BIOLOGICAL DIVERSITY PROTOCOL

BDP
BIODIVERSITY DISCLOSURE PROJECT

ENDANGERED WILDLIFE TRUST
Protecting forever, together.

Foreword by Yolan Friedmann, Chief Executive Officer, Endangered Wildlife Trust

When consulting the Biological Diversity Protocol, you are joining a growing community of businesses, consultants and civil society practitioners that believe it is time to act to reverse the biodiversity crisis. The International Platform on Biodiversity and Ecosystem Services has recently confirmed numerous other assertions that our planet is experiencing unprecedented levels of ecosystem and species loss, and that our development agenda, which is largely driven by the private sector, is the key protagonist behind this dramatic change to life on earth.

Founded in 1973, the Endangered Wildlife Trust (EWT) is a non-governmental, non-profit, conservation organisation dedicated to conserving threatened species and ecosystems to the benefit of all people. In order to affect the impact of large corporations on biodiversity positively, the EWT began engaging with big business in the early 1990s. Strategic partnerships for biodiversity and business were developed and much knowledge was gained about how to navigate progressive pathways for conservation with otherwise strange bedfellows. From the early days it was clear that the private sector has a critical role to play in developing effective solutions to save biodiversity and that what is most important is a suite of tools which will assist and support this process meaningfully and effectively.

In the early 2010s, the EWT therefore began to proactively engage South African companies around the issue of cost-effective biodiversity mainstreaming. This led to the establishment of the National Biodiversity and Business Network (NBBN) in 2013, in partnership with five leading companies and the South African government. The NBBN quickly grew to a network of over 600 members and common themes soon began to emerge from the deliberations among them. Chief among them was the need for a biodiversity accounting framework for business which stemmed from the recurring two-pronged concerns held by business when discussing biodiversity risks and opportunities. First, it was perceived to be too complex to measure impacts on biodiversity in a standardised way and, second, it was deemed impossible to aggregate data from various sites across a company's value or supply chain to enable informed board level decision-making. This stumbling block to better biodiversity conservation therefore had to be removed.

The Biological Diversity Protocol (BD Protocol) is the first tool that provides a standardised approach to help any organisation account for and consolidate all its net impacts on ecosystems and species. It allows all companies, big or small, and no matter what industry, to establish a baseline dataset for determining their impact on biodiversity and identify areas of improvement. It enables companies to integrate biodiversity data into their integrated reports and inform shareholders of measures to reduce their impact, for the benefit of future generations of both customers and investors. It is the platform that

should, ideally, guide the private sector towards vastly reducing their impact on the ecosystems and species that are crucial for all life on earth.

The BD Protocol is the result of a two-year collaborative, multi-stakeholder effort, including an almost yearlong consultation process. I would like to thank all the people around the world, who have been involved: the authors and contributors, those who ran the consultation process - especially the Natural Capital Coalition for the online consultation, those involved in ongoing pilot case studies, the design team and the funders, notably Eskom Hld SOC Ltd and the WWF Nedbank Green Trust who made it possible. Eskom staff have made invaluable contributions to the collection and processing of data which will aid in the evaluation of the BD Protocol.

While the BD Protocol provides an important step forward, its success still requires collective action for biodiversity accounting to become an integral part of the way businesses operate. This collective action needs to be immediate, global and must include shareholders and consumers in their respective roles. Notably, we need to create enabling policy environments, making the annual disclosure of biodiversity footprints mandatory for all major companies. We need shareholder activism demanding this disclosure from their companies and we need investor activism using the BD Protocol as a tool to guide responsible investing. We need consumers to make informed decisions using their purchasing power and we need companies who deliver on promises of a future that stretches beyond short-term gains and into meaningful long-term sustainability. Biodiversity conservation and sustainable use should be at the heart of all of this. We believe that the BD Protocol makes this possible.

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Acronyms

ABMB: Aligning Biodiversity Measures for Business

BD Protocol: Biological Diversity Protocol

CBD: Convention on Biological Diversity

CITES: Convention on International Trade in Endangered Species of Wild Fauna and Flora

EU: European Union

EWT: Endangered Wildlife Trust

GET: Global Ecosystem Typology

GHG Protocol: Greenhouse Gas Protocol

GIS: Geographical Information System

IFC: International Finance Corporation

IIRC: International Integrated Reporting Committee

IPBES: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services

ISO: International Organization for Standardization

IUCN: International Union for Conservation of Nature

NC: Natural Capital

SDG: Sustainable Development Goals

UNEP – WCMC: United Nations Environment Programme – World Conservation Monitoring Centre

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1. INTRODUCTION

In 2019, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) confirmed the accelerating rate of biodiversity loss worldwide and highlighted its negative implications for our livelihoods and economies. As further recognised by The Global Risks Report 2020 (World Economic Forum 2020), biodiversity loss has become a material issue for the private sector. Indeed, business dependencies and impacts on biodiversity generate significant risks and opportunities for companies in all industries. These may be related to their social and legal licences to operate, their production processes, their access to finance or the timing of project delivery. For instance, our reliance on the wildlife trade and large-scale habitat clearance for production purposes facilitates the emergence of new zoonotic diseases which can have devastating economic impacts, as illustrated by the COVID-19 crisis.

Accounting for biodiversity from a business perspective has been the focus of recent academic research and practitioner work (e.g. Atkins & Maroun, 2018; Houdet & Germaneau, 2014; Houdet et al., 2016; Lamerant et al., 2019; Maroun & Atkins, 2018), alongside efforts to integrate biodiversity considerations within institutional investor engagement (e.g. Herron 2016, 2019; Thamotheram 2016). While there is growing number of biodiversity impact measurement approaches (EU Business @ Biodiversity Platform & UNEP-WCMC, 2019), concerns over biodiversity data quality, consistency and comparability in corporate biodiversity impact accounting and reporting have been widely discussed by academia and practitioners (e.g. Addison et al., 2018; Atkins et al., 2018; Boiral 2016; Houdet et al., 2016; Jones & Solomon, 2013; Maroun & Atkins, 2018) as well as the Convention on Biological Diversity[1] (CBD) (e.g. see 2018 report presented at the Subsidiary Body on Implementation 2 meeting[2]). These persisting issues are preventing the private sector from cost-effectively managing its biodiversity risks and impacts.

> Box 1: Biodiversity impact (or impact on biodiversity): The negative or positive effect of a business activity on the state of biodiversity (i.e. change in the extent and condition/integrity of ecosystems, the target and actual population/habitat sizes of taxa).

In response, the Biological Diversity Protocol (BD Protocol) has been produced to improve decision making by providing companies with an accounting and reporting framework which helps consolidate their biodiversity impact (Box 1) data across value chains and jurisdictions. With the help of the BD Protocol, companies can now develop their biodiversity impact inventory and the associated Statements of Biodiversity Position and Performance for various applications, from site or project management to disclosure. In addition, adhering to the accounting and reporting principles of the BD Protocol helps ensure that biodiversity impact data is presented in a standardised, comparable, credible and unbiased manner.

The BD Protocol is an output of the Biodiversity Disclosure Project (BDP), an effort spearheaded by the National Biodiversity and Business Network (NBBN) of South Africa and managed by the Endangered Wildlife Trust (EWT), in collaboration with a wide range of stakeholders (Houdet et al., 2019). The BD Protocol aims to support (and not replace) existing impact measurement approaches so that biodiversity impact disclosure becomes comparable across industries and companies.

1. URL: https://www.cbd.int/business/projects/reporting.shtml.
2. Note by the Executive Secretary of the CBD: Guidance for reporting by businesses on their actions related to biodiversity

1.1 Overview of the BD Protocol

The BD Protocol aims to enable any organisation, from any sector, to identify, measure and account for its impacts on biodiversity for various business applications, from site management and internal reporting to external mandatory and/or voluntary disclosures. For instance, it can be instrumental to companies working on voluntary, biodiversity commitments or targets for the post-2020 Global Biodiversity Framework[3] of the Convention on Biological Diversity (CBD).

Note:
This document is targeted primarily at a technical audience, notably one with experience on, or expertise in, biodiversity, natural capital and/or sustainability assessments, accounting, reporting and/or disclosure.

The BD Protocol provides guidance on how to:

- Select the appropriate organizational and value chain boundary (Section 2);
- Develop and manage a biodiversity impact inventory (Section 2);
- Determine material biodiversity impacts (Section 2);
- Assess impacts on biodiversity, considering the nature of the biodiversity fea tures impacted (i.e. ecosystems and taxa) (Section 3);
- Account for net changes in biodiversity, in accordance with the mitigation hier archy and the associated equivalency principle (Section 3);
- Apply the Biodiversity Accounting Framework to build Statements of Biodiversi ty Position and Performance and account for biodiversity gains and losses over time (Section 3);
- Validate or verify a biodiversity impact assessment (Section 4);
- Report on or disclose business impacts on biodiversity in a coherent and meaningful manner (Section 4).

3. In 2020, the CBD will adopt a post-2020 Global Biodiversity Framework as a stepping stone towards the 2050 Vision of "Living in harmony with nature".

1.2 The business value of a biodiversity impact inventory and its associated Statements of Position and Performance

A biodiversity impact inventory consists of all the individual biodiversity impact accounts which reflect your business' impacts on ecosystems and material taxa within the selected organisational and value chain boundaries (see Section 2 for more details). These accounts can be aggregated or disaggregated according to different business units or geographic scales (e.g. region, nation) and be consolidated as Statements of Biodiversity Position and Performance (see Section 3.3). By compiling a biodiversity impact inventory, you will improve your understanding of your company's biodiversity impacts, which is important for various reasons, including:

- Modelling impacts on biodiversity for internal decision-making purposes, for instance to assess the biodiversity liability/exposure of contemplated investments/supply streams, or to compare alternative scenarios regarding the implementation of the mitigation hierarchy for a greenfield project;
- For multinationals, enabling a standardised, integrated monitoring framework that provides specific information wherever necessary. For instance for biodiversity reporting requirements in different jurisdictions;
- Setting and reaching targets for the net biodiversity impacts of your company;
- Implementing the mitigation hierarchy for a new project, as per legal requirements and/or financing safeguard policies;
- Responding to information requests from investors and lenders regarding your biodiversity impacts, risks/opportunities and performance;
- Participating in a voluntary disclosure, reporting, certification or labelling programme;
- Achieving public, client or other key stakeholder recognition for early biodiversity leadership.

A biodiversity impact inventory should be designed to respond to the needs of different internal and external stakeholders.

Box 2: The many uses of a biodiversity impact inventory and its associated Statements of Position and Performance

The BD Protocol is designed as a comprehensive biological diversity accounting and reporting framework that can help you produce the credible and unbiased information needed for various biodiversity-related business applications:

- Implementing the mitigation hierarchy for a new development as per legal requirements and/or voluntary corporate biodiversity policy:
  - Identifying, managing and monitoring biodiversity impacts, including the conservation of key and irreplaceable biodiversity features, throughout the project life-cycle;
  - Avoiding negative impacts where feasible through innovative site selection and project design, especially for irreplaceable biodiversity components;
  - Exploring the most effective and least expensive ways of:
    - Reducing/minimising impacts;
    - Restoring biodiversity features;
    - Offsetting residual negative impacts in the context of no-net-loss or net positive impact requirements/commitments;
  - Identifying opportunities to voluntarily enhance biodiversity through activities associated with the project life cycle.

- Responding to information requests from investors and lenders regarding biodiversity impacts, risks/opportunities and performance:
  - Identifying and managing current and future biodiversity risks and opportunities linked to the biodiversity exposure and contributions of the business;
  - Setting biodiversity targets and key performance indicators, measuring and reporting progress;
  - Modelling and disclosing potential liabilities and/or cost-savings.

- Participating in a voluntary disclosure, reporting, certification or labelling programme:
  - Voluntary stakeholder reporting of biodiversity impacts, targets and the associated progress or performance (e.g. GRI[4] , CDP[5]);
  - Participating in national reporting programmes, for instance as part of governmental reporting process for National Biodiversity Strategies and Actions Plans (NBSAPs) as per the Convention on Biological Diversity (CBD);
  - Participating in NGO reporting programmes (e.g. Biodiversity Disclosure Project's annual company rating[6]);
  - Eco-labelling and biodiversity certification opportunities.

- Public, client or other key stakeholder recognition for early biodiversity leadership:
  - Demonstrating positive contributions to local, national or global biodiversity targets, such as Sustainable Development Goals (SDGs) (i.e. SDG 15 "Life on Land" and SDG 14 "Life under Water")[7] , the Aichi Targets[8] (e.g. Smith et al., 2018) and forthcoming Post-2020 Global Biodiversity Framework of the CBD;
  - Early preparation to secure access to markets in the future (e.g. French government commitment to stop deforestation imports by 2030[9]).

4. GRI 304: Biodiversity 2016, URL: https://www.globalreporting.org/standards/gri-standards-download-center/gri-304-biodiversity-2016/.
5. CDP work on forests, URL: https://www.cdp.net/en/forests.
6. The South African National Biodiversity and Business Network, managed by the Endangered Wildlife Trust, has been rating the biodiversity performance of JSE-listed companies since 2018.
7. URL: https://www.undp.org/content/undp/en/home/sustainable-development-goals.html.
8. The CBD has established 20 Aichi Targets organised in five strategic goals:
   - Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society;
   - Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use;
   - Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity;
   - Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services;
   - Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building.
9. In keeping with the commitment made under the Climate Plan adopted in July 2017, in November 2018 France adopted its National Strategy to Combat Imported Deforestation. By 2030, this aims to put an end to deforestation caused by importing unsustainable forest and agricultural products.

As recognised by The Global Risks Report 2020 (World Economic Forum 2020), biodiversity loss has become a material issue for the private sector. This is correlated with growing scrutiny by various stakeholders, including shareholders, clients, the investment, banking and insurance industries, as well as regulatory authorities. Various corporate (e.g. de Silva et al., 2019) and lending policies (e.g. IFC performance standards and the Equator Principles), as well as different forms of legislations, aim to reduce negative impacts on biodiversity and, in some cases, reach no-net-loss or even net positive/gain targets (e.g. various no-net-loss policies such as in Australia, Brazil, France, Germany or the United States; Quétier et al., 2014; Tucker et al., 2018).

Even so, an exclusive focus on impacts from a company's direct operations may fail to identify major biodiversity risks or opportunities upstream or downstream (e.g. Whatling et al., 2010), while leading to a misinterpretation of the company's actual biodiversity exposure or contribution to society. This explains why institutional investors are increasingly engaging with investee companies on biodiversity-related issues and asking detailed questions about how biodiversity is being managed throughout their value chains, both upstream and downstream (e.g. Thamotheram 2016; Herron 2016; 2019).

In the context of future biodiversity regulations and safeguards, significant negative impacts in your company's value chain may result in rising costs or decreasing sales, even if your business itself is not directly subject to such laws or policies. Thus, shareholders and investors may view material direct and indirect negative impacts upstream or downstream of your company's operations as potential liabilities that need to be managed. A salient example is the financial material risk attached to drastic losses of pollination services due to declining bee populations (Atkins and Atkins 2016).

Given the growing call for voluntary business contributions to national and global biodiversity targets , building a comprehensive biodiversity impact inventory for your business is necessary to define internal or public biodiversity targets, and for subsequently measuring and reporting the progress made to the relevant stakeholders (UNEP-WCMC 2020). This will enable your company to identify and model the most effective and least expensive ways to reach these goals, for instance through scenarios regarding the implementation of the mitigation hierarchy, from avoidance to offset measures. Effectively managing the negative biodiversity impacts of your direct operations, customers or suppliers can help drive improved land and resource use efficiency, reduce production costs, as well as support product or service innovation. This in turn can differentiate your business in a marketplace where consumers are increasingly environmentally conscious[13].

10.The IFC's Environmental and Social Performance Standards define IFC clients' responsibilities for managing their environmental and social risks. The 2012 edition of IFC's Sustainability Framework, which includes the Performance Standards, applies to all investment and advisory clients whose projects go through IFC's initial credit review process after January 1, 2012.
11.When a Project is proposed for financing, the EPFI [Equator Principles Financial Institutions] will, as part of its internal environmental and social review and due diligence, categorise the Project based on the magnitude of potential environmental and social risks and impacts, including those related to Human Rights, climate change, and biodiversity (Equator Principles 2020, p.8).
12.Note by the Executive Secretary of the CBD: Engaging business in the development of a post-2020 Global Biodiversity Framework.
13.Since 2009, the Union for Ethical Bio-Trade (UEBT) has assessed awareness of biodiversity, and interest in ethical sourcing in 16 different countries. 2018 surveys of more than 5,000 consumers in five countries indicate that the majority (79 per cent) feel that "companies have a moral obligation" to have a positive impact on people and biodiversity in their sourcing of natural ingredients, but only 37 per cent feel "confident that companies pay serious attention." to these issues.

1.3 Relationship to other standards, guidelines and tools

It is important to distinguish between the BD Protocol and other biodiversity programmes and tools. The BD Protocol addresses a key gap in current biodiversity impact measurement, monitoring, disclosure and accountability: It provides an accounting framework to record systematically and consolidate net biodiversity impact data, over time, at the company level. It supports (not replaces) existing impact measurement approaches so that biodiversity impact disclosure becomes comparable across industries and companies[14]. As shown by the Aligning Biodiversity Measures for Business (ABMB) collaboration led by UN Environment Programme World Conservation Monitoring Centre (UNEP-WCMC forthcoming) and supported by the EU Business & Biodiversity Platform, while there are a growing number of biodiversity impact measurement approaches, an accounting approach, as proposed by the BD Protocol, is essential to compile consistent, comparable and regularly produced biodiversity impact data at the company level (EU Business @ Biodiversity Platform & UNEP-WCMC, 2019; UNEP-WCMC 2020). Moreover, biodiversity impact measurement and accounting are critical steps before any valuation exercise, should they be required. Companies need to know the scale of their impacts (i.e. how much they impact on biodiversity) before starting to value them (i.e. how important, in qualitative, quantitative and/or monetary terms, are these impacts from a business and/or social perspective).

The BD Protocol is designed to be programme and policy neutral. It encourages companies to follow its biodiversity accounting and reporting principles, but it does not constitute a standard for how a verification or auditing process should be conducted on a biodiversity impact inventory and the associated Statements of Biodiversity Position and Performance. While it can support cost-benefit analysis, risk assessment, reporting to any business function or unit or organisation (e.g. as per GRI guidance[15], SDG 14 and 15 reporting) or submissions to various disclosure programmes (e.g. CDP[16], disclosure requirements of various stock exchanges), the BD Protocol does not require biodiversity impact information to be used in any specific way.

The BD Protocol does not aim to provide an exhaustive list of biodiversity impact indicators[17]. The BD Protocol provides a net impact accounting and reporting framework that enables the use of existing indicators on the state of biodiversity: i.e. the measurement of change(s) in the extent and condition of ecosystems and in the target and actual population/habitat sizes of material taxa (see Sections 2.3 and 3.2 for more details). Though it may be revised and expanded in the future, the BD Protocol currently draws from the two main biodiversity concepts (i.e. ecosystems and taxa; see definitions in Box 3) used by science, existing legislation, policy documents and recognised international guidance (notably IUCN guidance). This means that the BD Protocol does not cover all dimensions of biodiversity.

14.Lack of comparability and substantial variability in biodiversity reporting has been highlighted by researchers as a significant problem (e.g. Rimmel & Jonäll, 2013; Atkins et al., 2014).
15.GRI 304: Biodiversity 2016.
16.CDP work on forests.
17.See Addison et al. (2018) for more information on corporate biodiversity indicators.

For instance, it does not cover genetic resources[18], biodiversity dependencies[19] and the associated ecosystem functions, processes and services[20]. Also excluded are:

- Impact drivers, whether inputs (e.g. biodiversity dependency) or outputs to your business;
- The monetary value(s) of biodiversity dependencies and impacts on your business and/or society;
- Biodiversity elements for which labour and capital goods are, routinely or exceptionally, required for their renewal/reproduction or existence/persistence as part of business operations or activities (e.g. crops)[21].

Furthermore, the BD Protocol focuses on measuring and consolidating the biodiversity impacts of your whole company or organisation, according to your chosen organisational (Section 2.2) and value chain (Section 2.3) boundaries. This is instrumental to setting-up targets, notably in the context of the post-2020 Global Biodiversity Framework of the CBD. Assessing the biodiversity impacts of a landscape (e.g. watershed, biome), local government (e.g. municipality, district), product (e.g. bottle of water) or service (e.g. car rental) is outside of the scope of this document. Such additional guidance could be developed in the future, as was done for the GHG Protocol Corporate Accounting and Reporting Standard (i.e. the GHG Protocol[22]) with, for instance, its supplementary guidance documents on cities or products.

While the GHG Protocol was the benchmark standard for the vision and structure of the BD Protocol, the latter differs from the former in two main aspects:

- The BD Protocol focuses its guidance on accounting for/consolidating impacts on biodiversity (i.e. changes in the state of biodiversity caused by business), while the GHG Protocol provides guidance on accounting for/consolidating the impact drivers of climate change (i.e. greenhouse gas emissions emitted by business), which do not constitute impacts in themselves but contribute to climate change and its consequences[23].

18.This is primarily due to a (current) lack of understanding on how to measure and account for impacts on genetic resources from a corporate perspective. This may change in the future and hence warrant additional guidance as part of a supplement to the BD Protocol.

19.While biodiversity dependencies (i.e. business' uses of/reliance on biodiversity components) can lead to changes in the state of biodiversity, the BD Protocol does not focus on measuring them. The BD Protocol exclusively focuses on measuring and accounting for changes in the state of biodiversity (see Sections 2.3 and 3.2), which may be caused by various impact drivers, including biodiversity dependencies. Other guidelines, such as the Natural Capital Protocol (2016) and its biodiversity supplement, would be more useful to understand how to measure and value biodiversity dependencies (i.e. ecosystem services).

