewable, but this renewal depends on harmonious exploitation thresholds that must not be exceeded.

The exploitation of fisheries resources is a good illustration of this phenomenon. Worldwide, 93% of fish stocks are fully exploited and 35% are overexploited.<sup>32</sup>

<sup>32</sup> IPBES, 2019, "Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services", E. S. Brondizio, J. Settele, S. Díaz and H. T. Ngo (editors).

**Figure 3: Trends in World Fish Stocks**  
(1974-2019)



Source: FAO. 2022. *Summary of The State of World Fisheries and Aquaculture 2022. Towards a blue transformation.* Rome, FAO.

As early as 1955, in order to provide governments with a framework for sustainable fisheries management, the United Nations conceptualized “maximum sustainable yield (MSY)”. In the context of the 1982 Montego Bay Convention, MSY is defined as “the greatest quantity of biomass that can be extracted from a fish stock, on average and over the long term, under given environmental conditions and for given exploitation characteristics (fishing gear and mesh sizes)”. The Convention states that governments have the right and duty to ensure “MSY management” of the fishery resources in their exclusive economic zones.<sup>33</sup> However, the latest report on the state of world fisheries and aquaculture produced by

the FAO in 2022 shows that the proportion of fish stocks exploited at a biologically sustainable level fell between 1974 and 2019 (-35 points) to 64.6% of stocks. Of these, 57.3% of stocks are exploited at a maximum sustainable level, with a disparity between species: 2/3 of the most commonly landed species are managed in a biologically sustainable way, which is an improvement from 2017.

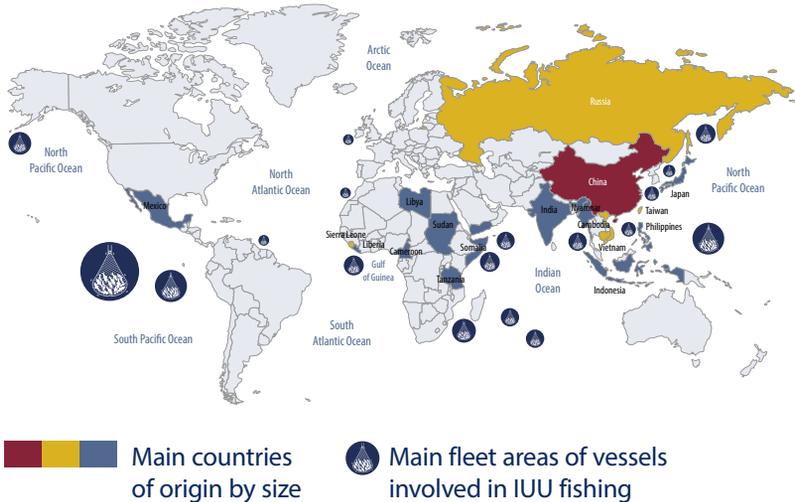
Recovery of overexploited stocks is made possible by scientific assessment and an effective regulatory framework promoting sustainable management based on ecosystems and incorporating the concept of maximum sustainable yield, making it possible to ensure production and improve food safety and quality, illustrating the co-benefits of preserving biodiversity.

Compliance with quotas is enshrined in the United Nations Convention on the Law of the Sea and in the implementation plan for the 2002 Johannesburg Summit. However, the scale of fraud still limits the “blue transformation” that the FAO is calling for. A study showed that, in 2001, China declared only 10% of what it caught in the international oceans.<sup>34</sup> Illegal, unreported and unregulated (IUU) fishing is a major threat to marine ecosystems.

<sup>33</sup> Gascuel D., 2019, “Overexploitation and sustainable fishing: what is at stake now and in the future?”, Scientific file of the Ocean and Climate Platform. <https://ocean-climate.org/wp-content/uploads/2020/01/8.-Surexploitation-et-p%C3%Aache-durable...-Fiches-S-2019.pdf>.

<sup>34</sup> Watson R., Pang L., et Pauly D., 2001, “The Marine Fisheries of China: Development and Reported Catches”, Faculty Research and Publications. R, Fisheries Centre, University of British Columbia. <https://open.library.ubc.ca/soa/cIRcle/collections/facultyresearchandpublications/52383/items/1.0348129>.

**Figure 4: Illegal, Unreported and Unregulated (IUU) Fishing Worldwide**



*Source: Centre d'études stratégiques de la Marine, "La pêche illégale, non déclarée et non réglementée", Brève Marine, no. 242, may 2021.*

According to the IPBES, illegal fishing accounts for 30% of the world's total catches. The example of Chinese industrial fishing is just one aspect of this practice: small-scale fishing, particularly on the coasts of West Africa, Asia and in the waters of French Guyana, is also affected. The consequences of IUU fishing are particularly damaging and can thwart protective measures (quotas, fishing bans, marine protected areas, etc.). It also has a paradoxical economic and social impact on local communities, who see their resources and food security diminish, especially considering the fact that fishing is the main source of animal protein for more than three billion human beings and that 10% of the world's population depends exclusively on the oceans for their livelihood.

In addition, the annual loss of revenue generated by IUU fishing for legal fishing is estimated at between 26 and 50 billion dollars. Thus, while combating IUU (Illegal, Unreported, and Unregulated) fishing is crucial for the preservation of marine biodiversity, it is equally crucial for economic and food security.

In addition, the fight against the overexploitation of wild species can be made more difficult by what French researcher Franck Courchamp calls the “anthropogenic Allee effect.”<sup>35</sup> Contrary to what one might expect, declaring a species to be rare does not guarantee that people will take action to preserve it. On the contrary, the irrational attraction of rarity “could accelerate the desire to capture, collect, appropriate and observe it, thereby hastening its extinction.”<sup>36</sup>

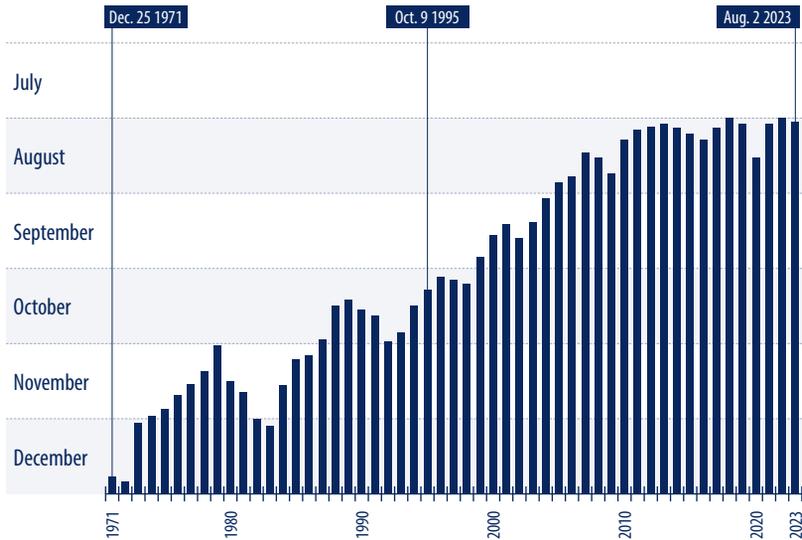
The concept of Earth Overshoot Day can be useful for visualizing resource consumption in relation to the population. The dynamics of resource renewal are essentially considered via the reconstitution and production of resources per ecosystem surface area and the capture of CO<sub>2</sub> emitted. Established by the Global Footprint Network, this tool refers to the day of the year on which humanity would have used all the resources that the planet is capable of regenerating in one year. There is some criticism of this tool, which should be seen as an educational tool for the general public, based on aggregations by national surface area, modelling assumptions and generalizations that only partially illustrate a complex and multifactorial reality. It is nevertheless a good way of raising awareness about the disparate pressures exerted by human societies on Earth’s resources.

<sup>35</sup> *The Allee effect was described in 1931 and bears the name of its author: Warder Clyde Allee. The Allee effect in a population is characterized by a decrease in its growth rate as the population size decreases, and vice versa. This principle contradicts the commonly held belief that smaller population sizes should lead to higher growth rates due to reduced competition within the species.*

<sup>36</sup> *Courchamp F., “Comprendre les activités humaines sur la biodiversité, Portrait de chercheur”, septembre 2022, Université de Paris Saclay. <https://www.universite-paris-saclay.fr/actualites/franck-courchamp-comprendre-limpact-des-activites-humaines-sur-la-biodiversite>.*

As the graph below shows, the Earth Overshoot Day has moved steadily forward, from 25 December in 1971 to 2 August last year.

**Figure 5: The Progression of Earth Overshoot Day Over the Years**  
 (Proportion of the year remaining after Earth Overshoot Day from 1971 to 2023<sup>37</sup>)



Source: <https://fr.statista.com/infographie/22657/progression-jour-du-depassement-mondial/>.

<sup>37</sup> Earth Overshoot Day: date on which humanity is supposed to have consumed all the renewable resources that the planet is capable of regenerating in one year.

#### d. Invasive Alien Species

The fourth pressure is exerted by invasive alien species (IAS), which are organisms introduced, intentionally or unintentionally, outside their natural habitat. The European Council's strategy on IAS gives the following definition: "a species, subspecies or lower taxon introduced outside its natural past or present distribution". More specifically, the European regulation defines an IAS as "an alien species whose introduction or spread has been found to threaten or adversely impact upon biodiversity and related ecosystem services," particularly in the absence of predators or natural competitors or because of its very rapid reproductive capacity.

The movement of species is a natural phenomenon. For example, it seems highly likely that the first snails to settle in Hawaii were transported by seabirds.<sup>38</sup> Similarly, fish can be found in high-altitude lakes, transported by climatic phenomena known as "fish showers." However, globalization has greatly accelerated the movement of species from one part of the planet to another, taking them across natural barriers. World trade, deforestation, shipping (with its 12 million tons of seawater of all origins dumped in ports every year by supertankers), aquaculture, ornamentation and the deliberate release of household pets provide numerous opportunities for new species to settle outside their native environment, with serious consequences for ecosystems and biodiversity.

IAS can compete with native species for resources in environments that are already under pressure. One example is the round goby, which poses a threat to freshwater fish, with which it competes for food resources and breeding grounds. Introduced to North America, probably via ballast water, and initially originating from the Azov, Caspian and Black Seas, it has developed widely there and is the subject of a specific management policy.

<sup>38</sup> For a fuller development of the subject see van Dooren T., Gabriel Cohen A., 2018, "The Worlds of Snails." <https://hal.science/hal-04046131/document>.

Furthermore, invasive alien species can introduce a new form of predation to which local species are not adapted, as seen with the Asian hornet preying on bees and other flying insects. IAS can also modify habitats, as is the case with Japanese knotweed. Introduced to Europe for ornamental purposes in the 19th century, this plant forms dense colonies, usually monospecific, which choke out the local flora.

Although it is still largely unknown to the general public and remains underestimated, this pressure is gaining attention.

In autumn 2023,<sup>39</sup> and with the aim of synthesizing scientific knowledge on this pressure, the IPBES produced a report on the subject from which the following key figures can be drawn:

- 200 new exotic species are recorded each year.
- More than 37,000 exotic species have been introduced by human activity.
- 3,500 of these species have documented negative impacts, with invasiveness varying from taxon to taxon.

These effects are particularly detrimental to island regions. According to the IUCN, “invasive alien species are involved in 60% of documented global species extinctions, and 90% of these extinctions occur on islands,”<sup>40</sup> as noted in a 2018 study.<sup>41</sup> The introduction of the brown rat on the island of Lundy has had devastating consequences for seabird colonies, and in particular for English Shearwaters and Puffins. After the collapse of the colonies (of 3,500 pairs of English Shearwater in 1939, only 297 pairs

<sup>39</sup> IPBES, 2023, *Summary for Policymakers of the Thematic Assessment Report on Invasive Alien Species and their Control of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*. Roy H. E., Pauchard A., Stoett P., Renard Truong T., Bacher S., Galil B. S., Hulme P. E., Ikeda T., Sankaran K. V., McGeoch M. A., Meyerson L. A., Nuñez M. A., Ordonez A., Rahlao S. J., Schwindt E., Seebens H., Sheppard A. W., and Vandvik V. (eds.). IPBES secretariat. <https://www.ipbes.net/ias>.

<sup>40</sup> IUCN. <https://iucn.fr/ipbes-premiere-evaluation-mondiale-sur-les-especes-exotiques-envahissantes/>.

<sup>41</sup> Leclerc C., Courchamp F. et Bellard C., (2018), “Insular threat associations within taxa worldwide”, *Scientific Reports*, 8.

remained in 2001), a brown rat eradication campaign was carried out. The campaign was a success, as no rodents have been seen in the area since 2006 and the bird colonies have since recovered.<sup>42</sup>

While the consequences of IAS on ecosystems are increasingly well documented from a scientific point of view, the economic consequences are still barely taken into account in analyses. However, a study published in *Nature* in 2021 estimated the economic cost of invasive species at 1,288 billion dollars over the last fifty years, and rising rapidly by a factor of three per decade.<sup>43</sup> The IUCN estimates the global economic cost of invasive species at more than €390 billion in 2019, focusing on the damage they cause. The main sectors affected are agriculture, forestry, health and aquatic resources.<sup>44</sup>

#### e. Climate Change, an Overpressure

Climate change and biodiversity loss are two interconnected phenomena that influence each other. Climate change accentuates the loss of biodiversity by rapidly altering ecosystems and the distribution of species. At the same time, the loss of biodiversity accelerates the effects of climate change: carbon sinks such as oceans, peat bogs, grasslands and forests, for example, are degraded and absorb less and less CO<sub>2</sub>. The concept of feedback loops, which will be discussed later, is essential to understanding the fundamental reciprocity of these two crises.

<sup>42</sup> Barkham P., May 28, 2019, "Seabirds treble on Lundy after island is declared rat-free", *The Guardian*. <https://www.theguardian.com/environment/2019/may/28/seabirds-treble-on-lundy-after-island-is-declared-rat-free>.

<sup>43</sup> Digne C, Leroy B, Vaissière A-C. et al, 2021, "High and rising economic costs of biological invasions worldwide", *Nature*, no. 592, quoted by Vonlanthen M., (2023), "La biodiversité, l'autre crise écologique", *Savoir Suisse, Presses Polytechniques et Universitaires Romandes*.

<sup>44</sup> IUCN, September 2021, "The economic costs of invasive alien species: a burden on society". [https://especes-envahissantes-outramer.fr/wp-content/uploads/2021/10/fiche\\_synthese\\_couts\\_economiques\\_eee.pdf](https://especes-envahissantes-outramer.fr/wp-content/uploads/2021/10/fiche_synthese_couts_economiques_eee.pdf).

Indeed, while biodiversity loss has so far been predominantly caused by the first four pressures, with measurable consequences for which we have some historical perspective, we are now shifting into a state of “super-crisis” related to the fifth pressure – climate change, sometimes referred to as an “overpressure.” This amplifies the other four pressures and complicates our capacity for modeling. A study published at the end of April 2024 concludes that land use changes have been the primary driver of biodiversity decline during the 20th century. However, climate change is playing an increasingly significant role and, according to projections, could become the leading cause of biodiversity loss globally.<sup>45</sup>

Climate change directly results in the destruction and fragmentation of habitats, as well as the depletion of food sources that species rely on due to heatwaves and droughts, which increase the risk of wildfires and lead to an expansion of arid and semi-arid lands by an estimated 5 to 8% by 2080, according to the IPCC’s 4th report.<sup>46</sup>

It is also the cause of an increase in extreme weather events (storms, rain, floods), which can lead to the disappearance of species: in Costa Rica, the disappearance of the golden toad in the 1990s was directly linked to flooding. Australian bushfires have led to the death or displacement of 3 billion animals in 2019-2020.<sup>47</sup>

Climate change is also forcing species to migrate, either because their food or water resources are becoming more scarce, or because they are forced to migrate northwards or to higher altitudes to find living

<sup>45</sup> M. Pereira H. et al., April 2024, “Global trends and scenarios for terrestrial biodiversity and ecosystem services from 1900 to 2050”. *Science*, no. 384. <https://www.science.org/doi/10.1126/science.adn3441>.

<sup>46</sup> WWF, 2015, “Impact of climate change on species”. [https://www.wwf.fr/sites/default/files/doc-2017-07/151110\\_rapport\\_les\\_impacts\\_du\\_changement\\_climatique\\_sur\\_les\\_especes.pdf](https://www.wwf.fr/sites/default/files/doc-2017-07/151110_rapport_les_impacts_du_changement_climatique_sur_les_especes.pdf).

<sup>47</sup> WWF, 2020, “Impacts of the unprecedented 2019-2020 bushfires on Australian animals”. [https://assets.wwf.org.au/image/upload/v1/website-media/resources/WWF\\_Impacts-of-the-unprecedented-2019-2020-bushfires-on-Australian-animals](https://assets.wwf.org.au/image/upload/v1/website-media/resources/WWF_Impacts-of-the-unprecedented-2019-2020-bushfires-on-Australian-animals).

conditions that are conducive to their survival. According to the French Muséum national d'histoire naturelle,<sup>48</sup> birds have shifted 90 km northwards over the past twenty years, while mountain forests have moved 30 meters upward in elevation over the last fifty years. These migrations lead to disease and imbalances in the food chain, with migratory species becoming invasive species for the new ecosystems in which they settle. In addition, these movements increase competition between species, which is also a vector for extinction in itself, and the transmission of zoonoses. Seasonal disturbances also have an impact on vegetation recovery periods (budding, flowering, fruit ripening) and the synchrony of cycles between animal and plant species (hibernation, birth and reproduction periods), which can reduce the amount of food available or disrupt the relationship between plants and their pollinators.

Climate change also influences the evolution of species. If it occurs too rapidly for some species to adapt through natural selection, others are biologically affected, experiencing changes in size or physiology. For example, turtle eggs develop into females when temperatures exceed 31°C, causing demographic imbalances that compromise their reproductive capacity. In the northern Great Barrier Reef, 87% of turtles are now female.

The IPCC estimates that if global warming exceeds +2°C by the end of the century, 18% of all terrestrial species will be at high risk of extinction, while if it reaches +4.5°C, around half of all recorded plant and animal species will be threatened. This situation is particularly critical in biodiversity hotspots, where up to 100% of endemic species living exclusively in these regions will be threatened with extinction.<sup>49</sup>

<sup>48</sup> MNHN, “Le Muséum face aux enjeux climatiques”. <https://www.mnhn.fr/fr/le-museum-face-aux-enjeux-climatiques>.

<sup>49</sup> IPCC, 2022, “Climate Change 2022: Impacts, Adaptation, and Vulnerability”, Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Pörtner H-O., Roberts DC., Tignor M., Poloczanska ES., Mintenbeck K., Alegría A., et al., editors. Cambridge University Press.

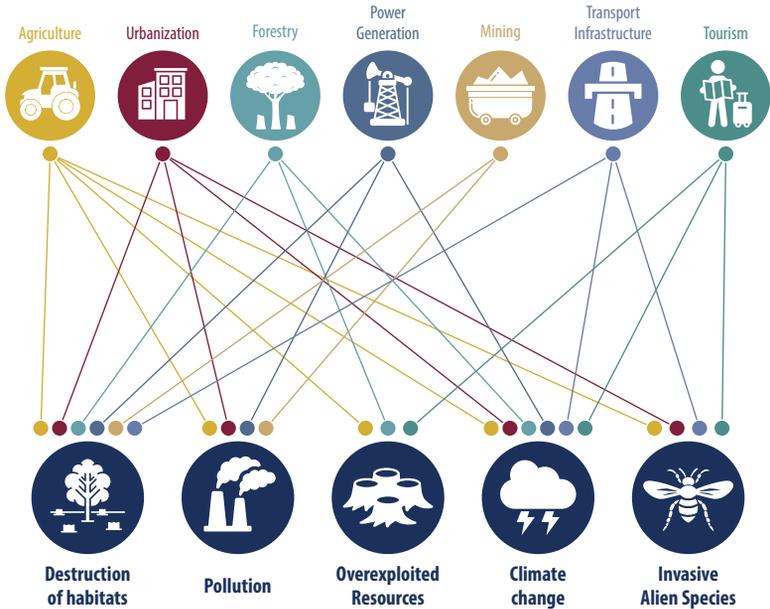
Lastly, the drying up of water bodies and the reduction in river flow increase the concentration of pollution.

Natural productivity, stimulated by near-tropical rainfall, increased temperatures and rising CO<sub>2</sub> levels, might in places seem like an opportunity for biodiversity. But by upsetting highly specialized species or encouraging the spread of opportunistic pests, these rapid changes are having the opposite effect.

Moreover, the increased growth of lianas, linked to rising CO<sub>2</sub> levels, is causing some fragile forests to collapse in on themselves.

In short, climate change is also disrupting the scientific framework within which we currently understand biodiversity loss, hindering our ability to accurately predict the consequences.

**Figure 6: Main Human Activities and Pressures on Biodiversity**  
 Operations Production Operations Infrastructure



*Source: Emmanuelle Porcher, Biodiversity and Ecosystems Chair, Inaugural lecture "Plant-pollinator interactions, a showcase for the biodiversity crisis", Collège de France, 18 January 2024*

The 2015 Paris Agreement established a trajectory to address this pressure. The numerous public policies and corporate action plans that followed are not the primary focus of this report. However, the synergies between biodiversity conservation and climate change mitigation will be examined.

Overall, the IPBES estimates that these first two pressures alone, changes in land and sea use and pollution, are responsible for most of the

biodiversity loss. The remaining third is due to three other factors directly linked to human activities: overexploitation of resources, climate change and the proliferation of invasive alien species. This order of magnitude is useful for analysis but should be nuanced based on the ecosystems studied. It is also important to stress the need for further scientific research into the consequences of human pressures on marine ecosystems, which are less well understood than terrestrial or aquatic ecosystems.

A common understanding of the five pressures is essential for anyone aiming to produce an operational analysis related to biodiversity. Therefore, our study will not focus on biodiversity itself but rather on the pressures it faces and ways to alleviate them. The consequences for biodiversity extend far beyond the loss of individual species. Since these pressures impact resource quality and quantity, as well as the health of ecosystems, each pressure diminishes their functional capacities, ultimately affecting human societies.

**1.2. FRAMEWORK 2:  
PLANETARY BOUNDARIES,  
THE LAST RED LINE?**

*“On a cosmic scale, liquid water is rarer than gold. For life, it is infinitely more precious.”*

Hubert Reeves

**a. Planetary Boundaries:  
Genesis of a Concept**

After outlining the main factors affecting biodiversity, we need to take into account certain critical thresholds beyond which Earth's habitability for human beings will no longer be guaranteed. The concept of planetary boundaries, defined in 2009 by an international team of researchers and adopted by the Stockholm Resilience Center, identifies nine biogeophysical processes necessary for the stability and resilience of the planetary system. This framework has been developed to provide decision-makers with a clear understanding of the evolution of the “Earth system” as a whole and the interconnection between these various issues.

For each of the defined planetary boundaries, the research group from the Stockholm Resilience Center has established three zones: a safe operating space that maintains viable conditions for evolution, a zone of uncertainty, and a high-risk zone.

Figure 7: The 9 Planetary Boundaries



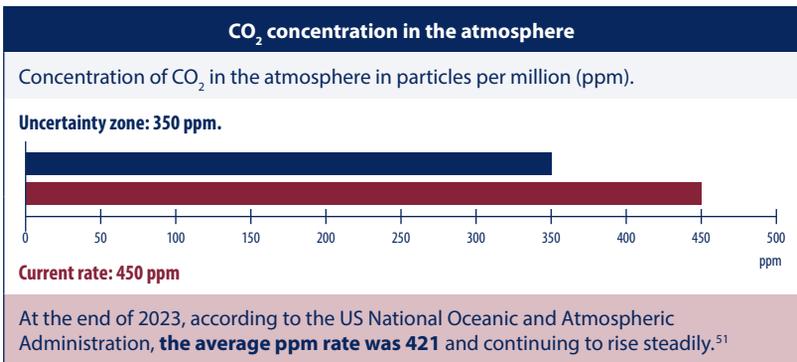
Source: based on the framework published by the Stockholm Resilience Center in September 2023.

