MEB'S REPORT
N°49 OCTOBER 2023

GLOBAL BIODIVERSITY SCORE

ACCOUNTING FOR POSITIVE AND NEGATIVE IMPACTS THROUGHOUT THE VALUE CHAIN

MISSION ÉCONOMIE DE LA BIODIVERSITÉ
GBS GLOBAL BIODIVERSITY SCORE®
CDC BIODIVERSITÉ
Caisse des Dépôts GROUPE

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PUBLICATION OF THE *MISSION ECONOMIE DE LA BIODIVERSITÉ*, FINANCED BY THE *BANQUE DES TERRITOIRES (CAISSE DES DÉPÔTS).*

REFERENCE: CDC BIODIVERSITE (2023). GLOBAL BIODIVERSITY SCORE: ACCOUNTING FOR POSITIVE AND NEGATIVE IMPACTS THROUGHOUT THE VALUE CHAIN , BERGER, J., BEZARD, M., BONNET, J., DURAND, M., KEMMEL, A., MAGUEUR, E., MARIETTE, J., MARTIN, A., ROUET POLLAKIS, S., ZHANG, P., MISSION ÉCONOMIE DE LA BIODIVERSITE, PARIS, FRANCE, 60P.

Foreword

Patrick de Cambourg

Chair of EFRAG Sustainability Reporting Board

The Kunming-Montreal Agreement adopted on December 19, 2022, at the 15th meeting of the Conference of the Parties (COP 15) to the Convention on Biological Diversity (CBD), establishing the Global Biodiversity Framework (GBF), is a powerful signal, particularly in that it sets out a medium- and long-term trajectory essential to the in-depth transformation of our economies.

This transformation is all the more urgent and necessary given the increasingly alarming signs of massive biodiversity loss. Life is in danger, and for the first time in history, we are primarily responsible for it.

It is now up to all of us to act collectively to reverse the loss of biodiversity, and governments all around the world have a pivotal responsibility in this task. First and foremost, implementing this new Global Biodiversity Framework in an ambitious and organised way implies to translate each goal and target into public policy and concrete action.

In order not to repeat the mistakes of the past (previous agreements were only partially implemented), all the public and private players in our economies should be involved and liable. Taking responsibility means having a clear and precise vision of our current impacts, risks, and dependencies on ecosystems, and drawing a trajectory that will enable us, individually and collectively, to meet the goals and targets of the Kunming-Montreal Agreement.

In our market-driven economies, companies and financial institutions play a crucial role given their interdependencies with nature. The role of governments is therefore to accompany and establish a framework that will enable this transformation, first by creating a harmonised ecosystem of relevant, reliable and comparable data on biodiversity. In this respect, Target 15 of the GBF, if properly implemented, should be a major factor for change, in that it requires each Party to the CBD to establish a mandatory reporting framework for large as well as transnational companies and financial institutions on their risks, impacts and dependencies on biodiversity.

Europe has taken the lead in this area, in particular through the Corporate Sustainability Reporting Directive (CSRD), which, together with its related European Sustainability Reporting Standards (ESRS), organise a reporting regime in alignment with these commitments.

The ESRS E4 standard, specific to biodiversity and ecosystems, will enable every company and financial institution to better explain how it is interconnected with biodiversity, and will require granular information on the short-, medium- and long-term trajectory it will chart.

In order to meet these new requirements in an ambitious way, and to contribute to the emergence of this ecosystem of comparable data, it is necessary to encourage the emergence of shared methodologies, tools and metrics that can quantify the footprint on biodiversity and drive a strategy as well as a change in business model to comply with the new international framework.

In this regard the Global Biodiversity Score (GBS) developed by CDC Biodiversité represents a very interesting way forward enabling companies and financial institutions to measure their impacts and dependencies on biodiversity by establishing a biodiversity footprint measure expressed in an aggregated metric representing ecosystem integrity, the MSA (Mean Species Abundance) and its surface equivalent, the MSA.km². This can be a reference tool for meeting commitments to protect and restore biodiversity, as it provides a precise view of the pressures on biodiversity, enabling companies and financial institutions to take relevant, targeted and, above all, measurable action over time.

Biodiversity often appears as a complex topic as our understanding of our impacts and dependencies on biodiversity and the risks it bears is often scattered. This updated version of the GBS adds new impact factors and covers a wider range of pressures on biodiversity, giving private players a more refined view of their impacts and dependencies.

It's time to act, with humility but above all with determination, and this will require close collaboration between the academic world, governments, jurisdictional and international standard setters, non-governmental organisations and private players, all working towards a common goal: life in harmony with nature.

1 Key concepts of the Global Biodiversity Score (GBS) and its ecosystem

1.1 Brief history and reminders on the GBS

On the 19th of December 2022, the Kunming-Montreal Global Biodiversity Framework (GBF) was adopted by the 15th Conference of the Parties to the UN Convention on Biological Diversity. Through this historic global agreement, nations agreed on four overarching goals for 2050 and 23 global targets for 2030 – to address the unprecedented loss of biodiversity and to restore and protect natural ecosystems. This new framework does not come without embarking businesses on the journey: Target 15 will require large, transnational companies and financial institutions to monitor, assess, and disclose their risks, dependencies and impacts on biodiversity along their operations, supply and value chains and portfolios. International, European, and national regulations and frameworks are heading in this same direction, leaving businesses no choice but to integrate biodiversity in their decision-making and strategies.

More than ever, tools and methodologies are thus needed to pave the way toward the achievement of the GBF and regulatory compliance: CDC Biodiversité is proud to be part of the solution and to play a role by developing its biodiversity assessment tool, the Global Biodiversity Score (GBS) (see Box 1). Released in 2020 after five years of development, road-testing, and scientific review, the GBS is now fully operational, while in continuous evolution to best meet the needs and constraints of companies and financial institutions. The GBS aims to accompany businesses seeking a leading role in the preservation of biodiversity through the quantitative and aggregated assessment of their impacts and dependencies on biodiversity, and the definition of a consistent, Science Based, and effective biodiversity strategy addressing both their direct operations and their value chain.

1.2 Overview of the GBS ecosystem

Through its development, release, and use, the GBS has established a rich ecosystem of stakeholders with the aim of mainstreaming biodiversity footprinting among the business community and beyond. Different types of actors have their role to play and show an increased interest for biodiversity footprinting and dependency measurement tools (CDC Biodiversité 2020d) – either as a **company or investor, consultant or data provider, academic, or even as a local authority** (see Figure 1):

- **Specialized external assessor consultants**, trained by CDC Biodiversité to master the GBS and conduct biodiversity footprint assessments (BFAs) for businesses;
- **Data providers and rating agencies**, trained by CDC Biodiversité to master the GBS and conduct biodiversity scoring for a wide range of companies, financial institutions, and portfolios;
- **Companies**, who can either go through a BFA with CDC Biodiversité or with external consultants, or get trained and conduct a BFA of their activities and value chain themselves;
- **Financial institutions**, who can get trained on biodiversity footprinting and reporting for financial institutions and/or buy ratings that are based on companies' biodiversity performance;
- **Academics**, who can get trained on biodiversity footprinting, conduct research and publish peer-reviewed papers using the GBS;
- **Auditors**, who sell assurance to companies willing to obtain a quality check on their BFA. CDC Biodiversité is developing the "**GBS Verified**" solution – to be launched in 2024, to provide such quality assurance with partner auditors.

The GBS ecosystem also includes experts and stakeholders who ensure its methodological robustness. Before the launch of the GBS in 2020, a formal review process was launched and a review committee[1] – composed of two panels – was established: the **experts panel**, in which academics took part, verified the consistency and quality of the tool (assumptions, limitations...) while the **stakeholders panel** assessed the consistency of the GBS tool with existing public policies related to corporate biodiversity and with existing tools.

More precisely, the experts panel included half of dozen international scientific experts among which members of the World Conservation Monitoring Centre (UNEP-WCMC), the French Geological Survey (BRGM), the Food and Agricultural Organisation (FAO), the French National Institute of Agriculture Research (INRA) and the Senckenberg Biodiversity and Climate Research Centre.

CDC Biodiversité, who is continuously improving the GBS and currently co-developing an adapted version of the tool for **local authorities** (to be launched in early 2024), has a central position in the GBS ecosystem: since 2018, CDC Biodiversité has been hosting the Business for Positive Biodiversity (B4B+) Club – a network of over 50 companies, financial institutions, consultants and data providers keen to better understand biodiversity footprinting, what role it could play and how they can use it. In 2022, the B4B+ Club – historically working around three French-speaking working groups on *Value Chain*, *Finance* et *Consultancies* – went global with the launch of a new *Biodiversity footprinting working group* and went even further in 2023, with the launch of two new working groups: one on *Biodiversity credits* (see Box 2 to read some insights from the World Economic Forum on biodiversity credits), and another one on *Energy utilities*.

The B4B+ Club allows its members to share best practices around biodiversity footprinting, to stay aware of the latest news, regulations, and frameworks around this topic, but also to test the GBS and other tools through case studies, as well as to benefit from a technical support. They also have a priority access to training courses created by CDC Biodiversité[2].

Indeed, CDC Biodiversité developed various trainings specifically designed for the different types of actors cited above – including consultants, data providers and companies' internal staff that are willing to conduct BFAs, provide biodiversity data or ratings for a wide range of companies and financial assets.

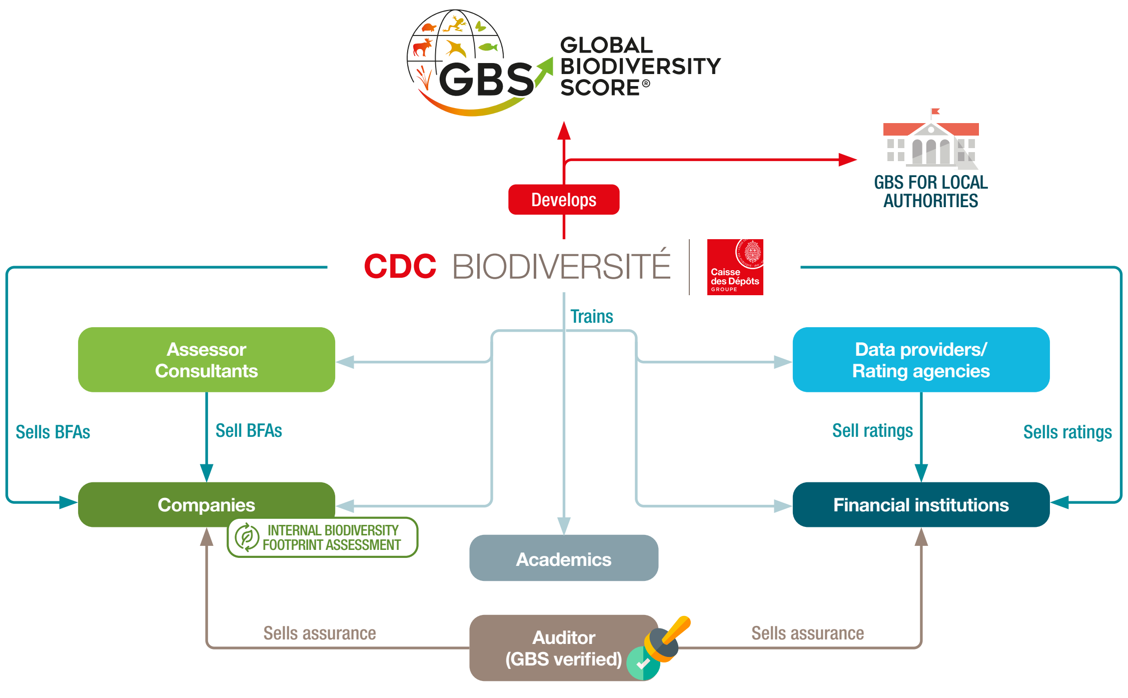

Figure 1: The GBS ecosystem

(1) The independent review report produced by this committee can be found here: https://www.cdc-biodiversite.fr/wp-content/uploads/2023/01/Rapport-final-des-experts-et-parties-prenantes.pdf
(2) Further details on the B4B+Club are available in the dedicated brochure: https://www.cdc-biodiversite.fr/wp-content/uploads/2023/04/B4B-Club_Brochure_EN.pdf.

BOX 1

The GBS in short

This box aims to remind the GBS main features to readers already somehow familiar with it. For a more comprehensive introduction, readers are invited to refer to the 2017, 2019, 2020 and 2021 reports (CDC Biodiversité 2017; 2019; 2020d; 2021c).

Some definitions and clarifications

The GBS is a **corporate biodiversity footprint assessment tool**: it can be used to evaluate the **impact** or **footprint** of companies and investments on biodiversity. The results of assessments conducted with the GBS are expressed in the MSA.km^2 **unit** where MSA is the Mean Species Abundance, a **metric** expressed in % characterising the intactness of ecosystems, integrated on an impacted surface (in km^2). MSA values range from 0 % to 100 %, where 100 % represents an undisturbed pristine ecosystem.

In order to break down impacts across the value chain and avoid double-counting, the GBS uses the concept of **Scope**, or value chain boundary. **Scope 1** covers direct operations. Impacts occurring upstream are broken down into non-fuel energy generation which falls within **Scope 2**, and other purchases which fall within **upstream Scope 3**. Finally, downstream impacts belong to **downstream Scope 3**. Section 3.3 provides more details on this concept, as well as our previous reports (CDC Biodiversité 2019; 2020d).

To account for impacts lasting beyond the period assessed, GBS results are further split into **dynamic** or **periodic gains/losses** – occurring within the period assessed –, **future** – which will occur in the future - and **static** or **accumulated negative** - persistent - impacts. These concepts are detailed in Section 1.4 and illustrated in our latest report (CDC Biodiversité 2021c).

Methodology

In order to assess corporate biodiversity footprint, the main approach of the GBS is to link data on **economic activity** to **pressures on biodiversity** and to translate these pressures into **biodiversity impacts**. A **hybrid approach** is used to take advantage of data available at each step of the assessment. Biodiversity footprint assessments (BFAs) use company specific data for instance on purchases or related to pressures (such as Land use changes or greenhouse gas emissions). In the absence of pressure or physical inventory data, a default calculation assesses impacts based on financial turnover data.

To link activity, pressures and impacts, the GBS uses peer-reviewed tools such as EXIOBASE, an environmentally extended multi-regional input-output model, or GLOBIO, a model assessing the impact of various pressures on biodiversity intactness. Its underlying assumptions are transparent.

In the long run, the aim of the GBS is to cover all biodiversity impacts all along the value chain (including both upstream and downstream impacts). It currently covers direct operations and upstream impacts ('cradle to gate') on terrestrial and aquatic (freshwater) biodiversity. The pressures covered are (see our 2021 report for a brief description of each of them) (CDC Biodiversité 2021c):

- Land use (LU)
- Fragmentation of natural ecosystems (F)
- Human encroachment (E)
- Atmospheric nitrogen deposition (N)
- Climate change (CC)
- Hydrological disturbance due to direct water use (HD_{water}) and due to Climate change (HD_{CC})
- Wetland conversion (WC)
- Freshwater eutrophication (FE)
- Land use in catchment of rivers (LUR) and wetlands (LUW)
- Ecotoxicity (X)

GBS GLOBAL BIODIVERSITY SCORE®

Four training are currently available:

- **Fundamentals of biodiversity footprint** (0.5 day), targeting anyone willing to better understand the challenges and key concepts behind biodiversity footprinting.
- **Biodiversity footprint and reporting for financial institutions** (1 day), targeting anyone intending to get familiar with the biodiversity footprint framework and regulations for financial institutions, as well as with the biodiversity-related risks and tools and initiatives for the financial sector.
- **GBS training level 1 | Introduction to the GBS tool** (1 day), targeting anyone aiming at understanding how to draw a link between biodiversity erosion and economic activities using a GBS-based BFA.
- **GBS training level 2 | Mastering the tool and conducting BFAs** (2 days), targeting anyone seeking to lead comprehensive GBS-based BFAs of any organization autonomously. Having completed the level 1 training is necessary to attend the level 2.

For more information and registration please refer to the training platform: https://cdc-biodiversite.riseup.ai.

These trainings ensure that rating agencies and GBS assessors know how to use the tool properly. Therefore, trainees take a test at the end of their course and CDC Biodiversité keeps an updated list of trained GBS assessors. In order to publish the results of a BFA, the BFA must have been conducted by an assessor who completed the level 2 training (see FAQ from our 2021 report) (CDC Biodiversité 2021c). The list of trained level 2 consultants with the required licence, is provided in Table 1 (they can conduct BFAs for their clients).

As of September 2023, over 180 participants had been trained at level 1 and over 100 at level 2. Also, over 55 BFAs or Sector level materiality assessments(3) had been conducted or are being conducted (see Table 2 below).

Users of the GBS need a licence to use the Global Biodiversity Score trademarks, but also to use the software and the associated databases and documentation, and for consultants to sell services using the GBS. For more information on the licences, readers can refer to the FAQ from our 2021 report (CDC Biodiversité 2021c).

(3) In a BFA, biodiversity footprint is assessed with financial and more accurate data (commodities and/or pressures data) while in a sector level materiality assessment (or screenings), biodiversity footprint is assessed with financial data only.

Table 1: List of trained level 2 consultants with valid licence as of September 2023

COMPANY	ASSESSOR	
	FIRST NAME	LAST NAME
Arcadis	Sarah	Berthe
Axa Climate	Théophile	Bellouard
B&L évolution SCOP EC	Sylvain	Boucherand
BiodivCorp	Véronique	Dham
BioPerf.biz	Olivier	Schär
Blooming	Kevin	Mozas
Carbone 4	Alexis	Costes
Carbone 4	Arthur	Pivin
Deloitte	Marianne	Dupré
Deloitte	Pauline	Renon
Ecoact, an Eviden business	Jeanne	Barreyre
Ecoact, an Eviden business	Sabrina	Capon
ERM	Rose	Choukroun
I Care by Bearing Point	Eliette	Verdier
I Care by Bearing Point	Justine	Mariette
The (RE)SET Company	Léa	Parel
The (RE)SET Company	Laura	Dos Santos De Oliveira
The Biodiversity Consultancy (TBC)	Adeline	Serckx
The Biodiversity Consultancy (TBC)	Chloé	Gerstenhaber
Utopies	Naomi	Delille
Utopies	Pierre	Viard
We Don't Need Roads	Arthur	Feletou

Table 2: List of BFAs or Sector level materiality assessments conducted or ongoing as of September 2023

COMPANY	SECTOR	ASSESSMENT	ASSESSORS
2020 – 2 ASSESSMENTS			
Schneider Electric	Electrical and electronic equipment	Schneider Electric's end to end Biodiversity Footprint Assessment	CDC Biodiversité, PRé sustainability
Decathlon	Distribution sector	Biodiversity Footprint Assessment	Decathlon
2021 – 23 ASSESSMENTS			
Vattenfall	Energy (production and supply of electricity)	Assessment of Vattenfall biodiversity footprint in line with the SBTN's guidance	CDC Biodiversité, Deloitte
Nestlé Waters France	Agriculture and Agri-Food	Nestlé Waters 4 brands Biodiversity Footprint Assessment	CDC Biodiversité, The Biodiversity Consultancy (TBC), BioPerf.biz
Hermès International	Manufacturing industry	Biodiversity Footprint Assessment	CDC Biodiversité, WWF
Almo Nature Benefit SpA	Agriculture and Agri-Food	Benchmark report for the cat & dog pet food industry	CDC Biodiversité
Adeo	Distribution sector	Biodiversity Footprint Assessment	B&L évolution
Agrifood company	Agriculture and Agri-Food	Sector level materiality assessment	Utopies
Food service company	Agriculture and Agri-Food	Sector level materiality assessment	Utopies
Engie	Energy (production and supply of electricity)	Sector level materiality assessment	Utopies
UTMB (Ultra Trail du Mont Blanc)	Non-financial services and other activities	Sector level materiality assessment	Utopies
ADEME	Non-financial services and other activities	Biodiversity Footprint Assessment on pilot sites	CDC Biodiversité, Camille Accolas
La Française des Jeux	Non-financial services and other activities	Case study on gaming materials	CDC Biodiversité, with partnership of FSC
Multinational Leisure company	Non-financial services and other activities	Sector level materiality assessment	Biodiv'Corp
Picard	Agriculture and Agri-Food	Biodiversity Footprint Assessment	Biodiv'Corp
TSE (Third Step Energy)	Energy (production and supply of electricity)	Sector level materiality assessment	Biodiv'Corp
Charcoal company	Processing	Biodiversity Footprint Assessment	Blooming
Energy company #1	Raw materials extraction	Preliminary study	Blooming
Multinational professional services company	Non-financial services and other activities	Sector level materiality assessment	TBC
Nestlé Waters UK	Agriculture and Agri-Food	Biodiversity Footprint Assessment	TBC
Telecommunication company	Non-financial services and other activities	Biodiversity Footprint Assessment	TBC
Retailer company	Agriculture and Agri-Food	Sector level materiality assessment	TBC
Technology company #1	Non-financial services and other activities	Sector level materiality assessment	TBC
Technology company #2	Non-financial services and other activities	Sector level materiality assessment	TBC
Energy company #2	Energy (production and supply of electricity)	Case study on pilot sites	TBC
2022 – 16 ASSESSMENTS			
Uniper	Energy (production and supply of electricity)	Biodiversity Footprint Assessment	CDC Biodiversité, TBC
Fortum	Energy (production and supply of electricity)	Biodiversity Footprint Assessment	CDC Biodiversité, TBC
Chloé	Manufacturing industry	Biodiversity Footprint Assessment	CDC Biodiversité
Société du Grand Paris	Building sector	Biodiversity Footprint Assessment	CDC Biodiversité
Fnac Darty	Distribution sector	Sector level materiality assessment	CDC Biodiversité
Groupement Les Mousquetaires	Distribution sector	Biodiversity Footprint Assessment	Biodiv'Corp
Food company	Agriculture and Agri-Food	Biodiversity Footprint Assessment	TBC
Real estate company	Non-financial services and other activities	Biodiversity Footprint Assessment	TBC
Renewable energy company	Energy (production and supply of electricity)	Biodiversity Footprint Assessment	TBC
Cosmetics company #2	Chemicals industry	Biodiversity Footprint Assessment	Utopies
Building company	Building sector	Biodiversity Footprint Assessment	Utopies
Transportation company	Transport	Biodiversity Footprint Assessment	Utopies
Energy Company #3	Energy (production and supply of electricity)	Biodiversity Footprint Assessment	Bioperf.biz, B&L évolution
Urban developer	Building sector	Biodiversity Footprint Assessment	Blooming
2023 – 14 ASSESSMENTS			
Legrand	Electrical and electronic equipment	Biodiversity Footprint Assessment	CDC Biodiversité, I Care
Fnac Darty	Distribution sector	Sector level materiality assessment	CDC Biodiversité
Schneider Electric	Electrical and electronic equipment	Biodiversity Footprint Assessment	CDC Biodiversité
GRTgaz	Raw materials extraction	Biodiversity Footprint Assessment	CDC Biodiversité, Blooming
Pierre Fabre	Cosmetics	Biodiversity Footprint Assessment	I Care
Financial institution	Financial services	Biodiversity Footprint Assessment	CDC Biodiversité
Energy infrastructure company	Energy (production and supply of electricity)	Sector level materiality assessment	Utopies
Capgemini	Consulting	Biodiversity Footprint Assessment	Utopies
Brangeon	Waste and waste management sector	Biodiversity Footprint Assessment	Utopies
Luxury Goods Company	Manufacturing industry	Biodiversity Footprint Assessment	CDC Biodiversité
Home Goods Company	Manufacturing industry	Biodiversity Footprint Assessment	CDC Biodiversité
Manufacture of electrical equipment	Electrical and electronic equipment	Biodiversity Footprint Assessment	Carbone 4
Luxury company	Manufacturing industry	Biodiversity Footprint Assessment	Carbone 4
Ski lift company	Tourism sector	Biodiversity Footprint Assessment	Carbone 4

As of September 2023, the B4B+ Club included the following members:

CORPORATES

CONSULTANCIES

FINANCIAL INSTITUTIONS

PARTNERS

1.3 The GBS and Science Based Targets (SBT)

The impact & dependency measurement ecosystem is structuring itself with initiatives such as the Science Based Targets Network (SBTN), and the GBS is creating linkages with this constantly evolving framework.