20.The 2005 Millennium Ecosystem Assessment (MA) defined ecosystem services as "the benefits people obtain from ecosystems". The MA categorized ecosystem services into:

- Provisioning: Material outputs from nature (e.g. seafood, water, fibre, genetic material);
- Regulating: Indirect benefits from nature generated through regulation of ecosystem processes (e.g. mitigation of climate change through carbon sequestration, water filtration by wetlands, erosion control and protection from storm surges by vegetation, crop pollination by insects);
- Cultural: Non-material benefits from nature (e.g. spiritual, aesthetic, recreational, and others);
- Supporting: Fundamental ecological processes that support the delivery of other ecosystem services (e.g. nutrient cycling, primary production, soil formation).

21.An exception to this general rule is the case of wild, threatened species or ecosystems requiring labour and financial support for their survival or recovery.

22.The GHG Protocol Corporate Accounting and Reporting Standard provides a step-by-step guide for companies to use in quantifying and reporting their greenhouse gas emissions.

23.The consequences of climate change on people and ecosystems, such as more frequent extreme weather events, are the actual impacts.

- In the BD Protocol, net impact accounting recognises the notion of equity in the type of biodiversity lost or gained (i.e. ecological equivalency or like-for-like): i.e. biodiversity losses (negative impacts) and gains (positive impacts) can only be aggregated for equivalent biodiversity components (e.g. Quétier & Lavorel, 2011). In net GHG emission accounting however, any type of greenhouse gas emissions can be reduced or offset by any type of greenhouse gas offset (e.g. carbon stored in new tree plantations, renewable energy projects).

The BD Protocol is aligned with the Natural Capital Protocol, which is a standardised framework to identify, measure, and value impacts and dependencies on natural capital. Specifically, it helps provide biodiversity-specific guidance to measuring changes in the state of biodiversity (i.e. impacts on biodiversity), by providing guidance on how to (see steps 6 and 7 of the Natural Capital Protocol):

- Measure change(s) in the state of impacted ecosystems and taxa;
- Value these impacts in qualitative and quantitative terms.

Finally, the BD Protocol can help your organisation account for and report on biodiversity impacts as part integrated reporting. While the International Integrated Reporting Council (IIRC 2013) recognises that biodiversity is a critical component of natural capital, information on species threatened with extinction has been recommended for inclusion in integrated reports (King with Atkins, 2016).

2. BIODIVERSITY IMPACT INVENTORY DEVELOPMENT

The combination of your selected organisational and value chain boundaries makes up your company's biodiversity impact inventory boundary. The biodiversity impact inventory of your business records all its material impacts on ecosystems and taxa within the selected organisational and value chain boundaries. These impacts are organised in individual accounts which can be aggregated and disaggregated according to different business units, or geographic scales (e.g. regional, national).

Building a comprehensive biodiversity impact inventory allows your company to assess and understand more effectively its biodiversity impacts, notably:

- Its potential biodiversity exposure or liability due to its negative impacts;
- Its potential biodiversity contribution to local, national or international targets due to its positive impacts;
- The efforts still required to reach its biodiversity targets.

This section provides guidelines on how to develop and manage the biodiversity impact inventory of your business, including:

- Section 2.1: Setting organisational boundaries;
- Section 2.2: Setting value chain boundaries;
- Section 2.3: Identifying and determining material impacts;
- Section 2.4: Applying accounting and reporting principles;
- Section 2.5: Managing inventory quality.

2.1 Setting organisational boundaries

When defining the organisational boundary of a biodiversity impact inventory, two approaches are available: The equity share and the control approaches. For companies with joint entities, the organisational boundary and the resulting biodiversity impact inventory may differ depending on the approach used. In both wholly owned and joint entities, the choice of approach may change how biodiversity impacts are categorised when value chain boundaries are set. See Figure 1 for an illustration of how the selection of different consolidation approaches can affect the organisational boundary of your biodiversity impact inventory.

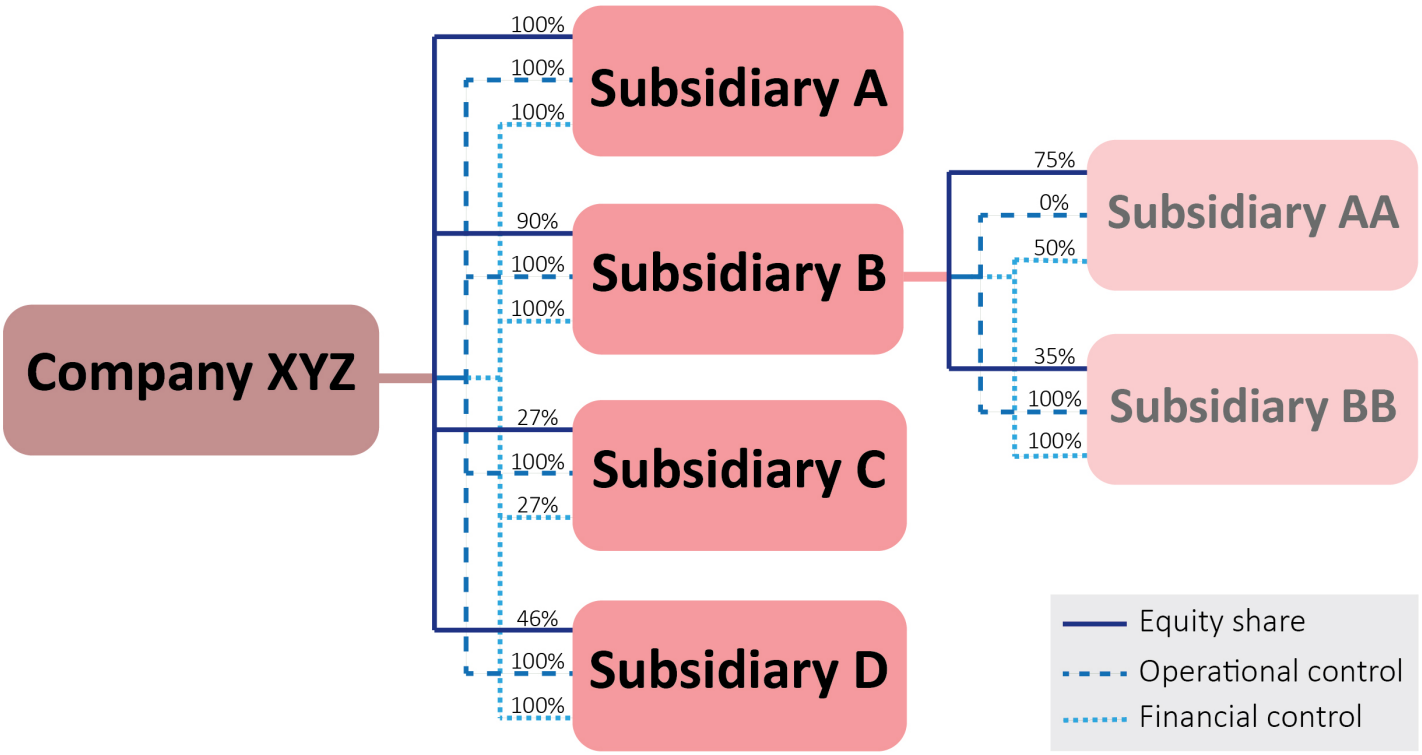


Figure 1: Applying the equity share and control approaches to set up the organisational boundary of company XYZ

Under the equity share approach, a company accounts for biodiversity impacts from entities according to its share of equity in these entities (Figure 1). It shows the extent of a company's share of risks and rights to rewards flowing from an entity, hence reflecting its economic interest in that entity.

Under the control approach, your company would account for 100 percent of the biodiversity impacts from entities over which it has operational or financial control – it would not account for biodiversity impacts from entities in which it owns an interest but has no control. In most cases, control can be defined in either financial or operational terms:

- Operational control: A company has operational control over an entity if it, or one of its subsidiaries, has the full authority to introduce and implement operating policies for that entity (e.g. equipment purchase, operating schedules).
- Financial control: A company has financial control over an entity if it can direct its financial and operating policies with a view to gaining economic benefits from its activities (i.e. the entity is considered as a group company or subsidiary for the purpose of financial consolidation in financial accounting). The economic substance of the relationship between the company and the entity takes precedence over the legal ownership status, so that the company may have financial control over the entity even if it has less than a 50 percent interest in that entity (e.g. subsidiary BB controlled by company XYZ in Figure 1). If this criterion is chosen to determine control, impacts from joint ventures, where partners have joint financial control are accounted for based on the equity share approach.

The BD Protocol follows the same approach as the GHG Protocol for setting up the organisational boundaries of a biodiversity impact assessment. It makes no recommendation as to whether biodiversity impact reporting should be undertaken according to the equity share or either of the control approaches. Companies need to decide on the approach best suited to their business activities and the needs or requirements of internal and/or external stakeholders.

It is important to note that cost requirements may he higher with the equity share approach. It can be challenging and time consuming to collect biodiversity impact data from joint entities not under the control of your company, as would collecting data from suppliers or clients. Furthermore, double counting of biodiversity impacts may occur when two companies hold interests in the same entity but apply different consolidation approaches. Where your business needs to satisfy mandatory reporting requirements, reasonable efforts should be able to clarify the situation with all the parties involved.

Once you have selected the appropriate data consolidation policy or approach for your business, you need to apply it consistently throughout the business interests of your company. This helps ensure that you produce a complete and accurate biodiversity impact inventory. Yet, different biodiversity reporting goals may require different data sets because they reflect different organisational boundaries. For instance, you may use the operational control approach for internal decision-making, while investors may request information based on the equity share approach. To be ready for such situations, your company may have to develop separate biodiversity impact inventories for various applications.

2.2 Setting value chain boundaries

Once you have defined the organisational boundary of your biodiversity impact inventory, you may now select the appropriate value chain boundary.

The value chain boundaries of the BD Protocol differ from the three scopes of the GHG Protocol[24]. In line with the Natural Capital Protocol (Natural Capital Coalition 2016), the BD Protocol first recognises three major parts of the value chain:

- Direct operations (gate-to-gate), which cover activities over which your business holds ownership or control;
- Upstream (cradle-to-gate), which covers the activities of suppliers;
- Downstream (gate-to-grave), which covers activities linked to the purchase, use, re-use, recovery, recycling, and final disposal of your business' products and services.

Table 1: Relative magnitude of expected biodiversity impacts across the value chain for a selection of industries

Key:

Large	🔴
Medium	🟡
Small	🔵

	Relative magnitude of expected biodiversity impacts		
Examples of industries	**Direct operations**	**Suppliers**	**Clients**
Agriculture	🔴	🟡	🔵
Chemicals	🟡	🟡	🟡
Construction	🔴	🟡	🟡
Energy	🔴	🟡	🟡
Finance & insurance	🔵	🔵	🔴
Manufacturing	🟡	🟡	🔵
Mining	🔴	🟡	🟡
Oil & gas	🔴	🟡	🟡
Retail	🔵	🔴	🔵
Tourism & entertainment	🟡	🟡	🔵

24.The GHG Protocol recognises three scopes:
• Scope 1: All direct GHG emissions;
• Scope 2: Indirect GHG emissions from consumption of purchased electricity, heat or steam;
• Scope 3: Other indirect emissions (e.g. the extraction and production of purchased materials and fuels, waste disposal).

The BD Protocol has no requirement as to whether the biodiversity impact inventory of your business includes one specific value chain boundary or several. Your company shall decide on the one(s) best suited to its activities and the needs/requirements of its internal and/or external stakeholders. However, once you have chosen your value chain boundary, you must uniformly apply it to identify and categorise the biodiversity impacts of your business. For example, if you are excluding the biodiversity impacts from disposal of your consumer goods, you cannot later claim biodiversity gains arising from restored ecosystems at landfill sites. The impact inventory boundary would need to be recalculated and all downstream impacts captured.

For effective and innovative biodiversity management, you should consider setting a value chain boundary which reflects the most important/material biodiversity impacts of your company across its value chain (Table 1). This will help you to manage the actual biodiversity risks (liability or exposure) and opportunities (e.g. new business, cost savings, contribution to society) of your business more effectively. While impacts from direct operations may be the easiest to assess, they may frequently be less relevant for many industries (e.g. retail, finance, insurance). However, starting with direct operations can be useful for several reasons, including demonstrating leadership to others and familiarising yourself with biodiversity impact accounting and reporting before engaging other companies across the value chain. For instance, if you work for a financial institution, you may wish for some of your clients to report on the biodiversity impacts of their direct operations. Demonstrating to them how you produced the biodiversity impact assessment of the direct operations (i.e. owned and leased buildings) of your own financial institution may help convince them to do so, too.

The BD Protocol recommends accounting and reporting biodiversity impacts from different value chain boundaries separately (Table 2). You may further subdivide biodiversity impact data within value chain boundaries where this supports decision-making, transparency, or comparability over time, depending on the needs of your stakeholders. For example, you may subdivide data by business unit, facility, country, activity type, or biodiversity impact account.

Table 2: Comparing the inventories of three companies with different value chain boundaries

Company	Chosen value chain boundaries	Direct operations	Upstream (example of direct operations of 1 key supplier)	Downstream (example of direct operations of 1 key client)
Financial institution	Direct operations, downstream and upstream	2 distinct ecosystem types 0 material species	Furniture supplier: 3 distinct ecosystem types and 5 material species	Financed greenfield project: 12 distinct ecosystem types and 3 material species
Manufacturer	Direct operations only	2 distinct ecosystem types 5 material species	Not applicable due to chosen value chain boundaries	Not applicable due to chosen value chain boundaries
Mine	Direct operations and upstream only	2 distinct ecosystem types 10 material species	Energy supplier (dam): 6 distinct ecosystem type and 12 material species	Not applicable due to chosen value chain boundaries

Dealing with uncertainty

Data availability, reliability and accuracy issues can arise. Data access can be problematic for upstream and downstream value chain boundaries due to limited control over clients and/or suppliers. This may influence which activities and businesses you are able to include in your biodiversity impact inventory, and hence the final value chain boundary you are confident to use for decision-making or reporting purposes. Data quality control will be difficult in such cases.

Contractual arrangements

The consolidation approach (i.e. equity share or either of the control approaches) you have selected for the organisational boundary also applies to identifying and categorising the direct and indirect impacts from contractual arrangements, such as leased assets, outsourcing operations and franchises. If the chosen control approach does not apply to the analysed contractual arrangement(s) for it (them) to be included in your direct operations, you may account for its (their) biodiversity impacts under the upstream (suppliers) and/or downstream (clients) value chain boundaries, as appropriate (Figure 2). For leases, under the equity share or financial control approach, you (the lessee) shall only account for the biodiversity impacts from leased assets that are treated as wholly owned assets in financial

accounting and are recorded as such on the balance sheet of your company (i.e. finance or capital leases). Under the operational control approach, you (the lessee) shall only account for impacts from leased assets that you operate (i.e. if the operational control criterion applies). Your company's accounting department should be able to help you differentiate operating leases from finance leases.

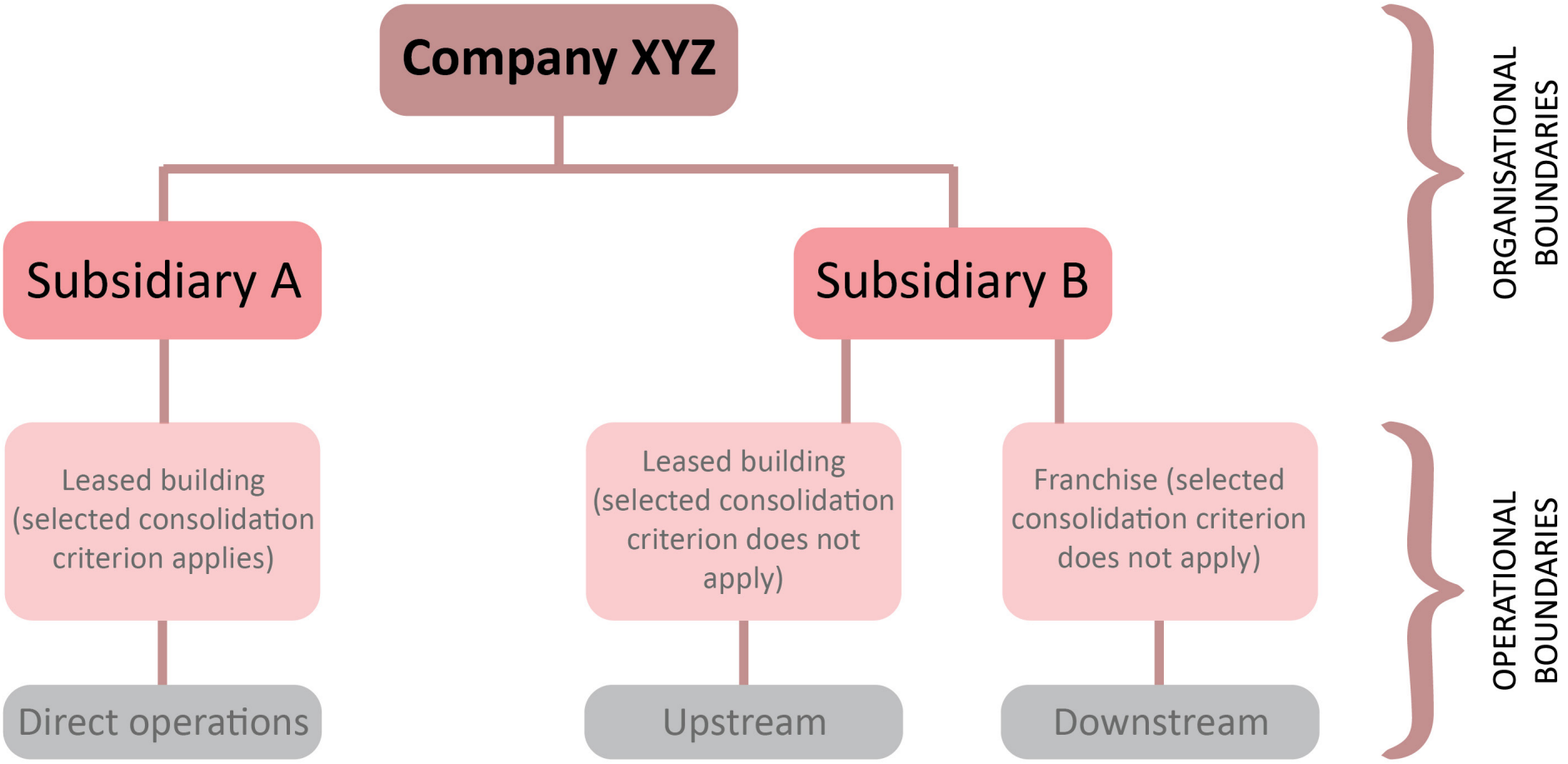


Figure 2: The implications of the selected consolidated approach on value chain boundaries

2.3 Identifying the components of your biodiversity impact inventory

With organisational and value chain boundaries determined, the next step is to build the corresponding biodiversity impact inventory.

Compiling the biodiversity impact inventory of your company involves identifying and recording the biodiversity components, or features, which are impacted by its activities. The BD Protocol recognises two main types of biodiversity impact accounts:

- Accounts that record impacts on ecosystems (see definition in Box 3),
- Accounts that record impacts on taxa (species and sub-species) (see definition in Box 3).

In other words, building a biodiversity impact inventory means listing the ecosystem types and taxa (species and sub-species) that your company interacts with within its selected organisational and value chain boundaries. However, the BD Protocol does not provide an exhaustive list of impacts, as biodiversity impacts are context dependent. Changes in the state of biodiversity will vary across regions and landscapes given the diversity of both business activities and biodiversity patterns.

The BD Protocol has different accounting requirements for impacts on ecosystems and impacts on taxa. To compile the biodiversity impact inventory of its selected organisational and value chain boundaries, your business shall account for:

- All ecosystems it interacts with, whether terrestrial, freshwater, subterranean or marine – not just important or significant biodiversity areas at the sub-national, national or international (e.g. legally protected areas, Key Biodiversity Areas[25]) level; as it will enable your company to assess its biodiversity footprint (see Section 3.1), the headline key performance indicator for decision-making and reporting/disclosure purposes (see Section 4.2);
- The taxa (species and sub-species) that are material to its internal and/or external stakeholders (e.g. regulators, lenders, NGOs, local communities).

25.Key Biodiversity Areas (KBA) are 'sites contributing significantly to the global persistence of biodiversity', in terrestrial, freshwater and marine ecosystems. The Global Standard for the Identification of Key Biodiversity Areas (IUCN 2016) sets out globally agreed criteria for the identification of KBAs worldwide.

Box 3: Definitions of key biodiversity-related concepts

- **Biological diversity (or biodiversity):** The international Convention on Biological Diversity (CBD 1992) defines "biodiversity" as the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part. This includes diversity within species, between species, and of ecosystems. Biodiversity is a critical component of natural capital.

- **Ecosystem:** The Convention on Biological Diversity (CBD 1992[26]) defines "ecosystem" as a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit. Ecosystems have four essential elements: a biotic complex (living components of the system); an abiotic environment (non-living, e.g. temperature and rock); the interactions within and between these two elements through energy flows; and a physical space in which to operate. Ecosystems may be terrestrial, freshwater, subterranean (e.g. caves) or marine systems. Different countries may have different classifications of ecosystem types. The International Union for Conservation of Nature (IUCN) has developed a Global Ecosystem Typology (GET) to support the development of its Red List of Ecosystems[27].

- **Habitat:** According to Krausman (1999, pp. 85-86), habitat is defined as "the resources and conditions present in an area that produce occupancy, including survival and reproduction, by a given organism. Habitat implies more than vegetation or vegetation structure. It is the sum of the specific resources that are needed by organisms …. These resources include food, cover, water, and special factors needed by a species for survival and reproductive success … Wherever an organism is provided with resources that allow it to survive, that is habitat. Thus, migration and dispersal corridors and the land that animals occupy during breeding and nonbreeding seasons are habitat."