Aside from the planetary boundary “Biodiversity Loss” presented separately, we have chosen in this report to interlink the five pressures and the planetary boundaries.<sup>50</sup>

## Biodiversity Loss

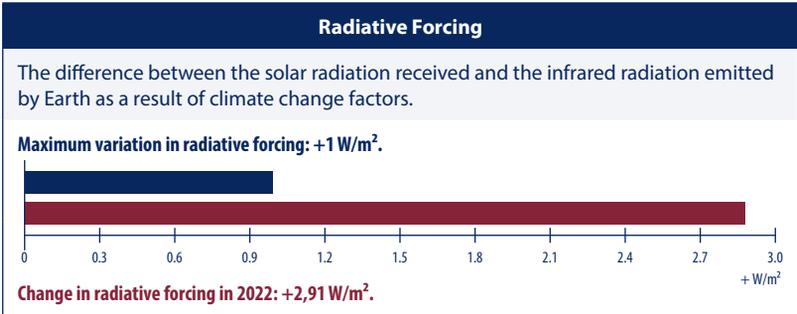
Introduction of new entities into the environment	
<p><b>Criteria:</b> Species extinction rate per million species per year and Biosphere Integrity Index (BII).</p> <p>Evolution since the pre-industrial era: Changes in population abundance by biome, major region or large ecosystem.</p>	<p><b>Critical threshold</b> L'IIB ne doit pas être inférieur à 90%.</p> <p> <b>Current threshold:</b> the boundary was crossed in 2009, with 100 extinctions per million species.</p>

## Climate Change

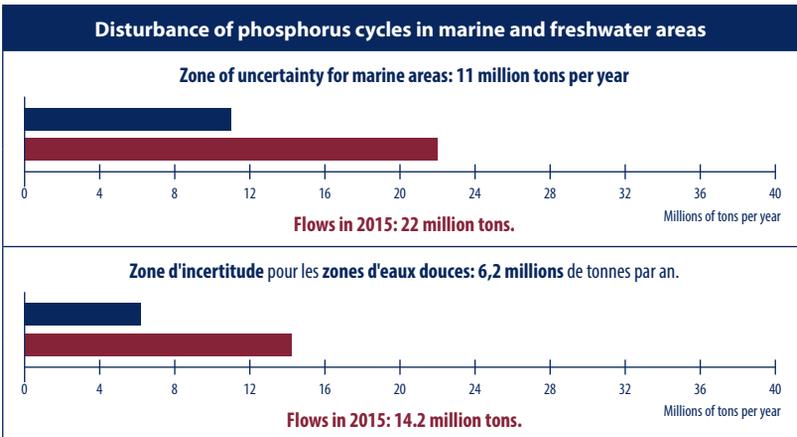
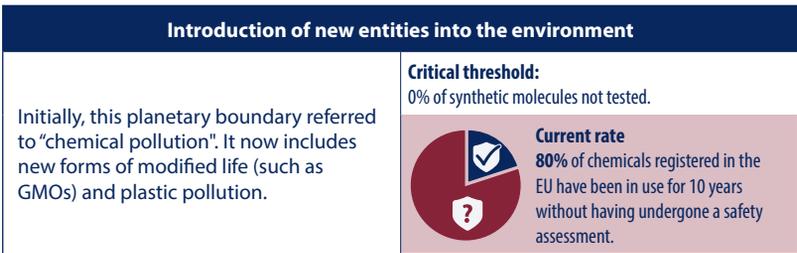


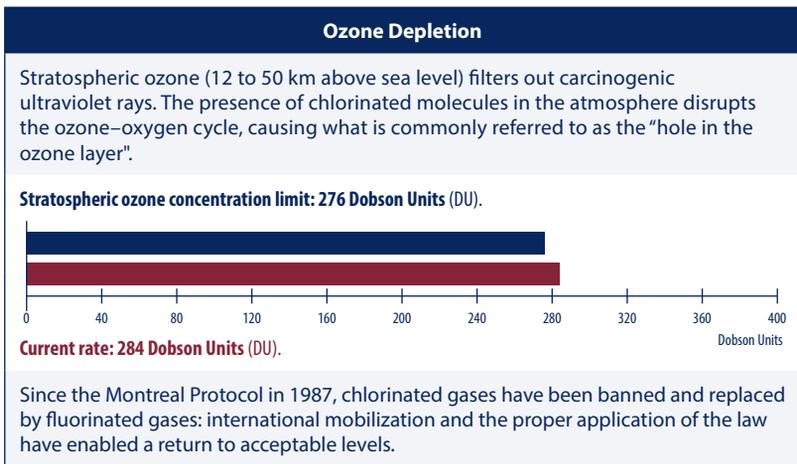
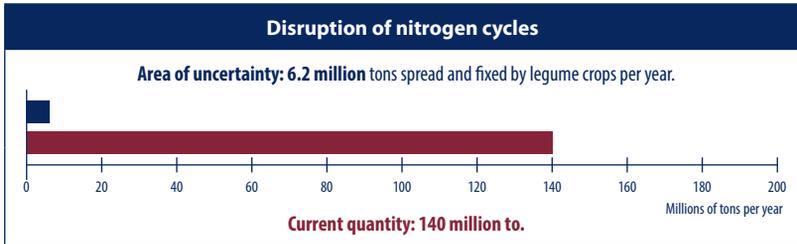
<sup>50</sup> Richardson K. et al., 13 September 2023, “Earth beyond six of nine planetary boundaries”, *Science Advances*, vol. 9, no. 37. <https://www.science.org/doi/10.1126/sciadv.adh2458>.

<sup>51</sup> Global Monitoring Laboratory, Trends in Atmospheric Carbon Dioxide. <https://gml.noaa.gov/ccgg/trends/global.html>.

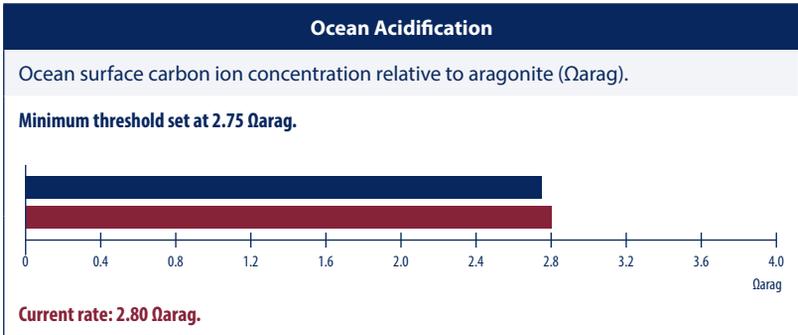


## Pollution

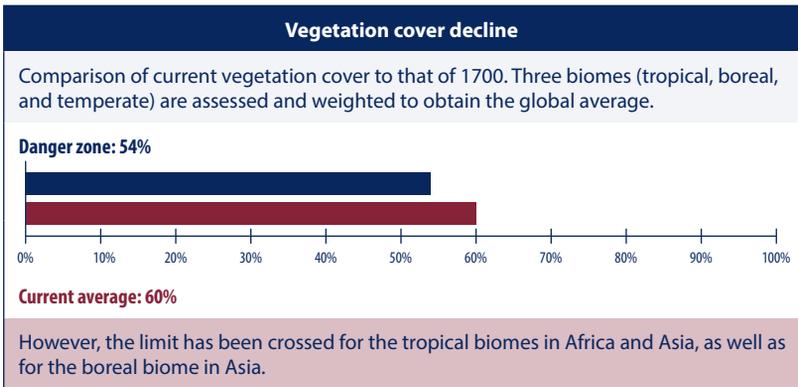




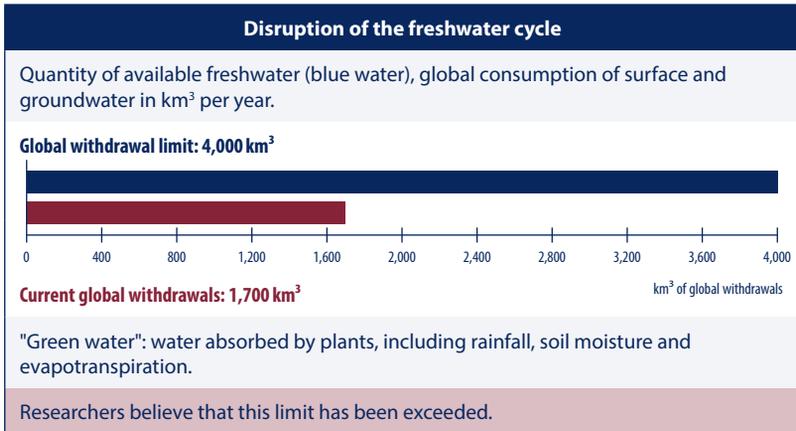
Quantity of Airborne Particles	
<p>It is expressed in terms of the <b>optical charge of aerosols</b>.</p>	<p><b>Current threshold:</b>            not quantified at global level but exceeded at regional level.</p>



## Land Use Change and Climate Change



## Overexploited Resources, Climate Change and Pollution



This analytical framework is intended to guide the sustainable management of natural resources. It evolves in line with scientific knowledge. For example, in the 2023 version of the study on planetary boundaries, published in the journal *Nature*,<sup>52</sup> the authors reformulated certain boundaries and defined two new ones linked to biodiversity. In their view, to maintain Earth's habitability, between 50 and 60% of the world's land surface should be covered by largely intact natural ecosystems (terrestrial and marine). In addition, all land managed by humans should contain at least 20-25% of diversified semi-natural habitats. These studies emphasize the need to preserve and restore critical natural ecosystems and to reintroduce nature into anthropized areas on a local scale.

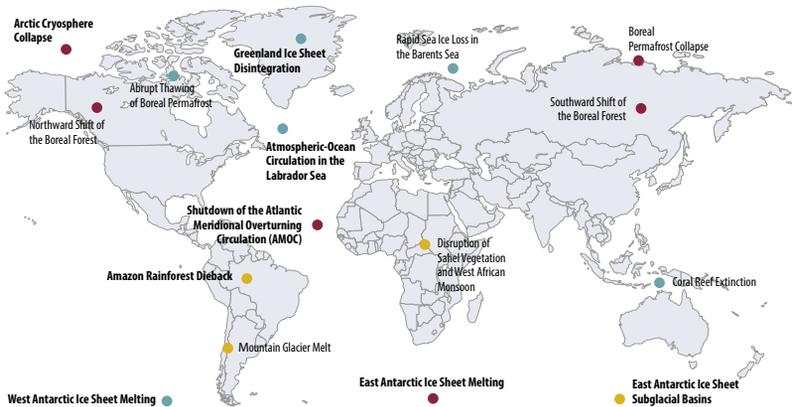
The concept of planetary boundaries makes it possible to map the planet's situation at a given moment in relation to habitability thresholds, and highlights the acceleration of threshold breaches. However, exceeding

<sup>52</sup> Rockström J., Gupta J., Qin D. et al., 2023, "Safe and just Earth system boundaries". *Nature*, 619. <https://www.nature.com/articles/s41586-023-06083-8>.

one threshold says nothing about the consequences for other planetary thresholds. To complete the picture, we need to introduce the notion of “points of no return” or “tipping points”.

The IPCC defines the point of no return as a threshold “beyond which a system often reorganizes itself abruptly and/or irreversibly”. When these tipping points are crossed, they in turn generate chain reactions that contribute to climate change: these are the feedback loops. Initially developed in the context of climate change, these points of no return apply to biodiversity. The 16 tipping points identified by the IPCC are illustrated on the map below.

Figure 8: Climate Tipping Points  
(based on global temperature rise)



Rising temperatures:

- Less than 2°C
  - 2 to 4°C
  - More than 4°C
- xxxx: regional point of no return      XXXX: global point of no return

Source: Blind Kempinski F., 21 November 2022, “Réchauffement: ces 16 points de bascule qui nous menacent”, Les Echos. <https://www.lesechos.fr/weekend/planete/rechauffement-ces-16-points-de-rupture-qui-nous-menacent-1915458>.

The IPCC estimates that all coral reefs would disappear with a 2°C increase in temperature. Although corals cover only 0.2% of the ocean's surface, they provide essential habitats, serving as breeding grounds, nurseries, and protection against predators for 30% of marine biodiversity. Additionally, 500 million people directly depend on corals for their livelihoods through fishing, not to mention the income generated by tourism. By absorbing wave energy, corals also help mitigate coastal erosion and reduce storm damage. Moreover, corals and humans share common genetic heritage. One coral species has a 48% genetic similarity with humans, presenting significant potential for medical research. In comparison, the genetic similarity of the widely used lab species, the fruit fly (*Drosophila*), is only 8%.<sup>53</sup>

Taken together, the three concepts of planetary boundaries, tipping points and feedback loops establish the geophysical framework necessary to sustain human life and the risks associated with environmental change.<sup>54</sup> They underline the interconnectedness of our planetary system and call for holistic analysis and action plans.

Indeed, these concepts are not just scientific notions; they also serve as a reminder that exceeding certain boundaries and the acceleration of extreme physical events jeopardize, in the very short term, the living conditions of certain populations, especially in developing countries. These communities are directly confronted with the degradation of their living conditions due to climate change, pollution, floods, and resource scarcity. While the concept of planetary boundaries indicates a ceiling that should not be exceeded, it also raises the question of a social foundation that ensures everyone has a decent standard of living and equitable access to ecosystem services. It is therefore crucial to align the social

<sup>53</sup> Monaco Oceanographic Institute.

<sup>54</sup> *Feedback loops are chain reactions resulting from climate disruption and climate change that contribute to speeding it up. 27 feedback loops have been identified by the scientists: melting permafrost, drying peat bogs and forest fires that release greenhouse gases into the atmosphere are just some examples.*

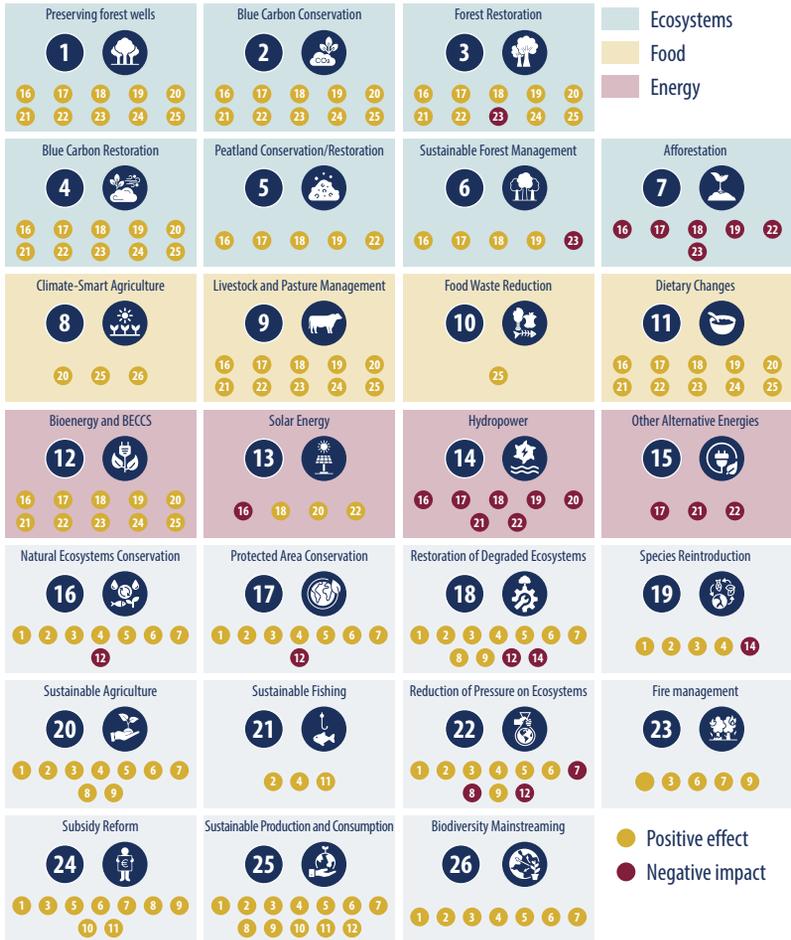
foundation of human rights with the ceiling of planetary boundaries, as they are interdependent, with the latter forming the very basis of the former.

The challenge is therefore twofold, but as illustrated by Kate Raworth in her Doughnut Theory, it should enable socially just and ecologically sustainable development. In her book, she advocates for a shift from the predominant linear economy, which focuses on GDP growth, to a circular economy that, without relying on degrowth, adopts a sustainable and inclusive approach aimed at reconciling human well-being with environmental protection. The doughnut is created by juxtaposing two discs that define the boundaries of this economic model: on one hand, a social foundation representing social indicators essential for well-being, based on the United Nations' Sustainable Development Goals; and on the other, an environmental ceiling indicating the nine planetary boundaries that must not be crossed to ensure environmental preservation. The area between these two boundaries forms the "safe and just space for humanity," which represents an optimal balance between social and environmental considerations. This approach emphasizes the need to address these issues holistically, without setting them against each other.

## **b. Climate and Biodiversity: Synergies to Develop**

While climate issues long remained on the periphery of environmental policies, they have gained such prominence since the 1980s that they now dominate the environmental debate. This predominance of climate change over all other environmental considerations often traps public and private stakeholders in siloed thinking, constrained by regulations, which can lead to counterproductive decisions from a biodiversity perspective and can have significant social impacts, particularly on the most vulnerable. There is still a strong tendency to address these two issues in isolation, especially since there is no universal biodiversity indicator comparable to tCO<sub>2</sub>e and there is a significant legislative and regulatory bias in favor of climate. However, while the vast majority of solutions provide co-benefits for addressing both crises and biodiversity-friendly solutions are generally beneficial for the climate as well, the IPBES report reminds us that the reverse is not necessarily true, as illustrated by Figure 9 on the following page.

Figure 9: Some Examples of Climate Action and its Impact on Biodiversity<sup>55</sup>



Source: IPBES-IPCC co-sponsored workshop report on biodiversity and climate change, 2021.

<sup>55</sup> This pattern is likely to change as certain solutions are scaled up. Interactions are also likely to change as a result of unforeseen positive or negative effects.

Historically, environmental protection emerged from concerns about hygiene and the desire to safeguard populations from local nuisances. It reflects a vigilance, even a degree of mistrust, towards certain activities considered dangerous or unhealthy.

The protection of resources, which forms the foundation of environmental law, dates back even further. For instance, in France in 1302, royal decrees aimed to reconcile the various possible uses of the forest but, more importantly, to ensure the sustainability of an economic resource.

With the creation of the IPCC in 1988, environmental policies have often adopted a somewhat narrow approach, prioritizing CO<sub>2</sub> equivalent (tCO<sub>2</sub>e) as the primary, if not sole, metric. Energy criteria dominate, while other equally fundamental issues, such as pollution control, resource use, and land-use change, are neglected. However, the IPCC emphasizes the crucial role of terrestrial vegetation, which absorbs 30% of anthropogenic carbon annually. Despite the recognition of biodiversity as a means of mitigating climate change, it remains under-analyzed, often reduced to this single role or simply overlooked. The shift from the concept of “nature” to the broader notion of “biodiversity” reflects an evolution from a case-by-case protection logic to a comprehensive approach to interactions. Thus, climate and biodiversity intersect: combating climate change is a precursor and integral part of the fight against biodiversity loss.

Climate and biodiversity co-benefits are real: in the previously mentioned joint report,<sup>66</sup> published in 2021, the IPBES and the IPCC emphasize that solutions that simultaneously address the dual crises of climate and biodiversity create fruitful synergies.

Biodiversity plays a crucial role in the fight against climate change. It contributes directly to the resilience of ecosystems, facilitates carbon

<sup>66</sup> IPBES-IPCC, (2021), *Co-sponsored workshop report on biodiversity and climate change*, IPBES and IPCC. <https://zenodo.org/records/4920414>.

storage and supports ecosystem services. In addition to the forests previously mentioned, mangroves, grasslands and wetlands are natural carbon sinks: plant biomass and soils store large quantities of CO<sub>2</sub>. For example, mangroves, found in tropical and subtropical coastal areas, sequester up to four times more carbon per hectare than terrestrial forests. As for peat bogs, which account for just 3% of Earth's surface, they store twice as much carbon as all the world's forests. The "Central Cuvette", the largest peatland area in the world located in the Congo Basin, contains almost 30 gigatons of carbon, equivalent to the CO<sub>2</sub> emissions of the United States for 15 years.<sup>57</sup> Generally speaking, in addition to their capacity to sequester carbon, wetlands contribute to the resilience of ecosystems and therefore limit the negative consequences of climate change for human communities. They mitigate flooding by absorbing water during periods of heavy rainfall while limiting the risk of drought, and filter pollutants and nutrients. Mangroves and other salt marches also protect coastlines from decay while reducing the impact of storms. The mangroves of the Sundarbans in India and Bangladesh, a Ramsar zone, biosphere reserve and UNESCO World Heritage Site, offer natural protection against cyclones.

In addition, a high level of biodiversity means that environments are more resilient and recover more quickly from disturbances. In grasslands, for example, different plant species contribute to the stability of the ecosystem by exploiting different soil layers for water and nutrients, while dams built by beavers, for example, create wetlands and calm water bodies that diversify the available habitat and encourage the establishment of numerous animal and plant species. They also reduce the risk of drought, decay and flooding, filter pollutants, trap sediment and nutrients, and sequester carbon by encouraging vegetation growth and burying organic matter.

<sup>57</sup> UNEP, 2018, "Protecting peatlands, protecting the planet," <https://www.unep.org/fr/actualites-et-recits/recit/proteger-les-tourbieres-proteger-la-planete>.

Finally, genetic diversity within species promotes better adaptation to changing conditions, thereby increasing the ability of species to survive in a changing climate. The diversity of crop varieties, such as traditional rice varieties in Asia or maize in Latin America, provides protection against diseases and extreme climatic conditions.

Consequently, and because biodiversity offers solutions for mitigating and adapting to climate change, it is necessary to develop an integrated approach that recognizes the existence of complex interactions between living organisms and the climate. Seeking convergences allows us to maximize synergies, which is a key factor for optimization in a context of limited resources. In this way, and to quote Aristide Briand, it will be possible to “reconcile the desirable with the possible.”

It is important to remember that the legislative context is increasingly attempting to strike a balance between the energy transition and the preservation of biodiversity.

A comprehensive approach to environmental issues is emerging, integrating both pressures on biodiversity and the climate challenge. However, the urgency of the environmental crisis calls for accelerating the integration of these two issues, giving them equal priority in both public and private stakeholders’ decision-making.

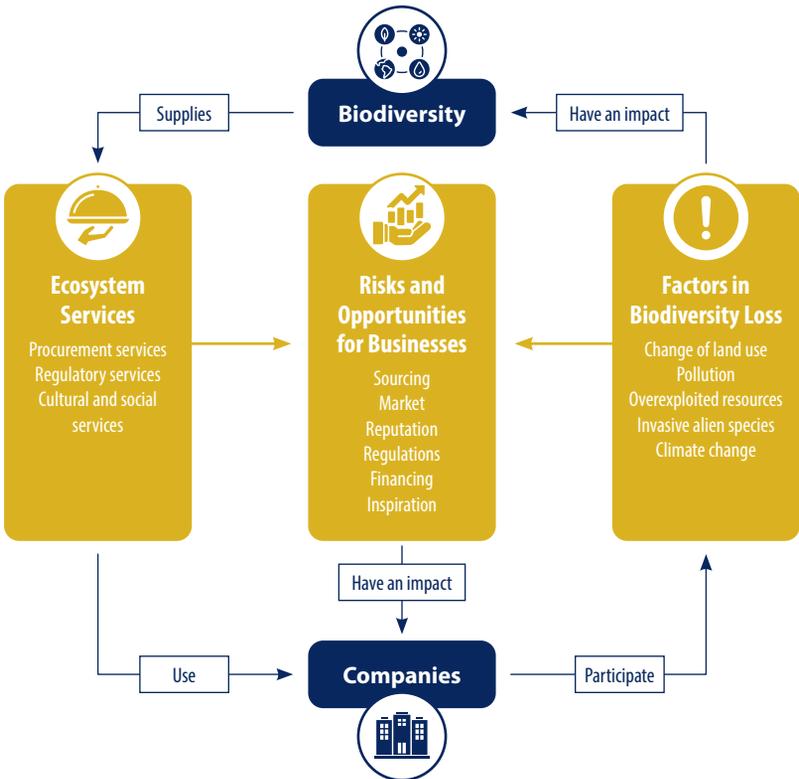
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## **2 Our Economic Prosperity Is Directly Dependent on Biodiversity**

Understanding biodiversity-related issues is an essential prerequisite for action. Today, it is hindered by a lack of recognition of the services provided by ecosystems and the challenges in measuring biological diversity

and the positive and negative impacts of business activities. While half of the global GDP directly depends on biodiversity, its decline is being accelerated by human pressures.

Figure 10: Interrelationships Between businesses and Biodiversity



Source: OFB, April 2022, "Biodiversity issues for businesses: What are the risks and opportunities of taking biodiversity into account? Why build a commitment to nature?". <https://www.arbe-regionsud.org/Block/download/?id=194777&filename=2-OFB-enjeux-ARBE.pdf>.

## 2.1. OUR DEPENDENCE ON NATURE IS DANGEROUSLY INVISIBLE

*"The geniuses of this world always show a contempt for cosmic laws proportional to the confidence they place in their own small selves."*

Sylvain Tesson, *Bérézina*, 2015

### a. Ecosystem Services: An Inescapable Reality

Ecosystem services can be defined as "the benefits that humans derive from ecosystems."<sup>58</sup> In contrast, environmental services are "the services that people provide to each other through their use of nature."<sup>59</sup> These include, for example, actions that encourage the planting or maintenance of hedgerows or the maintenance of a complete ecosystem such as a hedged landscape. From an economic point of view, environmental services are positive externalities. Payments for environmental services, which will be further elaborated on, are therefore intended to compensate for the additional provision of services.

Ecosystem services are economically valuable, but they are still poorly understood, even though several types of classification attempt to account for them. The first is based on the distinction between producers and consumers of services, in an economic system described as ecological solidarity. The second, based on the type of service provided, is the most commonly used and is the one used in this report.

<sup>72</sup> Millennium Ecosystem Assessment, 2005, "Ecosystems and Human Well-being: Biodiversity Synthesis", World Resources Institute.

<sup>73</sup> Karsenty A., 2013, *De la nature des "paiements pour services environnementaux"*. Revue du MAUSS, no. 42. <https://doi.org/10.3917/rdm.042.0261>.

- **Provisioning Services:** These include the production of resources obtained from ecosystems (food, water, timber, genetic resources...) that support numerous economic activities related to the primary sector. They provide a range of services free of charge, such as the production of food resources and raw materials for derivative industries like textiles, pharmaceuticals, etc. In France, these services are estimated to be worth 80 billion euros.<sup>60</sup>
- **Regulatory Services:** They refer to the ability of ecosystems to regulate essential environmental processes such as climate regulation, water purification, and waste management. Regulation services are among the most difficult to quantify. The EFESE estimates that in France, CO<sub>2</sub> storage alone can be valued at approximately 7 billion euros per year.<sup>61</sup>
- **Support Services:** These include everything that is necessary for the production of other ecosystem services (e.g., pollination, the nutrient cycle and soil formation).
- **Social and Cultural Services:** These more intangible benefits include spiritual enrichment, cognitive development, well-being, recreation, tourism, and, more broadly, aesthetic experiences. Many touristic and sports activities connect people with nature. According to the World Tourism Organization, 30% of stays and 33% of overnight stays in France take place in natural areas.

<sup>60</sup> Direction générale du Trésor, décembre 2021, *Étude Évaluations économiques des services rendus par la biodiversité*, Trésor-Eco no. 294.

<sup>61</sup> CGDD, septembre 2020, *Efese – Du constat à l'action, Rapport de première phase*.  
<https://www.ecologie.gouv.fr/sites/default/files/Efese%20-%20Rapport%20de%20premi%C3%A8re%20phase%20-%20Du%20constat%20%C3%A0%20l%27action%20-%20Synth%C3%A8se.pdf>.

Figure 11: Main Contributions of Nature to Populations



Source: "And biodiversity in all this", 2023, Auddicé.