1.3.1 Linkage of the GBS with the SBTN

The SBTN has developed a 5-step framework and is developing tools, guidance, and methods to help companies on their biodiversity journey.

Listed as one of the tools which could be used for Step 1 in the first tool database published by the SBTN[4], the GBS offers a large coverage in terms of pressures and sectors and is under continuous improvement to expand its coverage and robustness. As recommended in the SBTN Step 1 (Science Based Target Network 2023d) and Step 2 Technical complements (Science Based Target Network 2023e), the Global Biodiversity Score helps reporting on both indicators:

- General 'state of nature' indicator as it estimates biodiversity health and more specifically ecosystem's integrity with impacts expressed in MSA.km²;
- Pressure-sensitive 'state of nature' indicator as results can be disaggregated per pressure and the analysis can focus on specific pressures.

More globally, as illustrated by Figure 2, CDC Biodiversité believes that the GBS already allows companies to answer to Step 1 Assess and Step 2 Interpret & Prioritize, regarding ecological integrity. The SBTN covers more than just ecological integrity and other tools and data are thus necessary to fully cover species extinction, water, land and oceans. The GBS can also give some elements for Step 3 Measure, Set, Disclose but those elements will need to be reviewed once the SBTN releases a Step 3 method[5]. Lastly, the GBS could also be useful for Step 5 Track, through repeated assessments and the application of the GBS Verified solution to provide verifications of disclosed impacts.

Step 1 Assess includes two components (see Figure 2). The first one requires the company to conduct a sector-level materiality assessment to identify expected most important pressures (issue areas). Such a materiality assessment can be conducted with the GBS using only financial data (by associating turnover data to the EXIOBASE industries

(4) https://sciencebasedtargetsnetwork.org/wp-content/uploads/2021/08/SBTN-Tool-Database_July-2021.xlsx

(5) A biodiversity short paper was released by the SBTN (Science Based Target Network 2023a) but the full guidance on Biodiversity is not yet published.

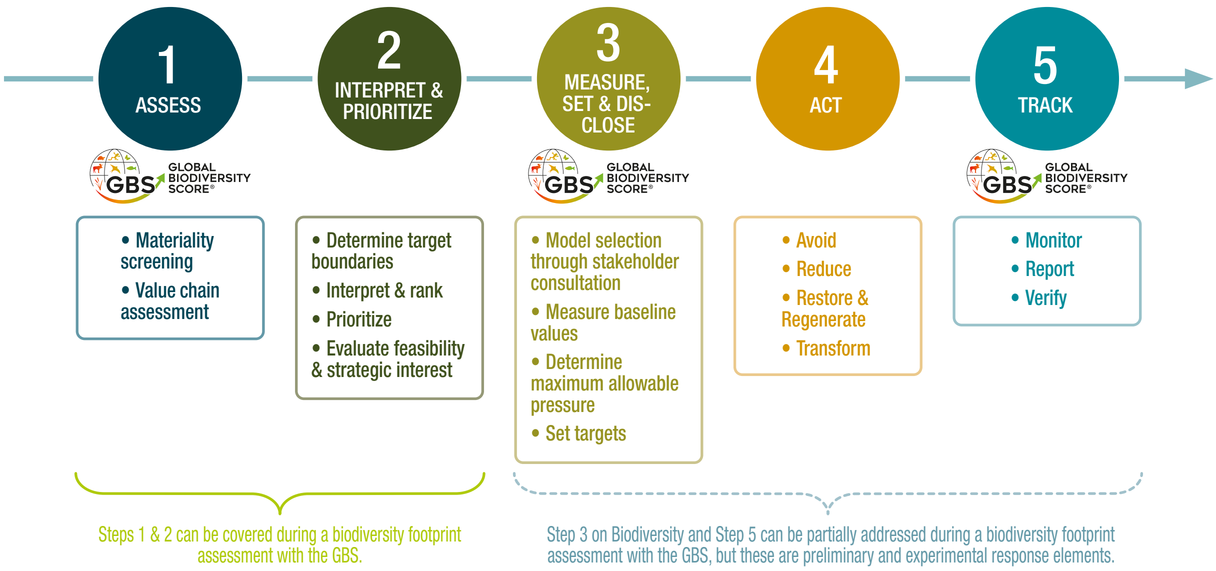

Figure 2: Linkages of the GBS with the SBTN framework according to CDC Biodiversité - Source: SBTN Guide for Readers

corresponding to the company's activities). Then, the second component requires to estimate the company's contribution towards environmental issue areas through a value chain assessment. It consists in a mapping of the company's main impacts in its value chain per Scope (1, 2, 3) and per industry. In order to compute impacts in the value chain with the GBS, financial data (turnover and purchases per EXIOBASE industry) would be the minimum data needed. Operational data should also be used to refine the impacts and strategic suppliers information is also very useful to link the company's activities to EXIOBASE industries and strategic suppliers, in order to identify in which sector the company needs to work first and with which suppliers it can engage actions.

To go further and prioritize actions, Step 2 Interpret & Prioritize requires the company to identify locations and economic activities where it has the greatest negative impacts. In the GBS, to facilitate this process, levels of influence are calculated (see FAQ). Levels of influence indicate the capacity of the company to act on the impacts associated with the activity assessed at short, medium or long term (this capacity is strongly related to the company's relation with its suppliers). The GBS feeds some of the work needed by Step 2, but this step requires work and data beyond what the tool provides.

Then comes Step 3 Measure, Set, Disclose for which the GBS helps to measure baseline impacts against which targets will be set. Unlike the overall assessment conducted in Step 1, measuring the baseline requires data which can lead to more accurate results, that is to say data with higher data quality tiers such as direct measurement of pressures. These tiers have been detailed in a previous report (CDC Biodiversité 2021c). The GBS can process those company-specific data (while industry-averages may have been used in Step 1).

The targets defined against the baseline can then be assessed as the GBS can model future trajectories (*e.g.*, up to 2030 or 2050) if adequate input data describing how the targets will impact land occupation, water consumption, greenhouse gas (GHG) emissions, etc. are provided. The SBTN's guidelines on Land (Science Based Target Network 2023c) and Water (Science Based Target Network 2023f) targets can be applied and several of the resulting targets can be translated into contribution to pressures on biodiversity (for instance a reduction in water withdrawals in a watershed can directly be entered into the GBS input files and will translate into lower Hydrological disturbance in that watershed).

The way the GBS can be used at each step is illustrated in Section 5.1, which presents the example of Vattenfall's Biodiversity Footprint Assessment conducted while trying to apply the SBTN recommendations and guidance available at the time of the assessment (in 2022).

1.3.2 Building "Science Based" sectoral trajectories using different allocation systems

1.3.2.1 FROM A GLOBAL BUDGET TO COMPANY TARGETS

The following paragraphs are not derived from the SBTN but rather reflects CDC Biodiversité's thinking.

The Global Biodiversity Framework (GBF) agreed upon in Montréal in late 2022 (CBD 2022) provides an ambition for ecosystem integrity by 2030 and 2050. **A global budget of maximum losses or minimum gains per year** could be built based on that and could be expressed in MSA.km^2. As long as the world stays within that budget, it would be able to achieve the GBF's ambition.

Allocating a share of the budget to each company would allow to define an annual buget per company and thus a reduction (and then gains) trajectory. Such a translation of the global budget to the company level defines a minimum level of efforts for each company, but because many biodiversity values are local, biodiversity targets should also take into account the **local landscape and context** (and of course biodiversity targets should not only take into account ecological integrity but also **other aspects of biodiversity such as extinction risk**)[6]. In the following paragraphs, the global budget is **allocated at the industry level** (and not at the company level) but the principle is the same.

The next section suggests a global budget based on a number of assumptions.

Subsequent sections detail how different allocation systems could be applied to obtain sectoral budgets and targets, by breaking down the amount of efforts across sectors and economic actors. The PBL has suggested four allocation systems: Sovereignty, Capability, Equality, and Efficiency (Lucas and Wilting 2018).

Finally, section 1.3.2.7 showcases the methodology applied by CDC Biodiversité in its benchmark factsheets (CDC Biodiversité 2021b; 2021a): it gives an example of impact trajectories according to the four allocation systems for the construction sector. More details on the approach can be found in the technical appendix of the benchmark factsheets (CDC Biodiversité 2021d) .

1.3.2.2 A CENTRAL TRAJECTORY OF THE GLOBAL BUDGET

The GBF's vision is to "halt and reverse biodiversity loss" by 2030 and its goal A states "The integrity, connectivity and resilience of all ecosystems are maintained, enhanced, or

(6) The allocated global budget approach would thus complement the approach the SBTN recommends for Step 3 for its Land (Science Based Target Network 2023c) and Water (Science Based Target Network 2023f) components, which includes a strong focus on ecological thresholds at the watershed or landscape level.

BOX 2

Invited expert – Alessandro Valentini on the biodiversity credits emerging market and associated expectations and challenges

Alessandro Valentini, Specialist, Sustainable Finance at the World Economic Forum since 2020

The biodiversity credits emerging market

The attention devoted to finance biodiversity protection and restoration at the international, regional, and national levels in the past year is unprecedented. The growing sense of urgency by both private and public sector stakeholders comes from the increasing awareness of the far-reaching consequences of biodiversity loss for wildlife, people, and the economy. On the back of the Kunming-Montreal Global Biodiversity Framework (GBF) signed in December 2022, and particularly of Target 19 of the Agreement, biodiversity credits markets have been gaining momentum as a key innovative financial instrument to increase the level of financial resources directed toward nature-positive investment.

Biodiversity credits are an innovative concept, and a widely accepted and clear definition does not yet exist. However, there are some distinctive elements that are emerging to differentiate biodiversity credits from other similar instruments. The first important one is the difference between **biodiversity credits** and **biodiversity offsets**. While both encourage a nature-positive approach, **offsetting** requires a localized approach which should not pertain to the voluntary sphere of business' action, but should be subject to tailored regulation by local governments to avoid the perception that these offsets represent a right to adversely impact natural ecosystems.

Biodiversity credits can be therefore described as verifiable and tradeable financing mechanisms which reward positive outcomes from projects through the sale of units of biodiversity gain. They are used to finance activities and projects whose purpose is to protect, restore and/or enhance the biodiversity state on a pre-defined area and that result in quantifiable and measurable positive outcomes for biodiversity (e.g., species, ecosystems, natural habitats) and its stewards (e.g., Indigenous People and Local Communities – IPs and LCs), through the creation and sell of a biodiversity unit. Terrain's Cassowary Credit Scheme, rePLANET's Cusuco Cloud Forest Credits, and GreenCollar's NaturePlus are all example of biodiversity credit schemes.

Presentation of WEF work on biodiversity credits

In 2022 the World Economic Forum launched a multi-stakeholder initiative on the development of biodiversity credit markets with the ambition to scale up financial flows toward a net-zero, nature-positive, and socially equitable future. The work has focused on two main workstreams to help unlock the market: one aims at defining the relevant integrity and governance framework within which the market should operate with, while the other is focusing on unpacking the dynamics between supply & demand stakeholders.

As seen from the recent developments in the carbon market, integrity, both environmental and social, represents an essential element for the success of biodiversity credits. Under the integrity & governance workstream, in collaboration with 100+ stakeholders, the Forum developed a framework of 19 high-level governance and integrity principles to guide the development of the biodiversity credit market and ensure it delivers positive outcomes for biodiversity as well as equitable and fair benefits for the stewards of biodiversity. The principles highlight three main topics:

1. **Transparent and sound governance**, including the transparency around projects design and data collected, and the legal rights to operate in the land;

2. **Equity and inclusion** to ensure the respect of the rights, the free prior and informed consent and the equitable benefit sharing with IPs and LCs; and

3. **Rigorous measurement, reporting and verification** systems to ensure the scientific robustness of the project claimed benefit on the ecosystems

The principles are not to be considered a conclusive standard for the market but more a high-level iterative framework subject to the continuous review of the wide range of stakeholders involved in the market. So far, the consultation process has included not only the private and public sector, but also IPs and LCs, as well as civil society and NGOs.

In addition to defining the right integrity framework, scaling up the biodiversity credit market will also require a clear business case for demand-side actors. The work of the Forum on supply and demand dynamics goes in this direction. The initiative has identified several internal and external drivers which might lead the growth of the market, including mission-driven approaches, risk mitigation around businesses' nature dependencies, reputational and regulatory drivers. In addition to the drivers, a compelling business case need also clarify the use cases of biodiversity credits – contribution to nature positive and climate targets, access to ecosystem services, etc. – particularly in light of their non-offset nature.

Building on the work of the two workstreams, in the coming months the initiative also aims at piloting and testing the dynamics of the market through the first-of-its-kind biodiversity credits auction. The auction will offer invaluable learning on both side of the market, allowing business actors to explore the options around the claims while also testing the use cases vis-à-vis their nature strategies, and offering an opportunity for project developers to test their methodologies on the market and draw important learnings on pricing, tradability of units, and product design.

Next steps

We look forward to continuing the collaborative process that will lead to the updated version of the principles, which will be released later in 2024, as well as to stress testing and piloting the implementation and trade of projects by market operators in the coming year. Based on the trends observed in the months following the CBD COP15, we can expect the momentum around biodiversity credits to continue its growth, with the proliferation of new initiatives (such as the work undertaken by CDC Biodiversité, with the launch of a new working group dedicated to biodiversity credits as part of the B4B+Club), projects, standards, methodologies, and challenges. Particularly important will also be the developments coming from governments and regulators, with many countries around the globe considering setting up national biodiversity credits and offsets regulations. Key enablers for the market will also be the progress around risk management and disclosure frameworks, such as the Taskforce on Nature-related Financial Disclosures (TNFD), and the progress around Science Based target setting initiatives, such as the Science Based Targets Network (SBTN). Achieving the objectives of the Kunming-Montreal GBF will require a "whole-of-society" approach, and instruments like biodiversity credits could play an important role in bridging the biodiversity financing gap in the years to come.

restored, substantially increasing the area of natural ecosystems by 2050" (CBD 2022). A "central trajectory" compatible with this vision and goal was built (Figure 3): it is associated to a global budget of maximum biodiversity loss (from 2020 to 2030), as well as minimum biodiversity gain (from 2031 to 2050). The detailed assumptions and references are listed in the technical appendix of CDC Biodiversité's benchmark factsheets (CDC Biodiversité 2021d). The exact figures reported in Figure 3 are not important *per se*, and this section seeks to provide a proof of concept that Science Based targets built on a global budget and sectoral or company allocations can be built. Other interpretations of the GBF could be valid, and for instance another translation of the implied trajectory has been conducted based on an evaluation of the meaning of each target for ecological integrity (CDC Biodiversité 2023).

This trajectory defines a **global (dynamic) impact budget** every year from 2020 to 2050 (CDC Biodiversité 2021d). In 2023 for instance, biodiversity (dynamic) losses should be limited to 250 000 MSA.km^2 to stick to the global trajectory, and in 2030 they should reach 0 MSA.km^2 before switching to gains of biodiversity between 2031 and 2050. This global impact budget is associated to **a global reduction/gain allowance** which is the variation of the global budget from one year to the next (for instance if the global budget was a loss of about 290 000 MSA.km^2 in 2022 and it needs to shrink to a loss of about 250 000 MSA.km^2 in 2023, the global reduction allowance is -40 000 MSA.km^2).

The following sections describe four allocation systems to distribute efforts between industries and companies. Depending on the allocation systems, either the global impact budget or the global reduction/gain allowance is used.

1.3.2.3 SOVEREIGNTY

This allocation system is based on a grandfathering approach, *i.e.,* the obligations of industries (or companies) are based on their historic impacts. **An industry's share of the global impact budget corresponds to its share of the global dynamic impact of the baseline year** (2020 in Figure 4 in the application example).

1.3.2.4 CAPABILITY

This allocation system is based on industries' ability to pay. **It allocates the budget between industries according to their turnover**. The efforts asked from industries are computed based on their share of the global turnover for the baseline year. Thus, sectors with high turnovers compared to other sectors will be asked to contribute more to the global reduction/gain allowance and to achieve both more biodiversity loss reduction (up to 2030) and more biodiversity gains (after 2030).

1.3.2.5 EQUALITY

This allocation system is based on the idea that each person has the same "rights". It means that the share of the global impact budget should be the same per capita. For companies, the allocation is based on the number of people employed in each sector. The more people the industries employ, the higher their share of the global impact budget.

1.3.2.6 EFFICIENCY

This allocation system is based on a principle of cost-effectiveness: the industries that can perform restoration actions at the lowest cost are asked to do more. This system minimizes overall costs to achieve a given global impact budget. The cost of restoration for each industry is the indicator used to allocate efforts. All industries must spend the same amount of money each year to restore biodiversity. Costs induced by reducing biodiversity loss and those induced to restore biodiversity are assumed to be equal. The costs of restoration vary by sector, especially due to the technologies used. In practice, the share of global reduction/gain allowance attributed to an industry is based on its share of the total restoration cost.

1.3.2.7 APPLICATION TO THE CONSTRUCTION SECTOR

Figure 4 illustrates a Science Based trajectory of dynamic impacts over time for the Construction sector from 2020 to 2050 according to the different allocation systems. The dynamic impacts are expressed as a proportion of the 2020 dynamic impact of the sector (implicitly assuming 2020 is taken as the baseline year against which the trajectory is set). For instance, impacts from the Construction sector should be 92 % of their 2020 level in 2021 if the Efficiency allocation system is chosen (meaning a reduction of 8 % compared to the baseline).

The four allocation systems cover a number of ethical considerations and their application builds a corridor of what may be requested to companies by the society. The blue area between the maximum and minimum values in Figure 4 thus delineates the likely boundaries of the path companies will have to thread to answer societal expectations. The Construction sector for instance should expect to aim for gains of biodiversity between -1 400 % (Efficiency system) to -8 100 % (Capability system) of its 2020 baseline by 2050. In other words, a company from the industry with a dynamic loss of +100 MSA.km^2 in 2020 would have to achieve gains of -1 400 to -8 100 MSA.km^2 by 2050.

Interestingly Figure 4 highlights that in the Equality allocation system, the Construction industry would be allowed more impacts until 2027 than its 2020 baseline impacts: its large number of employees means it could be allowed more impacts (whereas other industries already exceed their budget based on this allocation system).

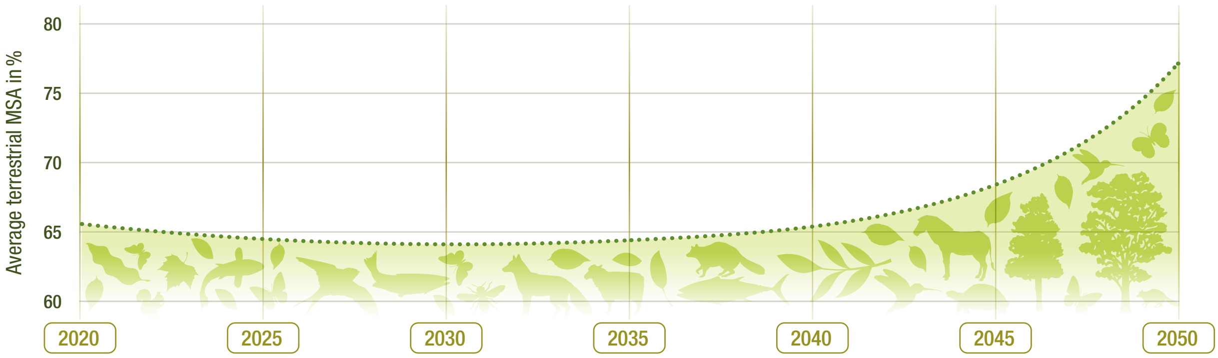

Figure 3: A central trajectory suggested by CDC Biodiversité to bend the curve of biodiversity loss by 2030 and restore biodiversity after 2030

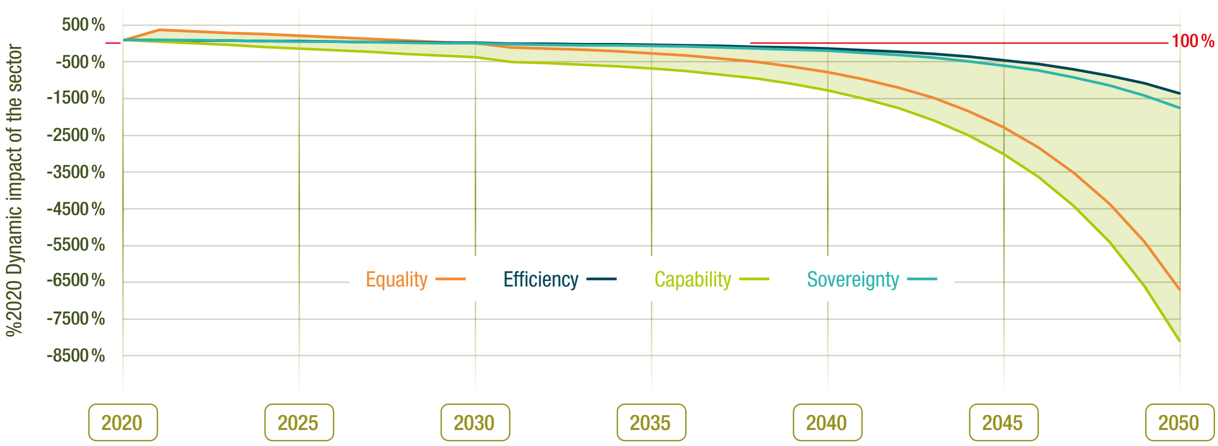

Figure 4: Distribution of efforts according to different allocation methods (example of the Construction sector)

1.4 Accounting for stocks and variations of stocks of biodiversity

Accounting for the state of biodiversity requires to distinguish stocks of **remaining biodiversity or accumulated positive impacts**[7], stocks of past accumulated impacts up to a given moment (**"static"** or **accumulated negative impacts**, see Box 1) and variations of stocks during a period (**"dynamic"** or **periodic gains/losses**). This section illustrates the linkages between indicators tracked by companies and the intensities of pressures, which in turn translate into periodic gains/losses and thus variations of stocks of biodiversity. This latter translation was described in Table 4 of a previous publication (CDC Biodiversité 2021c), which also described the conceptual accounting framework (in its section 1.4).

1.4.1 Understanding how economic activities translate into periodic losses/ gains or accumulated negative impact

Table 3 provides a handful of examples to help understand whether business activity translates into changes in the state of biodiversity (*i.e.*, periodic losses or gains, in red and green respectively in Table 3) or maintains the state of biodiversity constant (*i.e.*, the accumulated negative impacts do not change, which is displayed in blue in Table 3).

Changes in the state of biodiversity can be understood through impact pathways involving changes in the intensity of pressures such as Climate change or Land use. The contribution of businesses to the evolution of pressure intensity can itself be assessed through indicators (referred to as "corporate indicators" in Table 3) specific to each pressure[8].

(7) Compared to our previous report (CDC Biodiversité 2021c), a few terms have changed in order to align with existing and emerging frameworks (Endangered Wildlife Trust 2020; UNEP-WCMC et al. 2022). The terms "accumulated" (positive or negative impacts) is now preferred to "cumulated" (positive or negative impacts) and the term "variation of stocks" preferred to "flows" to describe dynamic impacts. Even though the word "impact" is used in "accumulated positive impacts", this reflects the stock of remaining biodiversity (which may not necessarily result from biodiversity gains originating from human activities).

(8) Please refer to our critical reviews for further details on the indicators of the pressures' intensity (Documentation Global Biodiversity Score | CDC Biodiversité (cdc-biodiversite.fr).

1.4.2 Example of hydrological disturbance

To give a concrete example of how economic activities can translate into periodic losses/gains or accumulated negative impacts, Figure 5 illustrates four situations for a river depending on the level of human withdrawals and (clean) water discharges. Those situations are:

(i) Undisturbed situation with no anthropic withdrawals and only **evaporation** (and evapotranspiration). The natural **inflow** (*e.g.*, coming from upstream) is +100 m³/s, **evaporation** is -5 m³/s, and the **outflow** (*e.g.*, going downstream) is +95 m³/s. All the figures provided in this section are assumed constant over time all year round to simplify. In this undisturbed situation, there is no "flow deviation" (the amended annual proportional flow deviation or AAPFD[9] is equal to 0) and no impact from Hydrological disturbance on freshwater biodiversity: the accumulated negative impact is 0.