- **Vegetation:** The term vegetation is often used to describe the overall characteristics of plant cover in an area. Vegetation can range from natural (i.e. unmodified plant communities, comprised of indigenous species) to cultural/artificial (e.g. crop farming, urban vegetation) mosaics of plant communities across the landscape.

- **Taxon (plural: taxa):** A taxon refers to any unit used in the science of biological classification (i.e. taxonomy). In the classification of plants and animals for instance, certain taxonomic categories are universally recognised and form a hierarchy: i.e. in descending order, kingdom, phylum (in plants, division), class, order, family, genus, species, and subspecies (or race). Rules for naming the various taxa are established in biological nomenclature.

26.URL: https://www.cbd.int/doc/legal/cbd-en.pdf.
27.URL: https://iucnrle.org/static/media/uploads/references/research-development/keith_etal_iucnglobalecosystemtypology_v1.01.pdf.

- **Species:** A species is often defined as a group of individuals that actually or potentially interbreed and produce fertile offspring in nature. From a broader perspective[28], a species is the biggest gene pool possible under natural conditions. Many debates remain on how best to define species (e.g. Donegan 2018).

- **Endemic taxon:** "A taxon naturally found in any specific area and nowhere else; this is a relative term in that a taxon can be endemic to a small island, to a country, or to a continent." (IUCN 2012).

- **Metapopulation:** A metapopulation is a collection of subpopulations of a species or taxon, "each occupying a suitable patch of habitat in a landscape of otherwise unsuitable habitat. The survival of the metapopulation is dependent on the rate of local extinctions of occupied patches and the rate of (re) colonisation of empty patches." (IUCN 2012).

- **Subpopulation:** "Geographically or otherwise distinct groups in the (global) population between which there is little demographic or genetic exchange; a subpopulation may or may not be restricted to a region." (IUCN 2012).

- **Natural range:** The "range of a taxon, excluding any portion that is the result of an introduction to a region or neighbouring region" (IUCN 2012).

- **Population viability analysis:** Population viability analysis is commonly used to describe both the process and the set of quantitative tools aimed at estimating the probability that a population, or collection of populations, will persist for some particular time in a particular environment (Beissinger & McCullough, 2002).

- **Minimum viable population:** Minimum viable population (MVP) is a lower bound on the population of a species, such that it can survive in the wild.

- **Extinct taxon:** Category for a taxon when there is no reasonable doubt that the last individual potentially capable of reproduction has died or has disappeared from the wild (IUCN 2012).

- **Sink:** "An area where the local reproduction of a taxon is lower than local mortality. The term is normally used for a subpopulation experiencing immigration from a source where the local reproduction is higher than the local mortality" (IUCN 2012).

28.The definition of a species as a group of interbreeding individuals cannot be easily applied to organisms that reproduce only or mainly asexually: e.g. Bacteria reproducing asexually by binary fission. Besides, many plants, and some animals, form hybrids in nature.

- **Natural capital (NC):** The BD Protocol uses the definition of the Natural Capital Protocol (Natural Capital Coalition 2016) whereby NC can be defined as the stock of renewable and non-renewable natural resources (e.g. plants, animals, air, water, soils, minerals) that combine to yield a flow of benefits to people. These benefits may be cultural or economic, and can be valued in qualitative, quantitative and/or monetary terms. These benefits relate to the concept of ecosystem services, most of which are derived (to varying extents) from biodiversity. However, NC includes some abiotic services (e.g. the supply of minerals, metals, oil and gas, geothermal heat, wind, tides, and the annual seasons).

- **Renewable resources:** These may be exploited indefinitely, provided the rate of exploitation does not exceed the rate of replacement, allowing stocks to recover (assuming no other significant disturbances). Renewable resources exploited faster than they can renew themselves may effectively become non-renewable, such as when over-harvesting drives species to extinction (UN 1997).

- **Non-renewable resources:** These will not regenerate after exploitation within any useful time period. Non-renewable resources are sub-divided into reusable (e.g. most metals) and non-reusable (e.g. thermal coal).

2.3.1 Assessing materiality of taxa for inclusion in your biodiversity impact inventory

In line with the Natural Capital Protocol, the BD Protocol defines an impact on taxa (species and sub-species) as material if consideration of its importance to internal and/or external stakeholders, as part of the set of information used for decision making, has the potential to alter that decision. A materiality[29] assessment is the process that involves identifying what is (or is potentially) material in relation to the objective of providing a relevant, complete, consistent, transparent and accurate account of the impacts on taxa of your company to its target stakeholders.
In other words, a materiality assessment should be carried out to select which taxa should be included within your biodiversity impact inventory. This is necessary for several reasons, including but not limited to:

- The lack of adequate resources to obtain, record and maintain accurate information on the impacts of your business on all species it interacts with. You should focus your attention and efforts on the taxa which really matter from a conservation and/or sustainable use perspective (e.g. CBD goals, national biodiversity strategy and action plan of countries your business operates in).
- Accounting for impacts on ecosystems does not necessarily mean accounting for impacts on species. For instance, two significantly modified forests may be similar from an ecosystem integrity perspective (i.e. very low biodiversity values), but one of the two may hold several threatened or legally protected species. Separate impact accounts should be developed for the latter.

The BD Protocol does not prescribe any method for assessing materiality, but instead underlines the importance of a systematic and transparent process to assess what matters to your internal and/or external stakeholders. Most companies have experience with at least one materiality assessment approach through their risk, governance, finance or strategy functions. This process may have involved using some combination of qualitative, quantitative or monetary information.

There are several criteria worth considering when determining the materiality of a taxon, including whether:

- The taxon is legally protected, according to local, national and international laws and conventions (e.g. listed by the Convention on International Trade in Endangered Species of Wild Fauna and Flora, CITES);
- The taxon is recognised as a priority/threatened species at a local, national or international level (e.g. species listed on the IUCN Red List);
- Your business impacts on the taxon are likely to result in a significant change in its local and/or overall population, whether positive or negative;
- The effective management (or lack thereof) of the taxon generates significant financial revenues (or receivables) and/or expenses (or liabilities);
- The taxon plays a critical role in the ecosystem, and can thus be defined as a keystone[30], umbrella[31] or engineer[32] species;
- The taxon plays a significant cultural or economic role (e.g. hunting, harvesting, pollinating services, educational and recreational services) for your stakeholders.

29.Materiality within the BD Protocol does not necessarily equate to the legal concept of materiality which applies to formal corporate reporting in many jurisdictions. If you have concerns about the potential interpretation of biodiversity impact disclosures you plan to make, you are advised to seek independent legal advice relevant to your industry and jurisdiction.
30.Keystone species constitute species that help define an entire ecosystem. Keystone species have low functional redundancy. This means that, if the species were to disappear from the ecosystem, no other species would be able to fill its ecological niche (e.g. elephants, apex predators). The ecosystem would be forced to radically change, allowing new species to populate the habitat and shape ecosystem processes in a different manner.
31.Umbrella species are species selected for making conservation-related decisions, typically because protecting these species indirectly protects the many other species that make up the ecological community of its habitat.
32.An ecosystem engineer is any species that creates, significantly modifies, maintains or destroys a habitat. These can have a large impact on the species richness and landscape-level heterogeneity of an area.

Assessing the materiality of species for the purpose of a biodiversity impact assessment requires a good knowledge of the species present (and potentially impacted) throughout the sites (and surrounding areas) making up the organisational and value chain boundaries of your biodiversity impact inventory. To that end, accessing public and/or private databases on species occurrence or distribution, which may be relevant at the local, national and/or international level(s), can be very useful and cost-effective. When such databases are unavailable, outdated and/or incomplete, contracting biodiversity specialists to undertake in situ assessments could help address the gaps.

It is worth noting that it is often easier to assess the materiality of impacts on species where you have operational control of the entity and hence better access to information. When securing the cooperation of suppliers and clients is not a viable option, it may result in significant inventory uncertainties with regards to the completeness and accuracy of taxa accounts. In all situations, making use of biodiversity specialists should help you identify the best information sources for the various components of your inventory. For instance, if potentially material taxa sub-populations are located in areas acting as sinks (see definition in Box 3) for reasons that cannot be changed/are beyond your control (e.g. vagrant individuals of a threatened species, non-breeding population), you may consider excluding them from your taxa impact inventory after consulting with biodiversity specialists and/or your key stakeholders.

Once the materiality assessment has been completed, you should be able to compile separate lists for impacted ecosystem types and impacted taxa. These categories will eventually make up the accounts of your biodiversity impact inventory as per the selected organisational and value chain boundaries. To facilitate net impact accounting (see Section 3.3), it is advised to compile these lists using a bottom-up approach, i.e. compiling impacted taxa per land asset or property.

2.3.2 Segregating direct impacts from indirect impacts

The BD Protocol further requires you to distinguish between the direct and indirect impacts on biodiversity of your company (see Table 3), excluding cumulative impacts (see Box 4). This distinction between direct and indirect impacts is critical for several reasons, notably to avoid the double counting of biodiversity impacts (see Box 5) and to establish which biodiversity impact account can satisfy the accounting and reporting principles of the BD Protocol (see section 2.4). It is further recommended to start with accounting for the direct impacts on biodiversity within your selected value chain boundary(ies).

For biodiversity impact accounting and reporting within the context of the BD Protocol, direct impacts constitute changes in the state of biodiversity which are caused directly by your business activities. In other words, direct impacts involve business impact drivers (see definition in Section 3.2.1) which can be traced to specific, verifiable biodiversity features, that is direct causal link between your company's actions (e.g. land clearing or ecosystem restoration measures) and a change in the state of ecosystems or taxa (e.g. decrease/increase in ecosystem condition, habitat loss/gain for several species). These impacts may be temporary (short-term or long-term), recurrent (e.g. seasonal, every time a specific activity is undertaken) or permanent impacts (e.g. built-up properties, such as office buildings or parking areas). For instance, the direct land footprint of your business operations leads to verifiable, on the ground changes in biodiversity. Similarly, water emissions may lead to verifiable changes in the state of freshwater ecosystems which can be attributed solely to your company, for instance when streams or wetlands are wholly contained within its direct operations or where it is the only significant polluter within the catchment.

In the BD Protocol, indirect impacts are defined as changes in the state of biodiversity which cannot be traced to specific business activities. This implies that changes in biodiversity arising from indirect impacts can only be modelled (e.g. GLOBIO[33]). In other words, indirect impacts involve the various impact drivers to which no specific change in biodiversity (e.g. degradation of the condition of an ecosystem type/loss of taxa in a specific location) can be attributed. Indirect impacts can have very large negative consequences for biodiversity, for instance through biodiversity loss due to climate change or water pollution. Moreover, indirect impacts are often harder to manage than direct impacts since they extend beyond the physical or legal boundaries of your business and arise from the interactions of multiple factors and stakeholders. In greenfield projects, the combined effects of social (e.g. population growth) and economic (e.g. increased access to area) factors create the conditions for these impacts to arise (e.g. increased clearing of land caused, at least partially, by immigration to a new mining site).

While the BD Protocol requires accounting only for the share of indirect impacts which can be linked to your business activities, it can be a complex process to undertake (see Box 4). Such apportionment challenges arise when various companies are collectively responsible for changes in biodiversity due to the combined effects of their impact drivers (e.g. combined effect of greenhouse gas and water emissions on coral reef ecosystems). For instance, when water emissions from various sources trigger significant changes in the state of freshwater ecosystems and taxa (i.e. above certain water quality thresholds; e.g. Carpenter et al., 2011), it may be difficult to assess the proportion of such changes only attributable to your business. Yet, provided there is complete transparency regarding the modelling and apportionment methods used, indirect impact estimates should be accounted for.

33. GLOBIO is a modelling framework to calculate the impact of environmental drivers on biodiversity for past, present and future.

Table 3: Requirements and options for developing your biodiversity impact inventory

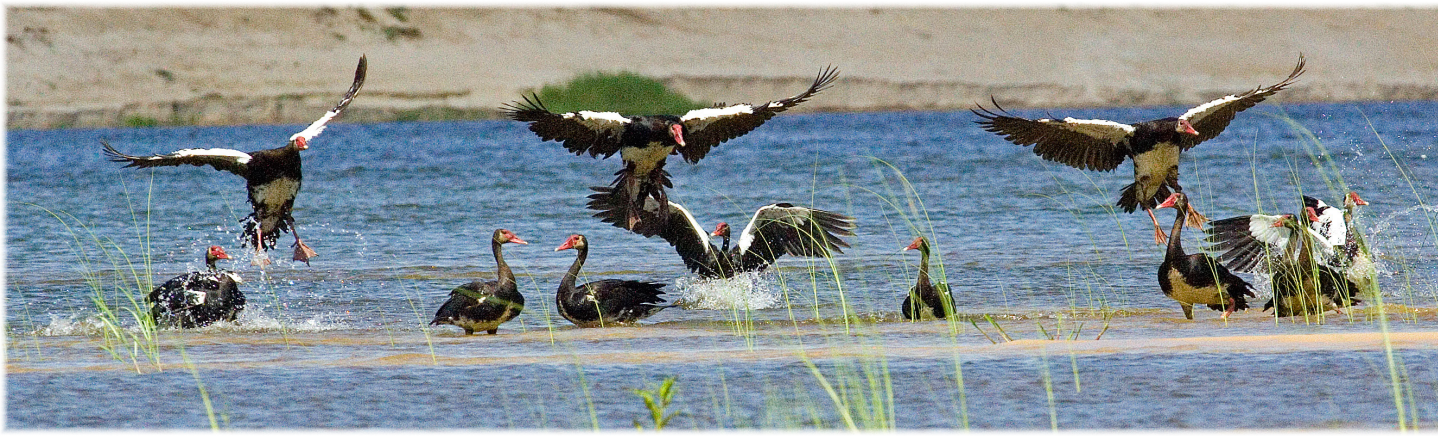
	Biodiversity features	Value chain boundary (at least one needs to be selected)		
		Direct operations	Upstream	Downstream
Direct impacts	Ecosystems	All impacts	All impacts	All impacts
	Taxa	Material impacts	Material impacts	Material impacts
Indirect Impacts	Ecosystems	All impacts	All impacts	All impacts
	Taxa	Material impacts	Material impacts	Material impacts

Box 4: Dealing with cumulative impacts:

Cumulative impacts include direct and indirect impacts, past, present and future, resulting from the actions of all actors, not just the target organisation or project assessed. Cumulative impacts may arise from the actions of both public and private agents. For instance, two facilities, belonging to different companies, may impact the same neighbouring property in similar ways (e.g. invasive species spill-over) and thus both contribute to the accelerated and/or increased cumulative degradation of receiving ecosystems. Similarly, all economic agents within a catchment collectively contribute to the accumulated changes in the state of freshwater and marine ecosystems.

The BD Protocol requires your business to only account for the changes in biodiversity which (a) can be attributed directly to its activities (i.e. direct impacts), and (b) can be linked indirectly to its impact drivers through impact modelling (i.e. indirect impacts). Assessing the latter can give rise to methodological challenges though, notably for the apportionment of responsibility amongst the parties involved.

Since cumulative impacts include the impacts of all agents, they are necessarily excluded from the scope of the BD Protocol. However, such impacts could be assessed at the landscape, watershed, local government, state/provincial and/or national level(s), as part of broader, non-organisational specific biodiversity impact assessments.



Box 5: Avoiding the double counting of direct and indirect biodiversity impacts:

Beyond the double counting of direct impacts, which would typically occur when different consolidation approaches are applied to a business interest or activity shared by two companies (see Section 2.2), double counting may also arise when a company accounts for both direct and indirect biodiversity impacts. Indeed, many indirect biodiversity impacts cannot be verified on the ground. For instance, changes in the state of biodiversity due to climate change result from the cumulative impacts of all greenhouse gas emissions, not just the emissions of a single company. In other words, the underlying impact drivers (i.e. greenhouse gas emissions from your company) cannot be traced to identifiable, tangible ecosystem assets or taxa. This means that the same ecosystem assets could be impacted by the direct (e.g. land use of your operations) and indirect (e.g. greenhouse gases) of your business, hence leading to the double counting of your biodiversity impacts.

Accordingly, direct and indirect biodiversity impact accounts should always be segregated. While double counting may hold lower risks for your business in the context of internal and/or voluntary external disclosure, legal requirements with respect to the implementation of the mitigation hierarchy (see Section 3.1) warrant dealing explicitly with this issue, in partnership with the involved stakeholders, to avoid taking responsibility for another business' impacts.

2.4 Accounting and reporting principles

The BD Protocol is based on seven accounting and reporting principles which are derived, in part, from the GHG Protocol and generally accepted financial accounting and reporting principles. These principles are intended to underpin all aspects of biodiversity impact accounting and reporting. Their application will endeavour to ensure that the biodiversity impact inventory constitutes a credible and unbiased representation of the company's biodiversity impacts. These accounting and reporting principles are defined as follows:

- *Relevance:* Ensure the biodiversity impact inventory appropriately reflects the biodiversity impacts of the company and its value chain. It shall serve the decision-making needs of users, both internal and external to the company.

- *Equivalency:* Ensure the notion of equity in the type of biodiversity (i.e. ecological equivalency or like-for-like principle) is integral to biodiversity impact inventory development and accounting. Undertake net impact accounting only for equivalent biodiversity losses (negative impacts) and gains (positive impacts).

- *Completeness:* Account for, and report on, all impacts on ecosystems but only impacts on material[34] taxa, within the chosen organisational and value chain boundaries. Disclose and justify any exclusion.

- *Consistency:* Use consistent methods to allow for meaningful comparisons of biodiversity impacts over time. Transparently document any changes to the data, inventory boundary, methods or any other relevant factors in the time series.

- *Transparency:* Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the data collection and estimation methods used.

- *Accuracy:* Ensure the measurement of biodiversity impacts is systematically accurate, as far as can be judged, notably by reducing uncertainties as far as is practicable. Achieve suitable accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information. When no direct observation is possible, estimate impacts on the basis that they are reasonably likely to occur, recording all methodological limitations.

- *Time period assumption:* Account for biodiversity impacts consistently across business reporting periods.

34.Section 2.3.1 defines what constitutes the material biodiversity impacts of your company or organisation.

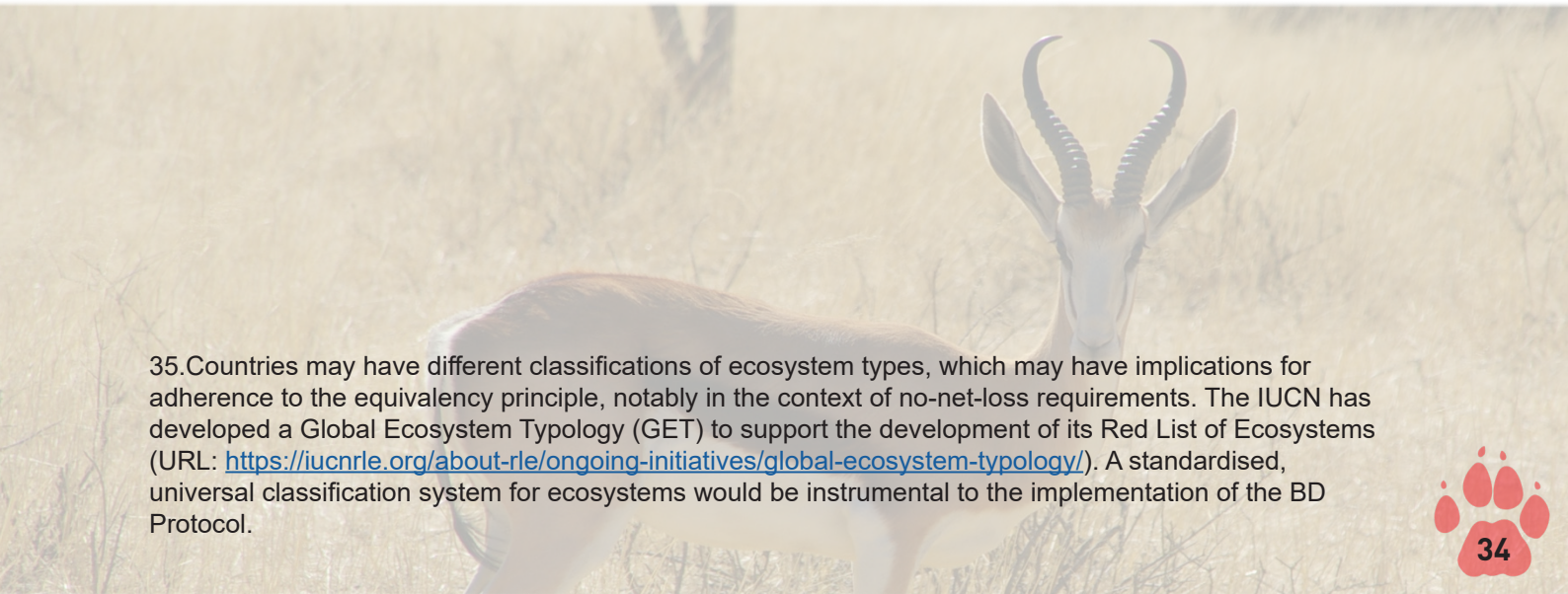
Relevance

This first principle ensures that the biodiversity impact assessment of your organisation is useful to its target stakeholders, both internal and/or external. This implies building a biodiversity impact inventory boundary which reflects the biodiversity reality of your company's business interests and value chain, considering the intended purpose of the information, and the needs of the target users. When defining the boundary of your biodiversity impact inventory, several factors should thus be considered, such as:

- Organisational structures: Control (operational and financial), ownership, legal agreements, joint ventures (see Section 2.1);
- Value chain boundaries: Direct operations, upstream (suppliers), downstream (clients) (see Section 2.2);
- Business context: nature of activities/sector, geographic locations, needs of stakeholders and information users.