Emphasizing the intrinsic value of nature, seen as external to human beings, may be insufficient to engage certain stakeholders. However, highlighting the social or anthropocentric value of biodiversity can promote individual and collective responsibility.

Anthropocentric value makes it possible to emphasize the many benefits provided by nature to humankind, and the fact that, given the current state of technology, biodiversity constitutes an unsurpassable framework in many areas. The regulating services provided by nature are not substitutable: acknowledging this dependence is the first step toward integrating the true value of nature into all our decisions, a prerequisite for ensuring a sustainable future on Earth.

### **b. Dependence on Biodiversity Is Underestimated: The Example of Health<sup>62</sup>**

According to IPBES scientists, the current decline of nature is already causing “serious impacts on human populations worldwide.” The effects of overexploitation of fishery resources on communities directly reliant on fishing have already been discussed. It is also important to note that 250 million vulnerable people depend on forests for food, heating, and shelter, and approximately 70% of fruits and vegetables produced in France rely on insect pollinators. The destabilization of ecosystems leads to limited or lost access to healthy and diverse food, increasing the risk of famine, malnutrition (including in France), and related chronic diseases.

Before the COVID 19 pandemic, the use of the term “zoonosis” – diseases that are transmitted from animals to humans<sup>63</sup> – was confined to scientific or veterinary publications, rarely reaching a broader audience. et, 65% of emerging infectious diseases are zoonoses, and 72% of these originate from wildlife.<sup>64</sup> The emergence or re-emergence of infectious diseases

<sup>62</sup> For a full review of the literature on the subject: Nilsson K., Bentsen P., Grahn P., Mygind L., 2019, “What scientific evidence do we have on the effects of forests on the environment? And trees on human health and well-being”, *Santé Publique, special issue no. 1*. <https://www.cairn.info/revue-sante-publique-2019-HS1-page-219.html#s2n7>.

<sup>63</sup> “Infections whose pathogens are transmitted naturally from vertebrate animals, most of which come from wild fauna, to humans, either through direct contact or indirectly, via biting insects such as mosquitoes and ticks”, Thierry D., 2020, “Atteintes à la biodiversité et risques épidémiques”, *Revue juridique de l’environnement, Éditions Lavoisier*.

transmissible to humans was found to be four times higher in the 2000s compared to the 1940s.<sup>65</sup> It has been demonstrated that biodiversity loss facilitates the spread of pathogens. Furthermore, land-use change brings humans, livestock, and domestic animals into contact with previously isolated wildlife species. For pathogens to thrive, they need a vector for transmission. By adapting to a dominant species (livestock), they not only ensure better dissemination but also, through increased contact with humans, develop the potential to adapt to our species as well.

Conversely, the biodiversity of prey and predators limits the multiplication of parasites and pathogens. A study conducted in twelve countries shows that mosquitoes are half as numerous in intact woodland areas as in those that have been cleared.<sup>66</sup> In the Netherlands, the prevalence of Lyme disease has been found to be correlated with the decline in the number of foxes, the natural predators of small rodents that carry ticks infected with the Lyme disease bacterium.<sup>67</sup>

Finally, certain species known as “dead-end hosts” or “epidemiological dead ends” (such as vultures) can harbor a pathogen but do not allow its transmission under natural conditions. This is the case with vultures. A 2023 study concluded that the unintended eradication of vultures in India resulted in nearly half a million additional deaths and estimated the public health crisis caused by the disappearance of this scavenger at nearly 70 billion dollars per year. The more plentiful the ecosystem, the more numerous such species tend to be.

<sup>64</sup> France Assureurs, *Rapport, Assurance et Biodiversité: enjeux et perspectives*.

<sup>65</sup> Miguel E., April 2019, “What are the mechanisms involved in the transmission of diseases?” in *La biodiversité : une alliée dans la prévention de certaines maladies infectieuses*, Colloque FRB, quoted by Thierry D., (2020), “Atteintes à la biodiversité et risques épidémiques”, *Revue juridique de l'environnement*, Éditions Lavoisier.

<sup>66</sup> Zimmer K., 29 January 2009, “Deforestation tied to changes in disease dynamics”, *The Scientist*.

<sup>67</sup> Hofmeester T. R., Jansen P. A., Wijnen H. J., Coipan E. C., Fonville M., Prins H. T., van Wieren S. E., 26 July 2017, “Cascading effects of predator activity on tick-borne disease risk”, *Proceedings of the Royal Society B: Biological Sciences*, volume 284 (no. 1 859). <https://royalsocietypublishing.org/doi/10.1098/rspb.2017.0453>.

Pressures on biodiversity can be a direct cause of zoonoses. For example, as a result of global warming, gigantic fires have affected the tropical forest in Malaysia. Fruit bats found refuge in pig farms, transmitting the Nipah virus, which spread from pigs to humans, with a mortality rate higher than 40%.

While the One Health concept links human health to the health of wild animals, the health of ecosystems is often overlooked. Beyond the necessary identification of viruses and bacteria (cycles, adaptations, emergencies) in domestic or wild animals, it is equally crucial to avoid and/or reduce human behaviors that directly or indirectly expose us to pathogens harbored by wildlife. Thus, preserving biodiversity is a key pillar of human health prevention. However, this pillar is still missing from public policy due to a lack of scientific understanding on this issue among decision-makers.

Building a comprehensive preventive health policy that takes biodiversity into account would reflect the true dependencies of human health on the environment. Pollution is a compelling example: the direct and indirect impacts of pollution on human health are estimated to cost 1,575 billion euros annually in Europe.<sup>69</sup> Biodiversity often positively influences air quality; for instance, green spaces directly absorb certain pollutant gases. By mitigating heat, they limit the toxic evolution of these pollutants. Additionally, according to a 2018 FAO study, the degradation of natural spaces increases risks to both physical and mental health. The same study found that obesity rates were 11 to 19% lower among children with access to green spaces. Moreover, it has been shown that living more than 300 to 400 meters away from parks significantly increases the risk of mental health deterioration and elevated stress levels.<sup>70</sup>

<sup>69</sup> *Born in the early 2000s, this “one health” concept is based on the principle that Human health depends on the health of animals and their interaction with the environment.*

<sup>70</sup> *Sturm R., Cohen D., 2014, “Proximity to urban parks and mental health”, The Journal of Mental Health Policy and Economics, no. 17.*

Moreover, research and development, as well as innovation, rely heavily on biodiversity as a source of biological compounds, active ingredients, and biological mechanisms to study. Traditional medicine is used by 70% of the global population, and 30% of pharmaceuticals sold worldwide contain components derived directly from plants. Over the past three decades, 80% of anticancer drugs introduced to the market have originated from medicinal plants or are directly inspired by their properties. At the same time, the extinction of wild species, even before their therapeutic properties can be identified, completely nullifies their option value. While health is often an overlooked aspect of humanity's dependence on biodiversity, it represents a significant unifying lever that could help raise awareness among a broad audience.

### **c. Ecosystem Services: Pricing the Priceless?**

While the nature conservation movements of the early twentieth century emphasized the intrinsic value of nature and the need to protect it, the twenty-first century began with an awareness of the services provided by nature to humans and an attempt to put a figure on them. Despite methodological difficulties, the amounts put forward are considerable.

Globally, the OECD estimates that nature provides free services to societies valued between 125 and 140 trillion dollars.<sup>71</sup> The wealth of poorer populations largely depends on these natural services: according to TEEB,<sup>72</sup> between 47% and 89% of the “GDP of the poor” – that is, the effective or total GDP of the livelihoods of poor households living in rural

<sup>71</sup> *OECD, Financing biodiversity, action for business and the economy, summary and synthesis prepared for the French Presidency of the G7 and the meeting of Environment Ministers G7, 5 and 6 May 2019. <https://www.oecd.org/environment/resources/biodiversity/Resume-et-Synthese-Report-G7-financing-biodiversity-acting-for-the-economy-and%20companies.pdf>.*

<sup>72</sup> *The Economics of Ecosystems and Biodiversity (TEEB) is a global initiative that aims to make the economics of ecosystems and biodiversity a reality.*

areas, forests, or dependent on small-scale fishing – directly relies on ecosystem services and other non-marketed goods.<sup>73</sup>

Attempts have been made to estimate these services more precisely. In 2018, the IPBES is proposing a monetary valuation in Europe, by type of service and surface area used:

**Table no. 1: IPBES Estimate of the Value of Services Rendered per Service and per ha in Europe**

Type of service	Service	Value in \$/ ha/year	Change in quality in Western Europe
Regulation	Water quality	765	Decrease
Regulation	Habitat maintenance	765	Decrease
Regulation	Climate quality	464	Rise
Regulation	Air quality	289	Variable
Supply	Grain	233	Rise
Supply	Polycultures	916	Rise
Supply	Wood and forests	255	Stable
Social and cultural	Tourism and leisure	1,117 (controversial)	Stable

*Source: IGF (November 2022), Le financement de la stratégie nationale pour la biodiversité (SNB) pour 2023. Annexe IV: The value of biodiversity and the costs of inaction.*

<sup>73</sup> TEEB, 2010, “The Economics of Ecosystems and Biodiversity: Integrating the Economics of Ecosystems and Biodiversity”. A summary of the TEEB approach, conclusions and recommendations. <https://www.teebweb.org>.

These substantial estimates of nature's contributions therefore call for a paradigm shift in the relationship between the economy and biodiversity.

However, reducing biodiversity to its monetary value can be challenging. A value is static, while ecosystems are inherently dynamic. Moreover, attempts to estimate the value of services provided by the natural world face a "philosophical" critique that fears the commodification of nature. Reactions to biodiversity loss can be both emotional and reflect a purely utilitarian perspective. Nevertheless, both economics and ethics enable us to systematically consider the various values of biodiversity and ecosystem services, including intangible ones.

This valuation seems necessary to raise awareness and to incorporate biodiversity-related issues into the strategies of both public and private decision-makers.

Take natural resources, for example. Whether or not they are traded, they still represent an economic asset. A number of ecosystem services already have direct use and consumption values, often through the existence of a market and therefore prices. As such, crops, livestock, fish, water and wood are marketable. Non-consumptive use values, such as those associated with recreation, can be monetized through market offers. Existence value, or non-use value, often associated with intrinsic value, is rarely estimated in monetary terms but can be assessed through contingent valuations. It typically aims to express the spiritual or cultural significance of a landscape or species. Indirect use values, on the other hand, relate to regulatory ecosystem services. However, the invisibility of ecosystem services and market signals often make it more profitable, in the short term, to destroy them – especially given that ecosystems are dynamic and future projections are complex.

The concept of negative externality is a useful addition to this discussion. Put forward by Arthur Pigou, it reflects the cost that an organization imposes on a third party or on society as a whole without this cost

being included in the market price. However, these collective costs are deficiencies that can be corrected in a free-market economy using taxes or investments commensurate with the value of these externalities. This logic of monetizing externalities is behind the introduction of an internal price for tCO<sub>2</sub>e in certain companies, for example.

However, environmental externalities represent large-scale systemic issues for ecological economist Karl William Kapp. Direct and linear causal relationships are insufficient to address them, making the concept of exchange value entirely irrelevant. In *The Social Costs of Business Enterprise*,<sup>74</sup> Kapp advocates for state intervention to correct these market imbalances, as social and environmental costs are not reflected in the financial accounts of businesses.

Effective environmental protection seems to require economic concepts that explicitly recognize, efficiently allocate, and equitably distribute the costs and benefits of sustainable resource use and conservation. To meet this threefold objective, various economic valuation methodologies for biodiversity and its ecosystem services have been conceptualized.

The IWAI, an initiative by Harvard Business School that analyzes the financial performance of 1,800 publicly traded companies while considering their environmental impacts, aims to highlight this issue. According to the IWAI, the invisibility of biodiversity values leads to inefficient or destructive use of natural capital, upon which our economies are built. Natural capital is defined as all natural resources, both renewable and non-renewable, with biodiversity being its living component. Of the 1,694 companies reporting a gross operating surplus (EBITDA), 32% would have seen their EBITDA reduced by at least 25%, and 15% would have had their surplus entirely wiped out if their environmental impact had been accounted for.<sup>75</sup> The same study also notes that some companies

<sup>74</sup> Published in 1978.

<sup>75</sup> Cohen R., Serafaim G., septembre 2020, "How to Measure a company's real impact", Harvard Business Review. <https://hbr.org/2020/09/how-to-measure-a-companys-real-impact>.

generate positive externalities that are not reflected in their financial statements. This initiative suggests adjusting corporate taxation based on their impact, including tax incentives for companies generating positive externalities. This data could also be used to promote investment in companies with a positive impact. In another study, the IWAI highlights the correlation between negative environmental impacts and lower market valuations in several sectors such as chemicals, construction, and textiles. The IWAI believes that, ultimately, all sectors will be affected.

The Environmental Accounting Chair at the Fondation AgroParisTech in France adopts a different approach, focusing not on externalities but on the “sustainability costs” associated with achieving good ecological status. At various scales, these good ecological states serve as objectives to be reached or maintained through a set of actions whose costs are evaluated. This strong sustainability accounting approach does not allow for substitutability between human, natural, and financial capital, which are considered complementary. Therefore, it is crucial to maintain the stock of natural capital to ensure a sustainable supply of flows, which is the foundation of human well-being. At a national level, these costs, referred to as “unpaid ecological costs” by the French General Commission for Sustainable Development,<sup>76</sup> could be represented in national accounts as “ecological debt.” Other organizations share this perspective on the economic valuation of nature, such as WWF and the French Development Agency, which are involved in developing ESGAP (Environmental Sustainability GAP).<sup>77</sup> This instrument serves as a compass, dashboard, and reporting instrument, enabling the definition and measurement of a territory’s environmental sustainability based on scientific principles. It assesses its ecological debt by calculating sustainability costs.<sup>78</sup>

<sup>76</sup> *Commissariat Général au Développement Durable, 2014, Les coûts écologiques non payés relatifs aux émissions dans l’air. Ministry for the Environment, Sustainable Development and Energy.*

<sup>77</sup> *Questions de développement, Synthèse des études et recherches de l’AFD, September 2021, “Vers une évaluation fiable de la soutenabilité environnementale des territoires”, no. 50, AFD Editions.*

<sup>78</sup> *WWF France, May 2021, “Measuring and managing an area’s environmental sustainability”, Implementation of the ESGAP scorecard in New Caledonia.*

In the corporate sector, Kering has implemented an environmental profit and loss (EP&L) account that measures the environmental impact of its activities across its entire value chain and translates it into monetary terms. This EP&L, based on weak sustainability, helps set targets for reducing impact.<sup>79</sup> Other methodologies based on strong sustainability or aimed at maintaining ecosystems for their own sake, such as the CARE method, are being tested.<sup>80</sup>

An alternative option is to measure the opportunity costs associated with other potential uses of these areas. This estimation of natural capital can then inform decision-making. For example, in Kampala, the development of a wetland area was abandoned because the estimated value of the ecosystem services provided far exceeded the benefits from the real estate project. In the United Kingdom, the opportunity cost analysis of a quarry expansion project on agricultural land led to the approval of the project. The benefits associated with the quarry, through compensation and restoration mechanisms, were found to be significantly higher than the current benefits provided by agriculture.

France undertakes various quantitative assessments that can be utilized in public policies, including at the local level. As early as 2009, the issue of the “economic approach to biodiversity and ecosystem services” was raised by the French Strategic Analysis Center. The aim of this initiative was to determine elements for a “reference value” that could be used in public decision-making, particularly in the socio-economic evaluation of public investments. This involved considering different components of value through a legal, ethical, and economic approach to environmental assets. It distinguished between “remarkable” biodiversity, which

<sup>79</sup> *In weak sustainability, technological progress and economic growth can compensate for the loss of natural capital by increasing material capital growth. (Fermes d'avenir, Fiche 10: Soutenabilité).* [https://fermesdavenir.org/wp-content/uploads/2022/03/CSE-Fiche-10\\_Soutenabilite.pdf](https://fermesdavenir.org/wp-content/uploads/2022/03/CSE-Fiche-10_Soutenabilite.pdf).

<sup>80</sup> *Comprehensive Accounting in Respect of Ecology. This method includes capital not as a source of productivity but as an advance constituting a debt to be repaid.*

is difficult to assess using economic tools, and “common” or “everyday” biodiversity, which is often less recognized but underpins identified economic services. This is also the focus of the work conducted by EFES (French Assessment of Ecosystems and Ecosystem Services).

Despite numerous attempts at evaluation, because of the invisibility of the contributions of the natural world and the binarism thus created between humans and nature, the very tangible benefits that humans derive from the proper functioning of the natural world are chronically undervalued by all stakeholders, including economic ones. However, in the words of the IPBES in its 2019 report, “nature is essential to human existence and a good quality of life, and most of nature’s contributions to people are not entirely replaceable” by technology-based solutions, and some are even irreplaceable. Although economic evaluation is not a compulsory prerequisite, and its use potentially raises questions about the respect shown for the intrinsic value of the natural world, it can be a useful evaluation and communication tool, capable of guiding public and private choices.

## **2.2. MEASURING THE IMPACT OF BUSINESSES ON BIODIVERSITY: A PREREQUISITE FOR ACTION**

*“Not everything that can be counted counts, and not everything that counts can be counted.”*

Albert Einstein

### **a. The Thorny Search for a Single Biodiversity Indicator**

The partial adoption of biodiversity-related issues by businesses is partly due to the difficulty in modeling indicators, which are defined as “a

measure, usually quantitative, that can be used to illustrate and communicate complex biodiversity-related phenomena in a simple way, including trends and progress over time.<sup>81</sup> The inability to develop a single, universal tool, similar to tCO<sub>2</sub>e, further complicates the consideration of this issue by stakeholders. While the aim of developing a single aggregated indicator to improve accessibility is commendable, it is challenged by the inherent complexity of a constantly evolving living world.

Moreover, the biodiversity indicator must consider and aggregate the impacts of a company's activities throughout its entire value chain, including the impacts at the business unit or product level, the inputs used in production processes, and the use and end-of-life of products. It must therefore reflect biodiversity issues that are both highly local and global.

Additionally, its modeling is further complicated by the growing share of international trade and the importation of resources derived from environmental degradation. Imported deforestation accounts for 20% to 40% of the wood entering the European market. It is closely linked to environmental crime, which has been increasing by 5% to 7% annually since 2016, making it even more challenging to model a biodiversity footprint measure. Far from being anecdotal, this type of crime is ranked as the 4th largest source of criminal revenue, just behind drugs, counterfeiting, and human trafficking.<sup>82</sup>

Quantitatively, the indicator should enable a dynamic approach, allowing the observation of changes in the quantity and genetic diversity of species present in a given area over time, measuring the gap between observed levels and targets, and determining the effectiveness of preservation

<sup>81</sup> IUCN France, 2014, "Biodiversity indicators for local authorities: a framework for Reflection and analysis for territories". [https://uicn.fr/wp-content/uploads/2016/08/UICN\\_Indicateurs\\_biodiversite\\_collectivites.pdf](https://uicn.fr/wp-content/uploads/2016/08/UICN_Indicateurs_biodiversite_collectivites.pdf)

<sup>82</sup> Gendarmerie Nationale, Central Office for Combating Environmental Crime and Public Health, March 2022, Threat Assessment. <https://www.calameo.com/read/0027192923df920437801?authid=H7yHls72N1AK>.

or restoration measures implemented. Beyond species measurement, to assess ecosystem health, such a tool should also consider water and soil pollution levels as well as the presence of invasive alien species. However, constructing such an indicator involves uncomfortable philosophical assumptions, as it requires assigning differentiated values to the species present. This often leads to a distinction between high-value biodiversity, which includes threatened species or those that provide useful active compounds, and so-called “everyday” biodiversity, whose market and aesthetic value is perceived as lower.

Despite the inherent challenges in its development, such a biodiversity impact indicator is highly desirable for several reasons. First, it would allow companies to assess the impact of their activities on biodiversity across the three scopes and measure their dependencies throughout their value chain. Second, it would enable the integration of short-, medium-, and long-term goals, promoting the inclusion of biodiversity preservation or restoration in the company's strategy. Internally, it would contribute to the development of performance indicators, setting objectives that can be adapted by business unit. Finally, it would serve as a tool to enhance the credibility of the approach by providing a quantified and scientific perspective on an issue often relegated, wrongly, to the realm of emotional concern. Externally, it would facilitate monitoring, communication, and scientifically-backed recognition of actions undertaken, for the benefit of shareholders, consumers, and the general public. It would also help foster a corporate culture that introduces the biodiversity issue and gradually elevates it to the same level of importance as climate issues.

The multiplicity of objectives currently leads to the definition of a variety of indicators. The typology developed by the European Environment Agency,<sup>83</sup> adopted by the IUCN, distinguishes four types of environmental indicators that serve different purposes:

<sup>83</sup> *European Environment Agency, 1999, “Environment in the European Union at the turn of the century”, Environmental assessment report no. 2. <https://www.eea.europa.eu/publications/92-9157-202-0>.*

- **Descriptive Indicators or State Indicators:** These provide information on the current state of a situation, dependencies, and pressures exerted, as well as the status of implemented actions. Examples include ecological quality and potential indicators developed by the French National Museum of Natural History, or the Roselière Indicator, etc.
- **Performance Indicators:** These comparative indicators assess the gap between a current situation and a past or target situation. They include sub-indicators for effectiveness, efficiency, and quality. For example, the Global Reporting Initiative's sets of performance indicators, such as protected or restored habitats, strategies, ongoing actions, and future management plans for biodiversity impacts.
- **Environmental Efficiency Indicators:** These measure the natural resources used by humans and the pollution generated by human activities per unit of production, such as the level of waste generated per unit of GDP.
- **Well-being Indicators:** These assess the sustainability of the relationship between humans and nature. An example is the World Bank's Adjusted Net Savings or Genuine Savings, which measures a country's savings rate, adjusted for education expenses, capital depreciation, natural resource depletion, and damage from CO<sub>2</sub> emissions.

Traditionally, environmental indicators are associated with a category within the "Pressure – State – Response" (PSR) analytical framework proposed by the OECD in 1993. This model has an obvious educational value, as it is based on the concept of causality. Human activities exert pressures on the environment, resulting in a state that requires a response through environmental and sectoral policies. However, it does not constitute a typology of indicators by itself, as the same indicators can be used at different stages of the analysis. For instance, forest area can indicate the

level of habitat degradation, the current state of the environment, or the effectiveness of reforestation policies.<sup>84</sup>

An initial set of around twenty indicators was adopted at the seventh Biodiversity COP in 2004 and adjusted in 2006 to assess progress towards the “2010 Biodiversity Targets.” In 2007, a partnership on Biodiversity Indicators (BIP), bringing together over 40 organizations, developed 18 key indicators, which encompass 29 operational indicators.

These 29 operational indicators, adopted by the European Union and France, are structured around seven focal areas:

- Status and trends of the components of biological diversity
- Sustainable use
- Pressures on biological diversity
- Ecosystem integrity and ecosystem goods and services
- Status of knowledge, innovations, and traditional practices
- Status of access and benefit-sharing
- Status of resource transfers

Following the COP10 on Biodiversity, a new set of indicators was revised to cover the 20 Aichi Targets, named after the prefecture where the conference was held. A new list of 12 headline indicators, broken down into 98 operational indicators, was established by a group of experts with a dynamic focus on the services provided by biodiversity and the opportunities it offers:

- Status of biological diversity
- Pressures and underlying drivers
- Benefits derived from biodiversity
- Multiscalar responses

<sup>106</sup> IUCN France, 2014, *Biodiversity indicators for local authorities: a framework and analysis for local and regional authorities*. [https://uicn.fr/wp-content/uploads/2016/08/UICN\\_Indicateurs\\_biodiversite\\_collectivites.pdf](https://uicn.fr/wp-content/uploads/2016/08/UICN_Indicateurs_biodiversite_collectivites.pdf).

This set of indicators currently coexists with thematic indicators developed by various organizations or international coalitions, such as the UN Sustainable Development Indicators, the OECD Core Set of Indicators, the Global Reporting Initiative's Environmental Performance Indicators, and the work of the Taskforce on Nature-related Financial Disclosures (TNFD), which is discussed further below.

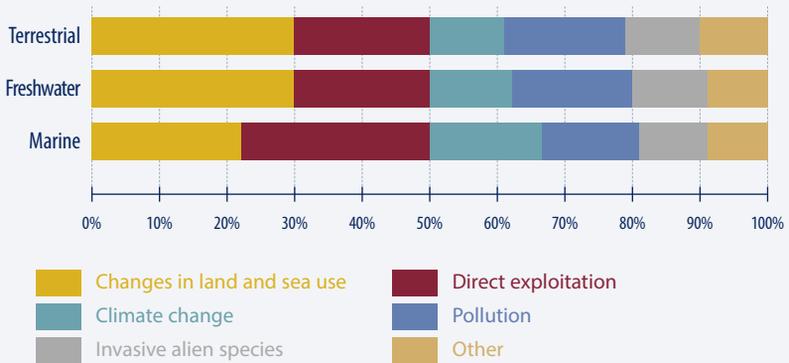
At European level, the 1998 Biodiversity Conservation Strategy and the 2003 Kiev Resolution stressed the importance of developing regional indicators, often variations of the indicators adopted by the COP, as part of strategies to halt the decline in biodiversity by 2010, 2020 and 2030.

### Aggregate Indicators

Aggregated indicators already exist. Notably, the Global Biodiversity Score (GBS), developed by the French CDC Biodiversité organization, measures the biodiversity footprint of companies based on a common unit, the Mean Species Abundance (MSA) per km<sup>2</sup>. The MSA ranges from 0% to 100%, with 100% representing an undisturbed, intact ecosystem. The GBS covers all pressures on terrestrial and aquatic biodiversity, with the exception of invasive alien species:

- For terrestrial biodiversity: land use (agriculture, forestry, urbanization), habitat fragmentation, human encroachment, resource extraction pressures, nitrogen deposition and terrestrial ecotoxicity, climate change.
- For freshwater biodiversity: wetland conversion, hydrological disruptions due to direct water use, hydrological disruptions due to climate change, land use in the watershed, freshwater eutrophication, and aquatic ecotoxicity.