(ii) Disturbed situation without discharge: human withdrawals amount to -45 m³/s. The **outflow** is thus +50 m³/s. The flow deviates from its natural value and the AAPFD is 1.6.

In this disturbed situation, the hydrological system is in equilibrium (no overshooting, *i.e.*, the withdrawals do not exceed the inflow). A constant level of pressure is maintained on the aquatic ecosystem: the outflow is constant at +50 m³/s and the AAPFD is constant at 1.6. While this situation is maintained, there is no change in the pressure level and therefore in the state of ecosystems / habitats: **there is thus no periodic gain / loss. There is however an accumulated negative loss** associated with the human withdrawals of -45 m³/s: whenever human withdrawals increased from 0 to -45 m³/s in the past, a periodic loss occurred and led to the current accumulated negative loss.

(iii) Disturbed situation with limited discharge: same situation as (ii) but +10 m³/s of clean water is also **discharged** in the river: the **outflow** is thus +60 m³/s.

(iv) Disturbed situation with larger discharge: same situation as (iii) but with +25 m³/s instead of +10 m³/s of clean water **discharged** in the river: the **outflow** is thus +75 m³/s.

When transitioning from (ii) to (iii), the AAPFD decreases from 1.6 to 1.3: the intensity of the Hydrological disturbance pressure on the ecosystem decreases. A **periodic gain thus occurs** (possibly over a period longer than a year because ecosystems do not regenerate instantly, but in order to simplify the situation, it is assumed in subsequent charts that ecosystems regenerate very rapidly and periodic gains occur within one year), and **a new level of accumulated negative loss** is reached (equal to the subtraction of the periodic gains to the previous accumulated negative loss).

If the outflow is maintained at +60 m³/s in the following years (in other words, situation (iii) is maintained), then there is no **periodic gain/loss** and the **same level of accumulated negative loss** is maintained.

Conversely, if the ecosystem moves from (iii) to (iv), discharges increase from +10 m³/s to +25 m³/s, then the intensity of the Hydrological disturbance pressure further drops as the AAPFD is lowered from 1.3 to 0.73. Additional periodic gains are achieved.

Figure 6 illustrates how maintaining a constant discharge would translate in terms of impact accounting for a company assessing its impacts in 2023. Pressures other than Hydrological disturbance are ignored to simplify. The following paragraphs provide additional elements on the situation before the year assessed (2023) and define a counterfactual scenario the company uses to assess accrued positive impacts (see Section 3.2.2 for further explanation and examples on this concept).

(9) In the GBS, the impact of Hydrological disturbance is assessed with the GLOBIO aquatic model's pressure-impact relationship (Janse et al. 2015; CDC Biodiversité 2019), which relies on the deviation, between an undisturbed and a disturbed river flow pattern, or in other words with or without anthropic use of the river's water. This is assessed by the AAPFD, which is calculated as follows:

$$AAPFD = \left[\sum_{i=1}^{12}\left(\frac{Q_i - Q_{i0}}{Q_{i0}}\right)^2\right]^{\frac{1}{2}}$$

where Q_i stands for the runoff in the i^{th} month, Q_{i0} for the natural runoff in the i^{th} month and $\overline{Q}_{i0}$ for the year-averaged natural runoff.

Table 3: Examples of how changes in economic activities impact biodiversity through changes in the intensity of pressures (does not exhaustively cover all pressures)

REALM	PRESSURE	CORPORATE INDICATOR	INDICATOR OF THE INTENSITY OF PRESSURE	CONSEQUENCES FOR THE STATE OF BIODIVERSITY
Terrestrial	Climate change	Accumulated GHG emissions (kg CO2-eq)	Global Mean Temperature Increase (GMTI)	Yearly GHG emissions add up and raise Accumulated GHG emissions, leading to an increase in GMTI and a periodic loss
	Land use	Land occupation (ha)	Land occupation by Land use	Constant land occupation (without Land use change) leads to no change in the state of biodiversity Ecological restoration involving a conversion from intensive Land uses to more natural Land uses would lead to periodic gains
Aquatic	Hydrological disturbance due to direct water use	Withdrawal intensity (m³/month)	Flow deviation	An increase in withdrawal intensity increases flow deviation and leads to a periodic loss

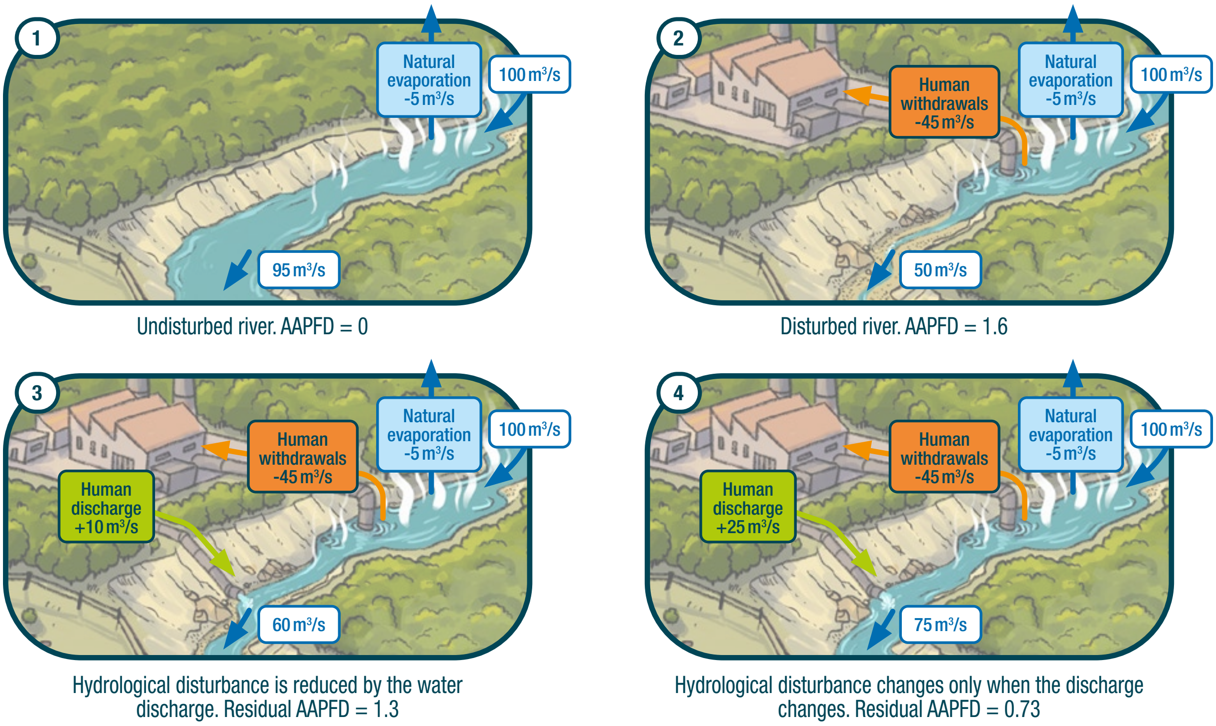

Figure 5: Illustration of changes in amended annual proportional flow deviation (AAPFD) in a simplified river ecosystem

(A) Before 2015, the watershed was under situation (ii) described in Figure 5: the outflow amounted to +50 m³/s and there was no discharge. The AAPFD was 1.6, which can be translated into an accumulated positive impact (or remaining biodiversity) of 50[10] % using GLOBIO Aquatic (Janse et al. 2015)[11]. The surface area of the river impacted is 123 km²: the accumulated positive impact amounted to 62 MSA.km². This pre-2015 situation is defined by the company as the **counterfactual scenario** it is going to use as a **baseline** to assess avoided impacts or accrued positive impacts.

(B) The company started discharging +10 m³/s in the watershed in 2015: the watershed transitioned towards situation (iii) described in Figure 5. The hydrological disturbance pressure was reduced as the outflow rose to +60 m³/s. By the start of 2016[12], the accumulated positive impact was 67 MSA.km². The company could register a periodic gain of +5 MSA.km² in 2015.

(C) The accumulated positive impact remains at 67 MSA.km² as the outflow is constant at +60 m³/s. This is still the case in 2023.

(D) Between 2015 and 2023, the company can claim to achieve an **accrued positive impact** compared to the counterfactual of 5 MSA.km² every year after 2015, if it maintains this discharge of +10 m³/s.

(10) This figure and others in this section is rounded to take into account the accuracy of measurement. As a consequence, some figures may appear inconsistent due to the rounding of others.

(11) Remaining MSA = -0.3985x + 0.60 with x = log(AAPFD + 0.1)

(12) As noted above, it is actually unlikely that freshwater ecosystems will require only one year to regenerate and in reality other factors than the flow deviation may affect their recovery. For simplicity's sake, in this example it is assumed that the regeneration does happen in one year.

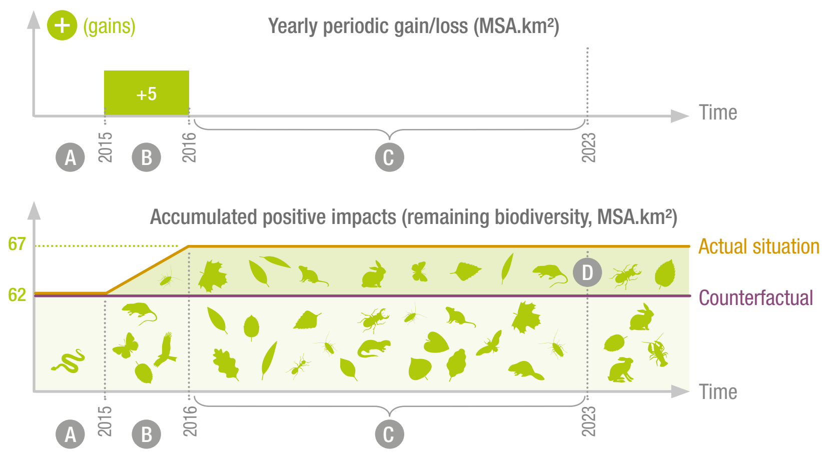

Figure 6: Illustration of how a company could account for its impacts while maintaining a constant discharge to a watershed

2 Role of the GBS in the overall landscape

2.1 Mapping of biodiversity impact measurement tools

Since our previous technical update, some tools have merged, new tools have been designed and some have become less active. Figure 7 provides an updated version of our previous mappings (CDC Biodiversité 2018; 2019). As for the previous mapping, Figure 7 does not seek to assess the initiatives listed against any criteria. Instead, it seeks to provide a non-exhaustive overview of existing biodiversity impacts measurement tools and illustrate that most of them fulfil different needs, thus being complementary to each other. Figure 7 focuses on the core (or primary) business applications and perimeters of each tool. However, most of the tools are not limited to their core applications.

Built on previous works, three broad categories of business applications (BA) can be distinguished in Figure 7 (Addison, Carbone, and McCormick 2018; CDC Biodiversité 2020d; 2019). The associated business applications of the joint European Union Business & Biodiversity (EU B@B) platform and ABMB report (Lammerant 2022) are listed in italics:

A - Assessment / rating by and for third parties with external data:

- *BA 5: Assessment / rating of biodiversity performance by third parties, using external data;*

- Assessment of corporate biodiversity performance by third parties (*e.g.*, rating agencies) for their own use and based on external (and often public) data. Typically, the assessment conducted by financial institutions (FIs) of the footprints of businesses they fund falls within this business application (FIs act as third parties here);

B - Biodiversity accounting for external audited disclosure:

- *BA 8: Biodiversity accounting for internal reporting and/ or external disclosure* (Lammerant 2019) *;*

- Accounting and reporting by companies of information on their corporate biodiversity performance based on internal data, to demonstrate effective impact management. The data used and impacts reported follow accounting principles such as the ones listed by the Biological Diversity Protocol or BD Protocol (EWT - NBBN 2019) and can thus be audited by third parties. This business application can fulfil the needs of regulatory external reporting of corporate biodiversity footprint;

C - Biodiversity management & performance:

- *BA1: Assessment of current biodiversity performance,*
- *BA2: Assessment of future biodiversity performance,*
- *BA3: Tracking progress to targets,*
- *BA4: Comparing options,*
- *BA6: Certification by third parties,*
- *BA7: Screening and assessment of biodiversity risks and opportunities;*

- Monitoring and evaluation by companies of the effectiveness of their own management interventions such as actions taken to mitigate impacts. This feeds into companies' internal decision-making on topics such as the concrete actions which could be implemented to move towards biodiversity net gains (for instance should one supplier be encouraged to switch to more biodiversity friendly practices, or should agricultural practice X or agricultural practice Y be implemented on farmlands operated by the company).

Internal communication is not listed as a separate business application because it is not a differentiating factor between tools: all can be used to support internal communication. In addition to business applications, Figure 7 lists six broad perimeters, covering different application areas and answering different questions (CDC Biodiversité 2018; 2020d; 2019).

1 - Public policy

- How can quantified targets for countries/sectors be set and monitored to reduce biodiversity loss; *e.g.*, by the CBD, national governments and other actors?

- How can trends in biodiversity decline be expressed and how can the contribution of each industry be assessed at a national level?

- What does the biodiversity footprint per capita look like?

- What percentage of the total biodiversity impact of a country is 'imported' through dependencies on foreign resources?

2 - Financial assets

- How do the investments in companies compare to each other regarding their biodiversity impact?

- What is the footprint of different asset classes and investments?

3 - Corporate

- What is the biodiversity footprint of a company and what is the footprint it induces across its value chain?

4 - Supply options

- How do different suppliers and supply chain options compare with regards to their impact on biodiversity?[13]

5 - Product and service

- Which design and composition of products or services guarantees the lowest biodiversity footprint? How do different commodities compare with regards to their impact on biodiversity?

6 - Project or site

- How can operational impacts on biodiversity be minimised at the site or project level and how can positive impacts be measured and compared?
- How can the impacts of onsite direct operations be summed to come up with aggregated figures at the corporate level?

The perimeter of the mapping was determined following the same rule as the assessment conducted by the EU Business and Biodiversity Platform in 2018: "*biodiversity accounting approaches for businesses and financial institutions (FIs) which rely on quantitative indicators that provide information on the significance of impacts on biodiversity, and which are not case-specific*" (Lammerant, Müller, and Kisielewicz 2018).

The selection of international initiatives mapped is briefly described below (from upper left to bottom right in the figure):

- **Biodiversity Impact Analytics (BIA-GBS)** (CDC Biodiversité, Carbon 4 Finance) measures the biodiversity impact of companies. Investors can identify biodiversity hotspots in their portfolios and use biodiversity impact data for decision-making and to engage with key stakeholders. By offering large-scale biodiversity data, BIA-GBS™ supports the transition of the financial sector to align with international targets and reduce the impact from multiple pressures on biodiversity.
- **ISS ESG'S Biodiversity Impact Assessment Tool** (ISS ESG): the Biodiversity Impact Assessment Tool enables investors to assess the biodiversity impacts of the commercial activity as well as the value chain of a company.[14]
- **ENCORE** (Global Canopy, UNEP FI and UNEP-WCMC): the biodiversity module within ENCORE enables users to explore the potential alignment of financial activities in mining and agriculture (and more sectors in the future) with a nature-positive future.[15]
- **BFFI** (ASN Bank): PRé and CREM assess the biodiversity footprint of the assets of ASN Bank and other financial institutions, combining data from EXIOBASE, other input-output databases and direct data, the ReCiPe methodology and a qualitative analysis.[16]
- **The Global Biodiversity Score for Financial Institutions (GBSFI)** (CDC Biodiversité) is based on the GBS, which provides an overall and synthetic vision of the biodiversity footprint of economic activities. It applies to all non-listed assets, including sectors such as real estate, private equity and infrastructure. The methodology of each assessment is adapted to take into account the data availability and the specificity of the assets covered.
- **GID** (Impact Institute): the Global Impact Database is a quantitative biodiversity impact database based on a variety of sources, providing asset/company, geographic and sectoral granularity. It is used by organisations to understand, report and act on the impact of their portfolios.[17]
- **CBF** (Iceberg Datalab): the Corporate Biodiversity Footprint developed by Iceberg Data Lab (IDL) provides data to investors on the biodiversity impacts of a large number of corporates depending on their activities (throughout the value chain) and the location of their facilities.[18]
- **CBF detailed** (I Care, Iceberg Datalab): CBF detailed follows the same approach as the CBF by IDL, using internal data from companies, to capture impacts on biodiversity at the highest possible granularity.
- **GBS** (CDC Biodiversité): CDC Biodiversité assesses the biodiversity footprint of economic and financial activities with the Global Biodiversity Score using GLOBIO cause-effect relationships.
- **ABD Index** (Biodiversity-CIAT): The Alliance of Biodiversity-CIAT is developing the Agrobiodiversity Index to assess risks in the food and agriculture industries related to low agrobiodiversity.[19]
- **EP&L** (Kering): Kering assesses its Land use (among other indicators) impact through its Environmental Profit & Loss methodology.[20]
- **BioScope** (Platform BEE): developed by Platform BEE, BioScope gives an approximation of biodiversity impact related to commodities purchased or from investments made by businesses and financial institutions.[21]
- **LIFE Key** (LIFE Institute): for over eleven years, the LIFE Key software has been applied in Latin America and Europe to calculate "Biodiversity Impact Index" and "Biodiversity Positive Performance", measuring "biodiversity balance", evaluating conservation projects, their results and capacity of offsetting company´s pressure on biodiversity.[22]
- **LCA methods**: several LCA endpoint methods allow to assess impacts on biodiversity, including ReCiPe[23], LC Impact[24], Impact World+[25]. These methods can be used through tools such as Simapro or OpenLCA.

(13) Assessing the impact of the commodities produced by one specific raw material producer without comparing different sourcing options falls under Product or service use.
(14) https://www.issgovernance.com/esg/biodiversity-impact-assessment-tool/
(15) https://s3.eu-west-2.amazonaws.com/ncfa.documents/resources/ENCORE_Biodiversity_Module_Method_and_Scoping.pdf
(16) https://www.asnbank.nl/web/file?uuid=14df8298-6eed-454b-b37f-b7741538e492&owner=6916ad14-918d-4ea8-80ac-f71f0ff1928e&contentid=2453
(17) https://www.financeforbiodiversity.org/wp-content/uploads/Finance-for-Biodiversity_Guide-on-biodiversity-measurement-approaches_2nd-edition.pdf
(18) http://www.icebergdatalab.com/
(19) https://www.bioversityinternational.org/abd-index/
(20) https://www.kering.com/en/sustainability/environmental-profit-loss
(21) https://bioscope.info/
(22) http://institutolife.org/o-que-fazemos/desenvolvimento-de-metodologias/documentos-que-dao-suporte-tecnico-a-metodologia/?lang=en
(23) Huijbregts et al. (2016)
(24) https://lc-impact.eu/
(25) http://www.impactworldplus.org/en

- **BIM** (CISL): Cambridge Institute for Sustainable Leadership has developed the Biodiversity Impact Metric to compare the impacts of different commodities and supply chains.[26]
- **PBF** (I Care + Sayari): I Care and Sayari combine biodiversity studies and companies' data to assess the impact of products and services through their Product Biodiversity Footprint along value chains using LCA-based approach.[27]
- **BFC** (Plansup): Plansup uses the Biodiversity Footprint Calculator to assess the impact of a range of business, *e.g.*, to compare biodiversity improvement options.[28]
- **STAR** (IUCN): the IUCN is developing the Species Threat Abatement Reduction tool to assess the gains of investing in biodiversity conservation to reduce species extinction risk.[29]
- **BISI** (WCMC): UNEP-WCMC, Conservation International and Fauna & Flora International have developed an aggregated approach for assessing corporate biodiversity performance resulting in biodiversity indicators for site-based impacts. With support from IPIECA and the Proteus Partnership and pilots with 7 energy and mining companies, it is focused on tracking state-pressure-response indicators at the site level, with the possibility to aggregate results at the corporate level.[30]
- **B-INTACT** (FAO): The Biodiversity Integrated Assessment and Computation Tool is a land-based accounting system that assesses the biodiversity effects of investments, projects and policies in Agriculture, Forestry and Other Land use (AFOLU) sector.[31]
- **SBF** (I Care): SBF is a tool and approach dedicated to sites' direct impact assessment, using site-level data (state, pressures) and complementary geographical data (protected areas, etc.). It can be articulated with the Product Biodiversity Footprint and the Corporate Biodiversity Footprint (detailed).
- **IBAT** (BirdLife International, Conservation International, IUCN, UNEP-WCMC): IBAT is a biodiversity data provider that grants commercial access to global biodiversity datasets (including STAR) and biodiversity reports to obtain site-specific information on biodiversity risks and opportunities.

Due to the lack of publications since 2020 on the Biodiversity Performance Tool (BPT), it has not been cited in our mapping.

A handful of key reports provide more in-depth comparisons of biodiversity footprint methodologies (Lammerant 2022; Finance for Biodiversity 2022).

(26) https://www.cisl.cam.ac.uk/resources/natural-resource-security-publications/measuring-business-impacts-on-nature
(27) http://www.productbiodiversityfootprint.com/
(28) http://www.plansup.nl/models/biodiversity-footprint-model/
(29) https://www.iucn.org/regions/washington-dc-office/our-work/biodiversity-return-investment-metric
(30) https://www.unep-wcmc.org/featured-projects/biodiversity-indicators-for-site-based-impacts
(31) http://www.fao.org/tc/exact/b-intact/en

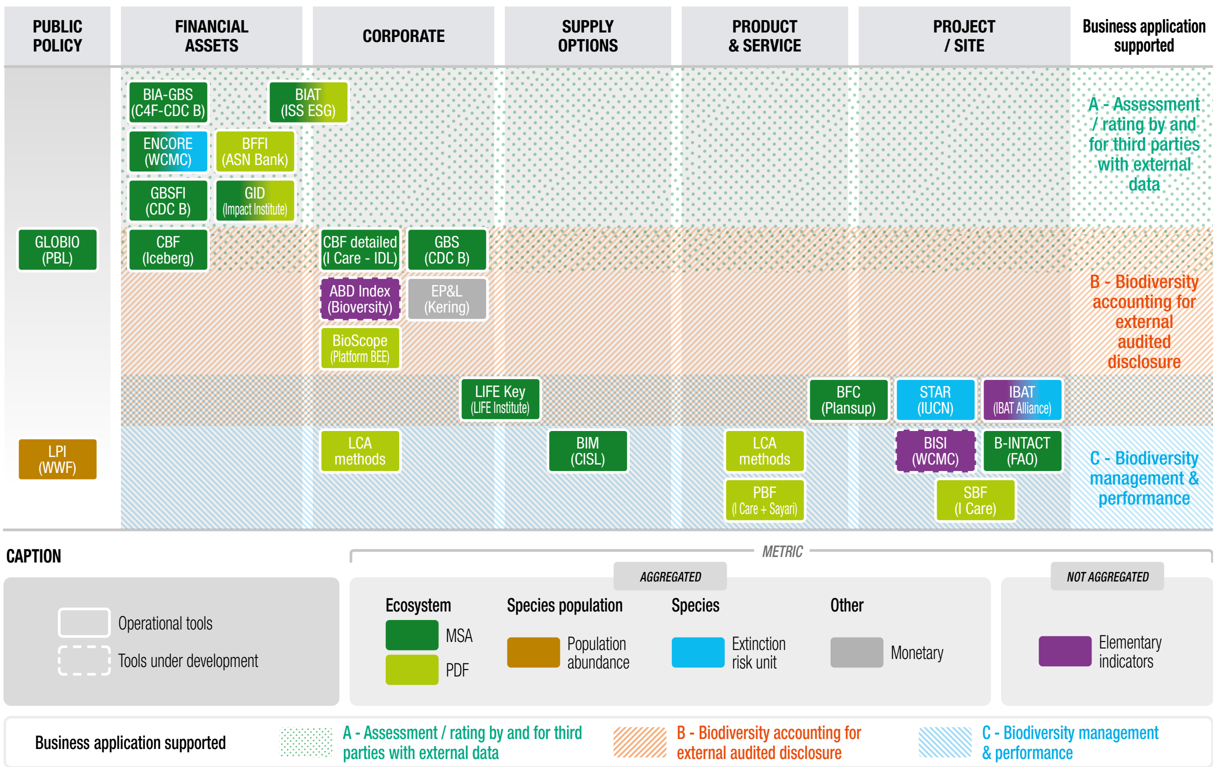

Figure 7: Mapping of the core business application and perimeters of biodiversity impact assessment initiatives

2.2 Mapping of existing initiatives

In the past few years, more and more initiatives have emerged with various goals and approaches: some focus on **biodiversity footprinting** while others address **biodiversity and nature-related topics more broadly**, some are destinated to **corporates** engagement while others are for **financial institutions** – and some can even support both.