Equivalency

Due to variability in biogeography and the type and intensity of human activities, biodiversity patterns vary significantly from one place to another. The second principle refers to the notion of ecological equivalency, or like-for-like. Although biodiversity is a non-fungible asset (i.e. no two components of biodiversity are strictly identical), your business needs to ensure that its biodiversity impact inventory is composed of individual accounts of like-for-like or ecologically equivalent biodiversity features (i.e. only the same types of ecosystems[35] or taxa can be aggregated within a single biodiversity impact account). This is derived from the mitigation hierarchy and no-net-loss/net gain policies that oversee the design and implementation of offset measures (see Section 3.1). This means that net impact accounting can only be undertaken for equivalent biodiversity losses (negative impacts) and gains (positive impacts). Adherence to the equivalency principle is essential to the accounting of direct impacts on biodiversity. For indirect impacts, since specific, verifiable changes in the state of biodiversity cannot be traced back to the activities of your business, it may be more challenging, impractical or impossible to conform to the latter principle given the selected impact assessment approach (see Section 3.2), notably the impact drivers assessed (e.g. greenhouse gases) and the input data used to model biodiversity impacts. Such limitations must be stated clearly, as part of disclosed biodiversity impact information, to enable third parties to make informed decisions.



35.Countries may have different classifications of ecosystem types, which may have implications for adherence to the equivalency principle, notably in the context of no-net-loss requirements. The IUCN has developed a Global Ecosystem Typology (GET) to support the development of its Red List of Ecosystems (URL: https://iucnrle.org/about-rle/ongoing-initiatives/global-ecosystem-typology/). A standardised, universal classification system for ecosystems would be instrumental to the implementation of the BD Protocol.

Completeness

The third principle ensures that all impacts on ecosystems, and only impacts on material[36] taxa within the chosen inventory boundary, are accounted for so that a comprehensive and meaningful biodiversity impact inventory is compiled (see Section 2.3). In practice, a lack of data, or the cost of gathering data, may represent limiting factors. Good quality maps of biodiversity pattern (e.g. spatial distribution of ecosystem types) may only be available in some countries, regions or at a local scale, and many parts of the world may lack quality biodiversity information. Satellite imagery can help reduce costs of data collection for large scale assessments, while in-situ assessments, for an appropriate number of sample sites, may be required to verify and monitor ecosystem condition. For impacts on taxa, information on target and actual population size may exist for only a limited number of species (e.g. highly threatened ones). For others, the presence of their habitats can act as an appropriate proxy. As explained in Section 2.3, your company should follow a consistent and transparent materially based inventory building process to ensure that all important biodiversity components are accounted for. Ultimately, adherence to the completeness principle is critical to the accounting of direct impacts on biodiversity. For indirect impacts, the selected impact assessment approach (see Section 3.2), notably the impact drivers assessed (e.g. greenhouse gases) and the input data used, may render impossible the identification and recording of all the ecosystems and material taxa impacted. To enable third parties to make informed decisions, limitations must be clearly stated as part of disclosed biodiversity impact information.

Consistency

The fourth principle requires the consistent application of accounting approaches, inventory boundary, and impact assessment methods to produce credible data over time. This is critical for users of your biodiversity impact assessment, who may want to identify trends and assess the performance of your company. This means that all the biodiversity impact information within an organisation's inventory boundary must be compiled in a manner that ensures that the aggregate information is internally consistent and comparable over time. If there are changes in the inventory boundary, methods, data, or any other factors affecting biodiversity impact assessment, they need to be documented transparently and justified.

Transparency

As with the GHG Protocol, the fifth principle relates to the degree to which information on the processes, procedures, assumptions, and limitations of the biodiversity impact inventory are disclosed in a clear, factual, neutral, and understandable manner based on clear documentation and archives (i.e. an audit trail). Biodiversity impact information shall be:

- Recorded, compiled, aggregated and analysed in a way that (a) enables internal reviewers and external verifiers to attest to its credibility, and (b) ensures biodiversity impact inventory continuity in the face of staff changes;
- Comprehensive enough, with assumptions disclosed, appropriate references provided for the methods applied and the data sources used, and specific exclusions or inclusions clearly identified and justified. This will enable a third party to generate similar accounting results if provided with the same source data.

Contracting an independent external auditor would support transparency and help determine whether an appropriate audit trail has been established, and suitable documentation provided.

36.Section 2.3 defines what constitutes the material biodiversity impacts of your company or organisation.

Accuracy

The sixth principle ensures that data users can make decisions with the reasonable assurance that the reported information is accurate. This implies making sure that uncertainties are reduced as far as practicable when measuring biodiversity impacts. Uncertainties may arise from interpreting secondary information, for instance when modelling direct and indirect impacts from impact drivers or economic data instead of undertaking in-situ assessments of the state of biodiversity. While accuracy is expected to be higher for direct impacts on biodiversity, indirect impacts can be expected to be less accurate and should be interpreted with caution (see Box 5 on the risk of double counting). This greater uncertainty for indirect impacts can be correlated with the selected impact assessment approach (see Section 3.2), notably the impact drivers assessed (e.g. greenhouse gases) and the input data used. When no primary data is available and no in situ assessments are possible, biodiversity impacts should be estimated on the basis that they are reasonably foreseeable or likely to occur, while also recording the level of uncertainty and associated methodological limitations. Reporting on measures taken to ensure accuracy in the assessment can help promote credibility while enhancing transparency.

Time period assumption

The time period assumption, also known as "periodicity assumption" and "accounting time period concept", refers to the division of the life of a business into equal time periods. Companies prepare their financial statements for each of these time periods, also known as accounting periods. While authorities typically mandate annual financial disclosures, many large companies report more frequently to their internal and external stakeholders, for instance every quarter. For the purpose of the BD Protocol, it is recommended that:

- Your biodiversity impact inventory be compiled, reviewed and/or updated regularly, typically following your business accounting periods, so that you produce credible, relevant and accurate biodiversity impact reports for use by internal and/or external stakeholders.
- Biodiversity impact assessments are carried out at appropriate intervals given the nature of the impacted biodiversity components (see Section 3.2). For instance, some ecosystem types grow or recover very slowly (e.g. ecosystems within very dry climates), which may warrant undertaking impact assessments every 3 to 5 years or more. Conversely, some material taxa, with short life spans, may require annual or seasonal population monitoring.

2.5 Managing inventory quality

There are quality management standards and methods available to most industries and business applications worldwide (e.g. ISO standards). The BD Protocol does not aim to provide guidance on how to develop and implement a quality management system for your company's biodiversity impact inventory. As for materiality assessment, your company most likely has experience with at least one approach to quality management through its operations and activities.

Accordingly, this section merely highlights key aspects you should consider while attempting to produce a biodiversity impact assessment that is both credible and unbiased. While there may be different reasons for managing the quality of your biodiversity impact inventory, your objectives for undertaking a biodiversity impact assessment, as well as the needs of your target stakeholders, should be the primary drivers for:

- The design of the inventory;
- The set-up and administration of a quality management system; and
- The application of measures intended to avoid or minimise uncertainty.

High quality information should help ensure that your biodiversity impact assessment adheres to the BD Protocol accounting and reporting principles, making it credible for use by your target stakeholders. High quality information should also contribute to the successful verification of the scope, method and content of your biodiversity impact assessment by an independent auditor. This may even be compulsory in some countries, for instance as a part of offset performance reporting requirements of a greenfield project, or for mandatory disclosure by listed companies or by corporations with a turnover above specific thresholds (IUCN 2014).

The BD Protocol recognises that assessing, accounting for and monitoring biodiversity impacts requires significant biodiversity expertise and data, which in turn may involve engaging significant resources. The capital and operational expenditures of your business in the administrative and technical dimensions of a quality inventory management system should be commensurate with the resources available, stakeholders' needs or requirements, and the organisation's short- to long-term biodiversity strategy. This means that you should first give attention to the activities most likely to generate the greatest improvements in overall inventory quality.

Furthermore, to implement the quality management system, the following steps may be considered:

- Establishing a team responsible for managing inventory quality;
- Developing a quality management plan, which would:
    - Cover the selection, application, and updating of inventory methods;
    - Record and update (when appropriate) the methods, data, processes, systems, assumptions, and assessment results used to prepare the inventory;
    - Facilitate the maintenance and improvement of data collection procedures;
    - Record institutional, managerial and technical procedures for preparing the inventory and, where appropriate, integrate them in other corporate processes related to quality in order to maximise synergies and reduce costs;

- Performing quality checks, including both:
  - General checks: e.g. data collection method consistency and documentation checks across the whole inventory; and
  - Biodiversity account-specific checks: e.g. rigorous investigations into the appropriate application of boundaries, impact assessment procedures, data quality consistency and adherence to accounting and reporting principles;
- Reviewing final biodiversity impact assessments, via internal reviews and/or through external experts;
- Institutionalising formal feedback loops to the quality management team for each quality check undertaken;
- Establishing regular reporting, documentation and archiving procedures, which would enable progress monitoring with respect to the implementation of the quality management plan.

Identifying and addressing uncertainty challenges

Preparing a biodiversity impact inventory is both an accounting and a scientific exercise. The standard practice would be to consider uncertainty as the objective quantitative metric for quality and hence to report quantitative data with estimated error bounds. This would enable you to compare impact results across organisational and value chain boundaries, across impact categories and over accounting time periods, with confidence.

There are two main types of uncertainty in biodiversity impact inventories, scientific and estimation uncertainty:

- Scientific uncertainty arises when the science of the actual impact assessment is not completely understood. For example, taxa-specific impact assessment methods may still be works in progress. Analysing, quantifying and addressing such scientific uncertainty would only be meaningful or justifiable for highly material biodiversity impacts.
- Estimation uncertainty arises any time impact estimations are undertaken (see Section 3.2), typically due to methodological (e.g. genetic analysis methods for species identification), model (i.e. equations used to characterise the relationships between various parameters and changes in the state of biodiversity) and parameter (i.e. input data) uncertainties. As with scientific uncertainty, dealing with estimating methodological and model uncertainty is likely beyond most company's inventory efforts.

Given these challenges, assessing uncertainty for the impact estimation procedures and models you have used can be valuable. Most methods and models require statistically appropriate sampling, which may not always be feasible under field conditions. Relying on the judgment of suitable experts (i.e. qualitative assessment of input data quality) may be useful to highlight and address key issues. However, obtaining unbiased and consistent views for all parameters across the inventory, especially for larger companies, may be a challenge, hence the need to systematically acknowledge and record the subjective components of your impact assessment process.

3. BIODIVERSITY IMPACT MEASUREMENT AND ACCOUNTING

For the purpose of the BD Protocol, biodiversity accounting refers to the systematic process of identifying, measuring, recording, summarising and reporting all the biodiversity impacts of an organisation, within its selected organisational and value chain boundaries, over business accounting periods. As previously mentioned, the BD Protocol defines biodiversity impact, or impact on biodiversity, as the negative and/or positive effect(s) of any business activity on biodiversity features. In biodiversity accounting, positive impacts are gains while negative impacts are losses. Also, two main types of biodiversity components are recognised by the BD Protocol: Ecosystem types and taxa (i.e. species, sub-species).

This section provides guidelines on how to develop the Biodiversity Statements of Position and Performance of your business, including:

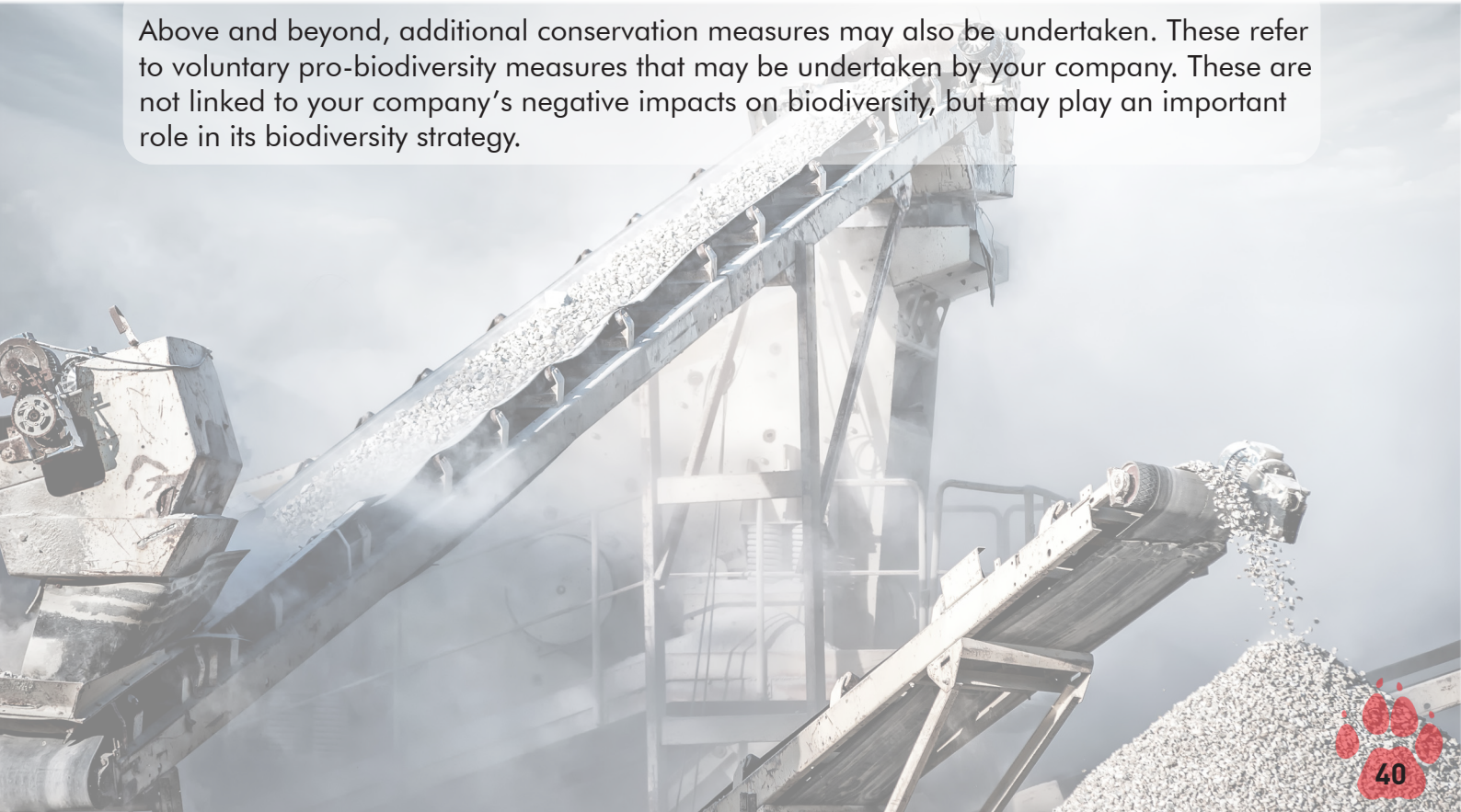
- Applying the mitigation hierarchy for the biodiversity impact inventory of your business (Section 3.1);
- Measuring impacts on ecosystems and taxa (Section 3.2);
- Applying the Biodiversity Accounting Framework of the BD Protocol (Section 3.3).

3.1 Applying the mitigation hierarchy to assess net impacts

The BD Protocol uses the mitigation hierarchy to assess the net biodiversity impacts of any business over time. The hierarchy refers to the sequence of actions taken to (a) anticipate and avoid impacts on biodiversity; (b) minimise or reduce impacts where avoidance is not possible; (c) rehabilitate or restore when impacts have occurred; and (d) compensate or offset significant residual impacts (Figure 3). This concept is widely used throughout the world and is often embedded into national legislation as regards to environmental permitting. More specifically, the mitigation hierarchy calls for the following steps when considering impacts on biodiversity (adapted from BBOP 2012):

- First, avoidance measures to avoid generating impacts from the outset, such as careful spatial or temporal placement of elements of infrastructure, in order to avoid impacts on natural capital as much as possible (e.g. locating a project outside a Key Biodiversity Area).
- Second, minimisation measures to reduce duration, intensity and/or extent of impacts that cannot be completely avoided, as far as practically feasible (e.g. minimising the spread of material and waste flows, scheduling of vegetation clearing at the appropriate time).
- Third, restoration measures to assist recovery of an ecosystem type that has been degraded, damaged, or destroyed by business activities (e.g. rehabilitation of a mining site or quarry).
- As a last resort, offset measures to compensate for any residual significant, adverse impacts on natural capital that cannot be avoided, minimised and/or rehabilitated or restored, often implemented in order to achieve no-net-loss, or a net gain, of biodiversity. This may be achieved outside the immediate project area, through active biodiversity restoration or creation projects, or through averted risk/loss offsets which aim to prevent likely future risks of harm to (or losses of) biodiversity from occurring (Bull et al., 2013). The latter option requires the definition of an appropriate counterfactual, in other words determining what would have happened without the offset. Examples of averted-loss offsets include the expansion of a protected area network in areas under pressure from third parties.

Above and beyond, additional conservation measures may also be undertaken. These refer to voluntary pro-biodiversity measures that may be undertaken by your company. These are not linked to your company's negative impacts on biodiversity, but may play an important role in its biodiversity strategy.



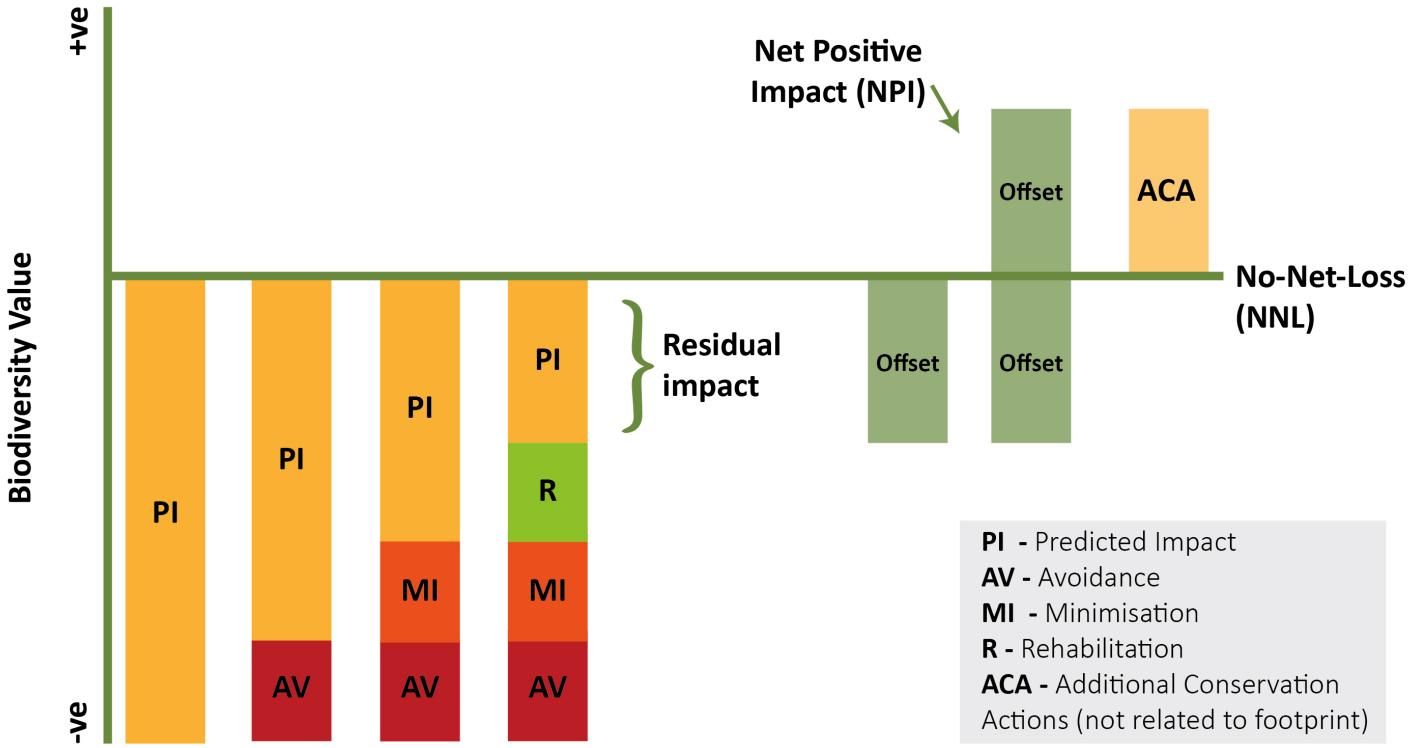


Figure 3: Applying the mitigation hierarchy for a greenfield project in the context of no-net-loss policy (adapted from the Business and Biodiversity Offset Programme[37])

The use of the mitigation hierarchy is often linked to the concept of no-net-loss or a net gain for a whole project, which requires an assessment of the baseline or existing conditions to provide a starting point (e.g. pre-project condition of biodiversity) against which comparisons can be made (e.g. post-impact condition of biodiversity), allowing changes in biodiversity to be measured throughout the asset life-cycle. Offset measures, aimed at reaching no-net-loss or net gains, have been applied to a growing number of projects worldwide (e.g. property development, linear infrastructures, mines; see Aima et al., 2015; Ekstrom et al., 2015; Bull & Strange, 2018), typically in the context of project authorisation processes (Figure 3).

From the perspective of the BD Protocol, adherence to the equivalency principle (Section 2.4) and the mitigation hierarchy implies that the net biodiversity impacts of your company can only be assessed for equivalent biodiversity features (i.e. equivalent ecosystem types and/or taxa). This means that net impact on a biodiversity feature (i.e. ecosystem type or taxon) refers to the net changes in its state: i.e. adding up gains from mitigation activities and subtracting ecologically equivalent losses generated by the company's activities. Accordingly, the BD Protocol defines:

- No-net-impact on (or no-net-loss of) a biodiversity feature (i.e. ecosystem type or taxon) as the point where gains from mitigation activities match ecologically equivalent losses generated by the company's activities;

37.URL: http://bbop.forest-trends.org/pages/mitigation_hierarchy.

- Net negative impact (or net loss of) on a biodiversity feature (i.e. ecosystem type or taxon) as the point where biodiversity losses exceed ecologically equivalent gains generated by business operations.
- Net positive impact (or net gain of) on a biodiversity feature (i.e. ecosystem type or taxon) as the point where biodiversity gains from additional conservation activities exceed ecologically equivalent losses generated by business operations.