**Figure 12: GBS Covers the Main Pressures on Terrestrial and Aquatic Biodiversity**



IPBES pressures	Terrestrial	Freshwater	Marine
Change in land/ sea use	Land use Fragmentation of natural environments Human encroachment	Wetland conversion	Not covered
Direct exploitation	Issues linked to resource extraction	Hydrological disturbance due to direct water use	
Climate change	Climate change	Hydrological disruption due to climate change	
Pollution	Aerial nitrogen deposition Terrestrial ecotoxicity	Land use in the catchment area (rivers and wetlands) Freshwater eutrophication Aquatic ecotoxicity	
Invasive alien species	Not covered		

Source: CDC Biodiversité. [https://www.amf-france.org/fr/actualites-publications/dossiers-thematiques/le-reporting-de-durabilite-csrd-0#La\\_directive\\_CSRD\\_et\\_les\\_standards\\_de\\_reporting\\_questce\\_qui\\_change\\_](https://www.amf-france.org/fr/actualites-publications/dossiers-thematiques/le-reporting-de-durabilite-csrd-0#La_directive_CSRD_et_les_standards_de_reporting_questce_qui_change_).

The GBS can be used to calculate the footprint of financial asset portfolios, to assess the footprint of companies throughout their value chain and across the three scopes, and to carry out macro-level assessments. As this indicator is not necessarily suitable for SMEs, CDC Biodiversité, ICARE Bearing Point and BL Evolution are working on the creation of an ad hoc tool.

The PDF (Potentially Disappeared Fraction) indicates the percentage of species lost (the extinction rate) on a given land surface or in a given volume of water, as a result of changes in land use, pollution, rising temperatures or eutrophication.

There are also the first indicators of dependency and positive impact, such as those proposed by the Iceberg Data Lab, the Dependency Score, the Biodiversity Positive Contribution or the Biodiversity Avoided Impact Score.

One pitfall remains: the difficulty of choosing between existing tools. A number of entities have therefore developed very detailed analyses of existing tools, highlighting their strengths, weaknesses and scope for deployment. Economic entities have carried out a number of reviews and classifications to determine which tool is best suited to their needs.

**Tableau no. 3: Mapping of Usage Categories by Companies and the Main Scopes of Biodiversity Footprint Initiatives for Businesses**

Public Policy	Company and Portfolio			Pro- vision- ing Op- tions	Pro- duct and Service	Project / Site			Type of Business Use
<u>ENational Biodiversity Footprint (UICN)</u>	<u>BFFI (ASN Bank)</u> <u>GBS (CDC B)</u>								A. Evaluation or rating by and for third parties using external data
<u>BRIM (UICN)</u>									B. Internal communication and external reporting
<u>IPV / LPI (WWF)</u>	<u>EP&amp;L (Kering)</u>	<u>BioScope (BEE platform)</u>	<u>Life Index (Life Institute)</u>			<u>BF (Plan-sup)</u>	<u>Extractive (WCMW)</u>	<u>Mining footprint (BHP + CI)</u>	
<u>GLOBIO (PBL)</u>		<u>BRIM (UICN)</u>		<u>BIM (CISL)</u>	<u>PBF (I Care + Sayari)</u>	<u>BRIM (UICN)</u>	<u>BPT (Solagro)</u>		C. Biodiversity management and performance

- Assessment of impacts on charismatic species (particularly threatened species)
- Assessment of the impact on biodiversity as a whole
- Does not belong to any of the categories

*Source: quoted in the France Stratégie report, Plateforme RSE Empreinte biodiversité des entreprises – opinion January 2020.*

In very practical terms, and because the proliferation of metrics hinders the consideration of biodiversity issues, it is essential that companies have access to reliable comparisons. As for the need to ensure the reliability of the chosen indicator, validation by a credible entity such as the OFB (French Biodiversity Office) and/or the FRB (French Foundation for

Biodiversity Research) could provide legal assurance and reduce the risk of the data being challenged.

Marine biodiversity remains a blind spot in footprint analysis tools. This is largely because it is still poorly understood, particularly in deep-sea areas, and with respect to bacteria and microorganisms. The lack of data is the primary obstacle to a detailed understanding of the various impacts of human activities on this environment. Nevertheless, strategies to reduce greenhouse gas (GHG) emissions and the subsequent modal shift towards maritime transport increase pressures on this ecosystem. The maritime freight sector accounts for 90% of global trade, and projections forecast a 3% increase by 2028.<sup>85</sup> The sector's priority is to reduce GHG emissions, which currently represent 3% of global GHG emissions. Some shipping companies are keen to integrate biodiversity into their corporate strategy, partly due to significant reputational risk: large marine mammals have strong public support, and civil society pressure is increasing. However, due to the lack of data, the marine environment is often excluded from the aggregated indicators used in many tools, such as the Global Biodiversity Score. Nevertheless, many research initiatives are underway to support and guide shipping companies, and "Green Marine Europe," the first environmental certification, has been developed for this purpose.<sup>86</sup>

Based on 11 environmental criteria such as underwater noise and ship recycling, this voluntary initiative enables shipowners to assess their own performance and define a path for reducing their impact.

As things stand, faced with a wide range of options of which they are not necessarily aware and which they do not necessarily know how to discriminate between, companies mainly use static measurement indicators which do little to reflect the issues:

<sup>108</sup> CNUCED, *September 2023, étude sur le transport maritime 2023*.  
<https://unctad.org/fr/publication/etude-sur-le-transport-maritime-2023>.

<sup>109</sup> *PTo find out more about this certification: <https://greenmarineeurope.org/fr/>.*

- Operational indicators include action plans, the number of sites implementing ecological management and/or planning, the number of certified sites, partnerships, the percentage of vegetation preserved on-site, the number of sites located in or near protected areas, the number of threatened species, and the number of actions taken to support biodiversity.
- Product-related indicators, particularly through eco-design, enable communication about more resource-efficient production methods, but they do not directly reflect the state of biodiversity.
- Specific indicators for imported deforestation, such as the one presented in the WWF report on the subject.<sup>87</sup>
- Sector-specific indicators, tailored to the most affected industries, such as the Biodiversity Indicator for Extractive Companies (BIEC).

In addition to the predominance of qualitative information, the indicators used are insufficiently linked to action plans. They do not allow for precise measurement of pressures, do not call for quantified objectives and provide only fragmentary information on the methodologies used. While it may be difficult to come up with a single indicator, it is already possible to indicate a set of criteria that it should meet.

For Iceberg Data Lab,<sup>88</sup> the indicator should be quantifiable and material to measure biodiversity status and the outcomes – both positive and negative – of actions over time. It should also be aggregable to adapt analysis and strategy at both macro and micro levels. Additionally, it should be discriminating to distinguish effective and beneficial behaviors from less effective or efficient approaches. Finally, it should be accessible and lead to the publication of information that is understandable to the general public.

<sup>87</sup> WWF, 2018, “Imported deforestation, stop sawing off the branch!”, report. [https://www.wwf.fr/sites/default/files/doc-2018-11/20181107\\_Rapport\\_Synthe%25CC%2580se\\_De%25CC%2581forestation\\_Importe%25CC%2581e\\_France\\_WWF-min.pdf&ved=2ahUKEWju7fXK1a2GAXU0RqQEHX3wCdoQFnoECBIQAQ&usq=AOvYaw2wl8xU4dyPR\\_A3sc4toWEY](https://www.wwf.fr/sites/default/files/doc-2018-11/20181107_Rapport_Synthe%25CC%2580se_De%25CC%2581forestation_Importe%25CC%2581e_France_WWF-min.pdf&ved=2ahUKEWju7fXK1a2GAXU0RqQEHX3wCdoQFnoECBIQAQ&usq=AOvYaw2wl8xU4dyPR_A3sc4toWEY).

<sup>88</sup> Iceberg data lab, a French fintech that creates data management solutions to enable to measure the impact of our investments on the climate and biodiversity,” argues so that the criteria contribute to the construction or selection of a relevant indicator.

However, several concerns need to be addressed before a single indicator can be selected. Firstly, defining such an indicator is complicated by the previously mentioned “tipping point” effects, as biodiversity collapse and climate change lead to unpredictable and potentially harmful synergies, whose full impact is not yet understood. Secondly, it requires data sharing between public and private stakeholders to enhance existing models. This kind of exchange involves the use of reliable, anonymized, and secure data-sharing and storage solutions to share best practices without compromising business confidentiality. It is also worth noting that existing storage solutions can themselves have a negative environmental impact.

Finally, for companies to be willing to invest the financial and human resources needed to master them, the indicators used must be credible. In particular, they must be endorsed by the scientific community, along the lines of the science-based targets discussed below.

While there is a demand for greater reliability and standardization of the indicators used, the emergence of a single unified indicator seems unlikely. Composite indicators are valuable for understanding the main pressures exerted by a company and therefore serve as a strategic decision-making tool. However, they are not sufficient on their own and must be supplemented by specific indicators for each pressure, based on the priorities identified by the company or industry sector. Operationally, each company should select the most relevant indicators based on its activities, the ecosystem services it relies on, and its impacts on biodiversity. These indicators should be easily understandable and integrable into its overall strategy. Conceptually, however, the potential to simplify the complexity of biological phenomena related to biodiversity to this extent remains limited.

While in the future the divide between quantitative and qualitative indicators will have to be overcome, and indicators will have to be enriched with measurements by type of pressure, ecosystem or environment, it

would seem initially preferable to contribute to making existing indicators more reliable, at European or even international level. In particular, these indicators should be better adapted to the specific needs of each user. In particular, their transparency and interoperability must be improved to combat the “black box” phenomenon.<sup>89</sup>

Initially, one might advocate for adherence to a generic rule in biodiversity, akin to Kant’s categorical imperative, such as the “Do No Significant Harm (DNSH)” principle. This involves consistently considering ways to reduce pressures or create conditions that enable living systems to activate their own regenerative capacities – the ability of systems to renew themselves while continuously adapting.<sup>90</sup> Ultimately, composite indicators enhance the understanding of the issues and pressures to which the company contributes, allowing for the prioritization of actions to reduce negative impacts on biodiversity. In contrast, the relentless pursuit of a single indicator, similar to tCO<sub>2</sub>e, could be counterproductive and may even justify inaction.

### **b. A Double Pitfall for Businesses: Inaction and Fragmentation**

Currently, the complexity of biodiversity modeling often leads stakeholders to use composite indicators or to attempt to develop sets of indicators based on their objectives, risking an “information overload phenomenon” that can lead to inaction, with potentially harmful consequences.<sup>91</sup>

The cost of this inaction can be defined as “the environmental damage that occurs in the absence of new public policies or changes to existing

<sup>89</sup> Silvain J-F., FRB, hearing on 25 October 2019, France Stratégie, January 2020, *Empreinte Corporate Biodiversity, CSR Platform Opinion*. <https://www.strategie.gouv.fr>.

<sup>90</sup> Brunel V., Dubreil S., et al., 2023, “Entreprendre pour la régénération du vivant”, *Bpifrance The Lab*. <https://lelab.bpifrance.fr>.

<sup>91</sup> *Biodiversity indicators: What for? Espaces naturels*, no. 33. ATEN, 2011.

public policies."<sup>92</sup> As a result of the absence of public policies or the implementation of damaging policies, the cost of inaction may be greater than the cost of environmental damage alone, and may lead to social and economic unrest, particularly in developing countries. The World Bank, for example, estimates that a partial collapse of ecosystems in Malaysia could lead to a loss of 6% of GDP per year by 2030, an impact similar to that of the COVID-19 pandemic.

While it remains difficult to quantify the costs of inaction on biodiversity, the total economic loss due to inaction was estimated globally in 2008 to be 14 trillion euros between 2005 and 2050, equivalent to 7% of global GDP at that time.<sup>93</sup> The OECD recently estimated the value of lost ecosystem services to be between 10 and 31 trillion dollars per year. At the European level, the European Commission estimates that the world lost between 3.5 and 18.5 trillion euros in ecosystem services from 1997 to 2011, equivalent to 1 to 7 times the GDP of France.<sup>94</sup>

More recently, research into the costs of future inaction has come up with a low range of 2,700 billion dollars per year for losses linked to the degradation of biodiversity if nothing is done by 2030.<sup>95</sup> The WWF considers that “business as usual”, in other words inaction, would lead to a reduction in ecosystem services of 0.67% of global GDP (500 billion dollars per year), or 10,000 billion dollars over the period 2010-2050.<sup>96</sup> Between 1997 and 2011, the world is already estimated to have lost USD 4,000 to 20,000

<sup>92</sup> Braat L., et al., 2008, “The Cost of Policy Inaction (COPI): The case of not meeting the 2010 biodiversity target”. Alterra Wageningen University and Research; Institute for European Environmental Policy (IIEP); Ecologic; Fondazione Eni Enrico Mattei (FEEM); GHK; Milieu en Natuurplanbureau; United Nations Environmental Programme – World Conservation Monitoring Centre; Witteveen en Bos, Wageningen / Brussels, commissioned. <https://archive.org/details/costofpolicyinac08braa>.

<sup>93</sup> Braat L., et al., 2008, *Ibidem*.

<sup>94</sup> European Commission, 2020, “Factsheets: The Business case for biodiversity”. [https://ec.europa.eu/commission/presscorner/api/files/attachment/865555/factsheet-business-case-biodiversity\\_en.pdf](https://ec.europa.eu/commission/presscorner/api/files/attachment/865555/factsheet-business-case-biodiversity_en.pdf).

<sup>95</sup> Meeting to Support Progress on the Multilateral Development Bank Joint Statement on Nature, People and Planet, Synthesis of Relevant Work and Priorities, 2022.

billion a year in ecosystem services due to changes in land cover, and USD 6,000 to 11,000 billion a year due to soil degradation.<sup>97</sup>

Beyond the losses generated by inaction, estimates suggest that delaying action on biodiversity is twice as costly as taking immediate measures. For instance, a report by the UK Treasury estimates the cost of action at the current global level to be \$7 trillion, compared to \$15 trillion if action is delayed until 2050.<sup>98</sup> These figures do not account for tipping points related to species extinction and ecosystem collapse, which could be irreversible. With current technologies, ecosystems – and therefore associated natural resources – bear the heavy burden of inaction and may not be able to regenerate.

For businesses, inaction has short-, medium-, and long-term costs. On the one hand, by delaying biodiversity actions, they expose themselves to regulatory, financial, market, and reputational risks. On the other hand, inaction or maladaptation directly impacts infrastructure (e.g., weakening of buildings), processes due to reduced availability of freshwater resources, and human capital (e.g., employee health, including mental health). Moreover, a wait-and-see approach reflects a narrow view that overlooks the potential opportunities offered by the transition and the development of new tools, such as nature-based solutions. For example, restoration activities represent a profitable avenue for businesses. Restoring 46% of the world's degraded forests is estimated to generate between 7 and 30 USD per dollar invested. Restoration also creates new markets,

<sup>96</sup> WWF, *Global Trade Analysis Project et natural capital project*, 2020, “Global futures: assessing the global economic impacts of environmental change to support policy-making”. [https://files.worldwildlife.org/wwfcmprod/files/Publication/file/75p5cvk0ul\\_Summary\\_Report.pdf?\\_ga=2.126115726.241784279.1717010751-1143331282.1717010751](https://files.worldwildlife.org/wwfcmprod/files/Publication/file/75p5cvk0ul_Summary_Report.pdf?_ga=2.126115726.241784279.1717010751-1143331282.1717010751).

<sup>97</sup> OCDE, *Financer la biodiversité, agir pour l'économie et les entreprises, rsummary and synthesis prepared for the French Presidency of the G7 and the meeting of Environment Ministers G7, 5 and 6 May 2019*. <https://www.oecd.org/environment/resources/biodiversity/Resume-et-Synthese-Rapport-G7-financer-la-biodiversite-agir-pour-l'economie-et%20les-entreprises.pdf>.

<sup>98</sup> *Report prepared for her majesty's treasury, February 2021, The urgency of biodiversity action*. <https://www.naturefinance.net/resources-tools/the-urgency-of-biodiversity-action/>.

offering companies unprecedented opportunities. In the United States, for instance, restoration activities generate 126,000 direct jobs and 9.5 billion USD annually in economic output.<sup>99</sup> Companies can no longer ignore the constraints posed by the availability of natural resources, whose renewal thresholds can be very slow. These limitations will inevitably affect both costs and supply chains, whose sustainability could quickly be threatened. Addressing this issue now means enhancing economic and reputational competitiveness and developing essential resilience.

Given the scale and complexity of the issue and the actions they can undertake, both public and private entities seeking to take action may find themselves at a loss. It is therefore essential to channel and legitimize the efforts being made.

The implementation of targeted support measures for businesses and local authorities should help reduce the risk of fragmentation. The lack of identification of relevant public stakeholders for economic action and co-financing by companies, particularly SMEs, is a significant barrier.

The proliferation of regulatory networks can lead to the emergence of unscrupulous players offering consultancy services of variable quality, potentially increasing unnecessary costs for small businesses and even creating new markets for criminal activity, as seen in the waste management sector. In such circumstances, the creation of a single operator to facilitate connections between companies and relevant stakeholders seems desirable.

As far as local authorities are concerned, in addition to training initiatives for elected representatives, support solutions need to be rolled out at local level in synergy with businesses.

<sup>99</sup> OECD, "Financing biodiversity, action for business and the economy, summary and synthesis prepared for the French Presidency of the G7 and the meeting of Environment Ministers G7", 5 and 6 May 2019. <https://www.oecd.org/environment/resources/biodiversity/Resume-et-Synthese-Rapport-G7-financer-la-biodiversite-agir-pour-l'economie-et%20les-entreprises.pdf>.

It is therefore essential for public authorities to encourage the deployment of measures to promote biodiversity. Their action is part of a long-term process that includes political debate and negotiations at national, European and international levels. We have to take into account the need to reconcile sometimes conflicting interests in the short term and the slowness with which new measures can be passed into law and implemented administratively over a period of several years. This means that in addition to the definition of shared frameworks that are legally binding and produce measurable effects, there must also be concrete, voluntary action on the part of private entities in the short term.

Recognizing the urgent need to act and the challenges faced by businesses should not overshadow the genuine efforts they have made in combating ecosystem degradation and implementing preservation and restoration measures. Although these efforts are sometimes underappreciated, they demonstrate an awareness and collective commitment that must be continued and encouraged.

## 3 Businesses Are Key Protagonists in Combating Biodiversity Loss

### 3.1. A GROWING MOBILIZATION OF FINANCIAL INSTITUTIONS AND BUSINESSES, SUPPORTED BY SHARED ACTION FRAMEWORKS

*"Far from the idea of interests defining individuals, the community of significance describes the fragile bond between interdependent collectives of living humans and non-humans, united by their shared concern for the habitability of their common environment."*

Baptiste Morizot, *Manières d'être vivant*

#### a. From Reporting to Business Model Transformation

Historically, the relationship between businesses and nature has been seen as a one-way street. At best, companies play a role in developing nature. At worst, they are seen as destroying the natural environment. However, over the last thirty years or so, the Corporate Social and Environmental Responsibility (CSR) approach has enabled companies to become more clearly aware of their social and environmental impacts and of the various aspects of the value of natural environments. CSR has made it possible to develop a more cross-functional, all-encompassing approach to performance and to improve relations with stakeholders.

However, the requirements placed on companies have long been inadequate.

Europe has implemented non-financial reporting tools that include biodiversity-related issues. One such tool is the European Non-Financial Reporting Directive (NFRD), which came into effect in 2017. Under its provisions, and for the first time at the European level, approximately 11,000 companies are required to report on their non-financial responsibilities. The analysis covers the company's impacts on environmental, social, and governance (ESG) aspects, as well as the risks faced by the company in relation to these same ESG criteria. This directive applies to large public-interest companies with over 500 employees, including listed companies, banks, and insurance companies. The NFRD aims to improve the transparency and consistency of published non-financial information, enabling investors, consumers, and other stakeholders to better assess the non-financial performance and social impacts of businesses.

The European Corporate Sustainability Reporting Directive (CSRD), applicable from 1 January 2024, replaces the NFRD and aims to fill the gaps mentioned above. The CSRD is an essential element of the European Green Pact 2020. Its ambition is summarized as follows: "a fairer and more prosperous society, with a modern, resource-efficient and competitive economy, where there are no net emissions of greenhouse gas by 2050 and where economic growth is decoupled from resource use."<sup>100</sup>

This CSRD reporting covers ESG data, including, under the environmental pillar, climate change mitigation and adaptation, biodiversity and ecosystems, and resource use. It is based on the principle of "double materiality," meaning that the company must identify its material topics by assessing them from both a financial materiality and an impact materiality perspective.

The CSRD seeks to overcome the limitations identified in non-financial performance declarations by increasing the number of companies

<sup>100</sup> *Communication from the Commission, 11 December 2019, "The Green Pact for Europe."*, COM(2019) 640 final. <https://eur-lex.europa.eu/legal-content/FR/TXT/HTML/?uri=CELEX:52019DC0640&from=ET>

concerned, encouraging the cross-checking of available information, raising the level of transparency required and ensuring the comparability of information.

Firstly, the directive aims to broaden the scope of companies covered by the reporting obligations. The number of companies concerned should increase from 11,700 companies subject to the Non Financial Reporting Directive (NFRD) to more than 50,000 at European level. The roll-out will take place according to the following timetable; new thresholds were determined on 28 February 2024 and are shown in brackets in the table below:<sup>101</sup>

<sup>101</sup> Decree no. 2024-152 of 28 February 2024 amending articles D. 230-1 and D. 230-2 of the Code trade.

**Table no. 5: Roll-out Timetable for Companies Subject to the Non Financial Reporting Directive (NFRD)**

<b>Entry into force of the CSR Directive</b>	<b>First reporting</b>	<b>Companies concerned</b>
1 January 2024	2025 (for the year 2024)	For companies already subject to the publication of non-financial information in force since 2018: <ul style="list-style-type: none"> <li>• €25m for the balance sheet (instead of €20m)</li> <li>• €50m for sales (instead of €40m)</li> <li>• 250 for the number of employees (no change).</li> </ul>
1 January 2025	2026 (for the year 2025)	For companies meeting two of the following criteria: <ul style="list-style-type: none"> <li>• €30m for the balance sheet (instead of €24m)</li> <li>• Sales of €60m (instead of €48m)</li> <li>• 250 for the number of employees (no change)</li> </ul> These thresholds for groups are to be assessed before eliminating intra-group transactions (as is already the case for calculating the thresholds for exempting a small group from the obligation to draw up consolidated accounts).
1 January 2026	2027 (for the year 2026)	SMEs listed on a regulated market, i.e., companies below the thresholds for large companies (see above), but above the following thresholds: <ul style="list-style-type: none"> <li>• €450,000 for the balance sheet (instead of €350,000)</li> <li>• €900,000 for turnover (instead of €700,000)</li> <li>• 10 for the number of employees (no change).</li> </ul>

*Source: [https://www.amf-france.org/fr/actualites-publications/dossiers-thematiques/le-reporting-de-durabilite-csr-0#La\\_directive\\_CSRD\\_et\\_les\\_standards\\_de\\_reporting\\_questce\\_qui\\_change\\_](https://www.amf-france.org/fr/actualites-publications/dossiers-thematiques/le-reporting-de-durabilite-csr-0#La_directive_CSRD_et_les_standards_de_reporting_questce_qui_change_).*

It is important to note that the CSRD has extraterritorial reach and acts as a driver of business model evolution for non-European companies. Those with at least one branch or subsidiary in the EU and annual revenues exceeding 150 million euros are subject to this regulation.<sup>102</sup> Over time, and through a ripple effect, their suppliers will also be held to a higher level of compliance.

<sup>102</sup> According to The Conference Board, an American think tank, 3,000 U.S. companies are subject to CSRD reporting. “Large Companies Increased GHG Emissions by Just 3% from 2021 to 2022, Leading the Way in Target Reduction,” Press release, November 14, 2023. <https://www.conference-board.org/press/press-release-GHG-emissions>.

The CSRD requires companies to report on “minimum disclosure requirements,” focusing on four main pillars: the company’s sustainability policies; governance, strategy, and management of impacts, risks, and opportunities (IRO); action plans and resources implemented and planned; and finally, targets to be achieved and related metrics.

This directive provides guidance on the indicators to be monitored among the multitude available by standardizing reporting obligations, based on European standards – specifically, the twelve ESRS (European Sustainability Reporting Standards). These standards were co-developed with businesses through a prior consultation process and are interoperable with international standards. The “Biodiversity and Ecosystems” standard (ESRS E4) is divided into four criteria: direct impact factors on biodiversity loss, impacts on species status, impacts on ecosystem preservation, and impacts and dependencies on ecosystem services. While the CSRD replaces the NFRD, it raises the level of environmental ambition, as demonstrated by the ESRS standards on climate and biodiversity.

Under ESRS E4 “Biodiversity and Ecosystems,” companies are required to disclose their IRO (impacts, risks, and opportunities) related to biodiversity, establish pathways and action plans to minimize negative impacts and risks while maximizing opportunities, and detail the financial effects of the IROs identified as material. Sectors with high biodiversity impact, as defined by the national biodiversity strategy (such as agri-food, energy, construction, transport, and tourism), must report on this ESRS. More broadly, reporting on ESRS E4 is an opportunity to highlight the economy’s overall dependency on biodiversity and ecosystem services and to build a robust pathway aligned with international commitments.

Furthermore, the reporting will be subject to verification by an accredited auditor or an independent third-party body in France.

In the long term, the CSRD aims to enhance information accessibility by centralizing it in a dedicated section of the management report, which

must be published in a single digital format using tags to facilitate readability and comparability, thus creating a ripple effect.

The key innovation and uniqueness of this reporting framework lie in the principle of double materiality. This key concept in sustainable finance and CSR is used to assess both the effects of environmental and social issues on a company's financial performance and, conversely, the company's impact on these same issues. It consists of two components: financial materiality, which helps investors and stakeholders understand how risks and opportunities may affect the company's financial value in the short, medium, and long term, and impact materiality, which evaluates the company's positive and negative externalities on its natural and social environment. Biodiversity, being a topic that has been poorly understood, often fell outside the scope of traditional financial materiality analysis, known as single materiality analysis. Despite the challenges faced, double materiality now firmly positions biodiversity within the scope of strategic business analysis.