To navigate this constantly evolving ecosystem, CDC Biodiversité worked on a mapping of biodiversity footprint-related initiatives, which were positioned according to their focus, the type of business supported, and the type of activities conducted. It aims to provide a non-exhaustive overview of existing initiatives and to show the different approaches they contribute to – thus being complementary to each other. The mapping was shared with the cited initiatives for their consultation and will keep being updated in the future.

In Figure 8, fifteen initiatives are classified according to the different areas of work they cover, which are the following:

- **Sharing best practices:** allows its members to share lessons-learnt and best practices around biodiversity footprint assessment (and potentially other topics), including around case studies conducted externally (through working groups; events within the network...).
- **Road testing:** offers the possibility to road-test in real conditions biodiversity footprint assessment approaches (*e.g.*, through case studies).
- **Common language:** promotes a common language, *i.e.*, standardized approaches or frameworks.
- **Literature / regulation review:** regularly updates its members on the latest news on biodiversity footprint assessment or nature-related matters (depending on its focus).
- **Technical support:** provides technical support to its members while they conduct biodiversity footprint assessments with specific tools (*e.g.*, with the GBS).
- **Capacity building:** allows its members to build capacity on biodiversity footprint assessment or nature-related matters (depending on its focus), through trainings or dedicated workshops.
- **Business commitments:** encourages concrete business action by collecting and aggregating biodiversity business commitments.
- **Tools description:** describes existing biodiversity footprint assessment tools, their features and perimeter.
- **Tools assessment:** evaluates existing tools through criteria (such as robustness, compatibility with existing frameworks, *etc.*) on biodiversity footprint assessment.
- **Business case:** explains and builds the business case to measure companies' impacts on and dependencies to biodiversity.
- **Recommendations to policy makers:** provides recommendations to policymakers on biodiversity measurement (*e.g.*, by providing feedback during consultations).
- **Data & calculation convergence:** aims at converging on a limited number of common input data and calculation processes.

The fifteen initiatives described and positioned in Figure 8 including the B4B+ Club and other major organisations, are:

- **Act4Nature International**[32] is a French collective initiative (aimed at global actors), initiated to accelerate business actions in favour of nature. Committed businesses are signing 10 common commitments at CEO-level and SMART individual commitments (Specific, Measurable, Attainable, Relevant and Time-bound).
- The **Align Community of Practice and Community of Interest** aim to support key stakeholders in the development of standardized natural capital accounting practices – including a standardized approach to measuring biodiversity. Companies can take part in the project both through the Community of Interest (members are kept informed) or the Community of Practice (members contribute to the creation of project tools and standards).
- The **B4B+Club**[33] is a network gathering over 50 companies, financial institutions, consultants, and data providers focused on biodiversity footprinting. The Club allows its members to understand how biodiversity footprint assessment tools can serve corporate decisions, investment decisions and external reporting, but also to anticipate financial, regulatory and market developments with regard to the reduction of the biodiversity footprint.
- The **Biological Diversity Protocol (BD Protocol)**[34] aims to enable organisations to identify, measure and account for their impacts on biodiversity - for various business applications, from site management and internal reporting to external mandatory and/or voluntary disclosures.
- **Business for Nature** (BfN) is a global coalition of businesses, conservation organizations and forward-thinking companies calling for governments to adopt policies to reverse nature loss in this decade with a credible business voice on nature. It also works to accelerate business action on nature.
- The **EU Business @ Biodiversity (EU B@B) Platform**[35] provides a forum for dialogue and policy interface to discuss the links between business and biodiversity at the European Union level. It was set up by the European Commission with the aim to work with and help businesses integrate natural capital and biodiversity considerations into business practices. This work is articulated in three workstreams: methods, pioneers and mainstream. The EU B@B Platform also organises the annual European Business & Nature Summit.
- **Finance for Biodiversity (FfB) Pledge and Foundation**[36] gather more than 150 financial institutions that have signed the Pledge and committed to collaborate, mobilize, assess, set tar-

(32) https://www.act4nature.com/en/
(33) https://www.cdc-biodiversite.fr/wp-content/uploads/2023/04/B4B-Club_Brochure_EN.pdf
(34) Biodiversity Protocol | NATIONAL BIODIVERSITY AND BUSINESS NETWORK (nbbnbdp.org)
(35) https://green-business.ec.europa.eu/business-and-biodiversity_en
(36) https://www.financeforbiodiversity.org

INITIATIVES	FOCUS	BUSINESS SUPPORTED	SHARING BEST PRACTICES	ROAD TESTING	COMMON LANGUAGE	LITERATURE / REGU-LATION REVIEW	TECHNICAL SUPPORT	CAPACITY BUILDING	BUSINESS COMMIT-MENTS	TOOLS DE-SCRIPTION	TOOLS AS-SESSMENT	BUSINESS CASE	RECOM-MENDA-TIONS TO POLICY MAKERS	DATA & CALCULA-TION CON-VERGENCE
ACT4NATURE INTERNATIONAL	Generalist	Corporate/ Finance	✔						✔			✔		
ALIGN COMMUNITY OF PRACTICE AND COMMUNITY OF INTEREST	Footprint assessment specialist	Corporate/ Finance	✔		✔					✔		✔	✔	✔
B4B+ CLUB	Footprint assessment specialist	Corporate/ Finance	✔	✔		✔	✔	✔					✔	
BIOLOGICAL DIVERSITY PROTOCOL (BD PROTOCOL)	Disclosure	Corporate			✔									
BUSINESS FOR NATURE (BfN)	Generalist	Corporate/ Finance	✔									✔	✔	
EU B@B PLATFORM	Generalist	Corporate/ Finance	✔			✔		✔		✔	✔	✔	✔	
FINANCE FOR BIODIVERSITY (FfB) PLEDGE AND FOUNDATION	Generalist	Finance	✔		✔	✔		✔	✔	✔		✔	✔	
INSTITUT DE LA FINANCE DURABLE'S BIODIVERSITY WORKING GROUP	Generalist	Finance	✔			✔		✔		✔			✔	
FRANCE INVEST'S COMMISSION SUSTAINABILITY	Generalist	Finance	✔			✔								
THE CAPITALS COALITION	Generalist	Corporate/ Finance	✔		✔			✔		✔				
ONE PLANET BUSINESS FOR BIODIVERSITY (OP2B)	Generalist	Corporate	✔									✔	✔	
PARTNERSHIP FOR BIODIVERSITY ACCOUNTING FINANCIALS (PBAF)	Footprint assessment specialist	Finance	✔		✔	✔	✔	✔			✔			✔
PROTEUS	Footprint assessment specialist	Corporate (oil & gas + mining)	✔	✔		✔	✔	✔				✔		
SCIENCE BASED TARGETS NETWORK (SBTN)	Generalist	Corporate	✔	✔	✔					✔	✔	✔		
TASKFORCE ON NATURE-RELATED FINANCIAL DISCLOSURES (TNFD)	Disclosure	Corporate/ Finance	✔	✔	✔								✔	

Figure 8: Mapping of existing initiatives

gets and report on biodiversity by 2024. Many are members of the Foundation, which sets up activities and working groups to share best practices in particular on measurement, metrics and data.

- The ***Institut de la finance durable*'s biodiversity working group**[37] - formerly known as *Finance for Tomorrow*, aims at building capacity of key stakeholders on biodiversity financing tools and at sharing information on initiatives in which the working group members are involved.
- The **France Invest Sustainability Commission**[38] supports non-listed companies around various topics including biodiversity. France Invest organizes webinars and other events, and released a «biodiversity guide» to encourage the integration of biodiversity within the activities of companies and investors.
- **The Capitals Coalition**[39] is an international collaboration promoting the capital approach – in particular valuing natural capital – in decision-making. In particular, it allows the sharing of good practices, to respond to collective challenges and to co-create solutions: collaborative projects are identified and managed by the coalition's members.
- **One Planet Business for Biodiversity (OP2B)**[40] is an international business coalition on biodiversity with a specific focus on agriculture, hosted by the World Business Council for Sustainable Development (WBCSD). The coalition is focused on three pillars: scaling up regenerative agriculture, enhancing cultivated biodiversity, and protecting high-value ecosystems.
- **The Partnership for Biodiversity Accounting Financial (PBAF)**[41] is an independent foundation to develop the "PBAF Standard", which allows financial institutions and data providers to assess and disseminate the biodiversity impacts and dependencies of loans and investments in a standardised way.
- **Proteus**[42] is a collaboration, in partnership with UNEP-WCMC, to provide extractive businesses with the information needed to make informed decisions, and to support the development, improvement and dissemination of data and information on global biodiversity. Proteus notably supports companies in the implementation of biodiversity strategies.
- **The Science Based Targets Network (SBTN)'s Corporate Engagement Programme**[43] is a programme under the SBTN – which develops methods and resources to encourage companies and cities to adopt Science Based targets and take action for biodiversity but also for water, soil and the ocean – that supports companies road-testing its framework.
- **The Taskforce on Nature-related Financial Disclosures (TNFD)**[44]: the TNFD develops and provides a risk management and disclosure framework in order to facilitate organizations' reporting and management of nature-related risks. Its development was accompanied by an extensive piloting with a number of partner organisations.

2.3 Linkage of the GBS with the Taskforce on Nature-related Financial Disclosures (TNFD)

As described in Section 2.2, the TNFD provides a framework for risk management and disclosure. It suggests in particular a four steps approach on nature-related impacts, dependencies, risks and opportunities: the LEAP approach. It also provides a list of disclosure metrics (TNFD 2023b).

By calculating impacts and dependencies on biodiversity, the GBS can be used in combination with other tools and approaches to connect to the LEAP framework. The following figures provide high-level linkages between GBS outputs and the TNFD approach at each phase of the framework. They also point to some additional data sources which can be used to complement GBS outputs such as IBAT (see section 2.1 for a short description of IBAT).

During the **Locate phase**, data fed into the GBS can and should include site-level data on pressures, which allow to assess ecosystem integrity at each location. As displayed by Figure 9, other data sources such as IBAT are required to go beyond integrity and identify for instance areas of high biodiversity importance.

The most direct use of the GBS occurs during the **Evaluate phase** as explained in Figure 10. The tool allows to identify and analyse the **dependencies (dependency score in %) and impacts on ecosystem integrity (in MSA.km²)** as expected in phase E3 and E4. To have a full picture, impacts on endangered species and areas of high biodiversity importance should be covered with other tools and metrics, such as STAR units for endangered species.

The **Assess phase** can derive a semi-qualitative analysis from GBS outputs to conduct a risk and opportunity materiality assessment as shown in Figure 11. In practice, **the impacts assessed with the GBS can be considered a proxy of the transition risk**: companies with higher impacts on biodiversity are more at risk of reputational and legal risks and are more exposed to market and regulatory risks (they will struggle more to adjust to shifts in their clients' preferences or to new permitting rules associated to impacts on biodiversity).

(37) https://institutdelafinancedurable.com/en/nos-groupes-de-travail/
(38) https://www.franceinvest.eu/club/commission-sustainability/
(39) https://capitalscoalition.org/
(40) https://www.wbcsd.org/Projects/OP2B
(41) https://www.pbafglobal.com/
(42) Proteus Partners
(43) https://sciencebasedtargetsnetwork.org
(44) https://tnfd.global/

L Locate

The interface with nature

Pressure data (such as land occupation by land use type) collected at the site level to feed the GBS can be used to assess ecosystem integrity.

The **global MSA layer for the Land use pressure** about to be published can also be used to screen the ecological integrity ecosystems at each location.

IBAT outputs provide the required information on ecosystem importance at each location.

L1 SPAN OF THE BUSINESS MODEL AND VALUE CHAIN

What are our organisation's activities by sector and value chain? **Where** are our direct operations?

L2 DEPENDENCY AND IMPACT SCREENING

Which of these sectors, value chains and direct operations are associated with potentially moderate and high dependencies and impacts on nature?

L3 INTERFACE WITH NATURE

Where are the sectors, value chains and direct operations with potentially moderate and high dependencies and impacts located?

Which biomes and specific ecosystems do our direct operations, and moderate and high dependency and impact value chains and sectors, interface with?

L4 INTERFACE WITH SENSITIVE LOCATIONS

Which of our organisation's activities in moderate and high dependency and impact value chains and sectors are located in ecologically sensitive locations?

And **which** of our direct operations are in these sensitive locations?

The GBS allows to conduct a **screening of both dependencies and impacts** across the **value chain** and **direct operations.**

With the right level of granularity in the input data fed to the GBS, the results from L3 can be used to identify the operational sites and suppliers with **high integrity ecosystems, rapid decline ecosystem integrity** and the **most significant impacts**. The global MSA layer can be used for the first two cases.

Figure 9: Linkage between the GBS and the Locate phase of the TNFD

E Evaluate

Dependencies & impacts

The GBS assesses the **dependencies** of a company on 21 ecosystem services for direct operations and the supply chain. The score ranges from 0 % (no known dependency) to 100 % (very high dependency on ecosystem services). The dependency score is calculated with two methodologies, an average dependency score and a critical dependency score, allowing to identify relevant ecosystem services and dependencies, and analyse them.

E1 IDENTIFICATION OF ENVIRONMENTAL ASSETS, ECOSYSTEM SERVICES AND IMPACT DRIVERS

What are the sectors, business processes or activities to be analysed? What environmental assets, ecosystem services and impact drivers are associated with these sectors, business processes, activities and assessment locations?

E2 IDENTIFICATION OF DEPENDENCIES AND IMPACTS

What are our dependencies and impacts on nature?

E3 DEPENDENCY AND IMPACT MEASUREMENT

What is the scale and scope of our dependencies on nature?

What is the severity of our negative impacts on nature? What is the scale and scope of our positive impacts on nature?

E4 IMPACT MATERIALITY ASSESSMENT

Which of our impacts are material?

The GBS assesses the **impacts on ecosystem integrity** of a company on the entire value chain, in MSA.km². The results are provided by realm, accounting category, pressure and Scope, allowing to both identify and analyse the company's impacts.

With the right level of granularity in the input data, the GBS can distinguish the impacts at each priority locations.

STAR scores calculated in an IBAT screening can be used to assess impacts on species extinction.

Figure 10: Linkage between the GBS and the Evaluate phase of the TNFD

A Assess

Risks & opportunities

A1 RISK AND OPPORTUNITY IDENTIFICATION

What are the corresponding risks and opportunities for our organisation?

A2 ADJUSTMENT OF EXISTING RISK MITIGATION AND RISK AND OPPORTUNITY MANAGEMENT

What existing risk mitigation and risk and opportunity management processes and elements are we already applying? How can risk and opportunity management processes and associated elements (*e.g.,* risk taxonomy, risk inventory, risk tolerance criteria) be adapted?

A3 RISK AND OPPORTUNITY MEASUREMENT AND PRIORITISATION

Which risks and opportunities should be prioritised?

A4 RISK AND OPPORTUNITY MATERIALITY ASSESSMENT

Which risks and opportunities are material and therefore should be disclosed in line with the TNFD recommended disclosures?

Impacts and dependencies results can feed into the identification and materiality assessment of the company's nature-related risks and opportunities.

Figure 11: Linkage between the GBS and the Assess phase of the TNFD

P Prepare

To respond & report

The Prepare phase can be conducted using results from the previous phases.

P1 STRATEGY AND RESOURCE ALLOCATION PLANS

What risk management, strategy and resource allocation decisions should be made as a result of this analysis?

P2 TARGET SETTING AND PERFORMANCE MANAGEMENT

How will we set targets and define and measure progress?

A Biodiversity Footprint Assessment using the GBS usually includes the establishment of impact reduction targets associated to quantitative estimates of the achievable reduction, together with key performance indicators to measure progress against those targets.

P3 REPORTING

What will we disclose in line with the TNFD recommended disclosures?

P4 PRESENTATION

Where and how do we present our nature-related disclosures?

The impacts assessed in a Biodiversity Footprint Assessment using the GBS, expressed in condition-weighted areas, combining ecosystem condition and ecosystem extent, can be used to feed the Ecosystem condition core disclosure metrics.

Data fed into the GBS can be used to report against impact driver core disclosure metrics.

Figure 12: Linkage between the GBS and the Prepare phase of the TNFD

The concept of shadow price for ecosystem integrity can usefully be used to appraise transition risks (see Box 3): it more or less represents the cost associated with aligning companies with a transition pathway protecting, restoring, and/or reducing negative impacts on nature, such as the cost of complying with future regulations, or the potential cost of restoring biodiversity after a reputational scandal. The monetary value of the transition risk can be approximated to amount to the multiplication of the abatement of negative impacts and restoration of ecosystem integrity required to transition (expressed in $MSA.km^2$) by the shadow price (expressed in $EUR/MSA.km^2$). Previous work has identified that significant gains of ecosystem integrity can be achieved with costs below 5 million $EUR/MSA.km^2$: this threshold can be used as a first approximation of the shadow price.

Similarly, **the dependencies assessed with the GBS can be used as a proxy of the physical risks**: companies relying heavily on ecosystem services are more at risk if those ecosystem services stop being provided by nature. In practice, the GBS provides an **average dependency score** (CDC Biodiversité 2021c) and a **critical dependency score** (see Section 3.4), helping companies to analyse both their average exposure to physical risks and the distribution of high to very high dependencies which may not be substitutable by technological solutions in the event of a loss of ecosystem service provision.

The conceptual foundation of this approach on impacts and dependencies linked to transition and physical risks and some quantitative results can be found in a working paper co-led by the French central bank using the GBS (Svartzman et al. 2021).

CDC Biodiversité is developing a stress test framework combining the assessment of the exposure of companies to transition and physical risks to an evaluation of the corporate financial losses which would occur if those risks materialised, and appraising how that would affect financial assets such as loans.

Finally, the GBS allows to **set targets** and **define strategies**, as requested in the **Prepare phase**. The TNFD defines 9 core disclosure metrics related to impact drivers (1 related to GHG emissions is already covered by the Task Force on Climate Related Financial Disclosures, TCFD) and 3 core disclosure metrics related to Invasive Alien Species and the state of nature. Among those 13 metrics, 8 are collected routinely (or calculated in the case of Ecosystem condition) during Biodiversity Footprint Assessments conducted with the GBS – for instance water withdrawal and consumption, or quantities of high-risk natural commodities -, 1 is partially collected and 2 more could easily be collected (and already are in some cases). Overall**, the coverage of TNFD core disclosure metrics during a BFA amounts to 60-85 %**. The Mean Species Abundance metric is cited as one metric which can be used to monitor Ecosystem condition (TNFD 2023a).

BOX 3

The concept of shadow price

The concept of shadow price has been used in the climate world (Price, Thornton, and Nelson 2007). The **shadow price of carbon** is based on the concept of **social cost of carbon**, which measures the full global cost today of an incremental unit of greenhouse gases emitted now, summing the full global cost for the whole society of the damage it imposes over the whole of its time in the atmosphere. It signals what society should, in theory, be willing to pay now to avoid the future damage caused by incremental carbon emissions. The social cost of carbon depends on total global emissions, but because individual countries or companies cannot control all GHG emissions (which depend on all the global stakeholders), it is not a practical measure for decision-making. There are also significant uncertainties with the estimation of the social cost of carbon. For those reasons, the shadow price of carbon should be preferred: it takes into account the marginal abatement costs and other factors that may affect countries and companies willingness to pay for reduction in GHG emissions. Whereas the social cost of carbon is determined purely by our understanding of the damage caused and the way we value it, the shadow price of carbon can adjust to reflect the political and technological environments.

3 New concepts

3.1 Comparing impacts on terrestrial and aquatic biodiversity: introducing MSAppb (MSA parts per billion)

Terrestrial and aquatic ecosystems can be compared by expressing both as a fraction of their respective global area. The fraction of the global area being in general very small, it is not expressed as a percentage (%) but rather as a **part per billion (ppb)**, *i.e.*, a billionth, drawing from the climate world where concentrations of GHG are expressed as parts per million (ppm).

The total emerged land surface is 133 million km² (Lehner and Döll 2004) and the total surface of freshwater or aquatic ecosystems is 10.3 million km² (lakes, rivers and wetlands)[45]. Conceptually, one could imagine drawing a grid of one billion cells over all the emerged land surface (or similarly one billion cells over all the surface areas covered by freshwater ecosystems): each cell's area is 1 ppb of the global emerged land surface. Figure 13 illustrates the value of 1 MSAppb[46].

Impact intensities can also be expressed using the MSAppb unit. In general, they are expressed in MSAppb per billion euros (MSAppb/bEUR).

For a terrestrial impact intensity of 3 200 MSA.m²/kEUR the corresponding aggregated value is:

$$\left(\frac{3\,200\ MSA.m^2/kEUR}{133\times10^{12}\ m^2}\times 10^6\times 10^9\right) = 24\,000\ MSAppb/bEUR$$

For an aquatic impact intensity of 100 MSA.m²/kEUR the corresponding aggregated value is:

$$\left(\frac{100\ MSA.m^2/kEUR}{10.3\times10^{12}\ m^2}\times 10^6\times 10^9\right) = 9\,700\ MSAppb/bEUR$$

Expressing impacts in MSAppb can help compare terrestrial and aquatic impacts in a more meaningful way. Publicly disclosed figures should always keep terrestrial and aquatic impacts separated: impacts from the two realms should not be summed, except for informational purposes.

(45) This surface area is the sum of the three types of freshwater ecosystems in GLOBIO Aquatic global figures associated to the GLOBIO Aquatic peer-reviewed article (Janse et al. 2015).

(46) To simplify, Figure 13 displays only one grid over the whole Earth, but in reality there are two grids, one for terrestrial and one for freshwater ecosystems, and they cover only the surface area of those respective realms. A third grid could be drawn over marine ecosystems to apply the same principle. 1 MSAppb equals 100 % MSA over 1 ppb.

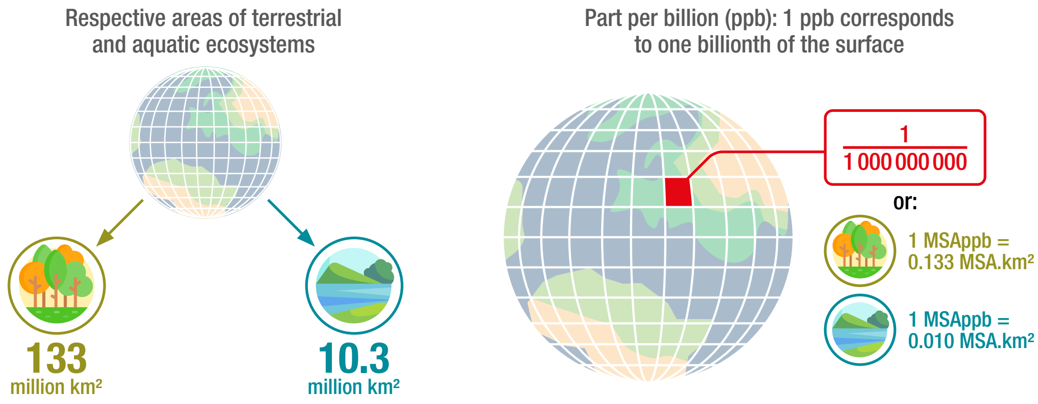

Figure 13: Rationale behind the MSAppb unit

3.2 Avoided, reduced and positive impacts

3.2.1 Defining negative and positive impacts

This section seeks to clarify the wording associated to different types of impacts and in particular what companies and financial institutions can claim as positive impacts. It also provides guidance on how positive impacts should be accounted for with regards to negative impacts.