In the end, your organisation should design and implement targets, policies, strategies and action plans which:

- Address all components of its biodiversity impact inventory (see Section 2.3);
- Apply the mitigation hierarchy for each component of its biodiversity impact inventory (i.e. each ecosystem type and each material taxon), though not necessarily adopting no-net-impact or net-positive-impact targets;
- Comply with relevant biodiversity legislations and lender requirements, as well as contribute to international targets (e.g. forthcoming post-2020 Global Biodiversity Framework); and
- Address your business' actual biodiversity risks/exposure and opportunities/ contributions to society.

3.2 Measuring impacts on biodiversity

Once you have established the biodiversity impact inventory of your business, the BD Protocol prescribes that you measure and record your business impacts on all the biodiversity features included in it (i.e. all ecosystem types, but only the taxa recognised as material to your business and/or its stakeholders; see section 2.3), which involves measuring:

- The extent and condition/integrity of ecosystems[38];
- The target population size and actual population size of taxa.

In this process, it is important to recognise that business impacts are not always negative. For instance, some business activities or projects (e.g. dam building or the conversion of natural forests to cattle pastures) may lead to some taxa gains: e.g. increases in the populations of certain bird species, such as waterfowls for dams and grassland specialists for pastures. Such gains are a direct result of the creation and/or expansion of habitats for some species. In other words, while business activities may increase the habitat available to some taxa (i.e. positive taxa gains), associated ecosystem changes will still constitute negative impacts on the impacted ecosystem types (as per the mitigation hierarchy), unless those activities are specifically designed and undertaken for ecosystem conservation purposes (see Section 3.4 to understand how to account for ecosystem conversions). Where such taxa gains involve species recognised as material for your business and/or its stakeholders (see Section 2.3 for identifying material taxa), you need to develop separate impact accounts for them. Indeed, these taxa-related changes cannot be accounted for as changes in ecosystem extent and condition/integrity in ecosystem accounts.

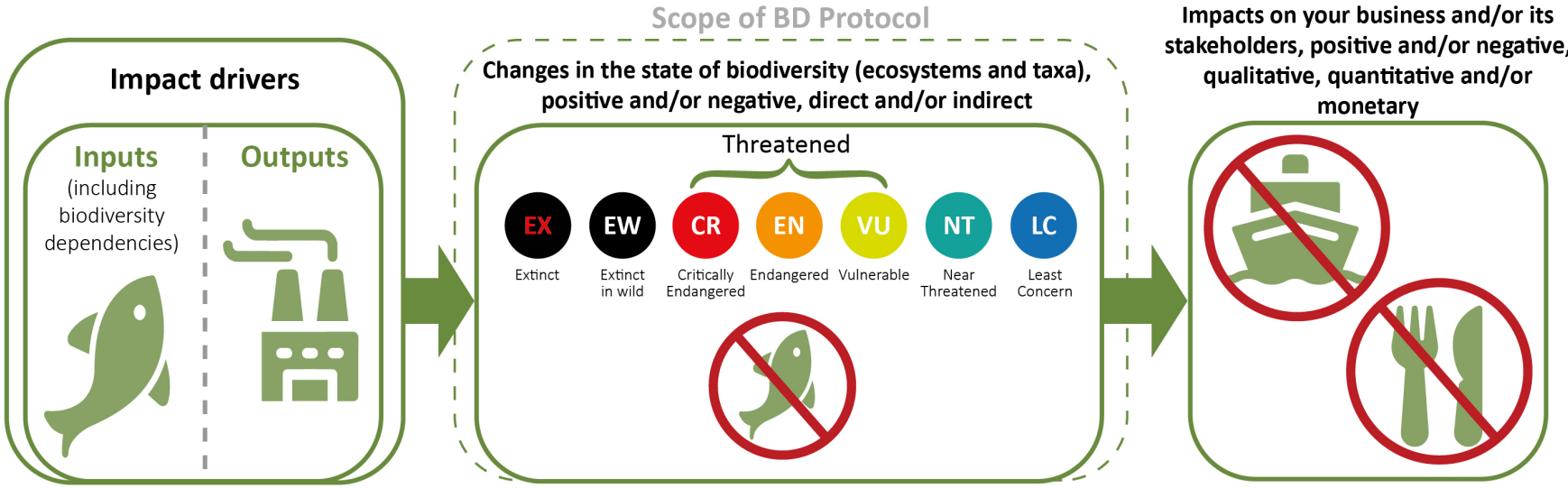


Figure 4: The biodiversity impact pathway (e.g. seafood): impact drivers, impacts on/changes in biodiversity and impacts on your business and/or society.

38.Ecosystems may be classified as terrestrial, freshwater, subterranean (e.g. caves) or marine types. However, this does not specifically include transition areas between ecosystem types, also known as ecotones. In some cases, stakeholders may argue that ecotones should be included in your inventory due to the presence of key ecological features warranting their conservation.

3.2.1 The biodiversity impact pathway

The BD Protocol focuses on accounting for biodiversity impacts, which constitute the middle component of the biodiversity impact pathway: i.e. changes in the state of ecosystems and taxa populations (Figure 4). As your company may already be measuring several impact drivers (e.g. measuring water use or greenhouse emissions) for various internal and/or external purposes, conceptualising and understanding the biodiversity impact pathway can be useful to help understand what constitutes a biodiversity impact and what you still need to measure in order to adhere fully to the accounting and reporting principles of the BD Protocol.

The key concepts underlying the biodiversity impact pathway (Figure 4) are as follows:

- *Impact pathway:* In line with the Natural Capital Protocol, an impact pathway refers to a process by which a biodiversity impact driver, either an input (e.g. material used, biodiversity dependency), or non-product output (e.g. air and water emissions) of a business, generates changes in biodiversity and how these changes impact the organisation and society.
- *Biodiversity impact (or impact on biodiversity):* The negative and/or positive effect(s) of business activity on the state of biodiversity (i.e. extent and condition of ecosystems, the target population size and actual population size of taxa).
- *Impact driver (or driver of biodiversity change):* The measurable quantity of an input to (e.g. volume of water and surface area used for agricultural production), or non-product output from (e.g. litres of water emissions released into a river by a manufacturing facility), a business activity. This implies that:
    - An impact driver may be related to a biodiversity dependency[39] of a business: e.g. a fishing business relies on wild fish stocks, which may impact the latter negatively and/or cause further damages to marine ecosystems due to the use of destructive fishing gear (e.g. bottom trawling);
    - A single impact driver (e.g. land-use change) may be associated with multiple biodiversity impacts (e.g. loss or gain of a species, and a decrease or increase in the extent and condition of an ecosystem type);
    - A change in biodiversity (e.g. decrease or increase in the population of a species) may be caused by several interacting impact drivers (e.g. land use change, increase or decrease in density of invasive alien species, changes in water emissions).
- *Impact on business and/or its stakeholders:* Impacts on biodiversity can lead to impacts on your business and/or its stakeholders. Assessing such impacts amounts to expressing their importance to your business and/or its stakeholders, a process also known as valuation. Valuation can use qualitative, quantitative and/or monetary approaches.

Accordingly, accounting for (a) impact drivers and (b) the impacts on business and/or society, which can be linked to your business' biodiversity impacts within its selected organisational and value chain boundaries, is beyond the scope of the BD Protocol. As explained in Section 2.3, the biodiversity impact inventory of your business will determine which biodiversity impacts (e.g. whether any taxon, only direct impacts, or both direct and indirect impacts are included; see Table 3) need to be assessed.

39.Biodiversity dependency (or dependency on biodiversity): A business reliance on or use of biodiversity. This includes:

- Biological resources (e.g. materials, liquids, genetic resources) from both wild (e.g. wild fish) and cultivated (e.g. crops, cattle) taxa;
- Interactions with various ecosystem processes, such as pollination, water filtration, crop pest/disease control or water flow regulation.

While biodiversity impacts may be caused by one or many interacting impact drivers, only a selection of impact drivers can be directly correlated with changes in biodiversity (i.e. direct impacts), whereas other impact drivers (e.g. greenhouse gas emissions) typically contribute to indirect impacts on biodiversity (Table 4; Section 2.3). Irrespective of whether you use impact assessment methods that measure changes in biodiversity per se (e.g. *in situ* assessments, satellite imagery), or model biodiversity impacts from various equations and input data (see impact measurement approaches analysed by EU Business @ Biodiversity Platform & UNEP-WCMC, 2019), the BD Protocol requires you to produce biodiversity impact data expressed as changes in:

- The extent and condition/integrity of ecosystems;
- The target population/habitat size and actual population/habitat size of material taxa.

Table 4: The links between a selection of impact drivers and direct/indirect biodiversity impacts

Your business, its supplier(s) and/or its client(s)	Impact driver category	Corresponding biodiversity impact category
Inputs	Energy	Indirect
	Land use	Direct
	Materials	Indirect
	Water use	Direct/indirect, context dependent
Outputs	Disturbances (e.g. noise, light, invasive species)	Direct
	GHG emissions	Indirect
	Solid waste	Direct/indirect, context dependent
	Soil emissions	Direct/indirect, context dependent
	Water emissions	Direct/indirect, context dependent

3.2.2 Compiling biodiversity impact accounts

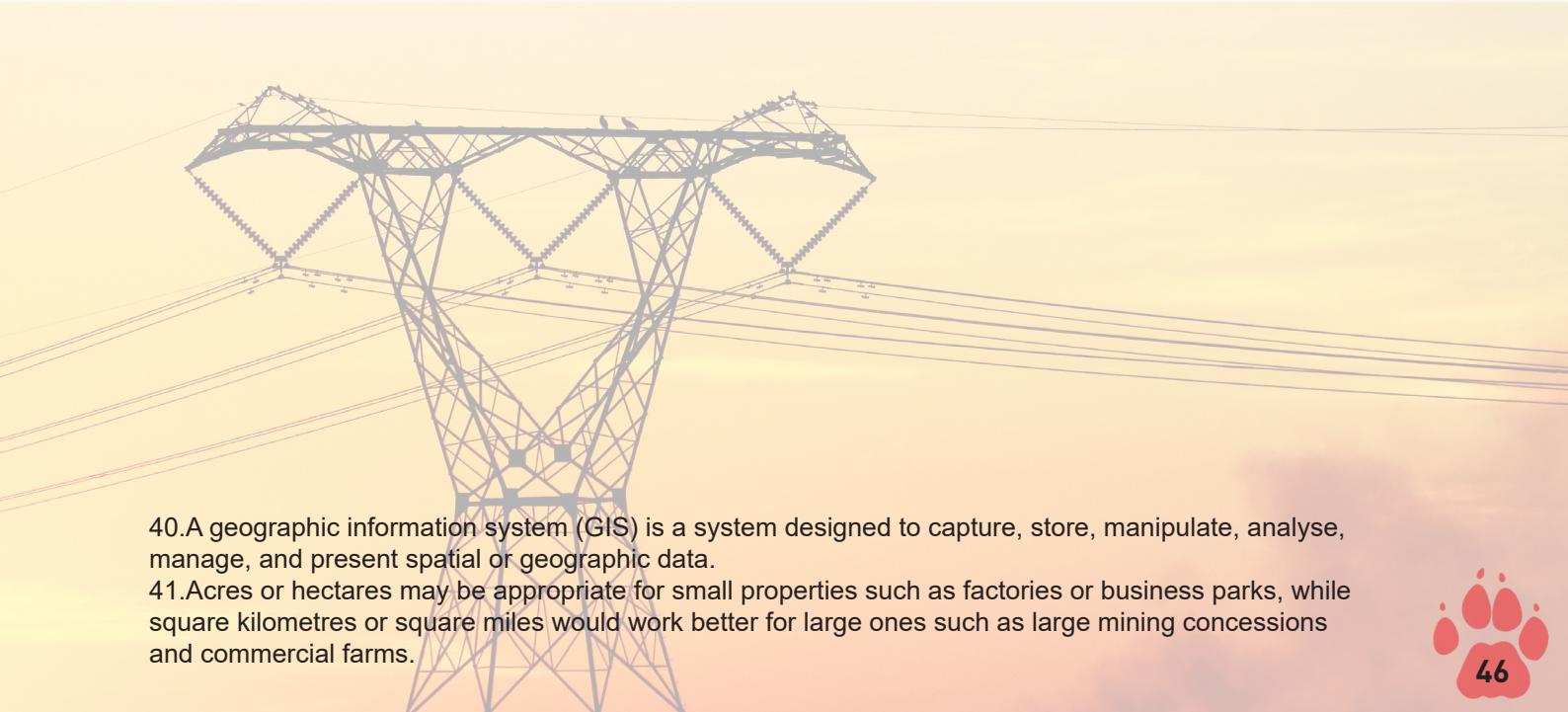
As previously explained (Section 2.3.2), the BD Protocol requires your business, for its selected organisational and value chain boundaries, to segregate its biodiversity impact accounts as follows:

- Direct impacts on biodiversity:
  - Individual ecosystem type accounts;
  - Individual taxa accounts;
- Indirect impacts on biodiversity:
  - Individual ecosystem type accounts;
  - Individual taxa accounts.

Furthermore, for each account, the impact assessment process involves two key steps that help produce the following impact data:

- For ecosystem accounts (example on Table 5):
  - Assessing the extent of each impacted ecosystem: The surface area and associated GIS[40] data of each ecosystem type impacted, in the appropriate unit, such as acres, hectares, square kilometres or square miles, depending on the order of magnitude[41];
  - Assessing the nature of the impact: The condition or integrity of each ecosystem type impacted, using the scoring or rating method best suited for each given the applicable policy environment, and hence expressing it in the appropriate condition/integrity-adjusted unit (such as acre equivalents, hectare equivalents, square kilometre equivalents or square mile equivalents);

- For taxa accounts (example on Table 5):
  - Assessing the target population or habitat size for each taxon: The target population or habitat size, whether socially or scientifically determined, with the corresponding GIS data; using the most cost-effective method for the taxonomic group to which the target species belongs to, and hence expressing it in the appropriate unit (e.g. surface area-based indicators, population size-based ones).
  - Assessing the nature of the impact: The actual population or habitat size of each taxon, with the corresponding GIS data; using the most cost-effective method for the taxonomic group to which the target taxon belongs.



40.A geographic information system (GIS) is a system designed to capture, store, manipulate, analyse, manage, and present spatial or geographic data.
41.Acres or hectares may be appropriate for small properties such as factories or business parks, while square kilometres or square miles would work better for large ones such as large mining concessions and commercial farms.

Table 5: Examples of biodiversity accounts for company XYZ: Direct impacts of direct operations

Inventory category	Impact assessment results	
	Extent of impact	Nature of impact
Ecosystem type	**Surface area (Ha)**	**Condition/integrity-adjusted surface area (Ha)**
Grassland 1	500,00	200,00
Wetland 1	400,00	240,00
Forest 1	55,00	44,00

Taxon	**Target population size (number of individuals)**	**Actual population size (number of individuals)**
Population-based approach		
Plant species 1	500	100
Habitat-based approach	**Target habitat size (surface area in Ha)**	**Current habitat size (surface area in Ha)**
Plant species 2	12,00	4,80
Bird species 1	400,00	240,00

3.2.3 Choosing appropriate methods for measuring impacts on ecosystems

There are several options available to your business for each step of the impact measurement process for ecosystems. The BD Protocol does not prescribe a comprehensive list of approaches suitable for different ecosystem types. Instead, it highlights the issues to consider for selecting the most appropriate, cost-effective methods to meet accounting and reporting principles given your business context.

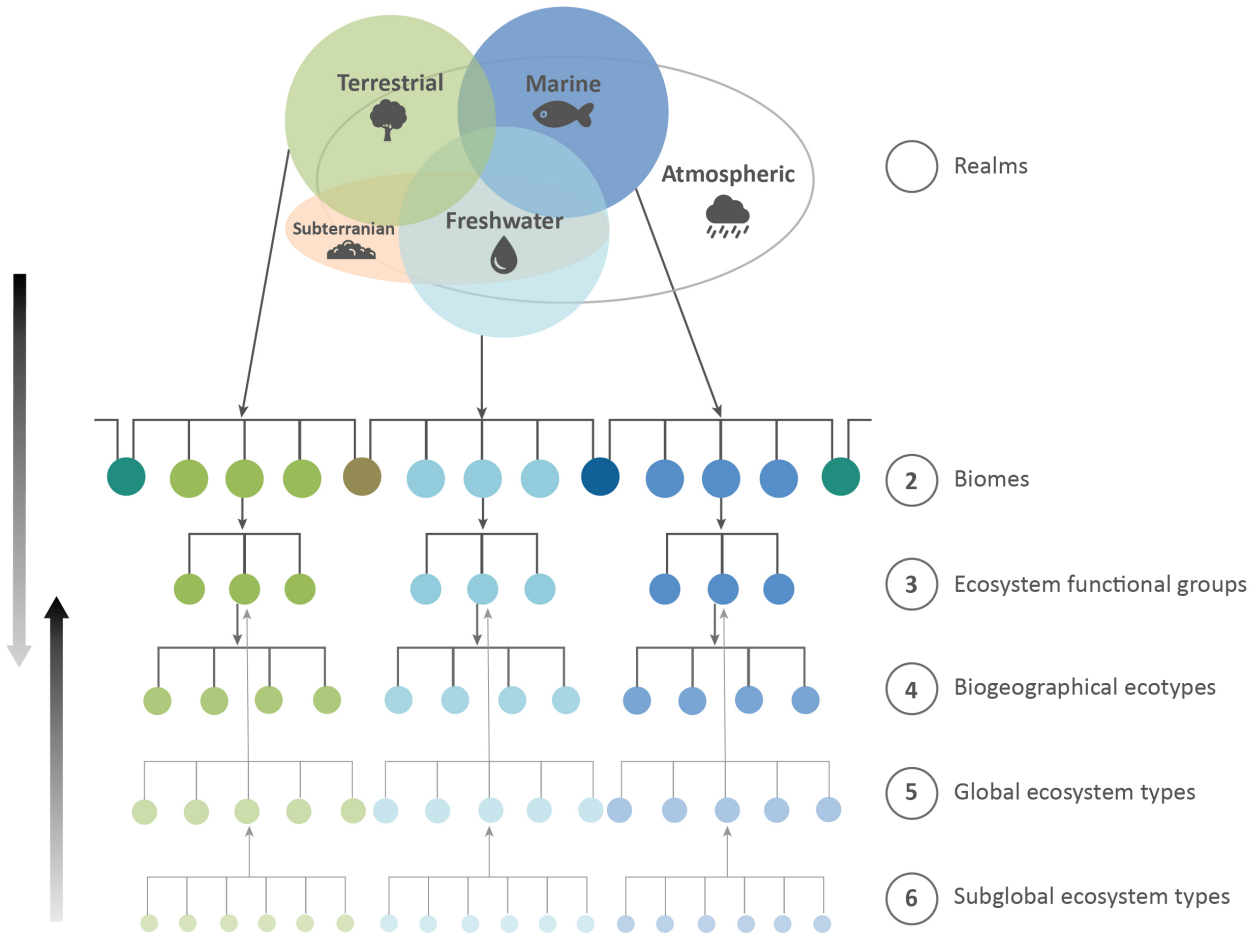
Measuring the extent of impacts on ecosystems

Using the IUCN Global Ecosystem Typology (GET)[42] (Box 6), two main approaches can be used to measure the extent of ecosystem types, namely satellite imagery and on-site assessments. The BD Protocol recommends using a combination of both. Satellite imagery can help to quickly distinguish and map the different ecosystem types over the organisational and value chain boundaries of your business, while on-site assessments may help clarify or address any uncertainty (i.e. ground truthing), such as the exact delineation of ecosystem types (e.g. delineating wetland boundaries during a dry season) or the exact ecosystem type (e.g. distinguishing between different grassland types within a mosaic of grassland ecosystems). Where ecosystems have been transformed for a long time (e.g. urban areas, most farmland in Western Europe), suitable biodiversity expertise can be sought to help you identify the ecosystem types that have most likely been lost and/or can reasonably be expected to occur at the target locations (see Section 3.3.5 to understand how to account for ecosystem conversions). This would typically be done through the analysis of historical records (e.g. historical maps of ecosystem types) and/or the identification of ecosystem types subject to similar climatic and geological conditions nearby.

42.URL: https://iucnrle.org/static/media/uploads/references/research-development/keith_etal_iucnglobalecosystemtypology_v1.01.pdf, accessed on March 20, 2020.

Box 6: The IUCN Global Ecosystem Typology (IUCN 2020)

The Global Ecosystem Typology comprises a nested hierarchy of units to facilitate application at different organisational scales and enable integration of existing classifications where possible. Groupings in the three upper levels of the typology are designated to represent ecosystems that share functional properties, irrespective of the biota engaged in the functions. Codes M, F, T, S and A systematically label ecosystem units within the Marine, Freshwater, Terrestrial, Subterranean and Atmospheric realms, respectively, and combinations of these for labelling ecosystems transitional between the realms.



Level	Definition
1. Realm	One of five major components of the biosphere that differ fundamentally in ecosystem organisation and function: terrestrial, freshwater, marine, subterranean, atmospheric.
2. Functional biome	A component of a realm united by one or a few common major ecological drivers that regulate major ecological functions, derived from the top-down by subdivision of realms (level 1).
3. Ecosystem functional group	A group of related ecosystems within a biome that share common ecological drivers promoting convergence of biotic traits that characterise the group. Derived from the top-down by subdivision of biomes.
4. Biogeographic ecotype	An ecoregional expression of an ecosystem functional group derived from the top-down by subdivision of Ecosystem functional groups (level 3). They are proxies for compositionally distinctive geographic variants that occupy different areas within the distribution of a functional group.
5. Global ecosystem type	A complex of organisms and their associated physical environment within an area occupied by an ecosystem functional group. Global ecosystem types grouped into the same ecosystem functional group share similar ecological processes, but exhibit substantial difference in biotic composition. They are derived from the bottom-up, either directly from ground observations or by aggregation of subglobal types (level 6).
6. Subglobal ecosystem type	A subunit or nested group of subunits within a global ecosystem type, which exhibit a greater degree of compositional homogeneity and resemblance to one another than global ecosystem types (level 5). These represent units of established classifications, in some cases arranged in a sub-hierarchy of multiple levels, derived directly from ground observations.