However, the implementation of the CSRD raises concerns among companies due to its complexity and the costs associated with collecting or creating the necessary information. It is true that the increased level of information requirements and the need for an integrated approach across the value chain demand a significant upskilling and expertise to meet the obligations for both quantitative and qualitative data. This also necessitates substantial training efforts to understand the “underpinnings” of each topic. Effective reporting cannot overlook the need to define biodiversity impacts, identify factors contributing to ecosystem pressures, and understand the interdependencies between biodiversity and other factors, such as climate. These competencies may not be readily available in companies, particularly in younger or smaller ones, which may need to rely on external consultants, leading to increased costs. In this regard, the costs associated with gathering information – such as data on suppliers or specific geographic areas – could be shared among multiple companies.

Additionally, the implementation of the CSRD requires the collection of a large volume of new information, which may involve creating certain data, supplementing existing data, and ensuring its reliability throughout the entire value chain. Although some of the requested information should already be documented to comply with existing regulations (such as the non-financial performance statement, climate report, risks included in the universal registration document, financial statements, and duty of vigilance plan), the collection of additional data can be costly and require an effort whose benefits may not be immediately apparent. The analysis of the entire value chain is particularly complex due to the numerous stakeholders involved – many of whom are subject to different regulations – and the need for all parties to adhere to their transparency commitments.

The goal of departmenting and promoting cross-functional collaboration is commendable and requires the involvement of all company departments, whose reporting cultures may sometimes vary. The CSRD will help bring biodiversity to the forefront, provided that all functions, including senior management, are actively involved in the development and verification of sustainability information.

However, some market participants view the implementation of the reporting required by the CSRD as a costly challenge, both in terms of gathering and analyzing the necessary information and in adapting the company's management and reporting processes.

Such concerns should be balanced against the opportunities the CSRD presents. On one hand, a thorough analysis of the value chain can enhance resilience and identify new opportunities. On the other hand, the systematic collection of biodiversity-related information fosters a collective understanding of sustainability and enables European stakeholders to gain a competitive edge on the issue. This requirement, still predominantly European, is spreading. In the United Kingdom, the Sustainability Disclosure Requirements (SDR) have been introduced, and in the United

States, despite some investors stepping back from ESG criteria, states like California have strengthened their legislation, and the Securities and Exchange Commission (SEC) has tightened its requirements. The International Sustainability Standards Board (ISSB) has also taken up sustainability reporting (under single materiality), while Chinese stock exchanges have announced that double materiality reporting will be mandatory by the end of 2026.

This reporting also serves as a valuable tool for investors to incorporate biodiversity into their investment decisions, and could even promote the inclusion of biodiversity criteria in executive “green bonuses.” Consequently, beyond reporting and communication strategies, the CSR policy supported by the CSRD can contribute to the evolution of the business model if integrated into the factors guiding strategic decision-making. Double materiality, in fact, requires rethinking the company’s relationship with the world, focusing on its impact on stakeholders.

### **b. Application Frameworks for Assessing the Commitment of Economic Players with Regards to Biodiversity**

While non-financial reporting requirements are increasingly enabling companies to address biodiversity issues, it is important to remember that, for a long time, international frameworks for biodiversity preservation and associated measures primarily targeted States. In the texts of the three Rio Conventions – on biological diversity, climate change, and desertification – as well as the Ramsar Convention on Wetlands of International Importance and the CITES Convention, there was no mention of the potential contribution of businesses. The lack of private sector engagement has, in part, contributed to certain failures. The failure to meet the Aichi Targets, established at COP10 on Biodiversity to create a global framework for biodiversity, can be partly attributed to the “poor integration of economic players and other stakeholders, lack of political will, insufficient monitoring and accountability, and the absence of

specific and time-bound targets.”<sup>103</sup> It is crucial to avoid repeating these mistakes in the future.

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The Global Biodiversity Framework, part of the Kunming-Montreal Agreement from COP15, which includes specific and time-bound targets to be achieved by 2030, is the first action plan to specifically incorporate business objectives. For instance, Target 15 encourages states to adopt mandatory reporting frameworks for companies to enable them to disclose their actions to reduce negative impacts and enhance positive impacts on biodiversity. This requirement reflects not only the will of public authorities in response to civil society demands but also the efforts of private coalitions, such as Business for Nature and its Make it Mandatory campaign. Representing more than 330 companies and financial institutions, the campaign strongly advocated for the adoption of this target.<sup>104</sup>

<sup>103</sup> Orée, 2023, “Biodiversity and the economy, an immersion at COP 15”, Orée. [http://www.oree.org/source/Biodiversite\\_Economie\\_Immersion\\_COP15.pdf](http://www.oree.org/source/Biodiversite_Economie_Immersion_COP15.pdf)

<sup>104</sup> “Business for nature, Make it mandatory,” <https://businessfornature.org/make-it-mandatory-fra>.

The increasing presence of corporate representatives at international biodiversity summits also demonstrates their growing involvement: 90% of the economic stakeholders attending COP15 in Montreal were participating in a biodiversity COP for the first time.<sup>105</sup>

Figure 13: Kunming-Montréal 2022-2023  
Global Biodiversity Framework Targets



<sup>105</sup> Orée, 2023, "Biodiversity and the economy, an immersion at COP 15", Orée.  
[http://www.oree.org/source/Biodiversite\\_Economie\\_Immersion\\_COP15.pdf](http://www.oree.org/source/Biodiversite_Economie_Immersion_COP15.pdf)

**8** Increasing resilience through nature-based solutions and the protection of ecosystems

**9** Encourage indigenous practices and promote socio-economic activities that respect ecosystems

**10** Sustainable management of food, agriculture, aquaculture, fisheries and forestry production systems to ensure efficient production while protecting biodiversity

**11** Promote natural solutions to protect people from hazards and use them in risk management

**12** Ensuring more biodiversity-aware urban planning, increasing access to nature and developing more sustainable and inclusive urban spaces

**13** Fair and equitable sharing of benefits from digital sequencing information (DSI) resulting from the use of genetic resources

**14** The integration of biodiversity objectives and policies into sectoral policies and legislation in all sectors

**15** **Corporate impact and sustainable consumption**  
Monitoring and publishing the impacts of major transnational corporations and financial institutions on biodiversity

**16** **Reducing the carbon footprint of consumption**  
Reducing waste generation and over-consumption so that people can live in harmony with nature

**17** **Application of Article 8 of the Convention on Biological Diversity**  
Development or improvement of biosafety capacities and measures for the distribution and handling of biotechnologies

**18** **Eliminate or reform subsidies that harm biodiversity**  
Reduce subsidies that harm biodiversity by at least 500 billion dollars by 2030

**19**

**Increased sources of funding**

At least USD 200 billion per year by 2030 for developing countries to finance biodiversity conservation

**20**

**Capacity building and technology transfer**

Promote the development of and access to scientific and technical cooperation, including North-South, South-South and triangular exchanges

**21**

**Investment in reliable information**

Encouraging fair, effective and participative governance through accurate and up-to-date information

**22**

**Participation in decision-making**

Respecting the rights and promoting the participation of indigenous peoples, local communities, women, children, young people and people with disabilities in the governance of biodiversity

**23**

**Gender equality**

Ensuring gender equality in participation, rights and access to land and natural resources

*Source: Centre de droit de l'environnement et de la durabilité mondiale – Université d'Ottawa.*

Today, the European Union's biodiversity strategy includes the economic sector, as do the national biodiversity strategies that implement the objectives of the Global Biodiversity Framework.

At the same time, business engagement is primarily demonstrated through the launch of both national and international coalitions. For example, the It's Now for Nature initiative, launched by Business for Nature, aims to help companies develop their entire biodiversity strategy, including setting objectives, based on a formalized handbook.

In light of these pilot initiatives, scaling up remains a significant challenge. Indeed, in its 2022 Nature Benchmark, the World Benchmarking Alliance highlighted that out of 400 companies, only 5% understand their impacts on nature.<sup>106</sup>

<sup>106</sup> World Benchmarking Alliance, 5 December 2022, Nature Benchmark press release. <https://www.worldbenchmarkingalliance.org/news/nature-benchmark-communique-de-presse/>

To develop a common reporting framework to better understand the biodiversity issues and policies of companies, two voluntary frameworks were launched in the early 2010s. The first framework, known as the TNFD (Task Force on Nature-related Financial Disclosures), was released in its final version in October 2023. It includes 14 themes grouped into 4 pillars. So far, 300 financial institutions and companies worldwide have expressed their intention to adopt this disclosure framework in their Reference Document within the next two years at the latest.<sup>107</sup>

## Focus TNFD

The Task Force on Nature-related Financial Disclosures is a private international initiative launched in 2021, inspired by the six-year-old Taskforce on Climate-related Financial Disclosures (TCFD). It aims to establish a framework for assessing and communicating risks and opportunities related to nature. The forty members of the TNFD, drawn from the financial, banking, and multinational sectors, have developed a standardized framework to evaluate and report on risks caused by biodiversity loss and assess the impact of economic activities and investments. The goal is to incorporate biodiversity reporting, similar to climate reporting, into corporate ESG (Environmental, Social, and Governance) reporting to enable stakeholders to make informed decisions. The approach outlined in the framework published in September 2023 is based on the following four pillars:

- Governance;
- Strategy;
- Risk Management;
- Target and Metrics.

<sup>107</sup> The list is available at <https://tnfd.global/engage/tnfd-adopters-list/>.

To identify and evaluate nature-related issues, the TNFD recommends using the “LEAP” methodology: Locate, Evaluate, Assess, and Prepare. To be applied as widely as possible, the TNFD framework has been designed to accommodate the perspective of double materiality reporting.

### *Focus: Science Based Targets for Nature (SBTn)*

The Science Based Targets for Nature (SBTn) initiative has been developing methodologies since 2018 to measure the impacts of companies on nature. Its goal is to set environmental objectives for ecological health, aligned with the best scientific knowledge. These science-based targets for nature are measurable, actionable, and time-bound, aligned with planetary boundaries, major international conventions (SDGs, Paris Agreement, GBF...), and local ecological thresholds.

The five stages to the process:

**1. Evaluate:** Companies quantitatively measure and geographically locate their impacts across their value chain. They assess the sensitivity of the environments where these impacts occur. This initial step allows them to quantify their environmental footprint and identify their most sensitive activities and priority locations. The second methodology, Science Based Targets for Nature (SBTN), follows the same principles as the TNFD and is still under development. It provides recommendations for

companies to set quantified global impact targets on key environmental components: carbon (integrating SBTi), freshwater, soil, biodiversity, and oceans. Currently, 115 companies are part of the SBTn “community” (through the Corporate Engagement Program), and 17, including 6 from France, are likely to be the first to submit their targets to the Science Based Targets Network (SBTN) in 2024.

- 2. Interpret and Prioritize:** Based on the results of step 1, companies interpret and prioritize their impacts, activities, and locations according to their spheres of influence (room for maneuver, relationships with suppliers, etc.). They define priority environmental objectives and their scope.
- 3. Measure, Set, and Publish:** After setting targets (available for terrestrial and freshwater ecosystems), companies use the SBTN measurement framework to establish science-aligned targets, either at the global level (e.g., zero land-use change) or for their priority locations (e.g., reducing water withdrawals).
- 4. Act:** Companies use the SBTN action framework and best practices to develop actionable plans to achieve their goals. Actions follow the AR3T sequence (avoid, reduce, regenerate, restore, transform).
- 5. Monitor:** Companies monitor their impacts, adjust their strategy, and publicly report their results through environmental performance reporting. All company proposals are gradually submitted for validation by independent SBTN teams before they can be communicated.

**Figure 14: Interrelationships Between Businesses and Biodiversity**



Source: BL évolution, <https://www.bl-evolution.com/la-methodologie-science-based-targets-for-nature-est-publiee/>.

Thus, the SBTN framework provides a shared platform for reflection and action among numerous stakeholders, strengthened by scientific advancements, and enabling the accreditation of corporate initiatives.

### 3.2. BIODIVERSITY, THE CORNERSTONE OF BUSINESS RESILIENCE

*“The success of a business often depends on the ability of entrepreneurs to identify their objectives and ask themselves the right questions, even if this means departing from the dogmas of rational management. This includes the idea that local optima are not necessarily conducive to global robustness, as is the case with living beings.”*

Olivier Hamant, *The Third Path of the Living*

#### a. A Risk-Based Approach Is Necessary but Insufficient

Aware of environmental issues and the role of the economy in combating climate change, private sector stakeholders are gradually taking up biodiversity topics, focusing on the pressures exerted on natural environments that need to be reduced. This includes impacts related to company infrastructures and sites, as well as those associated with the life cycle of products (extraction, production, transportation, use, and end of life).

However, it is often through the lens of risks that the initial assessment of biodiversity is constructed. In 2021, for the first time, the top five global risks for the next ten years, as defined by the World Economic Forum, were all related to the environment. *The Earth Action Report 2024* by ChangeNOW and KPMG confirms this trend. Biodiversity ranks as the top priority among the five key areas identified by economic stakeholders to accelerate the transition and increase resilience.<sup>108</sup>

<sup>108</sup> ChangeNOW et KPMG, 2024, “Earth action report”. <https://www.changenow.world/earth-action-report-par-changenow-x-kpmg/>.

This analysis, which is more detailed among companies in the primary sector, is still often limited to an approach focused on resource management. Certain industries, whose revenues directly depend on living resources, are therefore compelled to account for biodiversity, as its preservation or destruction will directly impact their performance and the conditions of their medium- and long-term survival. In this regard, the latest EU Biodiversity Strategy estimates that the sectors of chemicals, tourism, real estate, extraction, logistics and transport, trade, and lifestyle are more than 50% dependent on nature, and that over 75% of global food products rely on pollinators.<sup>109</sup>

Conversely, in sectors or industries that are less directly dependent on biodiversity, such as the digital sector, biodiversity preservation is primarily seen as a cost, a constraint, or a significant element of competitive distortion, especially since the relationship between impacts and dependencies can be asymmetric. While most sectors that have a negative impact on biodiversity are also the most vulnerable to risks associated with its decline (e.g., primary sector, industry), some sectors can have a strong negative impact on the environment without directly relying on the services provided by nature. The banking sector, largely influenced by investment choices, is one such example.

<sup>109</sup> European Commission, 2020, “Factsheet: The Business case for biodiversity”.  
[https://ec.europa.eu/commission/presscorner/api/files/attachment/865555/factsheet-business-case-biodiversity\\_en.pdf.pdf](https://ec.europa.eu/commission/presscorner/api/files/attachment/865555/factsheet-business-case-biodiversity_en.pdf.pdf).

**Tableau no. 6: Dependency and Impact Levels  
per Business Sector**

<b>Sector (Sector according to the Statistical Classification of Economic Activities in the European Community, NACE)</b>	<b>Sector (NACE Division)</b>	<b>Risk Level</b>	<b>Impact on Biodiversity</b>
Agriculture, forestry and fishing	Agricultural and livestock production, hunting, forestry, logging, fishing and aquaculture	Significant	Significant
Electricity, gas, steam and air conditioning	Electricity, gas, steam and air-conditioning production and distribution	Significant	Significant
Mining and quarrying	Coal and lignite mining, crude oil and natural gas extraction, metal ore extraction, other mining and quarrying	Significant	Significant
Manufacturing industry	Manufacture of food products, furniture	Significant	Significant
Arts, entertainment and leisure	Sports, cultural and leisure activities	Significant	N/A
Wholesale and retail trade, repair of motor vehicles and motorcycles	Retail trade, except motor vehicles and motorcycles	Significant	Significant
Transport and warehousing	Land and pipeline transport, sea and river transport	Medium	Significant

*Source: Iceberg Data Lab, (2020), Finance & Biodiversity – Understanding and acting.*

Nevertheless, the risk-based approach is valuable as it helps to anchor the company within the natural environment it depends on. This analysis allows for a combined reflection on the company's geographical location and the state of its reference ecosystem (local perspective) as well as

on the origin of its raw materials, logistics, and the location of its clients (global perspective). The advantage of the risk-based approach is that it introduces considerations of biodiversity issues within companies that are below the threshold for mandatory non-financial reporting and are therefore not subject to regulations such as the CSRD, for instance.

The risks that biodiversity poses to businesses are traditionally of two types. The first, physical or ecological risk, encompasses all operational risks arising from a company's dependency on resources. This can lead to increased costs and a deterioration in debt repayment capacity. The loss of access to raw materials can also jeopardize the sector and destabilize the business model.

The second type, transition risks, can be further divided into regulatory, reputational, market, and financial risks. These are driven by the implementation of stricter regulations, which may result in difficulties accessing funding. Such risks are likely to increasingly affect companies with a high negative impact, effectively raising costs. For instance, in 2019, immediately after the mega-fires in the Amazon, 230 investors representing over \$16 billion in assets threatened to withdraw their capital from companies that did not manage their risks and failed to meet deforestation commitments.

Finally, the OECD, which has developed a typology of biodiversity-related risks inspired by climate risk typologies, highlights the existence of this financial risk. The very financing of companies is at stake here. This risk can materialize as increased insurance premiums, difficulty accessing capital, and reduced investment capacity, while the value of held assets could decline as ecological pressures increase. More broadly, and without corporate adaptation, legislative developments related to biodiversity will lead to an increase in the number of stranded assets.<sup>110</sup>

<sup>110</sup> *Stranded assets are investments or assets whose value is depreciated due to changes in legislation, environmental constraints, or technological advancements.*

Reputational risks can have an equally significant impact. As stakeholders become increasingly aware of environmental issues, expectations regarding biodiversity rise, potentially leading to “bad press” or boycotts. This demand can also prompt consumers to shift their purchases towards more sustainable products, thereby creating a market risk.

In this context, double materiality, which assesses impacts, dependencies, risks, and opportunities, enables companies to recognize their reliance on biodiversity. This is the first step toward acknowledging the opportunities it presents. Reducing risk exposure also involves decreasing negative impacts and increasing positive impacts in terms of nature protection and restoration, especially as this issue also resurfaces in public debates during discussions on related topics. Such is the case with free trade agreement negotiations, where biodiversity provides an additional argument: 90% of the negative impacts of Western countries on biodiversity stem from imports.<sup>111</sup>

The shift from the NFRD approach, which primarily focused on describing risks, to the CSRD, which requires highlighting the opportunities associated with biodiversity preservation, reflects a desire to promote transformation toward more sustainable business models.

## **b. Turning Constraints into Opportunities**

Two strategic approaches to opportunities can be considered: defensive or offensive. The defensive approach takes into account the risks in sectors that are highly dependent on ecosystems and aims to anticipate them.

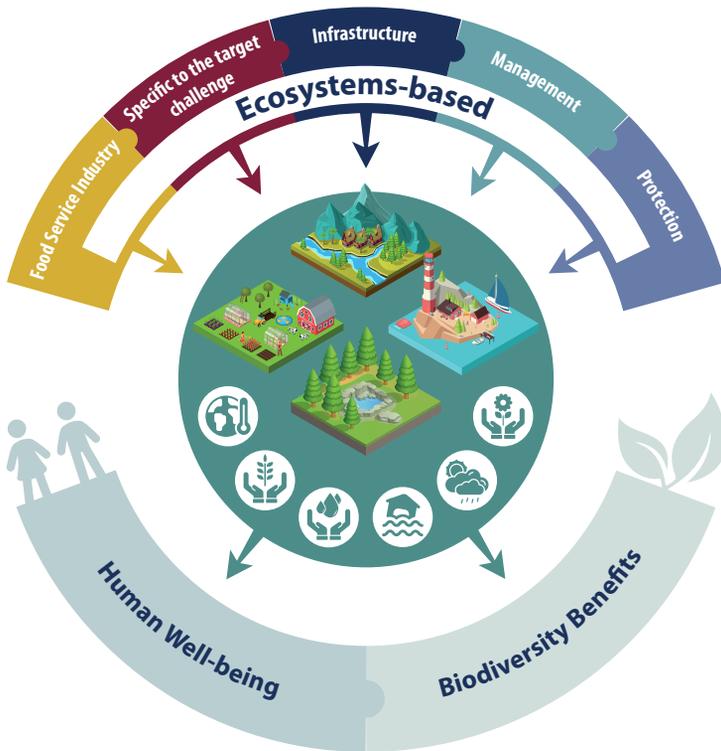
<sup>111</sup> *Fondation Nicolas Hulot pour la nature et l'homme et Institut Veblen, 2019, Mettre le commerce international au service de la transition écologique et sociale cité dans France stratégie, (January 2020), Avis de la Plateforme RSE Empreinte biodiversité des entreprises. [https://www.strategie.gouv.fr/sites/strategie.gouv.fr/files/atoms/files/fs-rse-avis-empreinte-biodiversite-entreprises-march-2020\\_0.pdf](https://www.strategie.gouv.fr/sites/strategie.gouv.fr/files/atoms/files/fs-rse-avis-empreinte-biodiversite-entreprises-march-2020_0.pdf).*

Companies with strong local and heritage ties are among those who have taken up this issue. However, this commitment still relies too heavily on individual goodwill, the appreciation of preserved nature as a local cultural element supporting tourism, or even on a secondary dependence of the company on outdoor activities. The premium positioning of some companies, combined with higher customer expectations, also seems to encourage viewing biodiversity as an opportunity.

The so-called “offensive” approach embraces the innovation opportunities offered by biodiversity and leverages them sustainably. As a result, it readily incorporates Nature-based Solutions (NbS). These are defined by the IUCN as “actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively, while simultaneously providing human well-being and biodiversity benefits.” NbS require a holistic approach as they consider both human well-being and biodiversity conservation, as illustrated in the diagram below.

The implementation of Nature-based Solutions by companies encourages a reflection on their business model. Even if the company’s impacts on nature are indirect or occur further along the value chain, the deployment of NbS requires a strong territorial anchorage. It involves bringing together stakeholders within a territory for a common project and a specific ecosystem. According to the IUCN, NbS can be categorized into three major types of actions based on the ecosystem’s condition: preserving functional ecosystems, improving ecosystem management for sustainable human use, and restoring degraded ecosystems or even creating new ones. These three types of actions can be complementary and combined with each other.

Figure 15: Nature-based Solutions



Source: <https://uicn.fr/solutions-fondees-sur-la-nature/>.

To engage all stakeholders and encourage scaling up, it is essential to link these NbS to viable economic, fiscal, and financial models. While there are some examples where NbS have proven to be less costly with a similar outcome,<sup>112</sup> cases where these solutions are either more expensive for a comparable impact or have more uncertain outcomes remain the most common.<sup>113</sup> This uncertainty is mainly due to their long-term effects,

their vulnerability to climate change (such as reforestation), and the knowledge gap regarding the functions of the ecosystems they rely on.

Among innovative solutions, insurance policies that include natural capital and NbS could be highlighted. The insurance sector is beginning to explore the reduction of natural disaster risks induced by the implementation of NbS and to assess the economic benefits of their restoration. Tools such as the Coastal Risk Index, launched by Axa during COP26, could eventually contribute to setting insurance prices, help clients better understand their exposure to certain types of risks, and even develop parametric insurance products aimed at protecting or restoring specific ecosystems.<sup>114</sup> The Coastal Risk Index maps current and future flood risks resulting from climate change and incorporates the protective role of coastal ecosystems into insurance risk models. On the investment side, it could help identify stranded debts or assets as well as financing opportunities for NbS where their positive impact is greatest. This example underscores the need to develop an economic, fiscal, and financial model that promotes investments in biodiversity and natural capital.

At the same time, and to underline the opportunities created by nature, natural asset companies are emerging. These companies, which hold rights over the productivity and health of natural assets, enable owners to convert nature into financial capital and use this financial capital to invest

<sup>112</sup> Narayan S., Beck M. W., Reguero B. G., Losada I. J., Van Wesenbeeck B., Pontee N., Sanchirico J. N., Carter Ingram J., Lange G.-M., Burks-Copes K. A., (2016), “The Effectiveness, Costs and Coastal Protection Benefits of Natural and Nature-Based Defences”, *PLoS ONE*, vol. 11, no. 5, cité dans rapport de l’Onerc au premier ministre et au Parlement, 2020, “Les solutions fondées sur la nature pour s’adapter au changement climatique”, *La Documentation française*. [https://www.ecologie.gouv.fr/sites/default/files/ONERC\\_Rapport\\_2019\\_SFJ\\_WEB.pdf](https://www.ecologie.gouv.fr/sites/default/files/ONERC_Rapport_2019_SFJ_WEB.pdf).

<sup>113</sup> CGDD, 2018, “Analyse multicritère des projets de prévention des inondations – guide méthodologique 2018”, collection Théma Références. <https://www.ecologie.gouv.fr/sites/default/files/Th%C3%A9ma%20-%20Analyse%20multicrit%C3%A8re%20des%20projets%20de%20pr%C3%A9vention%20des%20inondations%20-%20Guide.pdf>.

<sup>114</sup> The Coastal Risk Index launched by Axa at COP26: a tool for mapping risks and future floods resulting from climate change. It incorporates the protective role coastal ecosystems in the insurance risk model.

in natural assets with the aim of protecting them or improving their sustainable use. While the sustainable management of nature is generally perceived as a constraint generating additional costs, this approach aims to counter this, transforming natural assets into investments geared towards sustainable production.

It is becoming increasingly clear that taking biodiversity into account does not systematically lead to a loss of income. However, integrating biodiversity into the business model will require a transformation of manufacturing processes. For example, by setting up a voluntary carbon and/or biodiversity credit market (see below), forest owners can diversify their activities and generate new income. As well as producing materials (wood), they can provide services (carbon capture, but also ecosystem services such as oxygen production, soil maintenance, water infiltration and purification, etc.).

This adaptation seems even more necessary given the global legislative trend towards stricter biodiversity regulations. Biodiversity regulations will require companies to adjust their processes. In the Netherlands, starting in 2025, any construction or extension over 15 square meters will need to include features beneficial to local wildlife. In France, the “Zero Net Land Take” (ZAN) objective is another example of the necessary evolution in the construction sector and the opportunities it can represent. As a direct consequence of the “zero net land take” regulation, the scarcity of land – whose social impacts should not be underestimated – opens new avenues for deconstruction, depollution, and renovation services in the building sector and potentially in public works in general.