Negative impacts are relatively straightforward to define: they are losses of biodiversity, *i.e., periodic losses* using terms from the BD Protocol or *dynamic losses* using terms from the GBS. Those losses accrue into *accumulated negative* or *static impacts*.

Positive impacts have historically not been defined as clearly and have been mixed with avoided and reduced impacts. PBAF provides a useful definition of positive impacts for project finance, which can be used more broadly: “More animals, plants and/or microbes, improving the health of a natural ecosystem, in a specific location and timeframe, as a result of a human intervention” (PBAF 2022b).

Positive impacts thus require to enhance biodiversity and to achieve *real periodic (or dynamic) biodiversity gains* (not just reduction or avoidance of negative impacts)[47]. Those gains accrue into *accumulated positive impacts* or an *increase in remaining biodiversity*. The gains can occur within or outside the value chain. Two kinds of actions are possible to enhance biodiversity: regenerate and restore (Science Based Target Network 2020; 2023b).

- **Regenerate**: “Actions designed within existing Land uses to increase the biophysical function and/or ecological productivity of an ecosystem or its components, often with a focus on specific nature’s contributions to people (*e.g.,* on carbon sequestration, food production, and increased nitrogen and phosphorus retention in regenerative agriculture)”.
- **Restore**: “Initiate or accelerate the recovery of an ecosystem with respect to its health, integrity, and sustainability with a focus on permanent changes in state”.

Regeneration differs from restoration in its objective: it is more compatible with ecosystems that are currently being used by humans whereas restoration seeks to change from a degraded state (due to human use) to a more natural state.

Example of actions that can be implemented to restore and regenerate include (Science Based Target Network 2020): ecological restoration, regenerative agriculture, replenishment of freshwater ecosystems, etc.

An entity may decide to accrue the extra periodic gains obtained compared to a baseline (see Box 4 for a definition of baseline) into **accrued positive impact compared to a baseline**: it should then seek to associate the extra periodic gains to specific ecosystem assets as required by the BD Protocol (Endangered Wildlife Trust 2020), and it should specify over which time period the periodic gains have been accumulated.

Positive impacts as defined in this report are implicitly periodic gains of biodiversity compared to a baseline set in the past (state prior to the implementation of restoration or regeneration actions or state at an arbitrary date). Losing less biodiversity than a counterfactual baseline where biodiversity is lost at a rapid rate (*e.g.*, if the abundance of species decline only from 100 to 90 instead of declining from 100 to 80 in the counterfactual baseline, there is a lower loss of biodiversity, not a gain of biodiversity) does not constitute positive impacts.

Avoided and **reduced impacts** should be considered distinct from positive impacts.

Avoided negative impacts are periodic losses (or dynamic losses) within the value chain that are prevented and entirely eliminated (Science Based Target Network 2020), for instance thanks to the choice of an alternative solution (*e.g.*, product, technology, service, etc.). As for positive impacts, an entity may decide to accrue avoided periodic losses into **avoided accumulated negative impacts**: it should then seek to associate them to specific ecosystem assets and specify the associated time period. The quantification of avoided impacts by definition requires comparison to a counterfactual scenario. There is no consensus on standardised counterfactual scenarios that should be used to quantify avoided impacts yet so entities reporting avoided impacts should clearly describe and justify the counterfactual scenarios they use. CDC Biodiversité is building sectoral benchmark factsheets which provide average sectoral impact intensities: these intensities can be used as counterfactuals to assess avoided impacts compared to a sectoral average.

Avoiding negative impacts can involve three types of avoidance actions (Science Based Target Network 2020). The **spatial type** involves avoiding locating activities within or sourcing from a particular area or landscape/seascape, for example rerouting a road to avoid natural habitats or avoiding sourcing from fisheries with stocks below biologically sustainable levels. The **technological type** involves avoiding certain technologies and favouring others, for example eliminating use of broad-spectrum insecticides in order to

(47) Positive impacts on biodiversity are similar to negative emissions, *i.e.*, carbon removal from the atmosphere, in the climate world. Natural regeneration of ecosystems outside any human intervention and the associated gains of biodiversity should be accounted separately. Positive impacts by definition require human action. Natural regeneration following a voluntary anthropic reduction of pressures does qualify as positive impacts.

BOX 4

Counterfactual scenario, baseline, and reference state

The Aligning Biodiversity Measures for Business (ABMB) initiative provided a much-needed clarification on terms that are often used interchangeably, confusing discussions. The conclusions of ABMB have been compiled by the EU B@B platform (Lammerant 2019). **Reference state** is a chosen state of ecological integrity (it could be pristine, but it could also be a legally imposed protection regime for a species or a habitat or another reference) and **baseline** is the state against which progress is tracked.

At least four types of baselines can be considered:

- State prior to the implementation of the project;

- Current state of biodiversity;

- Counterfactual scenario in which impacts are described relative to a plausible alternative state that would occur if the project did not exist;

- State at an arbitrary date: for instance, a company can choose 1990 as the year to compare against its current performance. (*e.g.*, in 1990, its impact was 100 and now it is 80 so it reduced its impact by 20 % against the baseline) (Lammerant 2019).

The concept of baseline also applies to periodic losses (or gains) and accumulated negative (or positive) impacts and the same four types of baselines also apply.

The third type of baseline introduces the concept of **counterfactual scenario**: a trajectory of biodiversity state built to describe a plausible alternative trajectory (it can also be built based on a "control site" where the actions assessed have not been implemented). Actual impacts can be compared to impacts in a counterfactual scenario to quantify avoided impacts.

Some metrics (such as the MSA, the Biodiversity Intactness Index, etc.) use the *undisturbed state* as a built-in calibration *reference*: the undisturbed state represents the 100 % value of the metric. This is completely different from a *baseline* and has no influence over it: using the MSA metric does not mean companies should set targets against the undisturbed state. Companies can select their own baseline (or it may be set by regulatory requirements or measurement frameworks such as the SBTN), which can for instance be the state of biodiversity in 1990 (as in the example above).

support pollinators. The **temporal type** involves avoiding conducting activities during a particular time period, for example not withdrawing water in months of water stress.

Reduced negative impacts are periodic losses (or dynamic losses) that are reduced and minimized, without necessarily being eliminated (Science Based Target Network 2020). As for avoided negative impacts, an entity may decide to accrue reduced periodic losses into **reduced accumulated negative impacts**: it should then seek to associate them to specific ecosystem assets and specify the associated time period. As noted by PBAF, "The fact that an avoided impact is linked to an alternative scenario sets it aside from a reduced negative impact, which is linked to a comparison of impact in time" (PBAF 2022b): reduced periodic losses are defined compared to a baseline past value of periodic losses at an arbitrary date.

Reducing periodic losses can be achieved by for instance: optimizing water use during a production process, changing the source materials or supplier to a less impact-intensive one, changing portfolio allocation to reduce the negative impact intensity of the companies within the portfolio, optimising the use of inputs such as irrigated water and controlling for outputs such as excess nutrient or ecotoxic substances from pesticides for agriculture.

In some cases, the border between reducing negative impacts and generating positive impacts may seem blurry but a simple rule should guide the classification of impacts: only actions leading to demonstrated (see below for a discussion on potential vs demonstrated impacts) and verifiable decrease of accumulated negative impacts (and thus increase of accumulated positive impacts) can be considered as generating positive impacts. A decrease in periodic losses (without generating periodic gains) still leads to an increase of accumulated negative losses and is thus only a reduced negative impact.

Figure 14 illustrates all the concepts defined above: it shows the evolution of periodic gains (at the top) and losses (at the bottom) reported by a company over time. The periodic losses at the beginning of the period (year 0) are used as a baseline to assess reduced negative impacts: the negative impact reduction in subsequent years increases the reduced periodic loss year after year. In the business-as-usual scenario, the growth of the reporting company would have led to an increase of its impacts, but thanks to the implementation of a number of measures, its impacts have not increased (and have actually decreased, leading to reduced negative impacts): avoided negative impacts can be measured against this business-as-usual counterfactual.

The company actively supports regeneration and restoration actions which lead to periodic gains of biodiversity (represented in green), *i.e.*, periodic positive impacts.

CDC Biodiversité requires companies using the GBS to report separately positive and negative impacts to take into account the non-fungibility of biodiversity. The company should thus not report only a net impact, as the one displayed on Figure 14 (sum of periodic losses, expressed as a negative figure and periodic gains, expressed as a positive figure)[48]. It can however disclose a net impact as an additional information for communication purpose, on top of the "official" disclosure of periodic losses on the one hand and periodic gains on the other hand. If it does, it should report net impacts at the appropriate level for ecological equivalency[49].

Beyond accounting and disclosure considerations, companies should keep in mind that the mitigation hierarchy must be applied: the priority should always be to avoid negative impacts, then reduce unavoidable negative impacts and only seek to counterbalance (through restoration and regeneration) residual negative impacts which could not be avoided or reduced.

As illustrated by Figure 14, avoided and reduced impacts do not influence net impacts: they do not play a role on the actual increase or decrease of biodiversity. As such, they should not be disclosed together with periodic gains or losses. Avoided and reduced impacts can however be reported separately for communication purposes (and providing a summed-up figure of both makes sense since the distinction between avoidance and reduction can sometimes be blurry) and the assumptions, in particular the baselines, used to calculate them should always be clearly explained.

Impacts measured through pressure-impact models such as the GLOBIO model used in the GBS[50] are by definition **potential impacts** (UNEP-WCMC et al. 2022), *i.e.*, the pressures may lead to the expected change in the state of biodiversity, rather than **actual impacts**, *i.e.*, changes in the state of biodiversity actually occurring to real world's ecosystems. In most cases, actual impacts match the potential impacts assessed based on pressure data. But in particular in the case of positive impacts, an improvement in the state of biodiversity may temporally lag behind a decrease in pressures. Claiming positive impacts require to properly measure actual impacts and cannot be achieved solely with pressured-based measurement.

3.2.2 Example of accrued positive impacts compared to a baseline generated by a wastewater treatment service

Consider a case involving two companies across four periods of time, as illustrated Figure 15. During the period 1, Manufacturer Inc. directly discharges its wastewater into the nearby river, affecting the local and potentially downstream watersheds. During period 2, Depollution Inc. is contracted to provide wastewater treatment service to Manufacturer Inc. and starts abating pollution at a wastewater treatment plant (WWTP): residual pollutant concentrations in the water at the outlet of the WWTP decline steadily. During period 3, the pollutant concentrations have stabilised and are maintained at a low level. The assessment of the impact of Depollution Inc. is conducted during period 4 which is a subset of period 3.

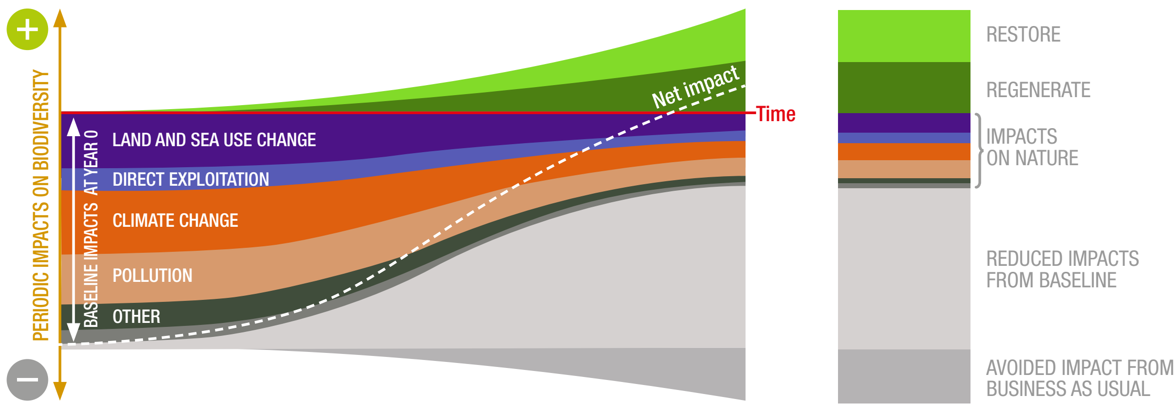

Figure 14: Illustration of periodic positive and negative impacts and reduced and avoided impacts, adapted from Science Based Target Network (2020)

(48) Please note that this representation was chosen to simplify Figure 14. The results obtained with the GBS are actually reversed: periodic losses and accumulated negative impacts are expressed as positive figures and periodic gains are expressed as negative figures.

(49) There is no consensus on what constitutes the right level for ecological equivalency but it is likely to at least be the ecoregion level (described in https://www.worldwildlife.org/publications/terrestrial-ecoregions-of-the-world).

(50) See the GBS's Terrestrial (CDC Biodiversité 2020c) and Aquatic (CDC Biodiversité 2020b) critical review documents for more information on how the GLOBIO model (Schipper et al. 2016) is used.

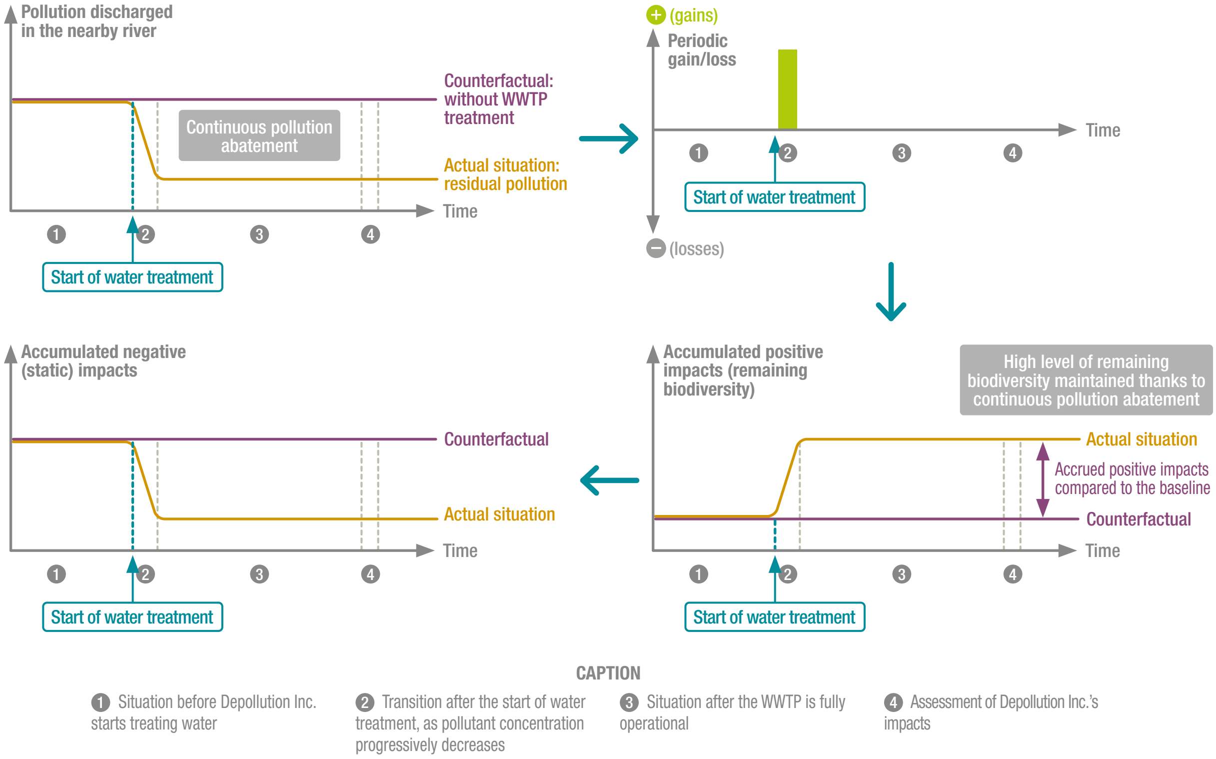

Figure 15: Evolution of the pollution discharged, periodic impacts and accumulated impacts for the river ecosystem downstream of Depollution Inc. Blue arrows show the logical flow between each chart (the variation of pollutants leads to periodic gains/losses, which leads to changes in accumulated impacts).*

* The usual convention that losses are displayed with positive figures and gains are displayed with negative figures is not applied here.

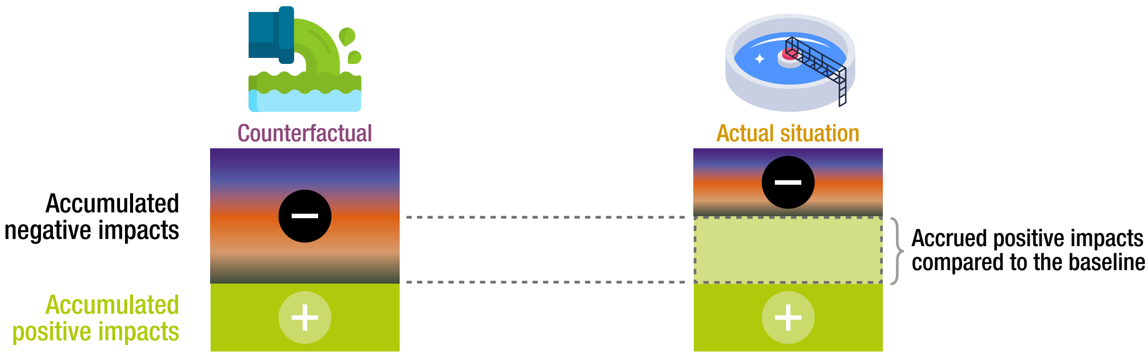

Figure 16: Depollution Inc. can report accrued positive impact compared to the baseline during the year of the assessment

As displayed in Figure 15, during period 2, the decrease in pollutant concentrations leads to potential periodic gains. To simplify, no time lag is considered between the decrease in pollutant concentrations and gains in biodiversity: biodiversity is assumed to regenerate instantly. The potential periodic gains are accrued to the potential accumulated positive impacts (*i.e.*, the remaining biodiversity of the river ecosystem), and by definition decrease the accumulated negative impacts.

During period 3 (as during period 1), the pollutant concentration does not change so the pressure is maintained at a constant intensity on the ecosystem and there is no periodic gain or loss.

Manufacturer Inc. seeks to highlight the benefits it brought to biodiversity by contracting with Depollution Inc. thanks to its WWTP: it defines a counterfactual scenario under which it would have continued to directly discharge wastewater into the nearby river and uses it as a baseline against which to compare the current situation during its assessment in period 4. It should be noted that the focus here is on impacts associated to the nearby river ecosystem but negative impacts affect other ecosystems because of the treatment of water, *e.g.*, ecosystems are likely to be affected by the extraction of fuel to generate the electricity required by the WWTP, and other ecosystems are likely to be damaged by pollution and other pressures caused by the production of the reagents used in the WWTP.

As displayed in Figure 15 and Figure 16, **accrued positive impact compared to the baseline** can be estimated[51].

(51) As explained in section 3.2.1, these impacts belong to Scope 1 of Depollution Inc. and Upstream Scope 3 of Manufacturer Inc.

Table 4: Upstream Scope 3 impacts on biodiversity, adapted from Greenhouse Gas Protocol (2011)

CATEGORY	CATEGORY DESCRIPTION	MINIMUM BOUNDARY	OPTIONAL
1A. Purchased goods (excluding biomass) and services (sub-category of 1. Purchased goods and services*)	All cradle-to-gate impacts on biodiversity caused by the production of products purchased or acquired by the reporting company in the reporting year, to the exception of biomass goods covered by category 1B. Products include both goods and services. This for instance includes biodiversity losses caused by the extraction of minerals which end up in the products purchased or acquired, as well as biodiversity gains generated by the restoration of mines or quarries at the end of their life, if those mines or quarries were involved in the supply chain of the reporting company. Services in this category do not cover waste management by a third-party, which is included in category 5. Waste generated in operations.	All upstream (cradle-to-gate) impacts of purchased goods and services, to the exception of biomass goods covered by category 1B	
1B. Purchased biomass (sub-category of 1. Purchased goods and services)	Impacts generated by the direct operation of companies producing biomass. Biomass is understood here to include all untransformed vegetal (cereals, vegetables, fibres, wood logs, non-timber forest products, etc.) and animal (raw meat, milk, etc.) products. It does not include transformed products such as leather, chocolate, cheese, processed meat products, etc. Other upstream impacts related to the production of biomass (*e.g.,* the production of inputs such as fuels, fertilisers, pesticides, etc.) are tracked in Scope 3, categories 1 and 3.	All upstream (cradle-to-gate) impacts of purchased biomass	
2. Capital goods	This category includes all cradle-to-gate impacts on biodiversity caused by the production of capital goods purchased or acquired by the reporting company in the reporting year. Capital goods are final products that have an extended life and are used by the company to manufacture a product, provide a service, or sell, store, and deliver merchandise.	All upstream (cradle-to-gate) impacts of purchased capital goods	
3. Fuel and energy related activities (not included in Scope 1 or 2)	Biodiversity impacts linked to the production of fuels and energy purchased and consumed by the reporting company in the reporting year that are not included in Scope 1 nor Scope 2. They are detailed as follow: 1: Upstream biodiversity impacts of purchased fuels and electricity 2: Biodiversity impacts related to the production of the electricity, steam, heating and cooling consumed (*i.e.,* lost) in transmission and distribution (T&D) losses 3: Upstream biodiversity impacts of the generation of purchased electricity that is sold to end users - reported by utility company or energy retailer only	1: all upstream (cradle-to-gate) impacts of purchased fuels and respectively purchased electricity (from raw material extraction up to the point of, but excluding combustion) 2: all upstream (cradle-to-gate) impacts of energy consumed in a T&D system, including impacts from combustion 3: impacts from the generation of purchased energy	
4. Upstream transportation and distribution	Biodiversity impacts from transportation and distribution of products (excluding fuel and energy products) purchased or acquired by the reporting company in the reporting year in vehicles and facilities not owned or operated by the reporting company, as well as other transportation and distribution services purchased by the reporting company in the reporting year.	Scope 1 and 2 impacts of transportation and distribution providers that occur during use of vehicles and facilities	Life cycle impacts associated with manufacturing vehicles, facilities, infrastructure
5. Waste generated in operations	Biodiversity impacts from third-party disposal and treatment of waste that is generated in the reporting company's owned or controlled operations in the reporting year. This category includes impacts from disposal of both solid waste and wastewater. This for instance includes gains and losses of biodiversity associated with the disposal of excavation spoil (*e.g.,* through quarry backfilling).	Scope 1 and Scope 2 impacts of waste management suppliers that occur during disposal or treatment	Impacts from transportation of waste
6. Business travel	Biodiversity impacts from the transportation of employees for business-related activities in vehicles owned or operated by third parties, such as aircraft, trains, buses, and passenger cars.	Scope 1 and Scope 2 impacts of transportation carriers that occur during use of vehicles (*e.g.,* from energy use)	Life cycle impacts associated with manufacturing vehicles or infrastructure
7. Employee commuting	Biodiversity impacts from the transportation of employees between their homes and their worksites. Companies may include impacts from teleworking in this category.	Scope 1 and Scope 2 impacts of employees and transportation providers that occur during use of vehicles (*e.g.,* from energy use)	Impacts from employee teleworking
8. Upstream leased assets	Biodiversity impacts from the operation of assets that are leased by the reporting company in the reporting year and not already included in the reporting company's Scope 1 or Scope 2 inventories.	Scope 1 and Scope 2 impacts of lessors that occur during the reporting company's operation of leased assets (*e.g.,* from energy use)	Life cycle impacts associated with manufacturing or constructing leased assets
U1. Areas used but not owned	Biodiversity impacts occurring on areas subject to restrictions or activities controlled by the reporting company but which are not owned by the reporting company (*e.g.,* hydropower lakes or easement strips**). These impacts should be reported in the reporting company's Scope 1 inventories if it selects the operational control approach.	All impacts generated directly within the spatial perimeter of the areas controlled	

* CDC Biodiversité recommends reporting separately categories 1A and 1B (Purchased biomass) because category 1B represents a very significant share of impacts on biodiversity upon which companies may have significant influence. Impacts from categories 1A and 1B should be summed and reported as category 1. Purchased goods and services to compare with GHG emissions reported under the GHG Protocol.

** In a case study conducted with GRTgaz and published by CDC Biodiversité, impacts related to the easement strip were accounted for in Scope 1 following an operational control consolidation approach (considering GRTgaz had control over the Land use within the easement strip). If a financial control approach had been followed, it would have been accounted for in Scope 3 category U1.