Measuring the nature of impacts on ecosystems

Precisely measuring the nature of impacts on ecosystems within the biodiversity impact inventory of your business helps you ensure full adherence to the accounting and reporting principles of the BD Protocol, notably accuracy and consistency. This process involves assessing whether your business impacts are positive and/or negative. To do so, the BD Protocol prescribes using ecosystem rating methods which express the relative condition, integrity and/or intactness of the impacted ecosystem types (i.e. surface areas adjusted for condition/integrity; see examples in Table 6). This means assessing each ecosystem type of your biodiversity impact inventory against its intact, reference, original or natural state (e.g. ecosystem exhibiting all its known, potential structural, functional and/or biological components, ecosystem without any human impact). Using the same ecosystem rating method for each ecosystem account is particularly important when monitoring changes in condition/integrity over time, for instance to ensure that the consequences of any management activity aimed at improving ecosystem condition/integrity can be measured against a comparable baseline.

However, there are two main sources of uncertainty in ecosystem condition/integrity rating:

- The first concerns the selection of the ecosystem rating method for each ecosystem type within your biodiversity impact inventory.
- The second lies in the application or use of each ecosystem rating method, notably in terms of rating parameters, data inputs and user bias.

With respect to the first source of uncertainty, there are indeed many condition/integrity-rating methods available in the world[43]. Some condition/integrity-rating methods may be universally applied (e.g. GLOBIO's Mean Species Abundance[44]), while others cater for specific ecosystem types (e.g. unique methods for wetlands, such as WET-Health[45] in South Africa; Macfarlane et al., 2009) and countries (e.g. Australia's Integrated Ecosystem Condition Assessment Framework; Department of the Environment and Energy 2017). This diversity of approaches may reflect both the spatial heterogeneity of ecosystem types and the different social perceptions of nature (e.g. diverse methods used in European countries for different ecosystem types listed as habitats under Article 17 of the EU Habitats Directive; Ellwanger et al., 2019). While engaging with biodiversity experts and your stakeholders may help you choose the most appropriate condition/integrity-rating methods for your business context, the BD Protocol recommends using the most cost-effective ones for the different ecosystem types within your biodiversity impact inventory and taking into consideration the objectives and scale of the assessment, as well as the financial, human and technical resources available.

The second source of uncertainty relates to the technical differences (e.g. parameters, data inputs) between each condition/integrity-rating method, which may lead to different condition/integrity ratings or scores for the same ecosystem impacted within the biodiversity impact inventory of your business (see example in Table 6).

43.Future work of the Biodiversity Disclosure Project may involve (a) producing a comprehensive listing of condition/integrity-rating methods and (b) assessing their appropriateness with respect to the accounting and reporting principles of the BD Protocol.
44.URL: https://www.globio.info/what-is-globio/how-it-works/impact-on-biodiversity, accessed 15/02/2020.
45.URL: http://www.wrc.org.za/wp-content/uploads/mdocs/TT%20340-09.pdf, accessed 15/02/2020.

Some methods may be relatively simple (high level qualitive assessment, single indicator gradient[46]) while others can be quite complex and resource-intensive (e.g. methods involving the assessment of the structure, functions, processes, landscape connectivity and/or species composition of ecosystems). Besides, as biodiversity experts may not always know or understand the intact, reference, original or natural state of an ecosystem type, they may overestimate and/or underestimate the condition/integrity of ecosystems. In largely transformed landscapes (e.g. most of Western Europe), the propensity for both over- and under-estimations can be high, as there are few wild/undisturbed ecosystems left and thus a very limited understanding of what the reference/original states of most ecosystems would look like. By contrast, in largely wild/undisturbed landscapes (e.g. Amazon basin), the propensity to overestimate the condition/integrity of ecosystems is probably more likely. This is due to our relatively poor knowledge of such ecosystems, for instance the failure to identify the loss of their critical functions, processes and/or features (e.g. apex predators) when undertaking an impact assessment. To minimise this second form of uncertainty, the BD Protocol prescribes using the most generally accepted condition/integrity-rating methods (e.g. scientific consensus over the method, its integration in national policies and/or legislations) for the different ecosystem types within your biodiversity impact inventory.

46.For instance, GLOBIO's Mean Species Abundance (MSA) is defined as an indicator of naturalness or biodiversity intactness and is expressed as the mean abundance of original species relative to their abundance in undisturbed ecosystems. An area with an MSA of 100% means a biodiversity that is similar to the natural situation. An MSA of 0% means a completely destructed ecosystem, with no original species remaining. In other words, the MSA is used as a proxy for measuring the condition/integrity of ecosystems. URL: https://www.globio.info/what-is-globio/how-it-works/impact-on-biodiversity accessed 15/02/2020.

Table 6: Three different condition/integrity-rating methods[47] and their implications for measuring the nature of impacts on the same forest ecosystem type

Defra Biodiversity Metric 2.0		**Method typically used for terrestrial ecosystems in environmental impact assessments in South Africa**		**GLOBIO's Mean Species Abundance - Example of forest ecosystem**	
Category	Score	Category	Score	Description	**Gradient in percentage**
Good	3	No change in natural habitat, biota and ecosystem processes (e.g full trophic cascades and predator - prey dynamics) have occurred	5	Pristine forest (100%)	Continuum of percentage values defined as the mean abundance of original species relative to their abundance in undisturbed ecosystems
Fairly good	2,5	Small changes in natural habitat and biota may have taken place, but the ecosystem function is essentially unchanged	4	Selective logging	
Moderate	2	Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged	3	Secondary vegetation	
Fairly poor	1,5	A large loss of natural habitat, biota and basic ecosystem functions have occurred	2	Plantation	
Poor	1	The loss of natural habitat, biota and basic ecosystem functions are extensive	1	Land degradation (0%)	
N/A - Agriculture	1	Complete loss of natural habitat, biota and basic ecosystem functions	0		
N/A - Other	0				

47.The UK Department for Environment, Food and Rural Affairs (DEFRA) Biodiversity Metric is available online; more specifically in the technical paper: the metric for the biodiversity offsetting pilot in England.

Table 6: Cont.

			Condition/ integrity - rating methodology		
Ecosystem type	Land use/ impact drivers	Extent of impact (Ha)	Defra Biodiversity Metric 2.0	Method typically used for terrestrial ecosystems in environmental impact assessments in South Africa	GLOBIO's Mean Species Abundance (gradient in percentage) for forest ecosystems
Decideous forest (isolated patch)	Selectively logging and resource extraction	100	2,5	4	75%
Decideous forest	Converted to crop monoculture	100	1	1	10%
Ecosystem type	Land use/ impact drivers	Extent of impact (Ha)	Condition/ integrity - adjusted impacts (Ha equivalents)		
Decideous forest (isolated patch)	Selectively logging and resource extraction	100	83,33	80,00	75,00
Decideous forest	Converted to crop monoculture	100	33,33	20,00	10,00

To summarise, since selecting different condition/integrity-rating methods will lead to different impact results (see example in Table 6), the BD Protocol adopts two main rules for the consistent use of condition/integrity-rating methods:

- For each ecosystem type, using the most generally accepted or recognised method applicable within the jurisdiction (e.g. a country or state) where the impact occurs.
- Using the same method for ecologically equivalent, or like-for-like, ecosystem types.

When these principles conflict, for instance when your business operates in two different countries which use different condition/integrity-rating methods for the same ecosystem type, you should consider the purpose of your biodiversity impact assessment (i.e. voluntary disclosure versus mandatory reporting) before deciding whether to select one approach for both countries or to apply the two methods separately for each country given local circumstances. In such cases, you should always record the reasons for the decision in order to satisfy the transparency principle of the BD Protocol.

Finally, while you may use different condition/integrity-rating methods in the countries where your business operates (e.g. to ensure the satisfaction of local stakeholders' needs or requirements), this should have limited effects on the overall consolidation of biodiversity impacts at the company level. This is for two main reasons:

- First, individual impacts on ecosystem types are accounted for separately so that you can always provide disaggregated impact accounts, per country, with the associated assumptions, methods and limitations; and
- Second, the BD Protocol is based on the principle of equivalency between biodiversity gains and losses so that net impact accounting would only take place for accounts using the same impact assessment method.

Sections 3.3 provides full explanations on how to resolve this issue. Sections 3.3.1, 3.3.2 and 3.3.3 present the Biodiversity Accounting Framework, and its associated Statements of Biodiversity Position and Performance, which enable the consolidation of local ecosystem and taxa impacts into aggregated impacts at the company level. Sections 3.3.4 and 3.3.5 explain how to account for biodiversity baseline impacts, gains, losses and net impacts over time.

3.2.4 Choosing appropriate methods for measuring impacts on taxa

As Section 2.3.1 details, assessing impacts on taxa (i.e. species and sub-species) should be undertaken only for taxa that are material for the business and/or its stakeholders (e.g. highly threatened bird species, with a decreasing local population due to business activities). Several options are also available to your business for each step of the impact measurement process for taxa. The BD Protocol does not prescribe a comprehensive list of approaches suitable for different taxa. Instead, it highlights the issues to consider for selecting the most appropriate, cost-effective method to meet accounting and reporting principles given your business context. However, you should note that this selection process is more challenging than the one for ecosystems.

Estimating the target population or habitat size of taxa

This first step of an impact assessment on a taxon can be particularly challenging for some species (e.g. poor knowledge of lifecycle or habitat requirements, monitoring challenges). Depending on data and resource availability, it involves establishing either:

- The target population size of the taxon: i.e. target number of mature, reproducing individuals or breeding pairs (e.g. bird species that mate for life such as some albatross species), depending on the social behaviour of the impacted species/sub-species; or
- The target habitat size of the taxon: i.e. target (potential) surface area of habitat for the taxon impacted (surface area metric, along with the associated GIS data).

Ideally, the minimum viable population (see definition in Box 3), estimated through a rigorous scientific process, should be used as the target population size, especially for threatened taxa. This can be both time and resource consuming, as it may require looking at the metapopulation (see definition in Box 3) within the broader landscape or migration route(s).

To minimise costs, you may consider using the presence of specific habitats as a proxy for the (potential) presence of material taxa (see example in Table 7), an approach regularly used by consultants in environmental impact assessments throughout the world. For instance when sizing the offset requirements for the residual impacts on protected or threatened species and sub-species. In this context, you would aim to assess the target (potential) habitat size (i.e. in surface areas metrics along with the associated GIS data) for the taxon impacted.

Table 7: Estimating the target population size and target habitat size for two species, a plant species (shrub) and a mammal species (browser). In this example, while the mammal is overabundant/has too much available habitat, the converse is true for the shrub species

Population-based approach	**Target population size (number of reproducing individuals)**	**Current population size**
Plant species 1	500	150
Mammal species 1	30	100
Habitat-based approach	**Target habitat size (surface area in Ha)**	**Current habitat (surface area in Ha)**
Plant species 1	100,00	50,00
Mammal species 1	50,00	100,00

In any case, for species that (may) cause conflicts with humans (e.g. predators or ecosystem engineers), or for those living in heavily modified landscapes, both approaches would probably entail defining the socially acceptable target population or habitat size rather than the minimum viable population or habitat size. Establishing this cultural carrying capacity would typically be coupled with management interventions (e.g. habitat improvement measures, introductions/culling of individuals to boost/reduce the population), as per your corporate biodiversity strategy, National Biodiversity Strategy and Action Plan and/or the relevant species recovery plan, if available. For instance, some material taxa (e.g. a browser species) may be overabundant (e.g. due to the lack of predators) and require specific population reduction interventions (e.g. culling so as to reduce the size of their population or habitat and hence allow browsed species to recover; see example in Table 7). From this perspective, setting target population or habitat size for all the material taxa of the biodiversity impact inventory of your business would help you track performance over time, improve decision-making, and steer management action towards greater positive biodiversity impacts.

Measuring the nature of impacts on taxa

With the target population size defined, the next step is measuring the nature of your business' impacts on the taxa. Depending on data and resource availability, this step involves estimating either:

- The actual population size of the taxon: i.e. number of mature, reproducing individuals or breeding pairs, depending on the social behaviour of the impacted species/sub-species; or
- The actual habitat size of the taxon: i.e. surface area of habitat for the taxon impacted (surface area metrics, along with the associated GIS data).

To avoid challenges with data collection when undertaking taxa impact assessments, which can occur for a variety of reasons – including intricate lifecycles and behaviours (e.g. some taxa, such as raptors or migratory birds, may only be visitors to the areas within your inventory boundary) – biodiversity specialists should be contracted as early as possible.

Direct observations of all individuals of a species or sub-species within an area and/or or at a specific time (e.g. during migration) may be made with reasonable confidence, and at reasonable costs, in a limited number of circumstances. For instance, one may count the number of nesting raptors, or the number of individuals of a mega-herbivore[48] species within a relatively small property. However, counting all the organisms in a population is typically too time-consuming, too expensive, or simply not feasible. Biodiversity specialists and scientists thus estimate the population size of a taxon, in a study area or region, by taking one or more samples from the population and using these samples to make inferences about the total number of individuals (i.e. through statistical analyses based on only a sample of population members). Accordingly, individual density per unit area, estimated from the mean number of individuals recorded across the sample sites, is frequently used as the basis for population trend analyses.

While there is a wide array of techniques available to estimate the population sizes of taxa (Table 8), you should aim to select the most cost-effective methods for each species and apply them consistently throughout your inventory. For instance, population densities of plants and sessile[49] animals can be estimated from counts taken on plots, or data describing the spacing between individuals (i.e. distance methods).

48.Any very large herbivore, typically one weighing more than 1,000 kg.
49.Sessile organisms, such as plants, sponges and corals, lack the capacity or means for self-locomotion.

Table 8: The main data collection techniques for estimating population numbers of different taxonomic groups (adapted from McComb et al., 2010)

	Mode	Technique	Examples of target taxa
Observational	**Direct**	Quadrats; fixed area plots	Sessile or relatively immobile organisms
		Avian point counts	Bird species that sing or call on territories
		Spot mapping & nest searches	Territorials bird species
		Line transect	Large mammals, birds
		Call playback response	Wolves, ground squirrels, raptors, woodpeckers
		Standardised visual searches	Large herbivores
		Census	Cave-dwelling bats, large mammals
	Animals sign	Foot track surveys	Medium/large mammals
	Pellet & scat counts	Medium/ large mammals	
		Food cache searches	Large carnivores
		Structures (e.g dens, nests)	Arboreal mammals, fossorial mammals, bears
	Remote sensing	Track plates	Medium/large mammals
		GPS telemetry	Limited by animal body (>2000g)
	Photo, audio, & video tracking	Medium/ large mammals	
		Ultrasonic detectors	Bats
		Audio monitoring	Frogs
		Hair traps	Small/medium mammals, large carnivores
		Radio telemetry	Limited by animal body size (>20g)
		Marine radar	Marine mammals, bats, migrating birds
		Harmonic radar	Bats, amphibians, reptiles
Capture	**Passive**	Pitfalls	Salamanders, lizards, small mammals
		Snap traps	Small mammals
		Funnel-type traps	Snakes, turtles
		Leg-hold & snares	Large mammals
	Active	Drives to an enclosure	Medium/large mammals with predictable flight response
		Canon nets	Medium/large mammals
		Immobilising agents	Large mammals
Marking	**Passive**	Visual	Individually identifiable species such as willd dogs, leopards, cheetahs, & saddle-billed strokes
	Active	Hand captured	Salamanders
		Mutilation	Small mammals
		Pigments	Small mammals
		Collars & bands	Birds, mammals

When population estimations and/or measurement methods are not appropriate for your business context, using habitat-based impact measurement approaches would involve:

- Accessing, if available, all credible taxa databases applicable to the ecosystem types present within the organisational and value chain boundaries of your business (e.g. lists published by relevant authorities, scientific records, records from citizen scientists, expert observations or opinions);
- Screening these databases for any taxon satisfying the selected materiality criteria of your biodiversity impact inventory (see Section 2.3.1);
- Assessing whether the ecosystem types identified actually act as habitats for those taxa (e.g. through ad hoc surveys, anecdotal expert and/or stakeholder evidence and/or opinions);
- For those ecosystem types acting as habitats for your material taxa, assessing their extent (see section 3.2.3) and treating the results as proxies for the nature of impacts on the target taxa.

Building on the principles of inventory quality management (see Section 2.5), you may strive to minimise uncertainties and reinforce the credibility of collected data by systematically:

- Applying the same population/habitat estimation method for each material taxon throughout your inventory (i.e. same method used for the same taxon present at different sites), unless there are reasonable objections for not doing so, in which case(s) the basis for decision-making and its implications should be recorded and mentioned in your biodiversity impact report;
- Ensuring that the sample selected, both in terms of size and location, is a statistically appropriate representation of the total population; which implies making use of statistical expertise;
- Recording the methodological choices, assumptions and limitations inherent to the selected data collection methods, such as the number of visits to sample units undertaken (e.g. for mark-recapture studies and catch-per-unit effort surveys), observer biases, different detection probabilities among sub-populations, or organism response to capture or observation.

Implications for taxa management

The difference between the actual and target population or habitat sizes of the material taxa of your business will give you an indication of whether current management efforts are successful in reaching taxa targets as per your biodiversity strategy. Since population and habitat sizes may vary according to many variables, both natural (e.g. natural mortality/ reproduction rates, immigrations/emigrations, changes in habitat quality and/or climatic conditions) and anthropogenic (e.g. harvesting or exploitation rates), your biodiversity management plans should cater for all important threats and put in place the relevant mitigation measures (see Section 3.1).

National and international policies on taxa at risk of extinction usually direct conservation efforts towards increasing, maintaining or reducing the rate of loss in the total number of individuals of target species and sub-species within their natural geographic range[50]. Therefore, trends in actual population sizes of taxa directly measure both the level/degree of threat facing a taxon and the effectiveness of conservation policies and practices. Since the mere presence of a taxon (e.g. surface area of habitat available) does not express its actual population size, using population-based impact measurement approaches can help ensure closer management of their actual population dynamics.

Furthermore, working at the landscape level will be warranted for some taxa. For instance, the populations of a mammal (e.g. apex predator species) at a specific site may be too small for their long-term survival. Efforts at a broader scale would be required and would typically involve other stakeholders and landowners. For instance, the introduction of individuals with suitable genetic materials may be necessary to maintain or improve the genetic variability, and hence the viability, of the target sub-populations. This is a tool commonly used as part of meta-population management activities.

50.There may be exceptions to this general principle. For instance, endangered species can be introduced outside of their known natural geographical range to expand their population size. The new site may lack predators, or may offer more suitable conditions for foraging and reproduction. According to the IUCN (1998, 2013), a benign introduction constitutes “an attempt to establish a taxon, for the purpose of conservation, outside its recorded distribution but within an appropriate habitat and ecogeographical area; a feasible conservation tool only when there is no remaining area left within a taxon’s historic range”.

3.3 The Biodiversity Accounting Framework

Once you have assessed all your business' impacts on ecosystems and taxa, it is time to record them in an overarching accounting framework. The BD Protocol embraces an accounting framework that measures net biodiversity impacts over time. This involves the adaptation of double-entry bookkeeping to account for both periodic and accumulated changes in biodiversity. This section presents the conceptual foundations, principles and equations that hold this accounting framework and the associated accounts together.

3.3.1 The Statements of Biodiversity Position and Performance

For any impact accounting framework to present a complete and accurate representation of the net situation of an organisation, it must be able to account for both periodic (e.g. annual) and historical (e.g. since the start of a business) performance. This is the case with financial accounting.

The BD Protocol builds from the foundations of financial accounting (see Box 7) through two simple equations, adapted from double entry bookkeeping, which ensures that the total biodiversity impacts of a company are equal to the sum of its accumulated positive and negative impacts (see theoretical foundations in Houdet et al., 2020). Accounting for biodiversity impacts thus revolves around the following equations:

- Statement of Biodiversity Position (Table 9): (A) total impacts on biodiversity features = (B) accumulated positive impacts on biodiversity + (C) accumulated negative impacts on biodiversity (for all periods to date);
- Statement of Biodiversity Performance (Table 10): (X) net biodiversity impacts on biodiversity features over the accounting period = (Y) periodic positive biodiversity impacts or gains - (Z) periodic biodiversity negative impacts or losses.

Table 9: Conceptual illustration of a Statement of Biodiversity Position

Total impacts on biodiversity features (ecosystem types / taxa) (A)	=	**Accumulated positive impacts on ecosystem types / taxa (B)** + **Accumulated negative impacts on ecosystem types / taxa (C)**

Table 10: Conceptual illustration of a Statement of Biodiversity Performance

Net ecosystem / taxa impacts (X)	=	**Periodic ecosystem / taxa gains (Y)** - **Periodic ecosystem / taxa losses (Z)**

Box 7: Financial accounting and reporting

Financial accounting is the process of recording, summarising and reporting the myriad of transactions resulting from business operations over a time period. These transactions are consolidated in the preparation of financial statements, including the balance sheet (or statement of financial position) and income statement (statement of financial performance). Reporting and disclosure are typically undertaken on a quarterly or annual basis.

The balance sheet is built upon a simple equation whereby the assets acquired by the company are financed either through debt/liability or owner's equity. To ensure that the equation remains in equilibrium, all transactions generate a double effect, and are recorded according to the double entry accounting principle (i.e. double-entry bookkeeping). For instance, any increase in expenditure (e.g. machinery purchase) will be offset by a decrease in assets (e.g. less cash at bank) or increase in liability (e.g. loan contracted) or equity (e.g. funds put into the company by shareholders) and vice-versa.