The opportunities provided by biodiversity conservation can also be understood on a more macroeconomic scale. In Bangladesh, the protection of wetlands has increased yields and boosted fish catches by 80%. In Costa Rica, pollination facilitated by forest fragments adjacent to coffee plantations accounts for 7% of the farm’s revenue.<sup>115</sup>

Biodiversity credits also provide opportunities to develop a new framework with respect to biodiversity.<sup>116</sup> Initially conceived to direct funding toward major ecosystems, such as the tropical forests of the Congo Basin or the Amazon, this concept is evolving to include more common ecosystems. Indeed, the discussions and decisions made during COP15, which accompanied the establishment of the Global Biodiversity Framework in Montreal, highlighted the need for increased funding to protect and restore biodiversity. Among current initiatives is the global roadmap aimed at establishing an inclusive co-design process for high-integrity biodiversity credit markets.<sup>117</sup> In addition to robust, legitimate, and transparent governance, this global framework must ensure appropriate pricing and fair value distribution to be effective. A large-scale supply of credits, with scientifically documented positive outcomes for nature, must be matched by high-integrity demand for financing.

Public opinion and the risk of greenwashing accusations should not be overlooked in this process. Public maturity and trust are crucial for the successful launch of these credits, as demonstrated by the skepticism surrounding carbon credits.<sup>118</sup> To prevent credits from being perceived as a license to destroy, purchasing should be limited to entities that have already assessed their impacts and dependencies and have planned a reduction trajectory within their value chain. To help companies integrate into a structured framework and evaluate the ambition of their commitments, it would be wise to scientifically and collaboratively define key

<sup>115</sup> 395 per hectare per year in Ricketts T.H, 2004, “Economic value of tropical forest to coffee production”, *Proceedings of the National Academy of Sciences of the United States of America*. [https://www.researchgate.net/publication/8403976\\_Economic\\_value\\_of\\_forest\\_to\\_coffee\\_production](https://www.researchgate.net/publication/8403976_Economic_value_of_forest_to_coffee_production).

<sup>116</sup> For a review of work on biodiversity credits, see *CBC Biodiversité et B4B+ Club*.

<sup>117</sup> High-quality carbon credits have been defined by the Market Integrity Council (ICVCM) on the basis of 10 scientifically supported criteria. For more details, see <https://icvcm.org/core-carbon-principles/>.

<sup>118</sup> Greenfield P., 18 January 2023, “Revealed: more than 90% of rainforest carbon offsets by biggest certifier are worthless, analysis shows”, *The Guardian*. <https://www.theguardian.com/environment/2023/jan/18/revealed-forest-carbon-offsets-biggest-provider-worthless-verra-aoe>.

biodiversity concepts and establish an international trajectory, similar to the Paris Agreement.

The creation of these credits also requires careful consideration of the market concept itself. Unlike the carbon market, nature is non-fungible. Additionally, the need to compensate for degradation at the local level makes the creation of an international market challenging, if not risky, and raises questions about the value of these assets. The only universally shared value is the land value associated with the wealth of biodiversity in a given area – yet it must be precisely quantifiable. As with measuring corporate footprints, it seems unrealistic, if not virtually impossible, to develop metrics that apply uniformly to all ecosystems. Indicators will inevitably be linked to specific ecosystems. So, how can we create a standardized biodiversity unit?

An op-ed titled “Shades of REDD+, Harmonized Biodiversity Claims as a Solution for Fragmented Biodiversity Markets,”<sup>119</sup> Charlotte Streck, co-author of an article on biodiversity credit markets,<sup>120</sup> highlights an additional limitation of the market: return on investment (ROI). This could lead to resource allocation favoring conservation actions with quick results over longer-term restoration efforts. Sensory and behavioral biases may also result in prioritizing investments towards charismatic species.<sup>121</sup>

<sup>119</sup> Published on 22 November 2023 in Ecosystem Marketplace, A forest trends initiative. <https://www.ecosystemmarketplace.com/articles/shades-of-reddharmonized-biodiversity-claims-as-a-solution-for-fragmented-biodiversity-markets/>.

<sup>120</sup> Palmegiani I., Inclan C., Ichilevici de Oliveira A., Streck C., (September 2023), Biodiversity credits markets, charting pathways for early investment and sustainable market growth, Climate Focus. <https://climatefocus.com/publications/biodiversity-credits-markets-charting-pathways-for-early-investment-and-sustainable-market-growth/>.

<sup>121</sup> Legendre E., 15 April 2024, “Comment expliquer le déni face à la crise de la biodiversité, les pistes de l’écologue Philippe Grandcolas”, AEF info, dispatch no. 710 682. <https://www.aefinfo.fr/depeche/710682-comment-expliquer-le-deni-face-la-crise-de-la-biodiversite-les-pistes-de-l-ecologue-philippe-grandcolas>.

To address some of the challenges mentioned above, including the diversity of ecosystems that would result in geographically limited biodiversity credits, proposals are emerging around biodiversity “certificates.” These certificates are not based on the value of existing biodiversity but on financial contributions to the preservation or restoration of healthy ecosystem functioning. In France, this is the focus of ongoing work by OBC Biodiversity, the French Muséum national d’histoire naturelle, Carbone 4, and the Foundation for Biodiversity Research. Measuring actions taken to preserve biodiversity – such as maintaining deadwood, establishing conservation zones, or prohibiting clear-cutting in forests – provides indicators that can be used to issue biodiversity credits or certificates. The aim is to create a catalog of actions for different types of ecosystems, such as tropical forests, temperate European forests, marine environments, agricultural soils, forest soils, etc.

This approach not only encourages project developers to focus on specific actions but also simplifies verification. The Canadian government has adopted this principle of scientifically constructed certificates for its “Conservation Exchange Pilot Project.” Canadian companies participating in these voluntary conservation or restoration projects can use these certificates to showcase their efforts to stakeholders.<sup>122</sup> Therefore, like credits, these certificates must be scientifically validated to demonstrate commitment to maintaining ecosystem functionality. Unlike biodiversity credits, they would not be tradable on a market. However, to be valuable for companies and recognized as opportunities reflecting their contribution to Target 19 of the Kunming-Montreal Framework, these certificates could be included in corporate reporting.<sup>123</sup>

<sup>122</sup> *Government of Canada, June 4, 2024, Government of Canada extends pilot project to support innovative funding opportunities for biodiversity conservation.*

<sup>123</sup> *Target 19: “Increase substantially and progressively the level of financial resources from all sources by 2030, mobilising at least 200 billion dollars a year. Developed countries have pledged to contribute at least \$20 billion a year by 2025, and at least \$30 billion dollars a year by 2030 to developing countries to help them to protect their biodiversity”.*

Finally, biodiversity credits or certificates require standardization by ecosystem at the international level to facilitate investments in local or national biodiversity conservation or restoration schemes. As with credits, the international development of local schemes will necessarily involve establishing criteria validated by a legitimate international governing authority. Additionally, on-the-ground verification by an independent and recognized entity is essential: transparency and comparability of certificates are indispensable conditions for them to hold any value.

An alternative option for immediate action, already in use, is the deployment of carbon credits with biodiversity co-benefits. This approach circumvents the challenge of measuring biodiversity through a single indicator. By leveraging the regulatory obligations related to carbon, this system integrates biodiversity considerations into corporate decision-making. These carbon credits help raise awareness and build a shared knowledge base. They also allow for a swift response, as they rely on existing certifications, to meet the demand expressed by some companies, sometimes under pressure from stakeholders. However, the limitation lies in the fact that funding is primarily directed towards projects aimed at reducing emissions or capturing carbon. In general, it is essential that all carbon credits, at a minimum, include biodiversity co-benefits.

### c. How to Value What We Know Little About?

Companies that have already considered the issue of biodiversity and are undertaking positive actions struggle to demonstrate their value to stakeholders. The combination of local and global challenges, which makes it difficult to ensure that actions will lead to the preservation of a specific species in a given location, further complicates communication on these issues.

Despite growing corporate engagement, it is crucial for companies to find ways to demonstrate the value of their initiatives to stakeholders in order to maintain momentum. These commitments still suffer from a lack of credibility and legitimacy among the general public, partly due to shortcomings in reporting. Methodological challenges related to indicators, as previously mentioned, pose an initial barrier by complicating the objectification of trajectories and the achievement of targets. This often results in reporting that is primarily qualitative and narrative, lacking precise data, which hinders companies' ability to clearly measure their impacts and exposes them to reputational risks.

The complexity of supply chains obscures a significant portion of companies' impacts on biodiversity, particularly regarding land use and the exploitation of natural resources. Despite their abundance, labels still serve as a tool for certification and communication to the general public. While they are well-regarded for promoting fair trade or adhering to environmental standards, the proportion specifically dedicated to biodiversity remains low. A few existing labels have addressed this issue, such as those compliant with ISO 14024, the EU Ecolabel, the “organic farming” label, or the High Environmental Value certification. However, only a few, like Afaq Biodiversité (Afnor NF X32-001) or Biodiversity Progress (Bureau Veritas), focus exclusively on biodiversity. Nevertheless, the growing interest in the topic is evident, as demonstrated by initiatives such as the development of the new “ISO Biodiversity” standard led by the ISO/TC 331 technical committee. In the short term, to enhance the recognition of commitments, existing environmental labels should, at a minimum, be reviewed and potentially redefined to incorporate biodiversity into their criteria. This way, they could not be awarded to companies prioritizing climate actions at the expense of biodiversity preservation.

While the proliferation of labels does not provide a sufficient solution, their increasing number and the current negotiations around the implementation of environmental labeling, known as the eco-score, initially for food and textile products, reflect a growing demand for information

from consumers who wish to make informed choices for responsible consumption. It is crucial that this future environmental labeling specifically considers biodiversity to ensure clarity.

However, consumers' relationship with labels is ambivalent. While they seek labels to help clarify their consumption choices, the creation of charters, labels, and audits – intended to promote transition and prevent unethical and ecologically harmful resource exploitation – faces a lack of transparency and even credibility. A web platform or a public application summarizing all the available labels and the standards used for their certification would be useful, contributing to better consumer information and enhancing the visibility of the commitments made by economic stakeholders.

In this context, the adoption of the Green Claims Directive, a key measure of the European Green Deal aimed at combating greenwashing, provides additional security for both companies and consumers. This directive seeks to establish strict and uniform minimum standards to regulate environmental claims made by companies, which will now be verified by an independent certifier. Member States will be required to ensure that violations result in effective, proportionate, and dissuasive sanctions, which, according to the Commission's proposal, could amount to up to 4% of the company's annual turnover.

To be approved, private environmental labels will need to demonstrate added value in terms of environmental ambition compared to the systems developed at the European Union level.

To meet the demand for credibility requested by consumers, and in addition to the progress promised by the implementation of the CSRD in terms of auditing, scientifically substantiated commitment declarations or pledges appear to be a second solution. This is the approach adopted by the SBTn methodology, which provides companies with indicators and interim targets compatible with achieving net zero carbon (ZNC), along

with a biennial review that accounts for any scientific updates during the period. Part of the SBTn strategy relies on public commitment through the signing of a letter of intent on a reduction pathway before setting specific targets, as well as the publication of pledges.

A third solution may lie in collective commitments on targeted issues, supported by global frameworks or initiatives. These initiatives help develop standards, build a common and ambitious foundation, and mitigate potential risks of greenwashing.

Hindered by the lack of pooled funding and contributions, which prevents large-scale actions, the biodiversity issue continues to remain somewhat under the radar. Large-scale philanthropy by French and even European private entities continues to prioritize social causes or the preservation of cultural heritage. It is hoped that, in the long term, education will help include biodiversity within the concept of natural or agricultural heritage. By contrast, it is much more developed in the United States, where it serves as a recognized means for companies to address biodiversity issues.

For companies, a more effective use of dedicated philanthropy funds could be to redirect them towards supporting research or ecosystem restoration and renaturation projects, while also benefiting from enhanced communication. Skills-based philanthropy, under Article 161, is another valuable lever for raising awareness.

Finally, in the wake of regulatory developments and the aforementioned coalitions, there is growing demand from investors for better information on companies' negative impacts and for projects with a positive impact on biodiversity. In a press release dated April 26, 2024, Mirova, a subsidiary of Natixis Investment Managers dedicated to responsible finance, and Phitrust, an impact investment management company, announced the launch of a written question campaign ahead of general meetings, targeting CAC40 companies with significant biodiversity-related issues.

Their dual objective is to enhance reporting for informed fund allocation and to promote the adoption of credible impact reduction targets. They aim to encourage companies to adopt the reporting framework set by the Taskforce on Nature-related Financial Disclosures (TNFD), or at a minimum, to report on biodiversity under the principle of double materiality as part of the CSRD implementation. They also seek to promote the widespread adoption of Science-Based Targets for Nature to establish impact reduction pathways.

One notable initiative is Nature Action 100, the biodiversity counterpart to Climate Action 100, officially launched at COP15 Biodiversity. Bringing together investors, this initiative aims to mobilize capital to support companies in their positive biodiversity actions and encourage them to set ambitious goals. Consequently, communicating the value of corporate actions to stakeholders has become almost essential.

This is especially true as such initiatives are set to become more widespread and create a ripple effect among companies: shareholders are beginning to engage with the issue. For example, at the general meetings of Pepsico and Home Depot in April 2024, two resolutions requesting an assessment of biodiversity dependency were proposed – although these resolutions, supported by AllianzGI among others, were not adopted. This highlights the fact that biodiversity is still an emerging topic and its crucial role in corporate sustainability is not yet fully recognized by all stakeholders.

Many companies, either individually or collectively, are already involved in actions to identify, protect, or restore biodiversity. However, the identified methodological and economic challenges call for strengthened action from public authorities at international, national, and local levels to support ongoing efforts and encourage the deployment of synergies across regions.

## 4 Public Authorities Must Support Collective Action

### 4.1. REGULATING WITHOUT RESTRICTING: THE NEED FOR LEGAL CERTAINTY

*“We cannot say that we did not know. Let us be careful that the 21st century does not become, for future generations, one of Humanity’s crimes against life.”*

Jacques Chirac

Environmental law is largely made up of “soft law” commitments. However, to achieve the biodiversity protection targets agreed upon by States at COP15 in 2022, it is essential to translate these commitments into actionable measures. To do so, public authorities must act as both guarantors and catalysts for the positive actions undertaken by private stakeholders. By setting an example, they also serve as a motivator for these same actors.

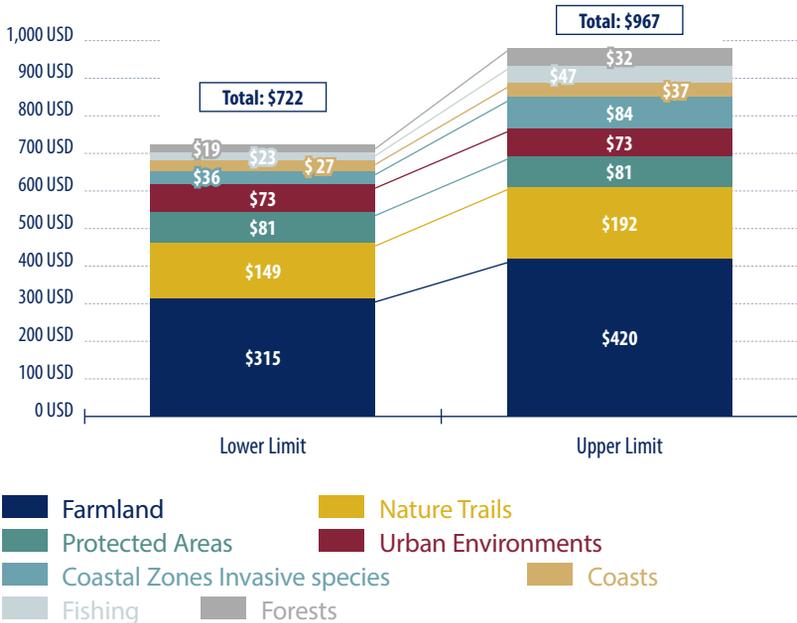
#### **a. Achieving the Financial Goals of the Kunming-Montreal Global Biodiversity Framework (GBF)**

The funding shortfall is the biggest issue facing all biodiversity policies. A significant portion of both private and public funding is harmful to biodiversity, while the funds allocated in its favor remain limited. Achieving the targets of the Global Biodiversity Framework therefore requires both eliminating harmful financing and increasing positive funding.

Although estimates of biodiversity financing needs vary, they range from \$700 to \$970 billion per year. In 2019, according to The Nature Conservancy, the total annual flow of funds allocated globally to biodiversity protection was approximately \$124-143 billion, mainly provided by public stakeholders (national budgets and fiscal policy accounting for \$75-78 billion), representing only 16% to 19% of the needs. This results in an annual funding gap of \$598 to \$824 billion.<sup>124</sup>

<sup>124</sup> Deutz A., Heal G. M., Niu R., Swanson E., Townshend T., Zhu L., Delmar A., Meghji A., Sethi S. A., et Tobin-de la Puente, January 2020, "Financing nature conservation: Filling the gap global biodiversity funding gap". The Paulson Institute, The Nature Conservancy and Cornell's Atkinson Center for a Sustainable Future. [https://www.nature.org/content/dam/tnc/nature/en/documents/FinancingNature\\_ExecutiveSummary\\_French.pdf](https://www.nature.org/content/dam/tnc/nature/en/documents/FinancingNature_ExecutiveSummary_French.pdf).

Figure 15: Global Funding Requirements  
for Biodiversity Conservation  
(in billions of USD per year)



Source: Deutz A., Heal G. M., Niu R., Swanson E., Townshend T., Zhu L., Delmar A., Meghji A., Sethi S. A., et de la Puente T., (January, 2020), "Financing Nature Conservation: Closing the Global Biodiversity Financing Gap". The Paulson Institute, The Nature Conservancy and Cornell's Atkinson Center for a Sustainable Future.

In response to this situation and to partially bridge this gap, The Nature Conservancy has identified 9 financial and policy mechanisms that collectively have the potential to contribute between \$446 and \$633 billion per year by 2030.<sup>125</sup>

<sup>125</sup> It has not been possible to produce an estimate of current and future amounts for the 'investment risk management' category.

**Table no. 7: Estimated Positive and Negative Flows for Biodiversity Conservation**

<b>Financial and Political Mechanisms</b>	<b>2019</b> (Billions USD per year)	<b>2030</b> (Billions USD per year)
<b>A. Mechanisms that reduce the overall need for funding for biodiversity conservation</b>		
Subsidy reforms with harmful impacts (agriculture, fishing and forestry)	(542.0) – (273.9)	(268.1) – 0 <sup>126</sup>
Investment risk management	N/A	
<b>B. Mechanisms that increase the flow of capital towards biodiversity conservation</b>		
Biodiversity offset mechanisms	6.3 – 9.2	162.0 – 168.0
National budgets and fiscal policy	74.6 – 77.7	102.9 – 155.4
Natural infrastructure	26.9	104.7 – 138.6
Green financial income	3.7 – 6.3	30.9 – 92.5
Nature-based solutions and carbon market	0.8 – 1.4	24.9 – 39.9
Official Development Assistance (ODA)	4.0 – 9.7	8.0 – 19.4
Sustainable supply chains	5.5 – 8.2	12.3 – 18.7
Philanthropic and conservation NGOs Not estimated	1.7 – 3.5	Non estimé <sup>127</sup>
<b>Total positive cash flow</b>	<b>123.6 – 142.9</b>	<b>445.7 – 632.5</b>

**NB:** All figures in this table are expressed in 2019 US dollars.

*Source: Deutz A., Heal G. M., Niu R., Swanson E., Townshend T., Zhu L., Delmar A., Meghji A., Sethi S. A., et de la Puente T., (January. 2020), "Financement de la conservation de la nature: Comblant le déficit de financement de la biodiversité mondiale». L'Institut Paulson, The Nature Conservancy et le Centre Atkinson de Cornell pour un avenir durable.*

<sup>1226</sup> Assume a scenario of global subsidy reform that gradually phases out the most harmful subsidies, as described by the OECD in 2020, by 2030.

<sup>127</sup> While the future flows for philanthropic and conservation NGOs are considered to be highly catalytic in mobilizing financial flows from the private sector, it has been established that they have not crossed the threshold necessary to be included in the report *The Nature Conservancy as the main mechanism for bridging the funding gap*.

The Nature Conservancy notes, however, that the implementation or acceleration of these measures will be insufficient without an ambitious policy to reduce public expenditures harmful to biodiversity, which were estimated in 2019 at between \$273.9 and \$542 billion.

Meanwhile, the OECD estimated global effective biodiversity funding at \$78 to \$91 billion per year for the period 2015-2017.<sup>128</sup> BIOFIN observed a positive trend, with global annual public investment increasing from \$100 billion in 2008 to \$140 billion in 2017, with an average of \$123 billion over the period.<sup>129</sup>

In addition to eliminating harmful subsidies, the Global Biodiversity Framework adopted at COP15 in 2022 encourages states, as well as economic and societal actors, to leverage funding mechanisms in support of biodiversity. In 2022, \$154 billion was invested in biodiversity protection, while it is estimated that this amount should increase to \$384 billion per year by 2025 and \$484 billion per year by 2030 – an increase of over 300% in just eight years.<sup>130</sup> Protecting biodiversity thus requires significant and growing financial investment, which can be mobilized through various mechanisms, including private and public sources as well as public-private partnerships, at both national and international levels.

Today, public investments constitute the majority of biodiversity funding. In 2022, public expenditures amounted to \$126 billion, with an average of \$67.8 billion per year between 2015 and 2017, contributing to a total annual investment ranging from \$78 to \$91 billion.<sup>131, 132</sup> These funds

<sup>128</sup> OECD, April 2020, “Global overview of biodiversity financing”. <https://www.oecd.org/fr/environnement/ressources/biodiversite/aperçu-général-du-financement-de-la-biodiversité-à-l'échelle-mondiale.pdf>

<sup>129</sup> Seidl A., Mulungu K., Arlaud M., van den Heuvel O., et Riva M., 2020, “Finance for nature: A global estimate of public biodiversity investments”, *Ecosystems Services*, vol. 46. Elsevier. <https://ideas.repec.org/a/eee/ecoser/v46y2020ics2212041620301583.html>.

<sup>130</sup> UNEP, ELD, 2022, “State of Finance for Nature Time to act: Doubling investment by 2025 and eliminating nature-negative finance flows”. [https://wedocs.unep.org/bitstream/handle/20.500.11822/41333/state\\_finance\\_nature.pdf?sequence=3](https://wedocs.unep.org/bitstream/handle/20.500.11822/41333/state_finance_nature.pdf?sequence=3).

can be provided through subsidies, taxes, or official development assistance and can involve multilateral development banks. Debt-for-nature swaps are a notable financial mechanism that enables the renegotiation of public debt for low – and middle – income countries while financing the protection of local biodiversity. For example, debt-for-nature swaps have reduced Belize’s external debt-to-GDP ratio by 10%, in exchange for investments in marine conservation, and have provided significant support for conservation funding in Ecuador’s Galapagos Islands<sup>133, 134</sup> Biodiversity protection financing also includes private sector mechanisms, such as green and blue bonds, sustainability-linked bonds, biodiversity credits, biodiversity offsetting, and philanthropy.<sup>135, 136</sup>

In 2010, the COP under the Convention on Biological Diversity (CBD) adopted a strategic plan in Nagoya, with one of the main objectives being the reformation, elimination, or reduction of harmful subsidies by 2020. It is worth noting that the EU has recommended this elimination since 1998. In France, the August 2009 Grenelle Environment Law explicitly states that “the State, based on an audit, will report on fiscal measures harmful to biodiversity and propose new tools to gradually shift towards a tax system better suited to new environmental challenges.”

<sup>131</sup> KPMG, December 2023, “The investment case for nature”.

<https://kpmg.com/xx/en/home/insights/2023/12/the-investment-case-for-nature.html>.

<sup>132</sup> OCDE, April 2020, “Global overview of biodiversity financing”.

<https://www.oecd.org/fr/environnement/ressources/biodiversite/apercu-generel-du-financement-de-la-biodiversite-a-lechelle-mondiale.pdf>.

<sup>133</sup> Banque de France, 2023, “Debt-for-nature swaps: a dual solution for sustainability”.

[https://publications.banque-france.fr/sites/default/files/medias/documents/bdf-244-2\\_echange-dette-nature.pdf](https://publications.banque-france.fr/sites/default/files/medias/documents/bdf-244-2_echange-dette-nature.pdf).

<sup>134</sup> Inter-American Development Bank, 9 May 2023, “Ecuador completes world’s largest debt-for-nature conversion with IDB and DFC support”.

<https://www.iadb.org/en/news/ecuador-completes-worlds-largest-debt-nature-conversion-idb-and-dfc-support>.

<sup>135</sup> OCDE, April 2020, Global overview of biodiversity financing. <https://www.oecd.org/fr/environnement/ressources/biodiversite/apercu-generel-du-financement-de-la-biodiversite-a-lechelle-mondiale.pdf>.

<https://www.oecd.org/fr/environnement/ressources/biodiversite/apercu-generel-du-financement-de-la-biodiversite-a-lechelle-mondiale.pdf>.

<sup>136</sup> Office français de la biodiversité, October 2023, Dossiers de la MEB no. 48. <https://www.ofb.gouv.fr/sites/default/files/2023-11/DOSSIER%20MEB%20%2348%20SAFN%20MD%20WEB.pdf>.

Building on France's commitments at COP15 and the translation of this global framework into the National Biodiversity Strategy (SNB), the General Inspectorate of Finance conducted a review of public expenditures based on their impact on biodiversity in its report on SNB financing and proposed ways to increase positive funding. In practice, the State's green budget exercise served as a preliminary step.

However, the green budget only imperfectly reflects public spending, as a significant portion of expenditures is sometimes referred to as the "grey budget." In the future, this grey budget could be refined to better assess the 91.9% of general budget expenditures currently considered to have "no impact" on the environment and to further explore the biodiversity aspect.