3.3 Classification of Scope 3 biodiversity impacts

3.3.1 Introducing the Scope 3 categories

As a reminder, the section 3.2. of a previous GBS report (CDC Biodiversité 2019) defines the concept of "Scopes" and the different consolidation approaches: operational control, financial control or share of the assets owned. The Scope 3 impacts on biodiversity of a given company are defined as "*the impacts of the activities of this company occurring from sources not owned or controlled by the company*". Table 4 **and** Table 5 **categorise Scope 3 periodic gains or losses,** *i.e.,* **dynamic impacts** (in an adaptation of the Greenhouse Gas Protocol (2011) categories to match the specificities of biodiversity), and describe the boundaries of each category for respectively **upstream impacts** (occurring in the supply chain) and **downstream impacts** (during the use or end-of-life of the products and services). These categories are suggested for use by companies in their reporting, to facilitate the use of disclosed impacts and better account for impacts outside their direct operations. Scope 3 accumulated negative impacts, *i.e.,* static impacts, are theoretically defined as the sum of Scope 3 periodic gains and losses since the incorporation of the reporting company.

Depending on the consolidation approach adopted by the reporting company, some categories may instead be reported as Scope 1 impacts. When a single system produces multiple outputs (*e.g.,* cows can produce milk, meat and skins used for leather production) and impacts are quantified for the system as a whole, allocation is required to partition impacts among the various outputs. The approaches described by the GHG Protocol can usefully be applied to understand how the choice of consolidation approach influences the Scopes under which each impact falls, and how to best allocate impacts (Greenhouse Gas Protocol 2011).

In Table 4, **"Minimum boundary"** is the minimum perimeter a reporting company shall account for in its biodiversity footprint assessment, which ensure that its major activities are included in the inventory - adapted from the Greenhouse Gas Protocol (2011). The reporting company may include impacts from **"Optional"** categories in a biodiversity footprint assessment.

Table 5: Downstream Scope 3 impacts on biodiversity, adapted from Greenhouse Gas Protocol (2011)

CATEGORY	CATEGORY DESCRIPTION	MINIMUM BOUNDARY	OPTIONAL
9. Downstream transportation and distribution	Biodiversity impacts from transportation and distribution of products sold by the reporting company's operations and the end consumer (if not paid for by the reporting company) in vehicles and facilities not owned or controlled by the reporting company.	Scope 1 and Scope 2 impacts of transportation providers, distributors, and retailers that occur during use of vehicles and facilities (*e.g.,* from energy use).	Life cycle impacts associated with manufacturing vehicles, facilities, or infrastructure. Impacts generated by customers traveling to retail stores.
10. Processing of sold products	Biodiversity impacts from processing sold intermediate products by third parties (*e.g.,* manufacturers) subsequent to sale by the reporting company. Intermediate products are products that require further processing, transformation, or inclusion in another product before use.	Scope 1 and Scope 2 impacts of downstream value chain partners that occur during processing (*e.g.,* from energy use).	
11. Use of sold products	Biodiversity impacts from the use of goods and services sold by the reporting company in the reporting year. A reporting's Scope 3 biodiversity impacts from use of sold products include the Scope 1 and Scope 2 impacts of end users (consumers and business customers that use final products).	Direct use-phase impacts of sold products over their expected lifetime, *i.e.,* the Scope 1 and Scope 2 impacts of end users that occur from the use of: products that directly cause pressures on biodiversity, *i.e.,* that emit GHG (*e.g.,* fuels and feedstock burnt during use), emit other pollutants (*e.g.,* pesticides), increase water withdrawals (*e.g.,* swimming pools), etc.	Indirect use-phase impacts of sold products over their expected lifetime, *i.e.,* products which require to be used with other products causing direct pressures on biodiversity, such as seeds genetically modified to be used with certain pesticides (those pesticides causing ecotoxic pollution). Impacts associated with the maintenance of sold products during use.
12. End-of-life treatment of sold products	Biodiversity impacts from the waste disposal and treatment of products sold by the reporting company in the reporting year at the end of their life. This category includes the total expected end-of-life impacts from all products sold in the reporting year.	Scope 1 and Scope 2 impacts of waste management companies that occur during disposal or treatment of sold products.	
13. Downstream leased assets	Biodiversity impacts from the operation of assets that are owned by the reporting company and leased to other entities in the reporting year that are not already included in Scope 1 or Scope 2.	Scope 1 and Scope 2 impacts of lessees that occur during operation of leased assets.	Life cycle impacts associated with manufacturing or constructing leased assets.
14. Franchises	Biodiversity impacts from the operation of franchises not included in Scope 1 or Scope 2. (Franchise: business operating under a license to sell or distribute another company's goods or services within a certain location.)	Scope 1 and Scope 2 impacts of franchisees that occur during operation of franchises.	Life cycle impacts associated with manufacturing or constructing franchises.
15. Investments	Biodiversity impacts from operation of assets owned or financed in the reporting year, not already included in Scope 1 or Scope 2.	Proportional Scope 1, 2 and 3 impacts of the assets owned or financed occurring in the reporting year. Financial institutions can refer to previous reports (CDC Biodiversité 2019) and the Partnership for Biodiversity Accounting Financials (PBAF 2022a) for guidance on the definition of "proportional" and guidance on calculations.	

Table 6: Categorisation of impacts from a leased assets from the perspective of a fictitious Lessee Inc., Finance/capital lease

		TYPE OF LEASE	
		FROM THE PERSPECTIVE OF LESSEE INC.	FROM THE PERSPECTIVE OF LESSOR INC.
APPROACH USED FOR THE ASSESSMENT	FINANCIAL CONTROL	Lessor Inc. left the ownership and full financial control to Lessee Inc. with this type of lease: biodiversity impacts caused by the asset operation belong to Lessee Inc.'s Scope 1 and use of purchased energy belongs to its Scope 2. Impacts are thus not classified as Scope 3, category 8 for Lessee Inc.*	Lessor Inc. left the full financial control to the Lessee Inc. with this type of lease: biodiversity impacts caused by the asset operation and use of purchased energy for the asset belong to its Downstream Scope 3, category 13 - Downstream leased assets.
	OPERATIONAL CONTROL	Lessee Inc. has operational control in any case: impacts caused by the asset operation belong to its Scope 1 and use of purchased energy belongs to its Scope 2.	Lessor Inc. does not have operational control: the same impacts fall within its Downstream Scope 3, category 13 - Downstream leased assets.
	SHARE OF THE ASSETS OWNED	Lessee Inc. owns 30 % of the asset leased: 30 % of the biodiversity impacts caused by the asset operation belong to its Scope 1 and 30 % of those caused by the use of purchased energy belong to its Scope 2. Lessee Inc. has operational control over the asset, thus the remaining 70 % belong to its Upstream Scope 3, category 8 – Upstream leased assets.	Lessor Inc. owns 60 % of the asset leased: 60 % of the biodiversity impacts caused by the asset operation belong to its Scope 1 and 60 % of those caused by the use of purchased energy belong to its Scope 2. Lessor Inc. does not have operational control over the asset, thus the remaining 40 % belong to its Downstream Scope 3, category 8 – Downstream leased assets.

* Impacts would be classified as Scope 3 category 8 Upstream leased assets if Lessee Inc. did not own or have financial control over the asset (Operating lease).

3.3.2 Application examples

3.3.2.1 LEASING AND OPERATIONAL CONTROL

Two different types of leases can bind a Lessor and a Lessee with regards to Scope 3's category 8 (Table 4) (Greenhouse Gas Protocol 2011): **finance/capital lease** enables the lessee to operate an asset and gives him all the risks and rewards, and is considered as fully owned by the Lessee in its financial accounting system (for example an oil concession owned by a public actor, leased to an oil major). The **operating lease** lets the Lessee operate an asset but does not give him any risk and reward (for example leasing a building).

Consider a case where Lessor Inc. owns 60 % of an asset, and the whole asset is leased to Lessee Inc. for one year during which Lessee Inc. has full control over the asset operations: this is a Finance or capital lease (the asset is considered to be wholly owned in financial accounting)[52]. The Lessee also owns 30 % of the asset (and the last 10 % are owned by other stakeholders). During this year, according to the chosen consolidation approaches of both companies, the Scope of the impacts linked to Lessee Inc. and Lessor Inc. will be defined as described in Table 6 respectively.

3.3.2.2 WASTEWATER TREATMENT

Consider two companies: Manufacturer Inc. has a plant producing a certain product and generates operational wastes and wastewater flows. Depollution Inc. provides depollution services to the town in which Manufacturer Inc. is located. Manufacturer Inc. has also internal wastewater treatment plants (WWTP). Both companies have full ownership and authority over their own facilities (the operational, financial and share owned consolidation approaches thus lead to the same breakdown by Scope).

1st case - Manufacturer Inc. fully internalises depollution operations (Figure 17): impacts linked to the **pressures** caused by the wastewater treatment fall in the **Scope 1 of Manufacturer Inc.** (for example, any residual concentration of reagent used to treat water, causing Ecotoxicity), impacts caused to **supply the inputs** required for water treatment (*e.g.*, Land use, greenhouse gas emissions, etc. required to manufacture reagent) fall within **Manufacturer Inc.'s Upstream Scope 3, category 1A: purchased goods and services except for biomass**. **Residual impacts** after internal treatment by Manufacturer Inc. (residual pollutants which could not be treated and are rejected in the nearby river, causing Ecotoxicity and Freshwater eutrophication in particular) belong to **Scope 1 of Manufacturer Inc**.

As detailed in section 3.2.2, **accrued positive impacts** (defined as the extra periodic gains obtained compared to a baseline, see section 3.2.1) **can be claimed for the pollution abatement achieved by the wastewater treatment, compared to a baseline without any treatment**. The pollution abatement in this case is defined as the difference in pollutant levels between (1) Highly polluted wastewater and (2) Water with residual pollution (Figure 17). Here, **the accrued positive impacts belong to Manufacturer Inc.'s Scope 1**.

(52) For more details on how impacts would be categorised for an Operating lease, please refer to the GHG Protocol (Greenhouse Gas Protocol 2011).

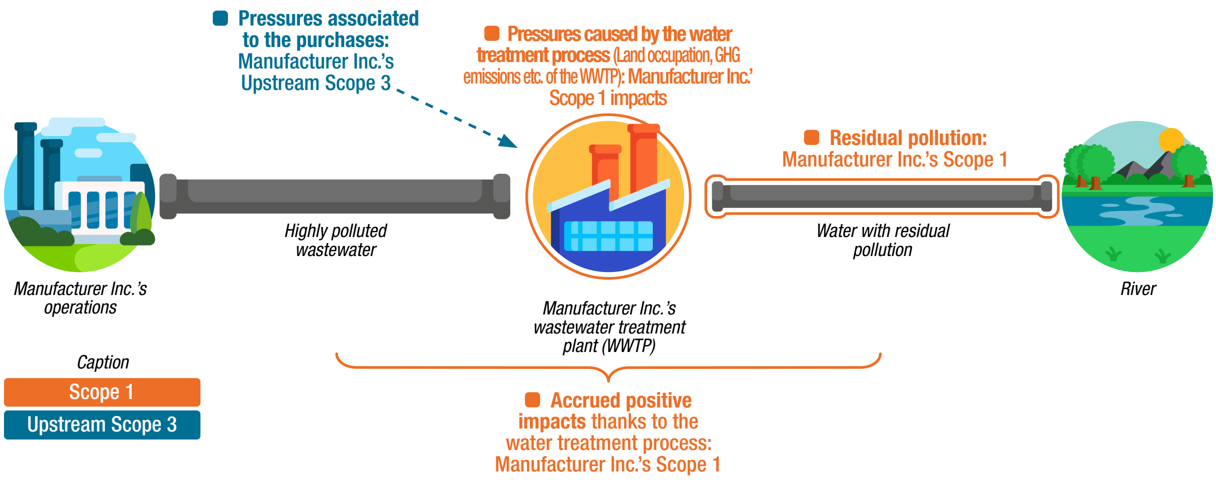

*Figure 17: Scopes accounting in a 1st case where Manufacturer Inc. fully internalises depollution operations, **accounting from Manufacturer Inc.'s perspective***

2nd case – Manufacturer Inc. fully externalises depollution to Depollution Inc.[53] (Figure 18 and Figure 19): impacts linked to the **pressures** caused during the wastewater treatment process fall into the **Scope 1 of Depollution Inc., which is the Upstream Scope 3 – waste generated in operations (category 5) of Manufacturer Inc**. Impacts generated to **supply the inputs** required for water treatment fall into the **Upstream Scope 3 (category 1A: purchased goods and services except for biomass) of Depollution Inc.,** and are optional for the Scope 3 upstream – waste generated in operations (category 5) accounting for Manufacturer Inc.[54] **Residual impacts** caused by the water discharged by Depollution Inc. (residual pollutants) shall fall within the **Scope 1 of Manufacturer Inc.** due to Manufacturer Inc.'s operation, and in the **Downstream Scope 3** – end-of-life treatment of sold products (category 12) **of Depollution Inc**.

The **accrued positive impacts compared to a baseline without wastewater treatment now fall within Depollution Inc.'s Scope 1**.

(53) Manufacturer Inc. purchases a depollution service from Depollution Inc. In many cases, a wastewater treatment company will have several clients (including municipal authorities seeking to treat their municipal wastewater) and all three sources of impacts (purchases of the WWTP, pressures caused by the treatment process and residual pollution) will not be entirely caused by the depollution of the wastewater of one client alone: an allocation of impacts to the different clients will be necessary. Applying a physical allocation based on the share of wastewater treated is then recommended.

(54) The minimum boundary for category 5 indeed includes only the Scopes 1 and 2 of the service provider, here Depollution Inc. Since the impacts generated by the provision of inputs for wastewater treatment belong to Scope 3 of Depollution Inc., they are optional for Manufacturer Inc.

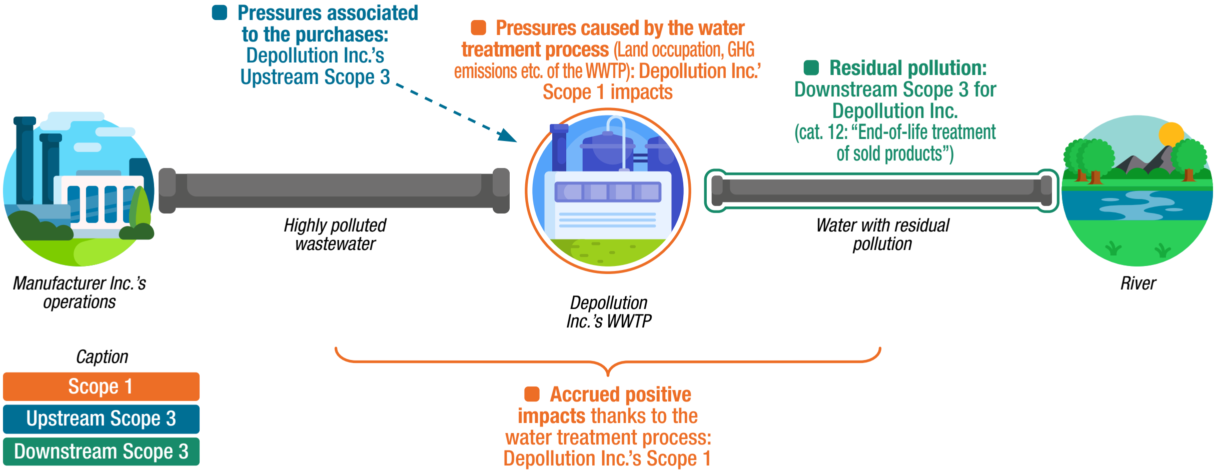

Figure 18: Scopes accounting ***from Depollution Inc.'s perspective*** *in a 2nd case where Manufacturer Inc. fully externalises depollution to Depollution Inc.*

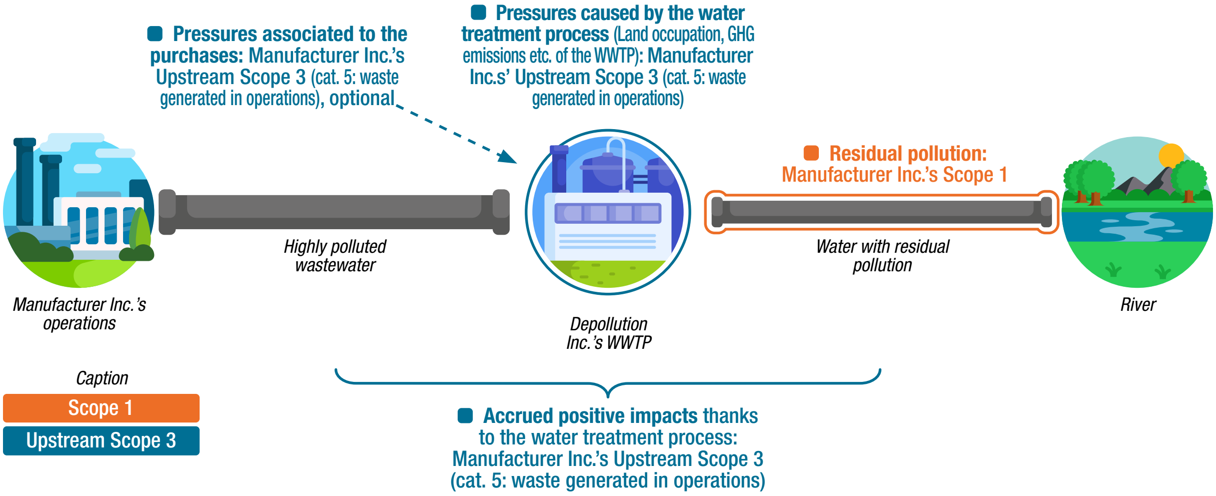

Figure 19: Scopes accounting ***from Manufacturer Inc.'s perspective*** *in a 2nd case where Manufacturer Inc. fully externalises depollution to Depollution Inc.*

3rd case – Water is treated by Manufacturer Inc., and then by Depollution Inc. (Figure 20 and Figure 21): two successive WWTP treat the wastewater. First an internal WWTP within Manufacturing Inc. removes some pollutants, then the water goes through a second WWTP from Depollution Inc., before being released to the river. Biodiversity impacts linked to the pressures caused by wastewater treatment in WWTP #1 (owned by Manufacturer Inc.) and to **the purchases of WWTP #1** fall within **Manufacturer Inc.'s Scope 1** and in **Upstream Scope 3 - purchased goods and services (category 1)** respectively. Similarly, biodiversity impacts linked to the pressures caused by wastewater treatment in WWTP #2 (owned by Depollution Inc.) and to **the purchases of WWTP #2** fall within **Depollution Inc.'s Scope 1** and in **Upstream Scope 3 – purchased goods and services (category 1)** respectively.

Manufacturer Inc. conduct one step of wastewater treatment and pays for a second step conducted by Depollution Inc. It is responsible for the residual pollution discharged into the river: the **residual impacts** caused by the final water discharge after WWTP #2 falls within **Manufacturer Inc.'s Scope 1.** Since Manufacturer Inc. is a client of Depollution Inc.'s wastewater treatment services, these impacts also fall within **Depollution Inc.'s Downstream Scope 3 - Use of sold products (category 11).**

The situation for the responsibility of the accrued positive impacts at the outlet of each WWTP is more complex than in the case of a unique WWTP. Each company can only claim accrued positive impacts for the pollution abatement achieved by its WWTP compared to a baseline without its own WWTP. For **Manufacturer Inc., the pollution abatement is thus the difference in pollutant levels between (1) Highly polluted wastewater and (2) Water with residual pollution**. For **Depollution Inc.**, the counterfactual is a situation without its WWTP but with Manufacturer Inc.'s WWTP: **the pollution abatement is thus the difference in pollutant levels between (2) Water with residual pollution and (3) Water with less residual pollution**.

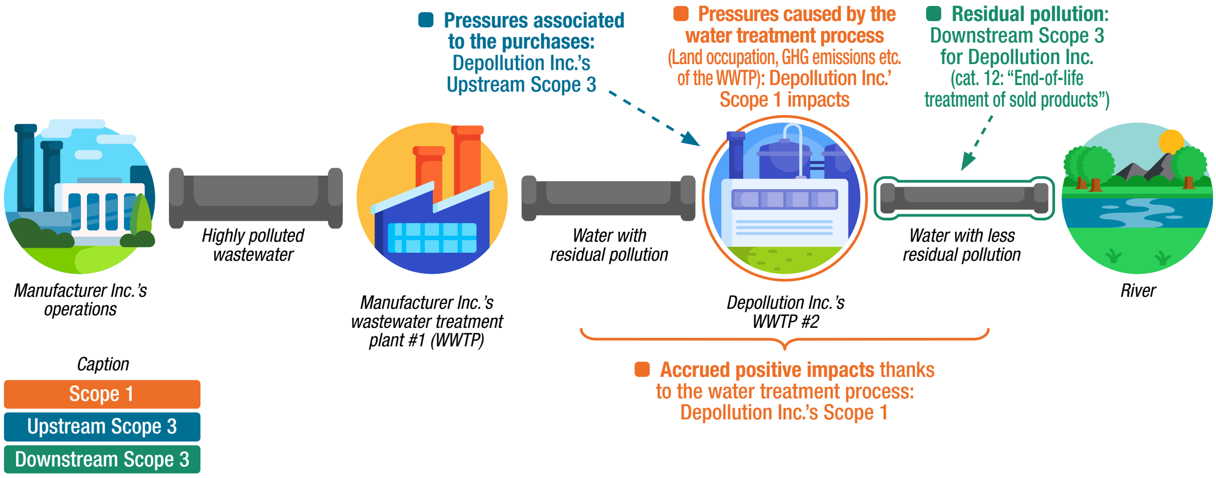

*Figure 20: Scopes accounting from **Depollution Inc.'s perspective** in a 3rd case where water is treated by Manufacturer Inc., and then by Depollution Inc.*

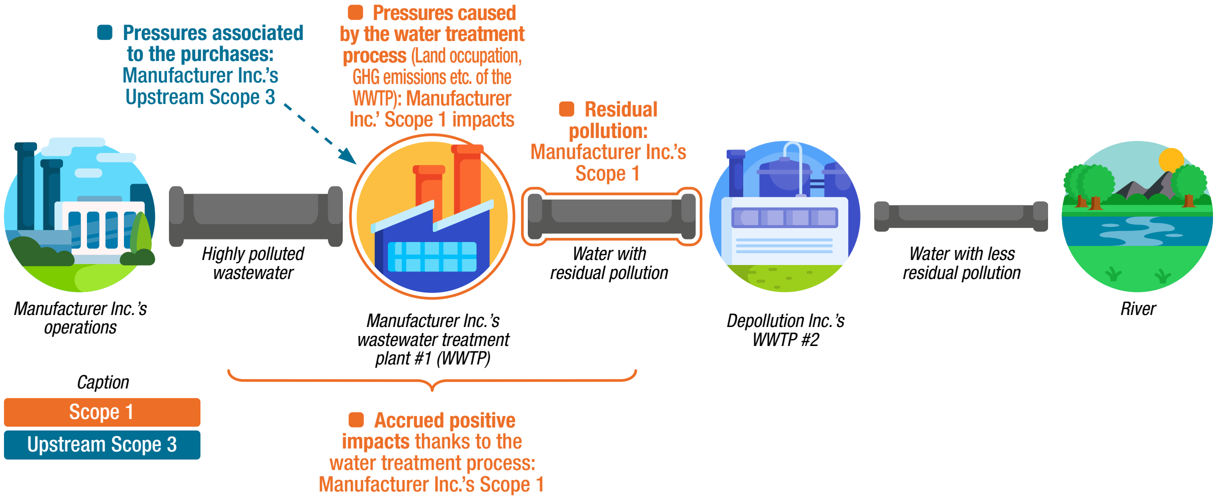

*Figure 21: Scopes accounting from **Manufacturer Inc.'s perspective** in a 3rd case where water is treated by Manufacturer Inc., and then by Depollution Inc.*

3.3.2.3 USE OF PESTICIDES

Consider a company called Chemicals Inc. producing pesticides bought by a company called Farming Inc. to apply on its cropland. Both companies here have full ownership and authority over their own facilities (the operational, financial and share owned consolidation approaches thus lead to the same breakdown by Scope). Figure 22 and Figure 23 clarify how to account for different impacts along the pesticide value chain in this example.