Assets (A) = **Liabilities (L)** + **Owner's equity (OE)**

Equation of the Statement of Financial Position (Balance Sheet): Assets = Liabilities + Owner's Equity.

This equation provides a condensed summary of all business transactions up to the end of the reporting period (e.g. end of the financial year). It accounts not only the events of the past reporting period, but also records the net, accumulated consequences of all past transactions of prior periods, as all accounts are carried over from the previous reporting period to the next.

Finally, the statement of financial performance is built on a simpler equation whereby annual profit or loss is calculated by subtracting expenses from revenues over the reporting period. This financial result is integrated into the balance sheet at year end in the owner's equity part of its equation (i.e. profits retained/losses borne by the company).

(P&L) Profit/ Loss = **(R) Revenues** − **(E) Expenses**

Equation of the Statement of Financial Performance (Profit & Loss Statement/Income Statement): Profit/Loss = Revenues – Expenses.

3.3.2 Impact segregation and apportionment

As explained in Sections 2.2 and 2.3.2, beyond the segregation of accounts per value chain boundary, the BD Protocol requires you to distinguish between the direct and indirect impacts on biodiversity of your company. This means accounting for them separately, as per the Biodiversity Accounting Framework. Impacts that have yet to occur or are likely to occur (i.e. future impacts), at the time of reporting or disclosure, should also be accounted for separately (see Tables 11, 12 and 13).

For direct impacts, the BD Protocol further requires that you only account for impacts that have occurred (e.g. confirmed species or ecosystem loss from a site) or are reasonably likely to occur (e.g. decrease in ecosystem condition interpreted from satellite data, which was not verified by an in situ assessment) at the time of reporting or disclosure. This includes impacts that are reasonably foreseeable to happen, in the near or immediate future, given past business decisions, such as the future impacts of a greenfield project approved by all relevant authorities, or those of a board-approved investment in facility expansion.

Table 11: The presentation of Statements of Biodiversity Position and Performance for different value chain boundaries

Value chain	Impact type	Biodiversity feature	Statement of Position	Statement of Performance
Upstream	Direct	Ecosystem	Aggregable individual accounts	Aggregable individual accounts
		Taxa	Separate for each taxon	Separate for each taxon
	Indirect	Ecosystem	Aggregable individual accounts	Aggregable individual accounts
		Taxa	Separate for each taxon	Separate for each taxon
	Future	Ecosystem	Aggregable individual accounts	Aggregable individual accounts
		Taxa	Separate for each taxon	Separate for each taxon
Direct operations	Direct	Ecosystem	Aggregable individual accounts	Aggregable individual accounts
		Taxa	Separate for each taxon	Separate for each taxon
	Indirect	Ecosystem	Aggregable individual accounts	Aggregable individual accounts
		Taxa	Separate for each taxon	Separate for each taxon
	Future	Ecosystem	Aggregable individual accounts	Aggregable individual accounts
		Taxa	Separate for each taxon	Separate for each taxon
Downstream	Direct	Ecosystem	Aggregable individual accounts	Aggregable individual accounts
		Taxa	Separate for each taxon	Separate for each taxon
	Indirect	Ecosystem	Aggregable individual accounts	Aggregable individual accounts
		Taxa	Separate for each taxon	Separate for each taxon
	Future	Ecosystem	Aggregable individual accounts	Aggregable individual accounts
		Taxa	Separate for each taxon	Separate for each taxon

If your company has elected to also include indirect impacts (e.g. impacts of greenhouse gas emissions on biodiversity) as part of its biodiversity impact inventory, the BD Protocol requires you to account for them separately from direct impacts. This is to avoid misrepresenting the actual biodiversity impacts of your company, because of scenarios that have yet to materialise and/or models may lead to the double counting of impacts (see Box 5). Indeed, in many cases, indirect impacts on biodiversity, resulting from impact drivers (see Section 3.2.1) that have or are reasonably likely to occur at the time of reporting or disclosure, can only be modelled (see impact measurement approaches analysed by EU Business @ Biodiversity Platform & UNEP-WCMC, 2019) and, hence, cannot be verified on the ground. Although critical to take into account as part of your biodiversity strategy, such impacts should be interpreted with caution.

Moreover, modelling future impacts on biodiversity should be undertaken primarily for internal decision-making purposes, for instance to assess the biodiversity exposure of contemplated supply streams, or to compare alternative scenarios regarding the implementation of the mitigation hierarchy for a greenfield project. These potential or future impacts may also be disclosed to target external stakeholders to satisfy their ad hoc requirements (e.g. safeguards of financial institutions). However, in such cases, the BD Protocol recommends that data on potential or future impacts be accounted for and disclosed separately from that of direct and indirect impacts that have occurred or are reasonably likely to occur at the time of reporting or disclosure.

Finally, if your company has elected to include its upstream and/or downstream value chain boundaries as part of its biodiversity impact inventory, the apportionment of biodiversity impacts, caused by third parties but attributable to your activities, will be required. In other words, your business would only need to account for a proportion of the biodiversity impacts of its suppliers and clients. Two main methods may be used to apportion these impacts for suppliers:

- Share of annual production (e.g. by volume or mass) purchased by your business;
- Share of annual sales/revenues attributable to your business.

For clients, the BD Protocol recommends using the share of their annual expenses attributable to your business.

Selecting an apportionment method for the biodiversity impacts of suppliers is not anecdotal. It may lead to incorrect estimations of the biodiversity impacts of your company. The BD Protocol recommends selecting the method which makes most sense given the business and biodiversity context, in accordance with the relevant accounting and reporting principle (Section 2.4). For instance, a food retailer buying fruits directly from a farmer might have purchased 70% of the fruits produced during the period, but only contributed to 40% of the farmer's annual sales/revenues. The two apportionment methods would have significantly different implications for biodiversity accounting:

- Applying apportionment method 1 would lead the retailer to account for 70% of the farmers' biodiversity impacts over the period.
- Applying apportionment method 2 would involving accounting for only 40% of the farmers' biodiversity impacts.

Yet, because annual production can be linked directly to the ecosystem assets controlled by the fruit farmer (i.e. assuming fruit production occurs uniformly across the property), the first method would constitute the best apportionment option for the food retailer (i.e. satisfying the relevance principle). In the case of financial institutions (e.g. loans to any industry), the more relevant apportionment method would be the second one.

3.3.3 Accounting conventions and journal entries

The Biodiversity Accounting Framework of the BD Protocol recognises six main biodiversity-related account categories (Houdet et al., 2020), namely:

1. Asset accounts: Accounts in the Statement of Biodiversity Position equation (A), representing the total biodiversity impacts on each feature of the biodiversity impact inventory of your organisation;
2. Accumulated positive impact accounts: Accounts in the Statement of Biodiversity Position equation (B), representing the accumulated positive impacts on each feature of the biodiversity impact inventory of your organisation, though not necessarily implying actual conservation measures[51]. This could be presented as the biodiversity contributions to society of your business;
3. Accumulated negative impact accounts: Accounts in the Statement of Biodiversity Position equation (C), representing the accumulated negative impacts on each feature of the biodiversity impact inventory of your organisation, with no financial liability implied[52];
4. Net impact accounts: Accounts in the Statement of Biodiversity Performance equation (X), representing the net impacts (gains minus losses) on each feature of the biodiversity impact inventory of your organisation in the reporting period.
5. Gain accounts: Accounts in the Statement of Biodiversity Performance equation (Y), representing the gains for each feature of the biodiversity impact inventory of your organisation in the reporting period;
6. Loss accounts: Accounts in the Statement of Biodiversity Performance equation (Z), representing the losses for each feature of the biodiversity impact inventory of your organisation in the reporting period.

By convention, debit (DR) journal entries are written before credit (CR) journal entries. In the Statement of Biodiversity Position equation:

- An increase in an asset (A) account corresponds to a debit (DR) accounting entry;
- A decrease in an asset (A) account corresponds to a credit (CR) accounting entry;
- An increase in a positive impact (B) account corresponds to a credit entry (CR) accounting entry;
- A decrease in a positive impact (B) account corresponds to a debit (DR);
- An increase in a negative impact (C) account corresponds to a credit (CR) accounting entry;
- A decrease in a negative impact (C) account corresponds to a debit (DR) accounting entry.

By convention, in the Statement of Biodiversity Performance equation:

- An increase in a net impact (X) account corresponds to a credit (CR) accounting entry;
- A decrease in a net impact (X) account corresponds to a debit (DR) accounting entry.
- An increase in a gain (Y) account corresponds to a credit (CR) accounting entry;
- A decrease in a gain (Y) account corresponds to a debit (DR) accounting entry;
- An increase in a loss (Z) account corresponds to a debit (DR) accounting entry;
- A decrease in a loss (Z) account corresponds to a credit (CR) accounting entry;

51.Recording positive impacts does not imply any formal conservation measures (e.g. well managed, legally registered private protected areas) realised by your business. These are records of existing biodiversity features (e.g. actual population of a taxon, condition-adjusted extents of different ecosystem types) within the selected organisational and value chain boundaries of your business.
52.The BD Protocol does not imply any financial liability or debt for your business. These are merely accounts that are similar to liability accounts for the purpose of the biodiversity accounting framework.

Table 12: Example of accounts and metrics (a) for the accounts of aggregated Statements of Position for direct and indirect impacts on ecosystems, and (b) for the accounts of separated Statements of Position for direct impacts on taxa; NB: A account = C account + B account for each biodiversity

Asset accounts (A) - Total direct impacts	Metrics
Ecosystem type 1 - extent	Surface area
Ecosystem type 2 - extent	Surface area
Ecosystem type 3 - extent	Surface area
Ecosystem type 4 - extent	Surface area
Total	**Sum of surface areas**
Taxon 1 - target population size	*Number of individuals*
Total	**Number of individuals**
Taxon 2 - target population size	*Number of individuals*
Total	**Number of individuals**
Taxon 3 - target habitat size	*Surface area*
Total	**Surface area**

Table 12: Cont.

Asset accounts (A) - Total direct impacts	Metric
Ecosystem type 1 - extent	Surface area
Ecosystem type 6 - extent	Surface area
Ecosystem type 7 - extent	Surface area
Ecosystem type 8 - extent	Surface area
Total	**Sum of surface areas**

Accumulated negative accounts (C) - Total direct impacts	Metrics
Ecosystem type 1/ corresponding account A - corresponding account B	Surface area equivalents
Ecosystem type 2/ corresponding account A - corresponding account B	Surface area equivalents
Ecosystem type 3/ corresponding account A - corresponding account B	Surface area equivalents
Ecosystem type 4/ corresponding account A - corresponding account B	Surface area equivalents
Total	**Sum of surface areas equivalents**

Taxon 1 - gap to target population size (corresponding account A - cor. acc. B	*Number of individuals*
Total	**Number of individuals**

Taxon 2 - gap to target population size (corresponding account A - cor. acc. B	*Number of individuals*
Total	**Number of individuals**

Taxon 3 - gap to target habitat size (corresponding account A - cor. acc. B	*Surface area*
Total	**Surface area**

Table 12: Cont.

Accumulated negative accounts (C) - Total direct impacts	Metric
Ecosystem type 1/ corresponding account A - corresponding account B	Surface area equivalents
Ecosystem type 6/ corresponding account A - corresponding account B	Surface area equivalents
Ecosystem type 7/ corresponding account A - corresponding account B	Surface area equivalents
Ecosystem type 8/ corresponding account A - corresponding account B	Surface area equivalents
Total	**Sum of surface areas equivalents**

Accumulated positive accounts (B) - Total direct impacts	Metrics
Ecosystem type 1 - condition/ integrity-adjusted extent	Surface area equivalents
Ecosystem type 2 - condition/ integrity-adjusted extent	Surface area equivalents
Ecosystem type 3 - condition/ integrity-adjusted extent	Surface area equivalents
Ecosystem type 4 - condition/ integrity-adjusted extent	Surface area equivalents
Total	**Sum of surface areas equivalents**

Taxon 1 - actual population size	*Number of individuals*
Total	**Number of individuals**

Taxon 2 - actual population size	*Number of individuals*
Total	**Number of individuals**

Taxon 3 - actual habitat size	*Surface area*
Total	**Surface area**

Table 12: Cont.

Accumulated positive accounts (B) - Total direct impacts	Metrics
Ecosystem type 1 - condition/ integrity-adjusted extent	Surface area equivalents
Ecosystem type 6 - condition/ integrity-adjusted extent	Surface area equivalents
Ecosystem type 7 - condition/ integrity-adjusted extent	Surface area equivalents
Ecosystem type 8 - condition/ integrity-adjusted extent	Surface area equivalents
Total	**Sum of surface areas equivalents**

Beyond these conventions, there are differences between biodiversity accounting and financial accounting. Here are the key principles underpinning the Biodiversity Accounting Framework of the BD Protocol (Houdet et al., 2020):

- First, while all transactions are expressed in financial values in financial accounting, your company cannot use a single metric to account for losses or gains of any type of biodiversity feature. Different metrics are appropriate for different biodiversity accounts:
  - For impacts on ecosystems:
    - Accounts belonging to the Statement of Ecosystem Position have two types of metrics (Table 12). A accounts are expressed in surface area metrics (e.g. hectares) while B and C accounts are both expressed in surface area equivalents (e.g. hectare equivalents).
    - All accounts (X, Y and Z) belonging to the Statement of Ecosystem Performance are expressed in surface area equivalents (e.g. hectare equivalents) (Table 13).
  - For impacts on material taxa:
    - Accounts belonging to the Statements of Taxon Position and Performance also have different types of metrics, either:
      - For population-based impact assessment approaches: All accounts (A, B, C, X, Y and Z accounts) are expressed in numbers of individuals/pairs (choice depends on the taxon's behaviour; see Section 3.2.4) (Tables 12 and 13, see taxa 1 and 2);
      - For habitat-based impact assessment approaches: All accounts (A, B, C, X, Y and Z accounts) are expressed in surface area metrics (e.g. hectares) (Tables 12 and 13, see taxon 3).
- Second, to develop asset accounts (A accounts), the Biodiversity Accounting Framework recognises that:
  - For impacts on ecosystems: The extent of ecosystem types, irrespective of their condition, constitute asset accounts (A accounts) recorded in a surface area metric (e.g. hectares) (Table 12).
  - For impacts on material taxa, either:
    - For population-based impact assessment approaches: The target population sizes of taxa, irrespective of their corresponding actual population sizes, constitute asset accounts (A accounts) recorded in numbers of individuals/couples (choice depends on the taxon's

behaviour; see Section 3.2.4) (Table 12, see taxa 1 and 2); or
    - For habitat-based impact assessment approaches: The target habitat sizes of taxa, irrespective of their corresponding actual habitat sizes, constitute asset accounts (A accounts) recorded in surface area metric (e.g. hectares) (Table 12, see taxon 3).
- Third, to develop positive impact accounts (B accounts), the Biodiversity Accounting Framework requires that (Table 12):
    - For impacts on ecosystems: The nature of an impact on an ecosystem type (see Section 3.2.3) constitutes the positive impact (B account) of the corresponding ecosystem asset (A account). It is recorded as the actual condition/integrity adjusted extent, in surface area equivalents (e.g. hectare equivalents). In other words, the positive impact (condition-adjusted surface area) (P) = nominal surface area (G) multiplied by current condition score (I), divided by the maximum condition score (J), or P = G x (I/J).
    - For impacts on material taxa, either:
        - For population-based impact assessment approaches: The actual population sizes of taxa constitute positive impact accounts (B accounts), which can be recorded as numbers of individuals/couples (choice depends on each taxon's behaviour; see Section 3.2.4) (Table 12, see taxa 1 and 2); or
        - For habitat-based impact assessment approaches: The actual habitat sizes of taxa constitute positive impact accounts (B accounts), recorded in surface area metric (e.g. hectares) (Table 12, see taxon 3).
- Fourth, to develop negative impact accounts (C accounts), the Biodiversity Accounting Framework requires that:
    - For impacts on ecosystems: Negative impacts (C accounts) constitute the difference between the ecosystem asset (A account) and the associated positive impact (B account) (Table 12). In other words, a negative impact (N) is calculated as the impacted ecosystem extent (G) minus its condition/integrity adjusted extent (i.e. positive impact or P), and is thus expressed in surface area equivalents (e.g. hectare equivalents): N = G – P.
    - For impacts on material taxa, either:
        - For population-based impact assessment approaches: For each taxon, the difference between the target population size (A account) and the actual population size (B account) constitutes its negative impact (C account) (or gap to target population size); which can be recorded as numbers of individuals/pairs (choice depends on the taxon's behaviour; see Section 3.2.4) (Table 12, see taxa 1 and 2); or
        - For habitat-based impact assessment approaches: For each taxon, the difference between the target (potential) habitat size and the actual habitat size constitutes its negative impact (C account) (or gap to target habitat size); which can be recorded in surface area metric (e.g. hectares) (Table 12, see taxon 3).
- Fifth, while each type of ecosystem and taxon requires segregated double entry bookkeeping, the consolidation of accounts differs for impacts on ecosystems and impacts on taxa. Statements of Position and Performance must be kept separate for each taxon and only ecosystem accounts can be aggregated in overall Statements of Ecosystem Position and Performance (Table 11):
    - For impacts on ecosystems: Aggregating the Statements of Position and Performance of all ecosystem types (Table 12) is not only possible (while

adhering to the equivalency principle through distinct ecosystem type accounts; see Section 2.4) but essential to generate the Biodiversity Footprint of your organisation. This headline key performance indicator can be defined as the total surface area of impacted ecosystems within the selected organisational and value chain boundaries of your business. In other words, equal to the sum of A accounts (surface area metric), the Biodiversity Footprint of your business is also equal to the sum of all accumulated positive (B accounts) and negative (C accounts) impacts on ecosystems, which further means that it can be broken down into a Positive Biodiversity Footprint and a Negative Biodiversity Footprint, both expressed in surface area equivalents (e.g. hectares, square kilometres).

- For impacts on taxa: Statements of Position and Performance must be kept separate for each taxon (Table 12) because it makes little sense to add up/subtract the population or habitat sizes of different species. Indeed, to assess the net impact of a business on taxa, you need to ensure that losses and gains are matched for each taxon. For instance, an increase in the population size of a plant species, through restoration measures, cannot offset the decreases in the population size of a mammal species which was caused by your project.

- Sixth, to build the baseline Statement of Biodiversity Position, you need:
  - To record (see example in Table 15):
    - The reference state of ecosystem assets (DR A accounts) as theoretical, maximum potential biodiversity gains (CR Y accounts);
    - The target population or habitat size of taxa (DR A account) as theoretical, maximum potential biodiversity gains (CR Y accounts).
  - To close the associated Statements of Biodiversity Performance by accounting for (see example in Table 15):
    - The net impacts on ecosystem assets (DR X accounts) and the associated accumulated positive impacts (for each ecosystem type) (CR B accounts);
    - The net impacts on taxa assets (DR X accounts) and the associated accumulated positive impacts (for each taxon) (CR B accounts).
- Finally, at the end of each accounting period, Statements of Position and Performance need to be produced for all features of the biodiversity impact inventory of your business (see Section 4.2). For ecosystems, aggregable accounts within one Statement of Ecosystem Position and the associated Statement of Ecosystem Performance are required. For material taxa, you will need to produce distinct Statements of Taxon Position and Performance for each taxon.

Table 13: Example of accounts and metrics (a) for the accounts of aggregated Statements of Performance for direct and indirect impacts on ecosystems, and (b) for the accounts of separated Statements of Performance for direct impacts on taxa; NB: X accounts = Y accounts - Z accounts

Net impact accounts (X) - Direct impacts	Metrics
Ecosystem type 1 - condition/integrity-adjusted net extent	Net surface area Equivalents
Ecosystem type 2 - condition/integrity-adjusted net extent	Net surface area Equivalents
Ecosystem type 3 - condition/integrity-adjusted net extent	Net surface area Equivalents
Ecosystem type 4 - condition/integrity-adjusted net extent	Net surface area Equivalents
Total	**Sum of net surface area equivalents**
Taxon 1 - net population size change	*Net number of individuals*
Total	**Number of individuals**
Taxon 2 - net population size change	*Net number of individuals*
Total	**Number of individuals**
Taxon 3 - net habitat size change	*Net surface area*
Total	**Net surface area**

Table 13: Cont.

Net impact accounts (X) - Indirect impacts	Metrics
Ecosystem type 1 - condition/integrity-adjusted net extent	Net surface area Equivalents
Ecosystem type 6 - condition/integrity-adjusted net extent	Net surface area Equivalents
Ecosystem type 7 - condition/integrity-adjusted net extent	Net surface area Equivalents
Ecosystem type 8 - condition/integrity-adjusted net extent	Net surface area Equivalents
Total	**Sum of net surface area equivalents**

Periodic loss accounts (Y) - Direct impacts	Metrics
Ecosystem type 1 - loss of condition/integrity-adjusted extent	Surface area equivalents lost
Ecosystem type 2 - loss of condition/integrity-adjusted extent	Surface area equivalents lost
Ecosystem type 3 - loss of condition/integrity-adjusted extent	Surface area equivalents lost
Ecosystem type 4 - loss of condition/integrity-adjusted extent	Surface area equivalents lost
Total	**Sum of lost surface areas equivalents**

Taxon 1 - decrease in population size	*Number of individuals lost*
Total	**Number of individuals lost**

Taxon 2 - decrease in population size	*Number of individuals lost*
Total	**Number of individuals lost**

Taxon 3 - decrease in habitat size	*Surface area lost*
Total	**Surface area lost**

Table 13: Cont.