### **Experimentation: Integrating biodiversity into a regional green budget framework**

Since 2020, various French local authorities, particularly major metropolitan areas, have engaged in environmental budgeting exercises, typically categorizing expenditures based on their impact on climate.

An experiment launched in 2022 by a working group from CDC Biodiversité and the Institute for Climate Economics (I4CE) aimed to expand this rating approach by incorporating biodiversity. Using the methodology outlined in the European Central Bank guide, the regions of Bourgogne Franche-Comté, Nouvelle-Aquitaine, Occitanie, and Grand Est attempted to assess budgetary actions based on the impact of expenditures on four of the five biodiversity pressures identified by IPBES, excluding climate.

Although they encountered similar challenges to those met for the green budget (detailed rating, ambiguity of certain measures, limited scope), they were able to develop some interesting proposals.

For example, to avoid a high percentage of unrated expenditures – due to their lack of alignment with major impact budget programs, such as mobility or economic development – the Occitanie region reviewed all its expenditures, applying ratios to evaluate those less directly related to biodiversity (such as an automatic 5% deduction for support of cultural players).

Such experiments would benefit from broader implementation.

To ensure consistency between its actions and international commitments, the State has two major tools available: raising and allocating taxes, and establishing legal frameworks. Budget reviews have been conducted numerous times and are essential. They will help identify expenditures harmful to biodiversity and establish options to adjust taxation to meet the requirements of an ecological transition that provides climate and biodiversity co-benefits. Existing reports consistently conclude that the priority should be to reduce subsidies harmful to biodiversity and redirect these funds toward beneficial expenditures, particularly those synergistic with climate change mitigation. Although environmental law is well developed, public authorities must ensure its effective implementation.

## b. Strengthening the Effectiveness of Environmental Law

While there is an international, European, and national environmental legal framework, the effectiveness of this environmental law – which is more “civil” than criminal – raises questions both about its objectives and its available means. The issue of environmental justice is increasingly debated on a philosophical level: should it be punitive, aimed at penalizing an infraction? Or should it serve as an educational tool, at the risk of discarding its punitive facet?

Often, the main challenges stem from the technical complexity of this body of law, inadequate penalties, and coordination difficulties within the criminal justice system and between judicial and administrative jurisdictions. The complexity and technical nature of cases require enhanced training for judges and educational efforts throughout the entire judicial system.

The growing importance of environmental criminal law is evident in the revision of the European directive on combating environmental crime through criminal law, which acknowledges the increase in this type of crime (5 to 7% per year) that causes irreversible damage, with negative impacts estimated between 80 and 230 billion euros annually.<sup>137</sup> This directive expands the number of offenses covered by EU law, aims to provide greater resources to investigative services and judges, and to increase the severity of certain penalties. In light of the revision of the status of cooperating witnesses, it would be prudent to consider its potential role in combating organized environmental crime. Similarly, to meet the challenges, the use of all special investigative techniques should be authorized for environmental offenses.

<sup>137</sup> Council of the European Union, 26 March 2024, “Directive on the fight against crime environmental protection through criminal law. Press kit. <https://www.consilium.europa.eu/fr/press/press-releases/2024/03/26/environmental-crime-council-clears-new-eu-law-with-tougher-sanctions-and-extended-list-of-offences/>.

To assess the threats posed by environmental crime, it is important to note that the profits generated from it in Europe currently exceed those from cannabis trafficking. Additionally, it would be beneficial to explore how environmental DNA could be used to identify environmental damage and even to assess restoration efforts. A key issue is the judge's ability to accurately assess ecological damage, which depends on the training received, the methodologies available, and the thoroughness of reports and analyses presented by parties representing the environment.

The relative instability of environmental law is a risk factor. The complexity of environmental regulations creates uncertainty for economic actors, who must incorporate it into their risk management culture. Therefore, a graduated approach to sanctions seems necessary to deter environmental crime without placing an excessive burden of responsibility on small and medium-sized enterprises (SMEs).

The effectiveness of the regulatory framework ties into a broader debate on the efficacy of various tools that can be mobilized to promote environmental preservation. It is essential to move beyond the perceived opposition between regulatory constraints and business competitiveness, as these two approaches can be used complementarily. On one hand, establishing a unified framework provides a methodological guide that companies can follow, even in the context of voluntary compensation or restoration measures. On the other hand, setting a sufficiently stringent level of regulation can help level the playing field by encouraging all economic players to internalize these standards, as demonstrated by the introduction of norms within the Carbon Border Adjustment Mechanism (CBAM).

While international mobilization against climate change is well established, it is now essential to incorporate biodiversity as a major geostrategic issue within French diplomacy, particularly as European environmental standards could create trade tensions with partners.

At European level, diplomats should receive advanced training on issues related to water, natural resources, and biodiversity to develop expertise and effectively address these topics when needed. This training is a prerequisite for integrating biodiversity criteria into environmental transition goals within trade agreements and industrial strategies at European level, promoting positive environmental externalities while aligning with the negotiation processes initiated by the Rio Conventions, particularly the Convention on Biological Diversity, which notably engages civil society stakeholders. Such a transition also requires a paradigm shift to make the environment a tool of asserted extraterritoriality. The European level seems best suited to leverage the “Brussels Effect.” The General Data Protection Regulation (GDPR) serves as an example of the EU’s capacity to lead and influence through its proactive stance.

Finally, it will be up to the State to encourage the environmental transition of partners operating upstream in the value chains. To this end, fundraising or the mobilization of development aid, including through embassy aid programs, could serve as effective levers for action.

## 4.2. ENCOURAGE AND SUPPORT

*"The survival of these environments therefore depends on their integration into everyday life: protecting nature against humans is out of the question; rather, it should be protected with them and perhaps even for them. [...] It is clear that the only truly sustainable protection system is one that involves the local population in the project."*

Luc Hoffmann

### a. Effective incentives: An Exemplary State, the Driving Force Behind Private Sector Initiatives

Beyond legislative and regulatory consistency, and in line with the COP15 goals, States must lead by example in their own approach to biodiversity.

To encourage a shift in perspective on biodiversity and support companies that take up this challenge, States can generate a "demand shock" through public procurement. Public procurement accounts for over 2,448 billion euros in transactions annually, representing 16% of the EU's GDP. Public contracts should be awarded based on the criterion of the "most economically advantageous offer," which must incorporate environmental, social, and product life-cycle factors.

In all calls for tenders and public procurement, a distinct environmental criterion should be applied, rather than being integrated into a technical score. Within this criterion, the focus on climate should be balanced to also include biodiversity. To achieve this, the "environmental criterion" should be divided into three sub-criteria: "climate change mitigation and adaptation," "water and biodiversity," and "circular economy," the latter contributing to reducing pressures on resources and thus on biodiversity. It is also advisable to increase the weight of the environmental criterion and

establish a minimum threshold for this criterion. Where relevant, a preference for Nature-based Solutions could be included in the specifications of calls for tenders.

In a society of abundance, as defined by the work of Sophie Dubuisson Quellier, supply shapes demand. The State must set an example by structuring private solutions through its procurement choices. Moreover, in companies or sectors where the State has a stake, biodiversity considerations should be integrated proactively.

The State can also utilize more traditional tools, such as private property rights and contracts, to encourage private initiatives from both businesses and individuals that complement public action. In France, Environmental Real Obligations (OREs) are an example of such an approach.

The legal framework for Environmental Real Obligations (ORE) was established by Article 72 of Law No. 2016-1987 of August 8, 2016, known as the Law for the Restoration of Biodiversity, and is included in the Environmental Code under Article L. 132-3. OREs are similar to the Anglo-Saxon concept of conservation easements, which are already well-developed, and they form part of the European Biodiversity Strategy through the European Network for Private Land Conservancy. These OREs impose real obligations on the contracting parties, as well as on subsequent property owners, as long as such obligations aim to maintain, conserve, manage, or restore elements of biodiversity or ecological functions.

These contracts often define the permitted and prohibited uses of land. Rights registered on property titles ensure long-term preservation, with a maximum duration of 99 years in France. In contrast, in the United States and Canada, rights established under a conservation easement are typically perpetual. This flexible contractual framework serves as a conservation tool for private landowners who wish to pass on living heritage beyond the physical property.

The adoption of this mechanism by private stakeholders and individuals greatly depends on the tax incentives offered by public authorities. In the United States, for example, thanks to this system, the number of hectares placed under protection in Virginia has quadrupled.<sup>138</sup> It is estimated that over 300,000 of these contracts, covering more than 13 million hectares, have been made in the United States. In the absence of such incentives, results in France have been much less successful.

- In New Zealand, exemptions from transfer taxes on gratuitous title transfers are in place, while in the United States, up to \$500,000 of land value can be excluded from estate taxes.
- Landowners entering into Environmental Real Obligations (ORE) can benefit from income tax reductions of up to 4% in South Africa, while in Canada, they receive tax credits ranging from 15% to 30% of the value of the donated land classified as ecologically sensitive.
- In South Africa, there is an exemption from property tax on undeveloped land, while in other countries like New Zealand, a reduced rate is applied.

By contrast, financial incentives in Australia are extremely limited. These primarily philanthropic projects cover more than 10,000 hectares with over 6,000 conservation agreements.<sup>139</sup> However, to meet the Kunming-Montreal preservation targets, the current Australian government is developing financial incentives.

This instrument, which is less costly than traditional conservation measures (such as creating parks or reserves), makes it easier to implement environmental protection measures to achieve national and global

<sup>138</sup> Pentz D., Ginzburg R., McMillen, R., 2007, "State conservation tax credits: impact and analysis", *The Conservation Resource Center*.

<sup>139</sup> *Fondation François Sommer*, 26 April 2024, "Les obligations réelles environnementales: a new tool for nature conservation", *Colloquium*.

strategy objectives and encourages private stakeholders and individuals to take ownership of these issues.

The “30 by 30” alliance, which brings together Japanese private and public stakeholders with the goal of achieving Targets 2 and 3 of the Global Biodiversity Framework (GBF) – protecting 30% of key terrestrial and marine areas for biodiversity and restoring 30% of degraded lands and seas by 2030 – serves as a model for other states to follow. This is already the case for companies like Honda in Japan.<sup>140</sup> French companies could also commit to protecting and/or restoring a portion of their own land. Even without owning land, companies could voluntarily enact this commitment by purchasing “renaturation units” within a designated compensation, restoration, and renaturation site. These units would represent 30% (or more) of their land surface area. This “30 by 30” commitment could be integrated into their reporting as a valuable asset. Monitoring these commitments requires the deployment of a public, cadastral database that includes contracts, commitments from all parties, and tracking mechanisms associated with voluntary conservation measures or other conservation easements.

The deployment of voluntary conservation measures could be carried out alongside the development of payments for ecosystem services (PES). This involves compensating practices, management approaches, or public policies that support the maintenance or enhancement of ecosystem services, reflecting the idea that landowners or communities should be rewarded when they promote positive practices that go beyond legal requirements and enable ecosystems to function effectively.

Private-private PES are the most widely implemented around the world. Mexico is one of the first countries to establish a large-scale forest PES aimed at preserving water resources. Landowners are invited to apply for PES after committing to preserving forests and abandoning certain

<sup>140</sup> An example of a company's commitment to this coalition can be found at <https://global.honda/en/newsroom/news/2022/c220426eng.html>.

agricultural practices. To determine priority regions, the Mexican government has established a points system based on environmental and social criteria.<sup>141</sup> Over seven years, the annual deforestation rate was halved: 3,000 landowners covering 2,365 km<sup>2</sup> benefited from this program, receiving \$300 million, partly funded by revenue from water agencies.

The nature of PES is highly flexible, allowing it to evolve as a public policy over time. Initially, to support the transition, PES can compensate for lost income from certain abandoned activities or practices, encourage the preservation or restoration of existing ecosystems (e.g., wetlands, degraded lands), and promote practices such as planting hedgerows and trees. It can then reward virtuous players who, for example, agree to suspend certain usage rights. However, property rights are crucial for implementing PES: the provider of the environmental service must have management and exclusion rights over the land or resources.

The deployment of PES allows for the remuneration of efforts made to conserve or maintain biodiversity-friendly practices without placing the areas under strict protection. This approach, which does not oppose social and economic development with environmental protection, is an effective tool for fostering acceptance of the transition.

Finally, the State must play a crucial role in reducing the financing costs of projects that take biodiversity into account, notably by offering guaranteed loans or interest rate subsidies. In addition to these financial signals, the State can contribute to educating and informing people to better direct their savings. The 2019 SFDR (Sustainable Finance Disclosure Regulation) aims to support this objective but remains largely unknown to the general public.<sup>142</sup>

<sup>140</sup> *Environmental system value + poverty level + deforestation risk.*

<sup>141</sup> *Regulation (EU) 2019/2088 of the European Parliament and of the Council of 27 November 2019 on Sustainability reporting in the financial services sector, <https://eur-lex.europa.eu/legal-content/fr/ALL/?uri=CELEX%3A32019R2088>.*

However, technical solutions will only be effective if the State integrates biodiversity into all long-term economic strategies aimed at ensuring sovereignty and the resilience of value chains. The State must take an ambitious stance in multilateral forums, particularly at European level. While the State has traditionally been a key player in environmental protection, its legitimacy – and even its good intentions – are increasingly called into question. Ensuring the coherence of its decisions is therefore essential to maintain its ability to build a framework, jointly with other State and non-State players, and most importantly, to ensure its effective implementation and enforcement of compliance.

Decisions to postpone or cancel environmental measures, including at European level, discredit all other actions that could be taken and public discourse in this area.

**b. Anticipating Crises and Opportunities:  
For a Multi-Stakeholder Territorial  
Biodiversity Project**

The profound changes caused by ecosystem degradation and/or biodiversity conservation actions require us to anticipate new vulnerabilities, potential conflicts over resource use, and possible inequalities between regions or stakeholders. This reflection must be conducted at the local level. Indeed, the proper functioning of ecosystems on a global scale depends on the preservation of biodiversity at the local level, where the negative impacts of human activities, as well as the positive actions taken to protect it, are most visible. Because the local level is the living environment of stakeholders with different activities, skills, and objectives, people who are connected through their shared attachment to a common natural heritage, biodiversity management requires an integrated approach that builds local synergies to support protection, restoration, or renaturation projects.

Local implementation first requires a shared territorial diagnosis among public and private stakeholders and civil society. Identifying each territory's opportunities, constraints, and limitations is the first step in developing adaptation and resilience strategies. Environmental DNA (eDNA) is a non-invasive, cost-effective method (compared to traditional methods) that does not require high-level skills for sample collection, making its large-scale deployment feasible.

Among the methods available for collecting data for local authorities, environmental DNA (eDNA) enables the creation of a comprehensive baseline assessment within a timeframe that aligns with the urgent need to address biodiversity decline. The resulting mapping could serve as a reference state, with public authorities responsible for determining the trajectory to meet global biodiversity preservation targets. These assessments would contribute to the development of territorial indicators (such as species diversity and the distribution between native and invasive species) available in a public database. An annual review of this data would allow private and public stakeholders to understand and compare the outcomes of their conservation efforts.

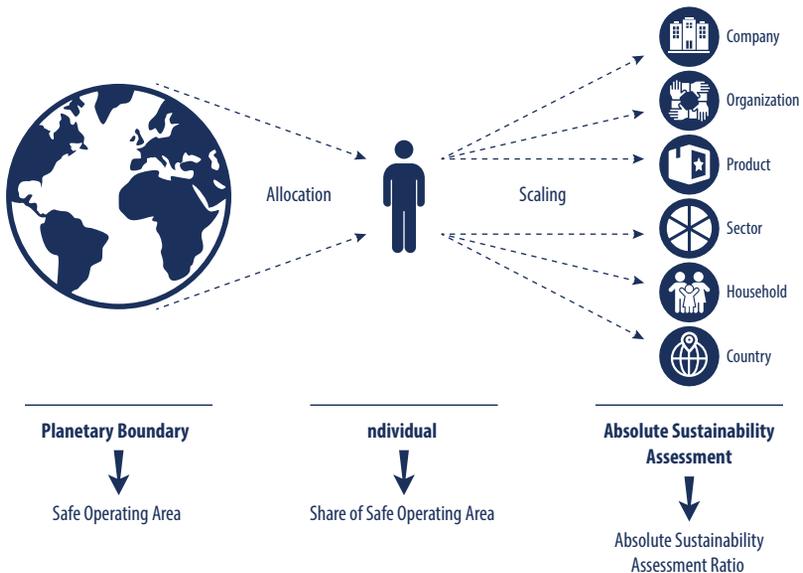
To ensure the legal robustness of this method, public authorities must guarantee the reliability of the methodology and, at a minimum, ensure the adoption of the highest standards across Europe. Considering the strategy published last June by the U.S. President's scientific committee,<sup>143</sup> and to achieve consensus on the issue, Europe should promote this topic at upcoming international forums, particularly at COP16 Biodiversity.

Territorial strategy planning documents can incorporate the nine planetary boundaries. This local scale should be defined based on the country's history and administrative divisions. Over a hundred studies have

<sup>143</sup> *eDNA Task Team of the Interagency working group on biodiversity of the subcommittee on Ocean Science and Technology Committee on Environment of the National Science & Technology Council, (June 2024). National Aquatic Environmental DNA Strategy. Executive Office of the President of the United States.*

already proposed adaptations of the planetary boundaries framework, either by combining it with product life cycle analysis – a tool specific to businesses – or by applying it at territorial level, such as in New Caledonia.<sup>144</sup>

**Graphique no. 25: Proposed Downscaling Process**



Source: Ministry for Ecological Transition and Territorial Cohesion, Statistical Data and Studies Department, October 2023. "La France face aux neuf limites planétaires". <https://www.statistiques.developpement-durable.gouv.fr/edition-numerique/la-france-face-aux-neuf-limites-planetaires/>.

<sup>144</sup> Although it was not originally designed to be applied in a specific way, it can be used to structure the analysis of the environmental impact of specific territories or activities.

The analysis using planetary boundaries should highlight the specific vulnerabilities of a given territory. In April 2020, in the post-COVID context, Amsterdam decided to develop a plan based on the Doughnut Theory, which combines a social foundation of human rights with planetary boundaries. Since then, every new public policy in the city must meet the dual objective of protecting the environment and natural resources, reducing social exclusion, and ensuring a good standard of living for all. This approach can offer new perspectives for decision-making on a territory that is now viewed through the dual environmental lens of available resources and its capacity to absorb pollution.

This approach necessitates multiscale coordination. It involves the allocation of “environmental budgets” that would define an “acceptable level of pollution” at the local level, interconnected with regional, national, or European levels. While this framework can be a powerful mobilizing tool, it will require a high degree of integration of environmental constraints at all levels of public decision-making. Beyond public stakeholders, businesses and individuals will be involved in the collective negotiation of resource use limits and the mechanisms for their implementation.

Indeed, this new governance model calls for a profound renewal of decision-making processes to ensure the sustainable and socially equitable management of resources, reconnecting with the principle of managing the commons. Resource management could face the dual challenge of overexploitation coupled with underinvestment in pollution mitigation measures. This is what Garrett Hardin referred to as the “tragedy of the commons,” the idea that shared exploitation of resources by too many players leads to consumption that exceeds the capacity for regeneration. Faced with resource scarcity, which no single players can tackle alone, each is incentivized to increase their exploitation, as the individual benefit remains greater than the share of disadvantage borne.

To overcome this limitation, various solutions have been proposed. First, the privatization of resources, allowing for their regulated management,

but excludes a large number of individuals. This approach is favored by Garrett Hardin, who developed his theory to justify enclosures. Second, public management, which carries the risk of excessive bureaucracy, lacking coherence and effectiveness, and potentially giving rise to what P. Lascoumes called “ecopower.”

Faced with this dualism, economic thought has addressed the issue of governing common goods, defined as rival but non-exclusive resources.<sup>145</sup> These are material or immaterial resources that can be shared, but their use may lead to degradation.

The management of the commons, which “involves a shared resource, managed collectively according to access rules and governed by specific models of governance,”<sup>146</sup> should adhere to several key principles:

- Limitation of resources and individuals who hold extraction rights.
- Adaptation of exploitation rules to the context of the resource being managed.
- Mechanisms for collective decision-making that allow for modifications in management practices.
- Internal monitoring mechanisms accountable to the community.
- Implementation of graduated sanctions for rule violations, starting with very mild penalties. This graduated approach aims to foster internalization and voluntary adherence to rules, serving both educational and punitive purposes.
- Quick and low-cost access to a local conflict resolution body.
- Legitimacy as a self-organized structure recognized by external entities, such as the State.
- Nested structures that operate at different levels and fulfill various functions.

<sup>145</sup> Classification established by Samuelson Paul, “The pure Theory of Public Expenditure”, *Review*

<sup>146</sup> Ostrom E., 1990, “Governing the Commons: The Evolution of Institutes for Collective Action”, Cambridge, Cambridge University Press.

Elinor Ostrom, whose examples, though relatively dated, all stem from empirical analysis, integrates contributions from political philosophy on collective responsibility through participation. François Ost advocates for a participatory approach based on a community management model: this means that the public has the right to oversee management practices, is regularly consulted and informed, and that there are available avenues for recourse.

Additionally, the management of current commons should not overlook collective responsibility for past commons, which have, in some cases, become “negative commons.”<sup>147</sup> This category traditionally includes waste generated by the production of goods or energy, such as nuclear waste. Their management requires moving beyond a profit-oriented mindset, which, in the absence of regulation, can be detrimental to local communities affected by the negative externalities they produce (pollution, nuisances, etc.). It also necessitates reuse, now widely accepted in the form of recycling. However, it may now be time to also include degraded commons, such as polluted or depleted soils, contaminated water, dried-up rivers, and industrial wastelands.<sup>148</sup> One characteristic of some negative commons is that they cannot be entirely considered public commons. For instance, soil remains private property, yet pollution affecting areas beyond property boundaries can be viewed as a public negative common. At the very least, the commons approach encourages collective responsibility to avoid burdening future generations with managing negative heritage. Identifying the appropriate level of governance is thus crucial for both “positive commons,” for which certain frameworks exist, and “negative commons,” some of which remain uncharted.

When discussing territory and collective management, it is essential to identify the appropriate level of action, particularly since current

<sup>147</sup> Expression coined by German sociologists. M. Mies and V. Bennholdt-Thomsen, “Defending, Reclaiming and Reinventing the Commons”, *Canadian Journal of Development Studies* – *Canadian Journal of Development Studies*, 22, no. 4, 1 January 2001.

<sup>148</sup> Monnin A., September 2021, “Les communs négatifs. Entre déchets et ruines”, *Études*.

administrative boundaries rarely align with the physical limits of natural environments. Several existing frameworks are available to public decision-makers. Options include natural park territories or extending territorial projects based on water basin management to include biodiversity considerations.

For these “territorial biodiversity projects,” inspiration can be drawn from territorial food projects or Italy’s biodistricts.<sup>149</sup> These options are not mutually exclusive and will depend on both ecological logic and the perceived legitimacy of the stakeholders involved. To avoid creating distortions, a sustainable resource use framework – including scientifically coherent resource use indicators, monitoring mechanisms, and control methods – should be defined at the European level. This political framework is particularly necessary due to potential conflicts over resource use, arising from the increased demand for natural resources to replace fossil fuels and, for example, the need to maintain or develop food sovereignty.

To support local stakeholders, a classification of territories based on their resources and their status regarding planetary boundaries, as well as priority measures to be implemented, could be proposed at European level and then adapted nationally. Consultation, adoption, implementation, and monitoring would take place at the relevant territorial level, involving cross-sectoral collaboration and engaging all stakeholders, directly or indirectly.

Just as scarcity within ecosystems often leads to cooperation between species, integrating planetary boundaries into the strategic thinking of public and private leaders will encourage the development of synergistic

<sup>149</sup> *A bio-district is a geographical area in which all the entities (farmers, citizens...) are involved, tourism companies, associations and public bodies) has signed an agreement to manage sustainable use of resources. The aim of the agreement is to “realise the economic potential and socio-cultural aspects of the region”. There are currently 51 in Italy. <https://www.fao.org/agroecology/database/detail/en/c/1073220/>.*

or even symbiotic approaches that enable production while renewing resources.<sup>150</sup>

Although planetary boundaries are objectively constraining, they invite us to invent a new space for freedom. Indeed, while this report aims to propose ways to integrate biodiversity at the highest levels of public and private decision-making, the transition must take into account both environmental and social cohesion challenges. The urgency and interdependence of crises – whether ecological or reflecting the erosion of the social contract – do not allow us the luxury of addressing them one at a time. They highlight the need to redefine living standards, create new narratives, and envision a different future. In essence, this reflection on the importance that businesses must assign to biodiversity, to ensure their resilience, marks the beginnings of an evolution not only in the economic model but also in society as a whole. The challenge is ultimately to integrate the necessary resource frugality while preserving the European social model.

<sup>150</sup> Delannoy I., 2017, *“The symbiotic economy, Regenerating the planet, the economy and society”*, Published by Actes Sud.

Rendered invisible in our representations and threatened by anthropogenic climate change, biodiversity is both a mystery and a challenge. A mystery, because it remains largely uncharted; the number of species present on Earth is still only an estimate, and certain life forms—such as fungi, bacteria, or unicellular organisms—continue to elude our full comprehension. A challenge, as the abundance of life forms, constantly evolving and characterized by its inherent complexity, makes it difficult to understand and quantify, yet remains essential to our existence.

This report aimed to demonstrate how biodiversity, often reduced to a few iconic species or unfounded value judgments, is fundamental to our productive, social, and cultural activities. Its erosion, or even collapse, would therefore have dramatic consequences for human societies, with social justice, environmental, and economic repercussions.

Throughout most of our shared history, nature has influenced every aspect of the development of human societies. Today, however, humans are the ones negatively impacting nature's ability to sustain its abundance. This is why everyone, including governments, businesses, and citizens in France and around the world, shares a common responsibility toward nature.

The observation we have just shared regarding biodiversity and its inherently systemic nature has led us to propose three priority areas of recommendations aimed at initiating a coherent and effective approach.