From Farming Inc.'s perspective, **pressures caused by applying the pesticide** (Ecotoxicity[55] caused by the pesticides) belong to its Scope 1. From Chemical Inc.'s perspective, Farmer Inc. is a client using the pesticide it sold: they belong to Chemical Inc.'s Downstream Scope 3 (cat. 11 – use of sold products).

From Chemical Inc.'s perspective, the impacts caused by **pressures related to pesticide production** belong to its Scope 1, whereas they fall within Farmer Inc.'s Upstream Scope 3 (cat. 1A: purchased goods and services except for biomass).

Impacts related to purchases made by Chemical Inc. to produce the pesticide belong to the Upstream Scope 3 (cat. 1A: purchased goods and services except for biomass) for both Chemical Inc. and Farming Inc. The minimum boundary of category 1A indeed contains all upstream impacts of the good purchased, and thus the purchases of a supplier (purchases of Chemical Inc., a supplier of Farming Inc.) also belong to category 1A (see Table 4).

3.3.2.4 SALES OF PURCHASED GOODS

Some companies have trading activities: they purchase goods or services (including electricity) then resell it to consumers (sometimes the goods or services are bought and sold several times before being used by an end user). Table 7 illustrates in which Scopes the biodiversity impacts related to each step of the value chain would fall for three fictitious companies. Each step of the value chain is further broken down into two so that the table illustrates the situation both for the case of electricity trading (which involves Scope 2) and goods trading (which does not). Producer Inc. manufactures the goods traded or generate electricity; Trader and transporter/distributer Inc. trades the goods or electricity (thus purchasing and then selling them) and transport or distribute them from Producer Inc. to User Inc.; User Inc. uses the goods or electricity. All three companies have full ownership and operational control over their own facilities (the operational, financial and share owned consolidation approaches thus lead to the same breakdown by Scope).

(55) To simplify, only the Ecotoxicity pressure is listed here, but in reality the use of pesticides impact both the field through the Land use pressure and ecosystems beyond the field through the Ecotoxicity pressure, as well as potentially other pressures (CDC Biodiversité 2020a).

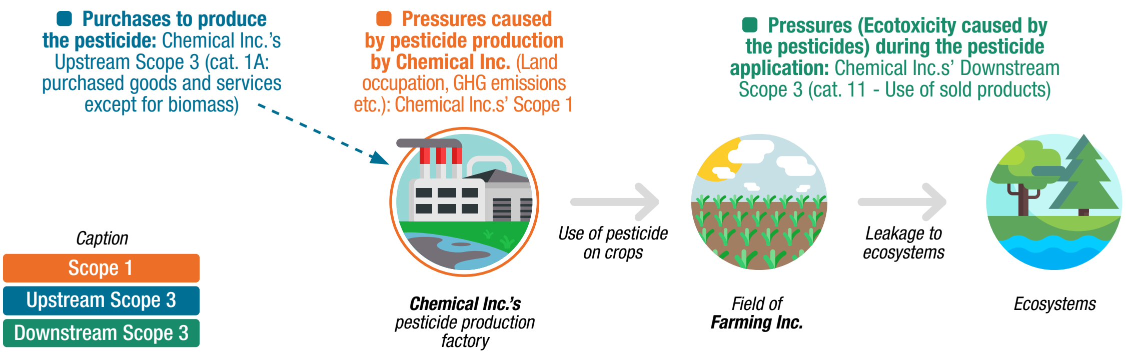

Figure 22: Scopes accounting ***from Chemical Inc.'s perspective***

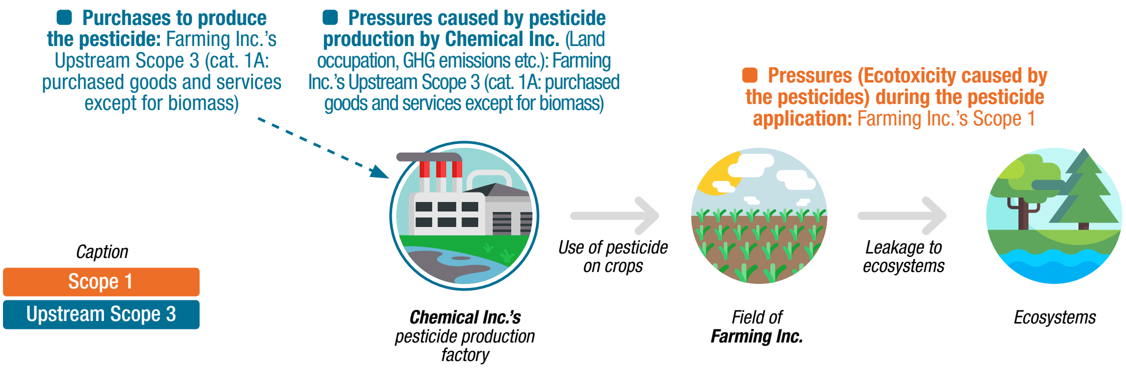

Figure 23: Scopes accounting ***from Farming Inc.'s perspective***

Table 7: Scope accounting in the case of goods or electricity trading when each company fully owns and operates its facilities

STEP OF THE VALUE CHAIN	PRODUCTION		TRANSPORT		USE OF	
COMPANY	GOODS MANUFACTURING	ELECTRICITY GENERATION	GOODS TRANSPORT	ELECTRICITY DISTRIBUTION	GOODS	ELECTRICITY
PRODUCER INC.	Scope 1		Downstream Scope 3 category 9. Downstream transportation and distribution		Downstream Scope 3 category 11. Use of sold products	
TRADER AND TRANSPORTER/ DISTRIBUTER INC.	Upstream Scope 3 category 1A. Purchased goods (excluding biomass)	Upstream Scope 3 category 3. Fuel and energy related activities	Scope 1		Downstream Scope 3 category 11. Use of sold products	
USER INC.	Upstream Scope 3 1A. Purchased goods (excluding biomass)	Scope 2	Upstream Scope 3 category 4. Upstream transportation and distribution	Scope 2	Scope 1	

3.4 Critical dependencies to biodiversity

While impacts on biodiversity are the main focus of the GBS, the assessment of dependencies on biodiversity of activities and their value chain was added in the version 1.3.0 of the tool, via the **average dependency score**. The average dependency score measures the dependency of a sector, a company, or a portfolio, on average on all ecosystem services, based on ENCORE (Exploring Natural Capital Opportunities, Risks and Exposure) data (Natural Capital Finance Alliance (Global Canopy, UNEP FI, and UNEP-WCMC) 2021). The methodology of this average dependency score will not be detailed in this section as it was already explained in a previous publication (CDC Biodiversité 2021c). By construction, the average dependency score gives an indication of the overall materiality of the dependencies and it does not provide indications on the distribution of dependencies between ecosystem services[56].

In order to provide a complementary view on hotspots of risks potentially hidden within a low average dependency score, the **critical dependency score** was introduced in version 1.4.3 of the GBS. This section details how it is calculated.

The critical dependency score evaluates the proportion of a company's activity or value chain which is critically dependent on at least one ecosystem service. A critical dependency is defined by CDC Biodiversité as a dependency with a materiality High or Very High in ENCORE: it is considered that the ecosystem service is non-substitutable. An EXIOBASE industry is critically dependent if at least one of the ENCORE processes included in this industry is Highly or Very Highly dependent on at least one ecosystem service.

The Scope 1 critical dependency score of the EXIOBASE industry i on the ecosystem service e can therefore be calculated as:

$$Dependency\ score_{i,e} = \begin{cases} 1\ if\ at\ least\ one\ process\ is\ critically \\ dependent\ on\ the\ ecosystem\ service\ e \\ 0\ otherwise \end{cases}$$

The overall Scope 1 critical dependency score of the industry i is then calculated as:

$$Dependency\ score_i = \max_e Dependency\ score_{i,e}$$

This Scope 1 critical dependency score can then be aggregated at company level through a weighted mean by turnover of each sector, and at portfolio level through a weighted mean by invested amount in each company. This critical score at company or portfolio level therefore represents the proportion of a company or portfolio's activity which is critically dependent on at least one ecosystem service.

The critical dependency score is also calculated for the upstream value chain. The methodology is identical to the methodology used for average dependencies (CDC Biodiversité 2021c), but the Scope 1 critical dependencies are used:

$$\begin{aligned} &Upstream\ dependency\ matrix \\ &\quad = Scope\ 1\ critical\ dependency\ matrix \\ &\quad \times (Leontief\ inverse\ matrix\ -\ Identity\ matrix)_{normalised} \end{aligned}$$

Like for Scope 1 dependencies, this upstream critical dependency score can then be aggregated at company and portfolio level. This upstream critical score represents the proportion of a company or portfolio's upstream value chain which is critically dependent on at least one ecosystem service.

(56) For example a low dependency on one ecosystem service can counterbalance a high dependency on another. Companies are rarely highly dependent on all ecosystem services. Therefore, a low overall average dependency score can sometimes hide high dependencies on some ecosystem services.

4 Update on methodological developments

4.1 The overfishing module

4.1.1 Context

The overfishing module is a first step into integrating marine biodiversity in the GBS. The pressure covered by the module belongs to direct exploitation in the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)'s classification of drivers of biodiversity loss.

The metric used by the module is the Depletion Index (DI) and not the MSA due to a lack of scientific data to express impacts of overfishing in MSA: overfishing impacts must thus be reported separately from other impacts in the GBS. DI estimates the impact of human activities on fish stocks. It is defined for year n as (Netherlands Environmental Agency (PBL) 2010)[57] :

$$1 - \frac{Biomass_n}{Biomass_{2004}}$$

4.1.2 Methodology summary

Figure 24 provides an overview of the input data and describes the main characteristics of the impact factors obtained.

What is the relationship between marine biomass and economic activities? In order to attribute a change of DI to companies, it is necessary to understand how marine biomass react to human activities (DI being a ratio of marine biomass to the 2004 marine biomass). A first simplification is made: only fish are considered and not molluscs and crustaceans. The focus is thus on fish stocks.

In this first rough version of the overfishing module, it is assumed that each fish of a given size caught in a given FAO fishing area contributes equally to maintaining its respective fish stocks at its current level, and thus to the associated DI. But the relationship between fish catch and fish stock (and DI) evolves over time due to the ecological dynamics of fish populations and to changes in fishing pressure. For instance, when fish stocks are especially over-exploited, the efforts expanded to catch fish are especially high, but even with high fishing pressure, the fish catch is relatively small. In such over-exploited fisheries, each fish catch has a relatively higher share of responsibility in maintaining fish

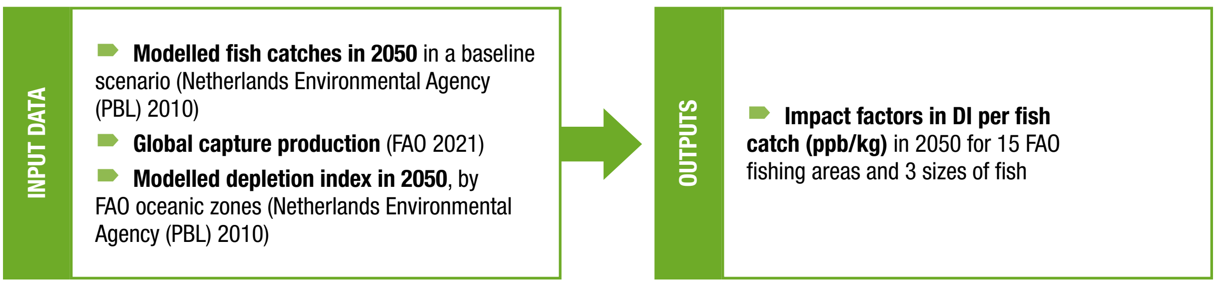

Figure 24: Overview of input and output data of the overfishing module

(57) This definition is in line with the initial definition of the DI (Alder et al. 2007). It actually deviates from the definition of the PBL, which uses it as a measure of the remaining biodiversity and not of the accumulated negative impacts (Netherlands Environmental Agency (PBL) 2010).

stocks to their low levels (compared to a situation where fish is plentiful and fish catches are large, diluting the responsibility associated to each fish caught).

The modelled 2050 level of DI and fish catch are available in the literature (Netherlands Environmental Agency (PBL) 2010) and presented in the Appendix. Unfortunately, those data are not available for recent actual observations and the impact factor of DI per kg of fish catch had to be calculated for 2050 and assumed to be close to the 2023 ratio. In practice, it is very likely that the 2023 ratio is lower because fisheries' overexploitation is expected to increase by 2050, increasing the responsibility in maintaining a high DI to each fish caught.

The data on fish catch available by ocean are then downscaled to the same level of granularity as the DI data, namely to the level FAO fishing areas using the reported captures of the FAO over all the fishing areas (FAO 2021).

A DI per catch can therefore be estimated and is presented in Table 8. It is expressed in ppb/kg of fish catch with ppb expressing billionth of DI (part per billion). An increase in fish catch of one kg will lead to a global increase of the Depletion Index of 0.12 ppb/kg in average. This average was weighed by kg of fish, but other metrics could have been used, such as the ocean surface or the ocean biomass.

The main limits and perspectives regarding this module include:

- Only fish biomass is considered whereas DI also theoretically include molluscs and crustaceans.
- The DI per catch calculated is probably overestimated, since fishing is likely to be even more unsustainable in 2050 than in 2023.
- All fishing is approximated as overfishing, while this is not true everywhere.
- The relationship between fish catches and DI is assumed to be constant over time and proportional, whereas in reality this relationship changes every year and may be linear or include non-linear thresholds (*e.g.*, DI does not increase until a certain level of fish catch is exceeded).
- At this stage, the calculated impacts are presented in DI and will not be converted into MSA due to the lack of available knowledge on the subject.
- Work is under way to extend the coverage of the GBS to other marine biodiversity pressures, but this will still take several years.

4.1.3 Linkage with other GBS modules

The overfishing module will be:

- Connected with fish items from EXIOBASE environmental extensions in the Input Output module.
- Connected with fish items in BIA-GBS using the bottom-up approach.

Table 8: Depletion Index and Depletion Index per catch, estimated for 2050

FAO FISHING AREA	DI IN 2050 (%)*				DI/CATCH (PPB/KG) IN 2050			
	LARGE FISH	MEDIUM FISH	SMALL FISH	ALL FISH	LARGE FISH	MEDIUM FISH	SMALL FISH	ALL FISH
NORTHWEST ATLANTIC (Major Fishing Area 21)	17%	50%	100%	44%	1.17	0.70	0.00	0.21
ATLANTIC, NORTHEAST (Major Fishing Area 27)	17%	83%	100%	33%	0.33	0.07	0.00	0.04
ATLANTIC, WESTERN-CENTRAL (Major Fishing Area 31)	17%	17%	83%	61%	1.99	1.99	0.40	0.49
ATLANTIC, EASTERN CENTRAL (Major Fishing Area 34)	17%	17%	50%	72%	0.90	0.90	0.54	0.26
MEDITERRANEAN AND BLACK SEA (Major Fishing Area 37)	17%	17%	50%	72%	1.18	1.18	0.71	0.34
ATLANTIC, SOUTHWEST (Major Fishing Area 41)	17%	50%	50%	61%	1.88	1.13	1.13	0.46
ATLANTIC, SOUTHEAST (Major Fishing Area 47)	50%	17%	83%	50%	1.14	1.89	0.38	0.38
INDIAN OCEAN, WESTERN (Major Fishing Area 51)	17%	17%	83%	61%	0.62	0.62	0.12	0.15
INDIAN OCEAN, EASTERN (Major Fishing Area 57)	50%	50%	50%	50%	0.29	0.29	0.29	0.10
PACIFIC, NORTHWEST (Major Fishing Area 61)	50%	83%	100%	22%	0.10	0.03	0.00	0.02
PACIFIC, NORTHEAST (Major Fishing Area 67)	50%	17%	17%	72%	0.67	1.11	1.11	0.32
PACIFIC, WESTERN CENTRAL (Major Fishing Area 71)	17%	50%	50%	61%	0.31	0.18	0.18	0.07
PACIFIC, EASTERN CENTRAL (Major Fishing Area 77)	50%	50%	83%	39%	1.23	1.23	0.41	0.32
PACIFIC, SOUTHWEST (Major Fishing Area 81)	50%	83%	100%	22%	2.83	0.95	0.00	0.42
PACIFIC, SOUTHEAST (Major Fishing Area 87)	17%	50%	50%	61%	0.21	0.13	0.13	0.05
GLOBAL	**29%**	**54%**	**72%**	**48%**	**0.47**	**0.38**	**0.20**	**0.12**

* Calculated from Table 11 using the following rules:
For a depletion index "Lower than 1/3" the numerical value chosen was (0+1/3)/2 = 0.17
For a depletion index "1/3 – 2/3" the numerical value chosen was (1/3+2/3)/2 = 0.50
For a depletion index "2/3 – 1" the numerical value chosen was (2/3+1)/2 = 0.83
For a depletion index "Higher than 1" the numerical value chosen was 1.

4.2 Climate change static impacts

Climate change causes shifts in the geographic distribution of biomes and threatens species unable to adapt.

In the GBS, Climate change dynamic impacts are assessed by (1) identifying the global mean temperature increase (GMTI) generated by a given emission during the assessed period and (2) linking this GMTI to impacts on biodiversity using GLOBIO cause-effect relationships. The underlying cause-effect relationships are based on a meta-analysis of studies quantifying the influence of Climate change on the distributions of plant and/or vertebrate species (CDC Biodiversité 2017).

In version 1.4.2 of the GBS, introduced in 2023, new assumptions on historical emissions allow to estimate the static impacts of Climate change. Corporate historical emissions are approximated based on a global ratio of historic emissions (from 1750 to 2018) over 2019 global emissions ($Global\ factor_{1750}$). The ratio is built based on Our World in Data figures on CO_2 emissions from 1750 to 2020 (Ritchie, Roser, and Rosado 2020)[58].

$$Global\ factor_{1750} = \frac{global\ historic\ emissions\ from\ 1750\ to\ 2018}{global\ 2019\ emissions} = 50$$

For a given company, its Climate change static impact is then obtained using the following calculation with n the year of its most recent assessment:

$$Climate\ change\ static_{2022} = Global\ factor_{1750} * Climate\ change\ dynamic_n$$

This approach should be understood and used as a rough approximation of corporate Climate change static impacts. Future improvements should consider first the proper time horizon to include in the calculations (should only emissions from the last 100 years be considered?), second the formula should in theory be applied to 2019 emissions and an updated factor for other years should be calculated.

This factor can be refined by sector, by estimating a sectoral ratio between historic emissions and 2019 emissions specific to each industry for the same 1750-2018 period: $Sectoral\ factor_{1750}$. However, emissions by sector are only available between 1990 and 2018 in Our World in Data (Ritchie, Roser, and Rosado 2020). In the absence of better data, an assumption is made: the "ratio of the shapes" of the curve of global GHG emissions over the curve of each industry's GHG emissions is assumed to be constant between 1750 and 2018. This is a very strong assumption, but it appears difficult to make a more informed one[59]. The share of global emissions is then assessed for the period 1990-2018 ("*Sector ratio*" below) and replicated to the whole 1750-2018 period.

$$Sectoral\ factor_{1750} = Sector\ ratio * Global\ factor_{1750}$$

with

$$Sector\ ratio = \frac{Sectoral\ factor_{1990}}{Global\ factor_{1990}}$$

And:

$$Global\ factor_{1990} = \frac{global\ historic\ emissions\ from\ 1990\ to\ 2018}{global\ 2019\ emissions} = 23$$

The Sectoral factor for 1990 and 1750 for each industry are presented in Table 9.

(58) In practice, the Global factor$_{1750}$ is actually 47 and not 50. It is rounded to 50 to take into account the uncertainties and limitations listed in this section. Once again, the approach described here should be used only as a rough estimate of historical cumulated emissions and more direct assessments of those emissions should be preferred.

(59) The assumption is actually sure to be incorrect. For instance industries with emissions growing more exponentially (faster) than global emissions will have a ratio lower than 1 (and conversely industries with a slower acceleration of emissions, with past emissions having more weight in the cumulated emissions, will have a ratio higher than 1) and the ratio is going to be higher when calculated for periods going further back in time (as the difference in growth of emissions is going to accumulate over time). But without better data, it is very complicated to make a better assumption. Two options could be considered in the future. First a sectoral proxy of emissions such as turnover or an indicator of physical output could be used if data going back before 1990 are available. Second a statistical regression could be conducted on 1990-2018 data to infer how emissions grow year over year and extrapolate that for the 1750-1990 period. Finally, it should be noted that the ratio is very close to 1 (Table 9) thus the inaccuracy should be limited, except for Building and Industry for which static Climate change impacts are likely to be under and over-estimated respectively.

Table 9: Sectoral factors to calculate the Climate change static impact

SECTOR	SECTORAL FACTOR$_{1990}$	SECTOR RATIO	SECTORAL FACTOR$_{1750}$
Building	28	1.2	60
Industry	18	0.76	38
Transport	22	0.97	49
Manufacturing and construction	23	0.99	49
Electricity and heat	22	0.98	49
Global	**23**	**1**	**50**

5 Case study

Case study Summary sheet

Context

CASE STUDY

Footprint use category: Corporate level
Assessment time: 2020

Perimeter

		LUEFN Pressure	CC Pressure	Aquatic Pressures
Scope 1		✓	✓	✓
Scope 2		✓	✓	✓
Scope 3	Tier 1	✓	✓	✓
	Rest of value chain	✓	✓	✓
	Downstream	☐	✓	☐

COMPANY'S IDENTITY

VATTENFALL

Industry
Utilities

Sub-industry
Production of electricity

2019 turnover
16.8 billion EUR

Unlisted
100 % owned by the Swedish state

Why?

Compute biodiversity impacts of Vattenfall and identify biodiversity hotspots and opportunities all along Vattenfall's value chain

When?

2020 impacts

How often?

One off, to be renewed later to track progress and monitor changes

What?

End-to-end (Scope 1, 2 and 3 upstream) impacts. Additionally downstream Climate change impacts have been assessed when data was available.

For who?

Internal use for the environmental and strategy teams. Also for external communication with the SBTN within the Corporate Engagement Program

How detailed?

Corporate level, detailed at business units' level and taking into acount data at various levels, including sites and purchases categories

DATA COLLECTED

Item	Description	Source
Land occupation	Surfaces (ha) and Corine land cover information for Scope 1 Upstream Scope 3 surfaces for woody biofuels and for leased offices (ha) Upstream Scope 3 surfaces also for the Distribution business unit and for wind farms (ha)	Vattenfall's internal reporting tool and Environmental Product Declarations (EPD) (all data are for 2020)
Water consumption and withdrawal	Volumes of water consumed and withdrawn (m^3) Flooded areas and regulated areas surfaces in ha and river monthly flows for the hydropower module (for 1 river)	
GHG emissions	GHG emissions for Scopes 1, 2, 3 upstream (and 3 downstream for one Business unit) (t CO_2-eq)	
Ecotoxicity	Scope 1 quantity of Mercury released in the air (in t)	
Raw material purchases	Upstream Scope 3 quantities of extracted coal and natural gas; oil; forage products; extracted uranium; waste as fuel; biomass fuels (mainly wood chips and pellets) and blast furnace gas	
Purchases	Breakdown of direct and indirect purchases by procurement category (in EUR)	
Turnover	Total turnover and breakdown by industry and business unit (in EUR)	
Energy	Electricity bought per country	

Footprint analysis

RESULTS

All results excluding Ecotoxicity impacts

Terrestrial static footprint
1 200 MSA.km²

Terrestrial dynamic footprint
90 MSA.km²

Aquatic static footprint
1 600 MSA.km²

vertically integrated
(Scope 1, 2, 3 upstream)

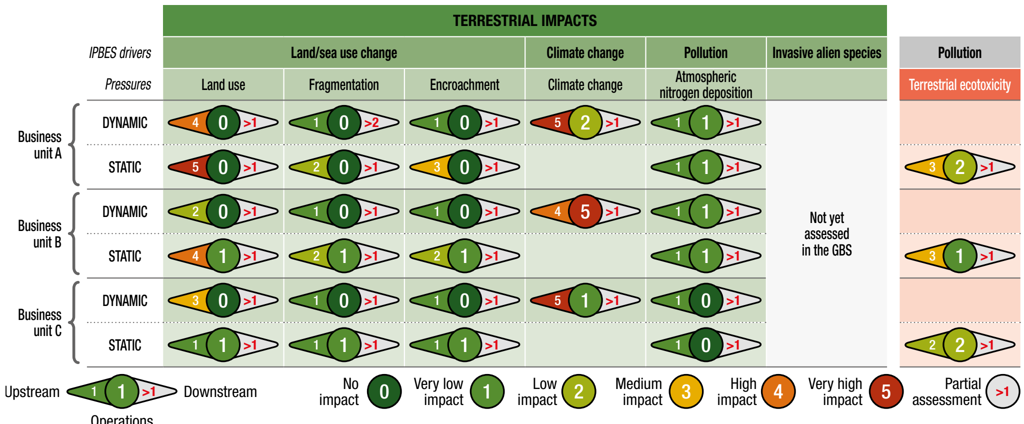

Figure 25: Overview of Vattenfall's impacts materiality for terrestrial biodiversity

KEY MESSAGES

- Land use impacts are material and mainly linked to land occupation needed for the distribution grids and raw material production (natural gas extraction, woody fuels and energy crops).
- Important Climate change impacts, mainly from fuels combustion (and sales of gas in downstream). The main impact comes from greenhouse gas emissions and impacts are connected to all scopes.
- Aquatic static impacts are also material, mainly through the Hydrological disturbance pressure linked to hydro power operations (the hydropower module in the GBS is however still experimental).