## Axis 1

**Build a European framework for biodiversity that effectively allocates responsibilities between public and private stakeholders.**

### **Recommendation 1**

Establish scientifically based definitions of key biodiversity concepts, to build a common European framework and promote its adoption at an international level.

Legal developments and the creation of international frameworks must provide economic and institutional stakeholders with new tools to facilitate a more comprehensive and informed understanding of their dependencies and impacts. They should also contribute to amplifying and broadening the efforts certain companies already make, by providing a common framework and promoting synergies through information sharing.

This effort to define must be accompanied by an effort to clarify, if not to simplify, the drafting and application of the resulting legal provisions, in light of the dual challenge of legal certainty and business acceptability.

### **1.1. Provide a scientific definition of the critical concepts that are “good ecosystem status” and “positive biodiversity,” in order to establish a diagnosis and set a trajectory.**

Based on the model of the Water Framework Directive, embed the concept of “good status” ecosystems in European legislation, and potentially within the global framework arising from the forthcoming biodiversity COP, leaving it to the Member States to provide a set definition in their national legislation. In line with the Kunming-Montreal commitments, set a trajectory for achieving these good statuses with realistic timelines.

Establish science-based definitions for the concepts of “neutrality,” “loss,” or “biodiversity net gain,” and “positive biodiversity” – which implies an additionality that goes beyond simple compensation – as well as for “protected areas” and “restored ecosystems.” This is an essential prerequisite for constructing a trajectory and ensuring legal certainty for private stakeholders. Establish criteria to guide private endeavors and public policies while respecting the Avoid-Reduce-Compensate sequence.

These definitions are essential for developing a variety of territorially relevant approaches that respond to the multiplicity of living things. Experiments and iterative processes are central to these localized approaches, which are not systematically replicable. Only under this condition can territories maintain ecosystem functionality that benefits all their inhabitants.

## 1.2. Set specific objectives to be achieved on a territorial level, based on planetary boundaries and habitability thresholds.

Planetary boundaries can be used to analyze pressures on biodiversity by defining quantitative indicators associated with habitability thresholds. It will then be necessary to set objectives on a territorial level and for each planetary boundary to either return to or maintain these habitability thresholds.

These experiments will establish reference conditions, based on the model of the Water Framework Directive, to assess the overall status of these territories (high, good, moderate, degraded, severely degraded) and thus guide the response.

Our prosperity depends on our ability to assess the state of biodiversity, its evolution, and future trends. We must accelerate the creation of comprehensive biodiversity inventories based on environmental DNA, without being invasive to ecosystems, which allows for large-scale mapping at a reduced cost. Public authorities should ensure the establishment of a rigorous and comparable methodological standard, along with the publication of this information on a public database. These experiments in localizing planetary boundaries and mapping the state of biodiversity will enable us to set reference states, assess the overall condition of these territories, and determine indicators to guide the actions of local public and economic stakeholders.

The response of the State, as the instigator of environmental protection policies, has been slow and imperfect in tackling the issues related to biodiversity, which have long been overlooked and overshadowed by the

fight against climate change. However, the interconnection of the climate and biodiversity crises requires both public and private stakeholders to tackle these two issues simultaneously – from analyzing impacts, dependencies, risks, and opportunities to defining environmental strategy.

### **1.3. Integrate biodiversity into energy transition deployment programs to ensure that biodiversity is not adversely affected by climate strategies.**

Promote climate-biodiversity synergies by supporting existing initiatives aimed at establishing frameworks that integrate the measurement of overall environmental impacts (including climate, biodiversity, resources, etc.).

Build on positive climate actions by integrating biodiversity protection and restoration efforts into labels, carbon credits with co-benefits, or measures such as the Net Environmental Contribution. The voluntary carbon market can help facilitate this synergy. Systematically enhancing high-integrity carbon credits with a biodiversity component within an existing and structured market would save time and promote funding for projects aimed at restoring and preserving biodiversity while mitigating climate change. Having learned from the fraudulent behaviors which occurred on the voluntary carbon market, it is essential to establish entry criteria for this market. Strict adherence to the mitigation hierarchy should be ensured: first set is to avoid, reduce if necessary, and compensate as a last resort. Companies should, at the very least, develop a pressure reduction plan before committing to any credit purchase scheme. The types of projects approved, which must contribute to public policies and territorial frameworks over the long term, will have to be determined. Furthermore, the types

players in charge of implementation (ecologists) and the governance and verification criteria must be clearly defined. Relevant control measures should be identified now, including the establishment of monitoring indicators.

Conversely, it is important to consider the benefits of biodiversity for climate change adaptation when conceptualizing and promoting climate projects (such as mitigating heatwaves and naturally regulating the water cycle, etc.).

## **Recommendation 2**

Coordinate the distribution of responsibilities between the public and private sectors on an ecological territories level.

Biodiversity is inherently local, and its protection must also be localized, relying on detailed territorial knowledge that only local entities possess. Instead of creating new bodies or tools that add complexity, the focus should be on capitalizing on existing structures and data sources to facilitate informed decision-making based on scientifically supported objectives. Special attention should be given to fostering dialogue between water and biodiversity stakeholders.

## **2.1. Extend governance at all levels for both positive and negative public commons by involving private players, civil society, and public stakeholders.**

Develop governance for both positive and negative public commons at the local level and integrate these decisions into territorial planning master plans. The establishment of rules for the use of common goods will result from a compromise among different interlinked decision-making spheres.

Drawing inspiration from existing tools and bodies, integrate scientific players, private stakeholders, environmental associations, and civil society. Civil society involvement can be partially achieved through a lottery system to enhance the acceptability of decisions arising from deliberative democracy. This will involve determining development trajectories that respect the environmental limits identified through planetary boundaries.

To ensure the implementation and effectiveness of decisions made, organize an annual scientific review led by a public body, such as the Ministry of Ecology's Directorate of Water and Biodiversity. Share the results with local citizens, utilizing data from the [naturefrance.fr](https://naturefrance.fr) portal.

This updated governance calls for a deeper consideration of biodiversity issues within existing regional planning instruments.

## 2.2. Strengthen the integration of biodiversity in existing territorial planning instruments by relying on established common objectives.

Immediately utilize existing biodiversity inventories as tools to guide local urban planning policies. At the same time, bolster the experimentation with planetary boundaries in the territories with an experimental “environmental budget” tailored to relevant levels (regional, inter-municipal, and municipal) and integrate it into territorial planning documents. Rate the budgetary operations of these territories based on pressures as defined by IPBES, excluding climate change. It would do well to assess all budgetary operations using a bonus-malus system.

Finally, the State would play a role in coordinating, monitoring, and overseeing the various experiments conducted, ensuring consistency among different frameworks to facilitate their broader application.

The preservation of biodiversity therefore depends on the active participation of businesses and citizens. As stakeholders and residents of a given territory, sharing its history and fate, they must be involved in the discussions that precede land-use decisions and development trajectories.

However, this common framework, while necessary, will be insufficient without structural change. Such a change is essential to reflect the fundamentally critical nature of biodiversity.

## Axis 2

### **Promote the integration of biodiversity in economic models.**

#### **Recommendation 3**

Shift the value paradigm by introducing biodiversity as an economic driver of prosperity and by focusing on innovation.

The market does not value biodiversity, viewing it instead as a risk that incurs additional costs. Therefore, a paradigm shift is necessary to integrate the dependencies of economic systems and societies on biodiversity by assigning it a value, including a financial one. Given the existential stakes involved, public authorities must be fully engaged in this effort.

#### **3.1. Develop public accounting for biodiversity based on sectoral experiments to better direct public spending towards positive impact endeavors.**

In addition to the commitments made at Kunming-Montreal, carry out or complete the green budget review by reflecting on the gray budget for two reasons. First, account for the negative impacts on biodiversity from environmental expenditures currently classified as neutral (such as agricultural and fishing subsidies, 1st pillar CAP expenditures, and support for renewable electric energy). Second, assess “neutral” expenditures that are not directly linked to, yet

contribute to, environmental policies, notably to land artificialization, by applying standardized rates.

As part of the financial legislation projects of various European countries, particularly the upcoming public finance programming bill for 2028-2032, raise the target for reducing the ratio of overall environmentally harmful expenditures to those that are either beneficial or mixed.

Companies must also recognize biodiversity as a cornerstone of their resilience. While cataloging dependencies may be tedious, and the standard sometimes viewed as a constraint that leads to competitive distortions, the ability to anticipate vulnerabilities and invent new technical and organizational solutions will be the competitive advantages of tomorrow.

### **3.2. Building on the CSRD framework, integrate biodiversity into corporate strategy and make it a priority for board members.**

We are seeing the emergence of resolutions related to biodiversity at corporate general meetings and inquiries from investors regarding this issue. However, for corporate leaders and board members to effectively address this concern, they need to understand it and appreciate its implications for the company. Three key leverage points have been identified.

At the next COP on Biodiversity, advocate for the recommendation that corporate CSR strategies go hand in hand with a biodiversity analysis. This analysis should be based on the pressures and dependencies identified, defining clear objectives over various time horizons, similar to what is already in place for climate issues. It should align with the recommendations of the TNFD and SBTN to avoid creating new frameworks.

Train corporate boards as to the implications of biodiversity for economic activity, as is already done for climate issues. Lastly, involve intermediary organizations, such as chambers of commerce, who are already mobilized in support of the ecological transition, in order to engage small and medium-sized businesses.

The preservation of biodiversity and the competitiveness of French and European companies also calls for an enhancement of environmental and economic diplomacy. Promoting this internationally, particularly during climate and biodiversity COPs, and, in the medium term, globally adopting currently voluntary initiatives like the SBTN, would highlight the positive actions of European companies on biodiversity without compromising their competitiveness or creating new frameworks that could lead to possible confusion.

### **3.3. Promote the joint consideration of biodiversity and the water cycle at OECD level, and during the COPs, encourage a framework for non-financial reporting on biodiversity impacts and contribute to the emergence of a new business model for companies.**

The aim here is not to create new frameworks but to have all parties adopt existing ones, such as SBTN and TNFD, which are robust voluntary instruments for which French stakeholders hold undeniable international leadership. In line with the first recommendation, the SBTN allows for the establishment of environmental objectives aligned with planetary boundaries. Consequently, the positive actions of European companies on biodiversity in terms of global competitiveness would be recognized. Encourage all stakeholders at the COP on biodiversity to chart the state of biodiversity in their national territories, which will serve as a reference point and help define future trajectories.

Current commitments, particularly financial ones, aimed at preserving biodiversity are often seen as generating additional production costs. In reality, they are investments in maintaining valuable natural capital. Due to its degradation and resulting scarcity, the economic cost of natural capital increasingly reflects its ecological importance.

### **3.4. Develop investments in activities that preserve or restore biodiversity and the water cycle, following the model of climate incentives.**

While financing strategies for the climate transition have grown among financial players, funding for the preservation and restoration of biodiversity remains insufficient to halt its decline.

The aim is to develop positive investment strategies for biodiversity based on a better understanding of companies' and financial institutions' exposure to dependencies, impacts, risks, and opportunities related to nature, particularly through international methodological frameworks (SBTN) and regulatory frameworks (CSRD). The alignment of upcoming standards with these frameworks should be encouraged to facilitate their use by companies and contribute to improving the quality of non-financial information related to biodiversity without excessively increasing the reporting burden.

A consistent approach to measuring impacts on biodiversity and ecosystems must be established to assess and verify the positive impacts of sustainable investment activities or products (drawing on indicators recommended by the SBTN).

Investors and rating agencies should recognize the positive contribution of environmental services in mitigating pressures on biodiversity. To this end, the specific nature of environmental services must be acknowledged, provided that the activity is carried out sustainably: residual negative impacts should not overshadow the primary positive impacts generated by these activities. The consideration of mandatory impact indicators (e.g., Principal Adverse Impacts of the SFDR) or voluntary indicators (e.g., SBTn) should be

adapted when applied to an activity whose primary objective is to reduce the pressure measured by the indicator.

"Biodiversity dividends," similar to "climate dividends," could be developed to assess companies based on the positive contributions they make to biodiversity.

More broadly, given the important role that water plays in maintaining biodiversity, this recommendation could be extended to activities that contribute positively to the quality of aquatic environments.

It is also the government's responsibility to create a supportive framework for innovation and experimentation by developing a long-term plan. Special support should be provided for research and for startups combining research and industry, to scale up their efforts. Research should notably focus on substituting or reducing dependencies (and thus certain pressures on resources) or on innovations that facilitate adaptive measures.

### **3.5. Accelerate research and innovation for solutions that promote the reduction of pressures on biodiversity, with a priority on the agricultural sector.**

While technological solutions can develop know-how that helps to account for biodiversity, the race for technological innovation may also reinforce a business-as-usual approach by overstating the merits of techno-solutionism. Innovations related to biodiversity should all adhere to the imperative of alleviating pressures.

This imperative could, in fact, serve as the primary lens through which these technological proposals are evaluated.

Investing in fundamental research aimed at better understanding and describing biodiversity and its dynamics could help identify innovations in green sciences and sustainable biotechnologies that are ecologically beneficial for the preservation and restoration of biodiversity:

- Promote the deployment of innovative agricultural technologies that facilitate the transition of large-scale crops to more sustainable practices.
- Support the deployment of biotechnologies, particularly through the development of processes for producing fermentable raw materials (carbon sources for industrial biotechnologies) derived from second-generation biomass or waste streams.

## **Recommendation 4**

Assign financial value to commitments favoring biodiversity.

Environmental issues extend beyond the purview management and business activities, requiring an integrated, collective, and substantial response. In the face of urgency, strong and clear commitment from public authorities is essential. In addition to redirecting public spending that harms biodiversity toward preservation and rewilding initiatives, new financing mechanisms and incentives, particularly fiscal ones, need to be developed.

#### **4.1. Compensate additional actions that support biodiversity and sustainable water management by scaling up payments for ecosystem services (PES).**

This approach aims to better acknowledge the direct link between sustainable management of the water cycle, of soils, of forests and of biodiversity.

Scaling up PES, which involves public-private or private-private contracts, serves as a lever in the context of territorial governance plans, which notably involve players from the agricultural and agro-industrial sectors, businesses, local officials, and government services.

In addition to existing public support for the transition, fair compensation for additional actions that contribute to the provision of environmental services, within the broader framework of redefining the role of farmers and foresters – as they often initiate these actions as providers of both products and services – represents a significant opportunity for preserving or restoring biodiversity. Linking PES, especially for agricultural operations, to the signing of voluntary conservation measures, could be considered.

The State's legitimacy will necessarily depend on its ability to set an example, which must include accounting for the preservation of biodiversity in its economic activities.

## 4.2. Align public procurement with the state's commitments to biodiversity.

Public procurement can be a catalyst for biodiversity preservation. In this regard, two leverage points have been identified: first, weighting the environmental performance criterion in tender offers; and second, when relevant, integrating a preference for nature-based solutions into the specifications.

Set the minimum contribution of the environmental performance criterion to 20% of the total score for all public procurement tender offers. This level may be increased to 30% of the total score for public procurement in high-impact sectors.

The environmental performance criterion will also be subdivided into several categories:

- Climate, focusing on mitigation and adaptation to the impacts of climate change.
- Water and biodiversity.
- Circular economy, which helps alleviate certain pressures on biodiversity, including the overexploitation of resources.

In the context of infrastructure projects led by local bodies, encourage nature-based solutions, either on their own or in conjunction with “grey” solutions. Services provided by nature-based solutions – measured by performance indicators – must meet high standards.

At international level, the State must also leverage its diplomatic influence to shape collective decisions toward taking biodiversity in account more seriously, but also to reinvent the comparative advantages related to biodiversity in order to make it a feature of economic competitiveness.

### **4.3. Develop State-backed bank loans to encourage private stakeholders to commit to biodiversity initiatives.**

Provide, through a state guarantee, long-term, highly subordinated bank and bond financing to SMEs and mid-sized enterprises (ETIs) allocated to projects aimed at preserving and/or restoring biodiversity, following the model of participatory loans.

Voluntary conservation measures are an important lever for biodiversity preservation initiatives coming from private stakeholder, as demonstrated by the experiments developed in the United States, Australia, and Canada, for example. These voluntary conservation measures can significantly contribute to achieving the “30 by 30” target set by the signatory states at COP15. However, international comparisons are clear: without fiscal incentives, there will be no large-scale implementation of this mechanism.

### **4.4. Provide tax incentives for private players (individuals and businesses) to subscribe to real environmental bonds.**

In addition to alleviating pressures on biodiversity, the voluntary commitment of private players can contribute to achieving the “30 by 30” target set at the COP15, through the signing of voluntary conservation measures, similar to the Japanese “30 by 30” alliance. These commitments should be recognized in the context of CSRD or non-financial reporting.

As far as voluntary compensation measures are concerned, fiscal incentive mechanisms should be developed, and several options can be explored. Converting notary fees associated with subscriptions into tax deductions is one possibility. Opening a zero-interest loan for the value of the land under ORE to carry out work directly related to environmental transition issues could be another. For farmers, voluntary conservation measures could be integrated into agri-environmental measures, and the income generated from this could be exempt from income tax and social contributions. For businesses, a corporate tax exemption could be considered.

### Axis 3

#### **Strengthen the social acceptability of biodiversity conservation measures.**

Territorial planning choices, interwoven across various levels of public decision-making, will stem from a shared culture and will require ambitious experiments as well as trade-offs to determine, on a case-by-case basis, solutions that are environmentally beneficial, economically competitive, and socially equitable.

#### **Recommendation 5**

Promote fairness in biodiversity conservation measures to ensure their acceptability.

Incorporating biodiversity into public and private decisions undoubtedly requires to reintegrate nature into our concept of heritage. However, it is often viewed merely as an asset of declining profitability.

It seems necessary to reconnect with what heritage should enable: ensuring that future generations can reasonably enjoy the legacy of a preserved past in order to build an equitable future. However, this requires overcoming the sometimes conflicting interests of its stakeholders, whose short-term perspectives may undermine the chances of successful transmission. To achieve this, it is essential first to identify the resources on which the highest pressures are applied.

### **5.1. Identify new vulnerabilities and potential conflicts of use at local level.**

The increasing scarcity of certain resources (such as water and healthy soils) and the needs for the energy transition (including mineral extraction and biomass) carry the risk of new conflicts over use, both within territories and between them, as well as the creation of new vulnerabilities that must be identified now. Documenting these conflicts through feedback from players in the field, particularly scientists, is imperative. Depending on the national administrative divisions, the appropriate level for collecting this data must be identified.

Arbitrate these conflicting uses based on strategic considerations and rely on the work of French Development Agency (AFD, ESGAP), while also anticipating potential compensations based on the loss of use value.

These decisions will inevitably lead to reconfigurations of relationships among stakeholders and in relation to biodiversity, sometimes resulting in loss of income, particularly in terms of taxation. Realism and equity therefore highlight the need for the establishment of redistributive systems to benefit the affected territories.

### **5.2. Experiment with redistributive mechanisms aimed at correcting new vulnerabilities.**

These redistributive mechanisms should be particularly applied to agricultural stakeholders, including those already engaged in regenerative and organic practices, as well as to specific territories. Plan for a review after five years to ensure the dynamic nature of the redistributive system in considering the economic and fiscal consequences of projects in each territory.

In the collective imagination, environmental issues are all too often associated with constraints on achievements or as obstacles to free consumption, which has long been synonymous with social progress.

## **Recommendation 6**

**Raise awareness, empower and mobilize stakeholders.**

A change in collective perceptions seems necessary to highlight the dormant value of biodiversity. While scientific awareness is essential, it will not be enough on its own. This change must be based on creating new

narratives and shifting environmental policing toward raising user awareness of the pressures exerted on biodiversity.

### 6.1. Develop new ways of raising biodiversity awareness.

The preservation of biodiversity goes beyond the scientific, economic, and political frameworks mentioned above. At the intersection of science, art, and culture, it also questions the status of humanity, its place in the hierarchy of life, and its responsibility toward the ecosystems that sustain it. This is why a genuine paradigm shift is needed, and perhaps a redefinition of some of our collective and individual modes of thinking and preferences. Scientific education could be furthered in educational institutions (e.g., through participatory science initiatives). In higher education, a better understanding of biodiversity among business stakeholders and a better understanding of business among biodiversity specialists seems necessary. Skills-based volunteering for biodiversity and an ecological solidarity leave, which already exist, provide opportunities for engagement between the business world and conservation efforts. Moreover, biodiversity should benefit from initiatives, particularly artistic and cultural ones, aimed at envisioning new ways of being in the world.

While the evolution of mindsets is essential in the long term, it must be accompanied by practical actions in the short term, particularly by empowering citizens in their daily relationship with nature through awareness initiatives and, where necessary, addressing detrimental behaviors. Due to their local roots and missions, environmental enforcement agents play a crucial role in transforming the relationship with biodiversity.

As such, they must be equipped with the resources needed to fulfill their primary role of raising awareness among users about the pressures on biodiversity while resolutely combating environmental crime.

## **6.2. Ensure the preservation of biodiversity locally through the deployment of a legitimized environmental enforcement agency.**

To ensure the effectiveness of governance for these commons and the actual environmental commitment of all stakeholders, it is essential to increase the number of environmental guards, who could be shared among several municipalities. Eco-guard programs represent another model that deserves further development, particularly as they are less costly in local budgets. These volunteer “nature guards” engage in activities related to monitoring, raising awareness, and preserving natural heritage.

Environmental crime further exacerbates pressures on biodiversity and undermines the efforts made by both private and public players to ensure the preservation of nature, especially given the sense of disparity between the efforts of some and the perceived impunity of offenders. Therefore, it is important to strengthen the resources available to investigative services.

### 6.3. Improve efforts to combat serious threats to biodiversity by strengthening the resources available to investigative services.

In the fight against organized environmental crime, provide investigative services with all available special investigative techniques. Develop a status for informants in the context of environmental offenses related to organized crime. The current lack of severity when it comes to penalties for environmental offenses could likely prove an obstacle to the attractiveness of such a status for offenders.

"What, then, is the barrier that prevents an indefinite increase in the number of species?" asked Darwin in 1859, in his *Origin of Species*. In 2024, the answer is all too well known and inevitably involves the pressures on biodiversity. While the collapse of biodiversity poses a significant medium-term threat, the political, organizational, and technical solutions to halt it are within reach. However, their implementation is often fragmented and relies too heavily on the conviction and goodwill of isolated players who struggle to build a cohesive response. This study aims to help public authorities and economic stakeholders engage more effectively in addressing one of the major challenges of this century and in responding to a very real demand from citizens.

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- **Billet P., Descoeur F., Girardot-Moitié C., Ranjard L.**, (13 December 2023), *Table ronde sur la santé des sols, commission à l'aménagement du territoire et du développement durable*, Sénat
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- *Fondation François Sommer pour la chasse et la nature*, (26 April 2024), *Les obligations réelles environnementales (ORE): un nouvel outil au service de la conservation de la nature*, Colloque
- **Frison-Roche MA., Leray G., Michon C., Racine JB.**, (26 February 2024), *Table-ronde sur le devoir de vigilance*, Commission d'enquête sur les moyens mobilisés et mobilisables par l'État pour assurer la prise en compte et le respect par le groupe TotalEnergies des obligations climatiques et des orientations de la politique étrangère de la France. Sénat
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- *Impact Tank*, (18 April 2024), *Sommet de la mesure d'Impact: changer le système*, Paris
- **Massini C., Pelissolo A., Sutter P-E, Santa Maria M.**, (7 February 2024), *Table-ronde sur l'éco-anxiété*, Commission des affaires sociales et commission à l'aménagement du territoire et du développement durable
- **Sainteny G., Casier P., Van Elverfeldt M., Bour-Poitrinal, B.**, (15 May 2024), *La taxation et la rentabilité des terres agricoles en Europe*, Académie d'agriculture de France

- **Sirami C.**, (1 march 2024), *Comment gérer les paysages agricoles pour protéger la biodiversité tout en produisant suffisamment de nourriture pour la population humaine ?*, Chaire Biodiversité et Ecosystèmes, Collège de France
- **Porcher E.**, (18 January 2024), *Les interactions plantes-pollinisateurs, une vitrine de la crise de la biodiversité*. Leçon inaugurale chaire Biodiversité et Écosystèmes, Collège de France
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*The opinions expressed in this report do not reflect those of the  
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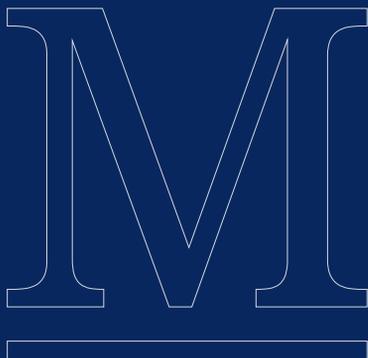
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Overshadowed by the climate crisis, and still largely overlooked in public discourse, the consequences of biodiversity loss for human societies remain widely unknown. Of the 8 million species documented on Earth, one million risks extinction in the coming decades as a result of human pressures. This sixth mass extinction exacerbates societal vulnerabilities to climate change. Biodiversity preservation is not only a matter of resilience but also of social equity: 50% of global GDP and all human needs depend directly on biodiversity and ecosystem services. Recent legislative developments, such as the implementation of the CSRD, global frameworks (biodiversity COP, SBTN, TNFD), and a growing collective awareness, have prompted companies – heavily reliant on the natural resources they exploit – to integrate biodiversity into their business models. However, while progress has been made, it remains insufficient.

In addition to an extensive review of scientific literature and a comparative analysis of international experiments, this report draws on the practices of economic, public, and civil society players, to identify the specific limitations of existing measures and the predominantly creative solutions they implement on a daily basis. Three main findings emerged from these discussions. First, the still largely misunderstood concept of biodiversity calls for the creation of a shared framework to guide the development of collective actions. Second, a paradigm shift is needed to make the integration of biodiversity into business models a competitive advantage, notably through financial compensation for environmental services and by leveraging national and international market opportunities. Finally, the acceptability of such changes relies on updated governance that ensures citizen participation and the establishment of redistributive mechanisms.

Political, organizational, and technical solutions exist. Their success now depends on the ability of public and private players to coordinate and deliver a comprehensive response at national, European, and international levels.



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