IMPROVEMENTS SUGGESTED BY CDC BIODIVERSITÉ

- Link strategic suppliers to spending data and thus to EXIOBASE industries to refine the value chain mapping.
- Refine the GBS to better reflect impacts due to hydrological disturbances caused by dams.
- Improve knowledge about the management intensity of forests and grasslands (*e.g.,* below power lines) to better identify the associated Land use categories.

5.1 Vattenfall

5.1.1 Context and objectives

Vattenfall is one of Europe's largest producers and retailers of electricity and heat, operating predominantly across Sweden, Germany, the Netherlands, Denmark and the United Kingdom. With over 100 years' experience, Vattenfall wants to make fossil free living possible within one generation and is driving the transition towards a sustainable energy system.

Aligned with a 1.5-degree scenario, the company's 2021 strategy to Power Climate Smarter Living targets a 77 % reduction in Scope 1 and 2 emissions by 2030 (with a 2017 baseline), driven by growth in renewables and a phasing out of fossil fuels. By 2040, Vattenfall hopes to reach net zero through a ~95 % reduction in emissions, neutralising the remaining emissions with carbon removals.

Biodiversity and environmental protection are also of paramount importance at Vattenfall, as the company works towards a Net Positive Impact on biodiversity by 2030. To achieve this goal, Vattenfall channels significant investment into biodiversity research and champions several local & voluntary biodiversity projects.

To advance this mission further, Vattenfall has partnered with CDC Biodiversité and Deloitte Sustainability France to assess its biodiversity footprint and set relevant Science Based targets for nature using the Global Biodiversity Score (GBS). The assessment comprises several steps, such as value chain mapping, identifying priority locations and suggesting target scenarios for 2030, while ensuring continued alignment with the Science Based Targets Network (SBTN).

See our Section 1.3 for more details on the SBTN's framework to help companies set targets.

5.1.2 Methodology

Using financial and operational data from 2020, and focusing on Vattenfall's principal operations and markets, the biodiversity footprint assessment covered hydropower, onshore wind, heat, electricity distribution, nuclear and gas sales in Sweden, Finland, Denmark, Germany, Poland, the Netherlands and the United Kingdom. All Scopes (1, 2, 3 upstream and downstream) were considered in the assessment, for both terrestrial and aquatic realms.

To highlight Vattenfall's ability to drive change over time, the level of influence was indicated for each type of data. For example, data for external purchases (oil, gas, electricity, coal, uranium) were awarded a "Low" level of influence but data related to directly owned and/or monitored activities within Vattenfall were attributed a "High" level of influence. This approach allowed Vattenfall to pinpoint the low-hanging fruit, where it can take immediate action.

5.1.3 Results aligned with SBTN recommendations

5.1.3.1 STEP 1 - ASSESS

Sector-level materiality assessment:

One of the first steps of the assessment was screening potential impacts from Vattenfall activities. Using the SBTN Sectoral Materiality Tool, which builds on ENCORE data, both very high and high materiality impacts were identified.

Value chain map:

Financial data was also used to map upstream impacts in Vattenfall's value chain, linking each business unit with relevant EXIOBASE industries. The EXIOBASE industries with the greatest negative impacts were then highlighted in the map. Strategic suppliers were also linked to business units, as they could not be directly linked to EXIOBASE industries.

Company level refinement:

Vattenfall's biodiversity impacts were viewed through two lenses - Scope and pressure - across both terrestrial and aquatic ecosystems. Results were also displayed in a simpler format, which indicates the share of impacts caused by each pressure for each level. The share of impacts ranged from 0 % to 50 % and above, in 6 categories: 0 when there is no impact, 1 for very low impact (0-1 %), 2 for low impact (1-5 %), 3 for medium impact (5-20 %), 4 for high impact (20-50 %) and 5 for very high impact (>50 %).

Figure 25 summarizes the shares of impacts of each pressure. For example, upstream impacts caused by Land use pressure represent 20 % to 50 % of business unit A's total terrestrial dynamic impacts, while Scope 1 Climate change impacts only represent between 1 and 5 % of business unit A's total terrestrial dynamic impacts (but Upstream Climate change impacts represent more than 50 % of those impacts).

Impacts on aquatic ecosystems were also computed and are non-negligible. Impacts are mainly due to the Hydrological disturbance pressure linked to hydropower operations. However, the hydropower module developed together with Vattenfall for GBS is still experimental and needs further development.

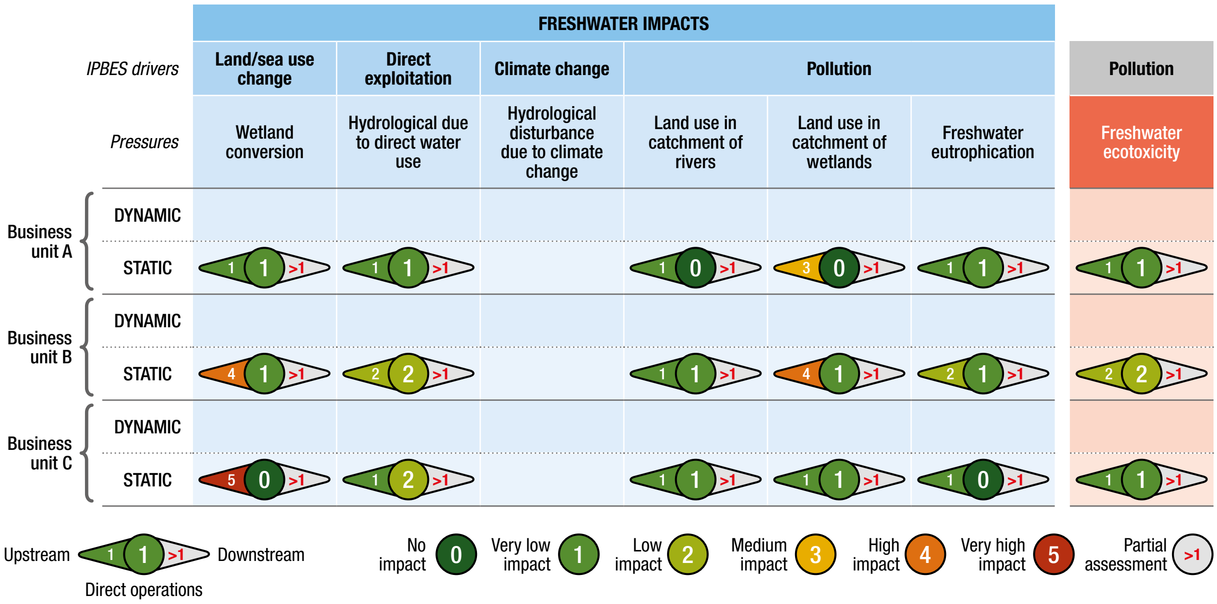

Figure 26: Overview of Vattenfall's impacts materiality for aquatic biodiversity

5.1.3.2 STEP 2 INTERPRET & PRIORITIZE

The GBS also identified where potential impacts could be reduced instantly, with varying levels of influence, enabling Vattenfall to easily spot quick wins and highlight immediate relevant focus areas.

The assessment provided clarity on which part of the footprint in MSA.km² per level of analysis (a business unit for example) has a total, high, medium or low level of influence. In Vattenfall's case, 33 % of terrestrial dynamic impacts were identified as those that could be reduced in the short term and most of them related to a single business unit. Conversely, most of terrestrial static and aquatic static impacts were identified as "Low" level of influence and would be difficult to reduce in the short term.

The assessment revealed two business units as having major impact, while also having the potential to drive change in the short term. The major source of impact was also highlighted, and examples of actions were provided to bolster Vattenfall's biodiversity action plan.

Climate change stood out as the major terrestrial dynamic pressure for Vattenfall's activities.

5.1.3.3 STEP 3 MEASURE, SET, DISCLOSE

The results of the assessment confirm that Vattenfall is on the right track regarding its current climate mitigation, local biodiversity enhancement measures and biomass sourcing strategies (such as sourcing certified biomass). While the biodiversity footprint assessment does provide a first measurement of the 2020 impact on ecological integrity, further refinement is necessary. Some uncertainties should also be reduced to build a robust baseline against which Science Based targets could be set.

In the assessment, different actions falling under the SBTN mitigation hierarchy - Avoid, Reduce, Restore and Regenerate - were modelled with a 2030 impact trajectory to help Vattenfall set appropriate targets. For Climate, the GBS was used to estimate the biodiversity impact reduction that could be expected if Vattenfall follows and reaches its climate roadmap to reduce GHG emissions. The GBS was also used to estimate expected impact reduction on biodiversity from the coal phase-out roadmap.

5.1.4 Lessons learnt

The next step for Vattenfall will be to evaluate its current strategies and targets within the three core areas highlighted by the BFA results and integrate them into its biodiversity strategy.

As an example, Vattenfall has identified biodiversity hot spots along the power line corridors and have developed, and in some cases implemented, special management plans for those areas. The next step is to undertake similar activities for transformer stations in the power grid. The objective of these interventions is to implement biodiversity enhancing measures focusing on pollinators while reducing maintenance costs. In 2022, a geographic analysis of 50 stations was conducted. Six were selected as having high potential for site inventories based on existing or nature conservation potential, the station area's character, and the neighbouring area's natural attributes. Proposals for biodiversity-enhancing measures have been drawn up for the sites, such as favouring meadow plants or leaving certain areas untouched to maximise their contribution as food for pollinators. The target is to implement measures on six sites in 2023. Vattenfall is also implementing actions related to other pressures, such as Climate change.


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6 FAQ

How to interpret levels of influence in order to prioritize actions?

In line with the SBTN framework, companies should **interpret** their biodiversity footprint and **prioritize** actions in different places across their value chain. One way to handle this prioritisation is to understand the extent of a company's operations and sphere of influence. A company can have direct control over activities (*e.g.*, direct operations) or can have influence over value chain activities (*e.g.*, upstream or downstream). Levels of influence have been defined to describe the range of control or influence a company may exert over these activities, as detailed in Table 10. The definition integrates several dimensions:

- **The relationship** between the company and the stakeholders. For example, the farther in the value chain suppliers or clients are, the less influence the company has over them. The relative leverage the company wields compared to other should also be taken into account: for example, if a company is the main buyer for one provider or if it is the only supplier for a client, its capacity to influence this provider or client is relatively higher.
- **The time frame** of the effect of a change in activities would have on biodiversity state. This lag between the moment a company takes the decision to act upon an activity and the actual effects on biodiversity from that decision stems first from the time required to influence the right internal (for direct operations) or external (for upstream and downstream) stakeholders, and second from the time required for a change in pressure to translate into changes in the state of biodiversity. For example, influencing suppliers to switch to certified copper ore for circuit boards may take several years after the decision is taken to use only certified copper in a company's products, and changing land practices might reach their full positive impacts on biodiversity only after more than 10 years.

In practice in the GBS, levels of influence are associated to each data points fed into the tool, such as a quantity of GHG emissions from a business unit or the land occupation of urban area at a specific site of the company, etc.

Levels of influence are useful to interpret and prioritise impacts across the value chain and thus to set target boundaries. As companies begin to implement a biodiversity strategy, they can start by focusing their efforts where they have the most influence (on impacts where they have "Total" or "High" influence).

Table 10: Description of the levels of influence used in the GBS

LEVEL OF INFLUENCE	DESCRIPTION
Total (fast changes)	The assessed entity has **total influence** on this data point (because it belongs to its Scope 1 or it is the only client of a supplier or the only provider of a client) and decisions modifying this data point could **impact biodiversity in less than 3 years**.
Total (slow changes)	The assessed entity has **total influence** on this data point (because it belongs to its Scope 1 or it is the only client of a supplier or the only provider of a client) but decisions modifying this data point are **likely to require more than 3 years to impact biodiversity**.
High	This data point corresponds to upstream or downstream Scopes. The assessed entity is the **main client for a provider or the main provider for a client**. The lag between the decision by the assessed entity to change this data point and its effective change on the provider or client's side, resulting in different impacts for biodiversity, amounts to **up to 3 years**.
Medium	This data point corresponds to upstream or downstream Scopes. The assessed entity **directly communicates with its provider or client but is not its main client or provider**. The lag between the decision by the assessed entity to change this data point and its effective change on the provider or client's side amounts to **up to 5 years**.
Low	This data point corresponds to upstream or downstream Scopes. The assessed entity has **no direct communication with its provider or client**. The lag between the decision by the assessed entity to change this data point and its effective change on the provider or client's side amounts to **between 5 and 10 years**.
Very low	Same as Low but the lag between the decision by the assessed entity to change this data point and its effective change on the provider or client's side amounts to **more than 10 years**.
Unknown	Level of influence unknown.

7 Conclusion

Since the GBS was launched in 2020, tremendous progress has been achieved towards the release of its latest version 1.4.7, in November 2023. To address the needs and constraints of businesses and financial institutions and to cover the most material impacts on biodiversity of these industries, improvements were made, new products were developed and impacts factors were refined. Of course, CDC Biodiversité's team keeps working continuously on GBS technical developments and is aiming at releasing version 1.5.0 in 2024. In the coming months and years, existing modules and CommoTools will be consolidated and refined, as it has already been the case for aquatic and ecotoxicity impacts factors. Also, CDC Biodiversité is currently working on improving the GBS user interface, to make it more user-friendly to the consultants and businesses using it internally. With this in mind, it is crucial to maintain the robustness and transparency that characterize the GBS methodology: to that end, a new critical review process will be launched in 2024 to verify the consistency and quality of the tool (assumptions, limitations...) but also to assess its consistency with existing public policies related to corporate biodiversity and with existing tools.

The tool developments are closely linked with the BFAs conducted by CDC Biodiversité and external trained assessors: more and more businesses are getting their activities assessed with the GBS tool, which also helps to gather feedback and lessons learnt and thus identify the most needed developments. To ensure the assessments are well conducted and to provide assurance of the reliability of results to stakeholders using the outputs of assessments conducted using the GBS, the GBS Verified solution will be launched in 2024.

All these activities do not go without a rich ecosystem of stakeholders and activities. Trainings started in 2021 and continue to evolve with new modules launched in 2022 on the fundamentals of biodiversity footprint, or biodiversity footprint & reporting for financial institutions. The Business for Positive Biodiversity (B4B+) Club also keeps expanding and progressively includes new working groups around biodiversity credits and sectoral focuses – such as energy utilities, enabling more and more businesses to collaborate around these specific challenges.

Furthermore, CDC Biodiversité remains committed to collaborating with major stakeholders and initiatives, including following and contributing to international frameworks and regulations such as the TNFD, EFRAG, GRI or SBTN. The recently adopted Kunming-Montreal Global Biodiversity Framework has also been considered and included as part of CDC Biodiversité's work and reflections, to ensure that businesses can effectively align their efforts with this new agreement – and especially target 15.

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Appendix

Table 11: Relative abundance of fish stock in 2050, by FAO oceanic zones. Based on Figure 4.25 from the report "Rethinking Global Biodiversity Strategies: Exploring structural changes in production and consumption to reduce biodiversity loss" (Netherlands Environmental Agency (PBL) 2010)

FAO FISHING AREA	DEPLETION INDEX		
	Large fish	Medium Fish	Small Fish
ARCTIC SEA (Major Fishing Area 18)	NA	NA	NA
Northwest Atlantic (Major Fishing Area 21)	Lower than 1/3	1/3 - 2/3	Higher than 1
ATLANTIC, NORTHEAST (Major Fishing Area 27)	Lower than 1/3	2/3 - 1	Higher than 1
ATLANTIC, WESTERN-CENTRAL (Major Fishing Area 31)	Lower than 1/3	Lower than 1/3	2/3 - 1
ATLANTIC, EASTERN CENTRAL (Major Fishing Area 34)	Lower than 1/3	Lower than 1/3	1/3 - 2/3
MEDITERRANEAN AND BLACK SEA (Major Fishing Area 37)	Lower than 1/3	Lower than 1/3	1/3 - 2/3
ATLANTIC, SOUTHWEST (Major Fishing Area 41)	Lower than 1/3	1/3 - 2/3	1/3 - 2/3
ATLANTIC, SOUTHEAST (Major Fishing Area 47)	1/3 - 2/3	Lower than 1/3	2/3 - 1
Atlantic, Antarctic (Major Fishing Area 48)	NA	NA	NA
INDIAN OCEAN, WESTERN (Major Fishing Area 51)	Lower than 1/3	Lower than 1/3	2/3 - 1
INDIAN OCEAN, EASTERN (Major Fishing Area 57)	1/3 - 2/3	1/3 - 2/3	1/3 - 2/3
Antarctic and Southern Indian Ocean (Major Fishing Area 58)	NA	NA	NA
PACIFIC, NORTHWEST (Major Fishing Area 61)	1/3 - 2/3	2/3 - 1	Higher than 1
PACIFIC, NORTHEAST (Major Fishing Area 67)	1/3 - 2/3	Lower than 1/3	Lower than 1/3
PACIFIC, WESTERN CENTRAL (Major Fishing Area 71)	Lower than 1/3	1/3 - 2/3	1/3 - 2/3
PACIFIC, EASTERN CENTRAL (Major Fishing Area 77)	1/3 - 2/3	1/3 - 2/3	2/3 - 1
PACIFIC, SOUTHWEST (Major Fishing Area 81)	1/3 - 2/3	2/3 - 1	Higher than 1
PACIFIC, SOUTHEAST (Major Fishing Area 87)	Lower than 1/3	1/3 - 2/3	1/3 - 2/3
Pacific, Antarctic (Major Fishing Area 88)	NA	NA	NA

Table 12: Fish catches (million ton) in a baseline scenario, based on Figure 4.25 from the report "Rethinking Global Biodiversity Strategies: Exploring structural changes in production and consumption to reduce biodiversity loss" (Netherlands Environmental Agency (PBL) 2010)

YEAR	PACIFIC OCEAN	ATLANTIC OCEAN	INDIAN OCEAN	MEDITERRANEAN SEA AND BLACK SEA
1950	7.0	8.9	1.2	1.2
1990	48.5	20.9	6.6	1.7
2000	45.4	22.2	9.3	2.3
2010	34.9	17.2	9.3	2.3
2050	33.6	16.4	8.5	2.1

Table 13: Fish catches per FAO region (million ton), downscaled from Table 12 thanks to the database "Global Capture Production. Fisheries and Aquaculture Division" (FAO 2021)

FAO FISHING AREA	2000 CATCHES (MT)	2050 CATCHES (MT)
Northwest Atlantic (Major Fishing Area 21)	2.9	2.1
ATLANTIC, NORTHEAST (Major Fishing Area 27)	10	7.6
ATLANTIC, WESTERN-CENTRAL (Major Fishing Area 31)	1.7	1.3
ATLANTIC, EASTERN CENTRAL (Major Fishing Area 34)	3.7	2.8
MEDITERRANEAN AND BLACK SEA (Major Fishing Area 37)	2.3	2.1
ATLANTIC, SOUTHWEST (Major Fishing Area 41)	1.8	1.3
ATLANTIC, SOUTHEAST (Major Fishing Area 47)	1.8	1.3
INDIAN OCEAN, WESTERN (Major Fishing Area 51)	4.4	4.0
INDIAN OCEAN, EASTERN (Major Fishing Area 57)	5.6	5.1
PACIFIC, NORTHWEST (Major Fishing Area 61)	20	15
PACIFIC, NORTHEAST (Major Fishing Area 67)	3.0	2.2
PACIFIC, WESTERN CENTRAL (Major Fishing Area 71)	11	8.2
PACIFIC, EASTERN CENTRAL (Major Fishing Area 77)	1.79	1.2
PACIFIC, SOUTHWEST (Major Fishing Area 81)	0.72	0.53
PACIFIC, SOUTHEAST (Major Fishing Area 87)	16	12
GLOBAL	**87**	**66**

CDC Biodiversité is a French consulting and engineering firm specialized in positive actions for biodiversity, biodiversity sustainable management, and measurement of corporate biodiversity footprint. It is a private subsidiary of the *Caisse des Dépôts et Consignations* Group, the biggest public financial institution in France. The *Mission Economie de la Biodiversité (MEB)*, a research initiative of the *Banque des Territoires* dedicated to the links between economy and biodiversity, translates its work through publications and various communications.

From 2012 to 2021, the MEB's work was published in two collections (*BIODIV'2050* and *Cahiers de BIODIV'2050*), but since 2022, it publishes its work within a single unified collection, the "MEB's reports". All of this work can be found on CDC Biodiversité's website.

Report's details

GLOBAL BIODIVERSITY SCORE: ACCOUNTING FOR POSITIVE AND NEGATIVE IMPACTS THROUGHOUT THE VALUE CHAIN

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THANKS TO: VATTENFALL FOR THE CASE STUDY

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PUBLICATION OF THE *MISSION ECONOMIE DE LA BIODIVERSITÉ*, FINANCED BY THE *BANQUE DES TERRITOIRES (CAISSE DES DÉPÔTS).*

REFERENCE: CDC BIODIVERSITE (2023). GLOBAL BIODIVERSITY SCORE: ACCOUNTING FOR POSITIVE AND NEGATIVE IMPACTS THROUGHOUT THE VALUE CHAIN , BERGER, J., BEZARD, M., BONNET, J., DURAND, M., KEMMEL, A., MAGUEUR, E., MARIETTE, J., MARTIN, A., ROUET POLLAKIS, S., ZHANG, P., MISSION ÉCONOMIE DE LA BIODIVERSITE, PARIS, FRANCE, 60P.

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What are the options to reduce the on-site and value chain-related biodiversity impacts of a business? How can financial institutions assess the physical and transition risks related to the biodiversity impacts of their activity and that of the businesses they finance? Can businesses set Science Based quantitative targets to reduce their impact on biodiversity as they do for climate?

The Global Biodiversity Score (GBS) is a corporate biodiversity footprint & dependency assessment tool which seeks to answer these questions. It assesses the biodiversity impacts of economic activities across their value chain, in a robust and synthetic way. It is developed with the support of over 50 businesses and financial institutions gathered in the Business for Positive Biodiversity Club (B4B+ Club) and through collaborations with academics, NGOs and other corporate biodiversity footprint initiatives.

This 2023 update describes how Science Based targets could be allocated to companies, it provides explanation and illustrations for the GBS impacts accounting system, but it also details the GBS and biodiversity footprinting ecosystems, notably through mappings of existing tools and initiatives around biodiversity footprinting. It transparently describes the latest technical developments, such as the new overfishing module or the methodology to consider Climate change static impacts. Finally, it also shares the results of the simplified description of a full-scale assessment by Vattenfall. It also completes the existing FAQ with more common questions about the GBS.

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