Periodic loss accounts (Y) - Indirect impacts	Metrics
Ecosystem type 1 - loss of condition/integrity-adjusted extent	Surface area equivalents lost
Ecosystem type 6 - loss of condition/integrity-adjusted extent	Surface area equivalents lost
Ecosystem type 7 - loss of condition/integrity-adjusted extent	Surface area equivalents lost
Ecosystem type 8 - loss of condition/integrity-adjusted extent	Surface area equivalents lost
Total	**Sum of lost surface area equivalents**

Periodic gain accounts (Z) - Direct impacts	Metrics
Ecosystem type 1 - gain of condition/integrity-adjusted extent	Surface area equivalents gained
Ecosystem type 2 - gain of condition/integrity-adjusted extent	Surface area equivalents gained
Ecosystem type 3 - gain of condition/integrity-adjusted extent	Surface area equivalents gained
Ecosystem type 4 - gain of condition/integrity-adjusted extent	Surface area equivalents gained
Total	**Sum of gained surface area equivalents**

Taxon 1 - increase in population size	*Number of individuals gained*
Total	**Number of individuals gained**

Taxon 2 - increase in population size	*Number of individuals gained*
Total	**Number of individuals gained**

Taxon 3 - increase in habitat size	*Surface area gained*
Total	**Surface area gained**

Table 13: Cont.

Periodic gain accounts (Z) - Indirect impacts	Metrics
Ecosystem type 1 - gain of condition/integrity-adjusted extent	Surface area equivalents gained
Ecosystem type 6 - gain of condition/integrity-adjusted extent	Surface area equivalents gained
Ecosystem type 7 - gain of condition/integrity-adjusted extent	Surface area equivalents gained
Ecosystem type 8 - gain of condition/integrity-adjusted extent	Surface area equivalents gained
Total	**Sum of gained surface area equivalents**

3.3.4 Accounting for baseline impacts

Now that you know how to measure biodiversity impacts (Section 3.2) and how biodiversity accounts fit together for net impact accounting (Sections 3.3.1, 3.3.2 and 3.3.3), it is time to understand how to start recording biodiversity impacts. Biodiversity accounting starts with the development of opening accounts for A (assets), B (accumulated positive impacts) and C (accumulated negative impacts) accounts (i.e. baseline impacts) (Houdet et al., 2020). To build this initial Statement of Biodiversity Position of your business, you need to select a baseline year for its biodiversity impact inventory. This first Statement of Biodiversity Position presents your company's initial (baseline) biodiversity exposure and/or contribution to society. All successive biodiversity impact assessments shall be undertaken against the baseline amounts recorded in these initial biodiversity accounts, thereby allowing you to track changes in biodiversity across time. Table 14 shows the typical accounting journal entries for building the initial Statement of Position for baseline impacts on ecosystems and taxa (adapted from Houdet et al., 2020).

Table 14: Typical accounting journal entries for the accounting of baseline impacts

	Accounting events	Account	Condition/ integrity score	Debit/ Credit	Unit	Account category	Comment
Impacts on ecosystem	Accounting for the reference state of the baseline ecosystem assets	Ecosystem asset	Maximum score	Debit	Surface area	**A** (Statement of Biodiversity Position)	Mandatory for recording baseline ecosystem assets
		Periodic gains	Maximum score	Credit	Surface area equivalent	**Y** (Statement of Biodiversity Performance)	
	Recording basline ecosystem assets according to their condition score	Ecosystem asset	Any, except maximum score	Debit	Surface area	**A** (Statement of Biodiversity Position)	Mandatory re-adjustment for all baseline ecosystem assets, reflecting their actual condition/ integrity scores
		Ecosystem asset	Maximum score	Credit	Surface Area	**A** (Statement of Biodiversity Position)	
	Recording condition-adjusted losses and gains associated to baseline ecosystem asset condition scores	Periodic losses	Maximum score	Debit	Hectare equivalent	**Z** (Statement of Biodiversity Performance)	Mandatory re-adjustment for baseline ecosystem assets, reflecting actual loss of ecosystem of maximum potential condition (reference state) and the associated accumulated negative impacts and periodic gains
		Accumlated negative impacts	Any, except maximum score	Credit	Hectare equivalent	**C** (Statement of Biodiversity Position)	
		Periodic gains	Any, except maximum score	Credit	Hectare equivalent	**Y** (Statement of Biodiversity Performance)	
Impacts on taxa	Accounting for the target population or habitat sizes of taxa assets	Taxon asset	N/A	Debit	Population size or surface area	**A** (Statement of Biodiversity Position)	Mandatory for recording baseline taxa assets
		Periodic gains	N/A	Credit	Population size or surface area	**Y** (Statement of Biodiversity Performance)	
	Recording initial/ baseline taxa assets according to their actual extent or habitat sizes	Periodic losses	N/A	Debit	Population size or surface area	**Z** (Statement of Biodiversity Performance)	Mandatory re-adjustment for all baseline taxa assets, reflecting their actual population or habitat sizes
		Accumulated negative impacts	N/A	Credit	Population size or surface area	**C** (Statement of Biodiversity Position)	

As soon as there is a change to the inventory boundary (e.g. land asset acquisition or sale), you should carry out baseline biodiversity impact assessments and account for them according to the accounting conventions of the Biodiversity Accounting Framework. Assessing baseline impacts involves measuring biodiversity impacts at the time of the assessment. This means that historical biodiversity gains and losses are accounted for at the beginning of your inventory development (see example in Table 15). Irrespective of whether these past impacts may (e.g. new building constructed at your business' facility on a natural grassland), or may not (e.g. purchase of a pre-existing business), have been caused by your business activities and/or its value chain, the BD Protocol recognises them as part of your impact inventory[53].

Furthermore, land cover and land uses are not recognised by the BD Protocol. This means that existing land cover categories or land uses (e.g. different forms of agriculture, buildings) within the biodiversity impact inventory of your business must be accounted as various, pre-existing (but now degraded or completely transformed) ecosystem types. Through suitable expert and/or stakeholder engagement, identifying and assessing the extent of these ecosystems should be feasible. When pre-existing ecosystems cannot be identified with precision (e.g. specific wetland or grassland type), for instance due to centuries of human use (e.g. old cities), it is important to record at least the relevant biome (see the Global Ecosystem Typology; IUCN 2020) in which the assessed properties lie and provide explanation why you can't be more specific.

For illustrative purposes, let's account for the baseline, direct impacts of the direct operations of business X. It has the following the biodiversity features within its biodiversity impact inventory:

- Ecosystem type 1: 10 ha of natural forests, with a condition score of 3 (maximum of 5[54]; i.e. 6 ha eq.), due to past wood harvesting.
- Ecosystem type 2: 2 ha of completely transformed ecosystems (buildings and gardens; condition score of 0, with 5 as maximum possible score), which were probably natural grasslands more than 100 years ago.
- Taxon 1: A highly threatened plant species with a socially determined target population of 250 reproducing individuals and a current population of 15 reproducing individuals.
- Taxon 2: An owl species, requiring cavities (e.g. in old tree trunks) for nesting, with a socially-determined target habitat size of 9 ha and a current habitat of 0.5 ha (no old tree present in most natural forests; more than 100 years of growth required).

The resulting accounting journal entries are shown in Table 15 and the associated initial Statement of Position is presented in Table 16. It notably shows a total Biodiversity Footprint of 12 ha (surface area of ecosystem assets), with 6 ha eq. of Positive Biodiversity Footprint and 6 ha eq. of Negative Biodiversity Footprint. For taxa, company X has significant work to do to reduce their respective gaps to their target population or habitat size.

53.The BD Protocol does not imply legal responsibility for impacts within your business' inventory, especially for impacts caused by a third party.
54.This simple condition/integrity scoring method, the second one in Table 6, has been selected for illustration purposes.

Table 15: Accounting journal entries for the baseline, direct impacts on ecosystems and taxa of Company X (direct operations)

Journal entries	Accounting events	Account type and unit	Account category in Statement of Position or Performance	Accounts details	DR	CR
1	Accounting for reference state of ecosystem assets, which underpins their subsequent condition scoring	Ecosystem asset (Ha)	**A** (Statement of Ecosystem Position)	Ecosystem type 1- Natural forest (5/5)	10,00	
1		Ecosystem asset (Ha)	**A** (Statement of Ecosystem Position)	Ecosystem type 2- Natural grassland (5/5)	2,00	
1		Periodic gains (Ha.eq)	**Y** (Statement of Ecosystem Performance)	Ecosystem type 1- Natural forest (5/5)		10,00
1		Periodic gains (Ha.eq)	**Y** (Statement of Ecosystem Performance)	Ecosystem type 2- Natural grassland (5/5)		2,00
2	Accounting for target population or habitat sizes of taxa	Taxon asset (Number of reproducing individuals)	**A** (Statement of Taxon Position)	Taxon 1- Plant species	250,0	
2		Taxon asset (Habitat in Ha)	**A** (Statement of Taxon Position)	Taxon 2- Owl species	9,00	
2		Periodic gains (Number of reproducing individuals)	**Y** (Statement of Taxon Performance)	Taxon 1- Plant species		250,0
2		Periodic gains (Habitat in Ha)	**Y** (Statement of Taxon Performance)	Taxon 2- Owl species		9,00
3	Recording ecosystem assets according to their actual condition scores	Ecosystem asset (Ha)	**A** (Statement of Ecosystem Position)	Ecosystem type 1- Natural forest (3/5)	10,00	
3		Ecosystem asset (Ha)	**A** (Statement of Ecosystem Position)	Ecosystem type 2- Natural grassland (0/5)	2,00	
3		Ecosystem asset (Ha)	**A** (Statement of Ecosystem Position)	Ecosystem type 1- Natural forest (5/5)		10,00
3		Ecosystem asset (Ha)	**A** (Statement of Ecosystem Position)	Ecosystem type 2- Natural grassland (5/5)		2,00
4	Recording baseline population or habitat sizes of taxa	Periodic losses (Number of reproducing individuals)	**Z** (Statement of Taxon Performance)	Taxon 1- Plant species	235,0	
4		Periodic losses (Habitat in Ha)	**Z** (Statement of Taxon Performance)	Taxon 2- Owl species	8,50	
4		Accumulated negative impacts (Gap to target in number of reproducing individuals)	**C** (Statement of Taxon Position)	Taxon 1- Plant species		235,0
4		Accumulated negative impacts (Gap to target in surface area - Ha)	**C** (Statement of Taxon Position)	Taxon 2- Owl species		8,50
5	Recording condition-adjusted losses and gains associated to baseline ecosystem asset condition scores	Periodic losses (ha.eq)	**Z** (Statement of Ecosystem Performance)	Ecosystem type 1- Natural forest (5/5)	10,00	
5		Periodic losses (ha.eq)	**Z** (Statement of Ecosystem Performance)	Ecosystem type 2- Natural grassland (5/5)	2,00	
5		Accumulated negative impacts (Ha.eq)	**C** (Statement of Ecosystem Position)	Ecosystem type 1- Natural forest (3/5)		4,00
5		Accumulated negative impacts (Ha.eq)	**C** (Statement of Ecosystem Position)	Ecosystem type 2- Natural grassland (0/5)		2,00
5		Periodic gains (Ha.eq)	**Y** (Statement of Ecosystem Performance)	Ecosystem type 1- Natural forest (3/5)		6,00
6	Closing the statement of Ecosystem Performance to build the baseline Statement of Ecosystem Position	Net impacts (Ha.eq)	**X** (Statement of Ecosystem Performance)	Net surface area adjusted for condition	6,00	
6		Accumulated positive impacts (Ha.eq)	**B** (Statement of Taxon Position)	Ecosystem type 1- Natural forest (3/5)		6,00
7	Closing the Statement of Taxon 1 Performance to build the baseline Statement of Taxa 1 Position	Net impact (Number of reproducing individuals)	**X** (Statement of Taxon Performance)	Net population size	15,00	
7		Accumulated positive impacts (Number of reproducing individuals)	**B** (Statement of Taxon Position)	Taxon 1- Plant species		15,00
8	Closing the Statement of Taxon 2 Performance to build the baseline Statement of Taxa 2 Position	Net impact (Ha.eq)	**X** (Statement of Taxon Performance)	Net habitat size	0,50	
8		Accumulated positive impacts (Surface area of habitat)	**B** (Statement of Taxon Position)	Taxon 2- Owl spcies		0,50

Table 16: Statements of Position for the baseline, direct impacts on ecosystems and taxa of Company X (direct operations)

	Ecosystem assets (Ha) (A accounts)	Accumulated positive impacts (Ha eq.) (B accounts)	Accumulated negative impacts (Ha eq.) (C accounts)
Ecosystem type 1 - Natural forest (3/5)	10,00	6,00	4,00
Ecosystem type 2 - Natural grassland (0/5)	2,00	0,00	2,00
Total	12,00	6,00	6,00
	Taxon asset (Number of reproducing individuals) (A account: Target population size)	**Accumulated positive impacts (Number of reproducing individuals) (B accounts: Actual population size)**	**Accumulated negative impacts (Number of reproducing individuals) (C accounts: Gap to target population size)**
Taxon 1 - Plant species	250,00	15,00	235,00
	Taxon asset (Ha) (A account: Target habitat size)	**Accumulated positive impacts (Ha) (B accounts: Actual habitat size)**	**Accumulated negative impacts (Ha) (C accounts: Gap to target habitat size)**
Taxon 2 - Owl species	9,00	0,50	8,50

3.3.5 Accounting for gains and losses

Since you now understand how to develop the initial Statement of Biodiversity Position of your business (Section 3.3.4), it is time to start accounting for changes (i.e. gains and losses) in the state of biodiversity. Changes in biodiversity features correspond to ecosystem or taxa gains or losses and may occur for a variety of reasons, including changes in the organisational (e.g. purchase or sale of subsidiary) and value chain (e.g. new supplier) boundaries, changes in business activities, or any mitigation measure put in place. Recording these biodiversity gains or losses involves double entry accounting, that is recording impact data into (at least) two accounts to ensure the overall equilibrium of the corresponding biodiversity accounting equation (Houdet et al., 2020).

Accounting for gains

While some biodiversity impacts are permanent or irreversible (e.g. destruction of last remaining habitat of an endemic taxon), there are many opportunities to generate positive biodiversity change. Setting biodiversity targets for your business, in line with the mitigation hierarchy (see Section 3.1) and stakeholder expectations (e.g. national and international targets such as the forthcoming post-2020 Global Biodiversity Framework of the CBD), is a critical first step to generate positive impacts.

Accounting for biodiversity gains may be necessary for:

- Positive impacts on ecosystems, which implies to record either:
  - Increases in the condition/integrity of ecosystems already recorded within the biodiversity impact inventory of your business (e.g. due to impact minimisation or restoration measures[55]) (Tables 17 and 18), or;
  - New ecosystem assets, with condition/integrity score superior to zero or the minimal possible score, which must be included in the biodiversity impact inventory of your company due to changes in its organisational (e.g. merger, purchase of a new business, purchase of new property for the purpose of securing specific offset measures) and value chain (e.g. new supplier) boundaries (NB: the same accounting journal entries as the ones used for baseline impacts should be used in this scenario– see Tables 14 and 15).
- Positive impacts on taxa, which implies to record either:
  - Increases in the population or habitat size of taxa already recorded within the biodiversity impact inventory of your business (Tables 17 and 18), for instance due to habitat restoration measures or to changes in land use leading to habitat expansion[56], or;
  - New taxa assets, with available habitats or reproductive individuals, which must be included in the biodiversity impact inventory of your company due to changes in its organisational (e.g. merger, purchase of a new business, purchase of new property for the purpose of securing specific offset measures) and value chain (e.g. new supplier) boundaries (NB: the same accounting journal entries as the ones used for baseline impacts should be used in this scenario – see Tables 14 and 15).

55.For instance, your business may implement specific pro-biodiversity management measures in the life cycle of forest biomass harvesting (Gaudreault et al., 2016).
56.For instance, forest conversion into pastures or dam building may increase the surface area of habitats available to certain species already included in your inventory (i.e. the ones which were assessed to be material to your business and its stakeholders). In the case of the dam, the population size of some bird species may be positively affected. In that of newly created pastures, the populations of grassland specialists would likely increase.

Table 17: Typical accounting journal entries for ecosystem and taxa gains

Accounting events	Account	Condition/ integrity	Debit/ credit	Unit	Account category	Comment
Accounting for increase in ecosystem condition/ integrity (gains)	Ecosystem asset	Superior to the one for the asset account credited below	Debit	Surface area	**A** (Statement of Biodiversity Position)	Required to record positive changes in the condition/ integrity of ecosystem assets of the same type, since similar ecosystem assets are segregated according to their condition scores
	Ecosystem asset	Inferior to the one for the asset account debited above	Credit	Surface area	**A** (Statement of Biodiversity Position)	
	Accumulated negative impacts	Same as the one for the asset account credited above	Debit	Surface area equivalent	**C** (Statement of Biodiversity Position)	
	Accumulated negative impacts	Same as the one for the asset account debited above	Credit	Surface area equivalent	**C** (Statement of Biodiversity Position)	
	Periodic gains	Same as the one for the asset account debited above	Credit	Surface area equivalent	**Y** (Statement of Biodiversity Position)	
Accounting for increases in population or habitat size of taxa (gains)	Accumulated negative impacts	N/A	Debit	Number of reproducing individuals or surface area	**C** (Statement of Biodiversity Position)	Required to record positive changes in the population or habitat sizes of taxa
	Periodic gains	N/A	Credit	Number of reproducing individuals or surface area	**Y** (Statement of Biodiversity Position)	

For illustrative purposes, let's account for the biodiversity gains of the direct operations of business X. The biodiversity features within its biodiversity impact inventory have improved as follows:

- Ecosystem type 1: 10 ha of natural forests, with a new condition score of 4 (i.e. 8 ha eq.), due to habitat restoration measures.
- Ecosystem type 2: 0.5 ha of partially restored natural grasslands after restoration measures (new condition score of 2: i.e. 0.2 ha eq.).
- Taxon 1: Highly threatened plant species has now 50 reproducing individuals (increase of 35 in population size).
- Taxon 2: Increase of 2.5 ha in habitat size of owl species after restoration measures (e.g. artificial nest boxes).

The resulting accounting journal entries are shown in Table 18 and the associated Statement of Position is presented in Table 19. Although the total Biodiversity Footprint of company X has not changed (12 ha of ecosystem assets), its Positive Biodiversity Footprint has increased to 8.20 ha eq., hence reducing by 2.20 ha eq. its Negative Biodiversity Footprint. In addition, taxon 1 has experienced a significant increase in its actual population size while taxon 2 has now more habitat available, both changes leading to a reduction in the gaps to their respective target population or habitat size.

Table 18: Accounting journal entries for the ecosystem and taxa gains of Company X (direct operations)

Journal entries	Accounting events	Account type and unit	Account category in Statement of Position or Performance	Accounts details	DR	CR
9	Recording condition-adjusted gains for ecosystem type 1	Ecosystem asset (Ha)	**A** (Statement of Ecosystem Position)	Ecosystem type 1- Natural forest (4/5)	10,00	
9		Ecosystem asset (Ha)	**A** (Statement of Ecosystem Position)	Ecosystem type 1- Natural forest (3/5)		10,00
9		Accumulated negative impacts (ha.eq)	**C** (Statement of Ecosystem Position)	Ecosystem type 1- Natural forest (3/5)	4,00	
9		Accumulated negative impacts (ha.eq)	**C** (Statement of Ecosystem Position)	Ecosystem type 1- Natural forest (4/5)		2,00
9		Periodic gains (Ha.eq)	**Y** (Statement of Biodiversity Performance)	Ecosystem type 1- Natural forest (4/5)		2,00
10	Recording condition-adjusted gains for ecosystem type 2	Ecosystem asset (Ha)	**A** (Statement of Ecosystem Position)	Ecosystem type 2- Natural grassland (2/5)	0,50	
10		Ecosystem asset (Ha)	**A** (Statement of Ecosystem Position)	Ecosystem type 2- Natural grassland (0/5)		0,50
10		Accumulated negative impacts (ha.eq)	**C** (Statement of Ecosystem Position)	Ecosystem type 2- Natural grassland (0/5)	0,50	
10		Accumulated negative impacts (ha.eq)	**C** (Statement of Ecosystem Position)	Ecosystem type 2- Natural grassland (2/5)		0,30
10		Periodic gains (Ha.eq)	**Y** (Statement of Ecosystem Performance)	Ecosystem type 2- Natural grassland (2/5)		0,20
11	Recording increase in the population size of taxon 1	Accumulated negative impacts (Gap to target in number of reproducing individuals)	**C** (Statement of Biodiversity Position)	Taxon 1- Plant species	35,00	
11		Periodic gains (Number of reproducing individuals)	**Y** (Statement of Biodiversity Performance)	Taxon 1- Plant species		35,00
12	Recording increase in habitat size of taxon 2	Accumulated negative impacts (Reduction of gap to target habitat size; Ha)	**C** (Statement of Biodiversity Position)	Taxon 2- Owl species	2,50	
12		Periodic gains(Surface area in Ha)	**Y** (Statement of Biodiversity Performance)	Taxon 2- Owl species		2,50
13	Closing the Statement of Ecosystem Performance to build the baseline Statement of Ecosystem Position	Net impacts (Ha.eq)	**X** (Statement of Ecosystem Position)	Net surface areas adjusted for condition	2,20	
13		Accumulated positive impacts (Ha.eq)	**B** (Statement of Ecosystem Position)	Ecosystem type 1- Natural forest (3/5)		2,20
13		Accumulated positive impacts (Ha.eq)	**B** (Statement of Ecosystem Position)	Ecosystem type 2- Natural grassland (2/5)		0,20
14	Closing the Statement of Taxon 1 Performance to build an updated Statement of Taxa 1 Position	Net impact (Number of reproducing individuals)	**X** (Statement of Taxon Position)	Net population size	35,00	
14		Accumulated positive impacts (Number of reproducing individuals)	**B** (Statement of Taxon Position)	Taxon 1- Plant species		35,00
15	Closing the Statement of Taxon 1 Performance to build an updated Statement of Taxa 2 Position	Net impact (Ha.eq)	**X** (Statement of Taxon Position)	Net habitat size	2,50	
15		Accumulated positive impacts (Surface area of habitat)	**B** (Statement of Taxon Position)	Taxon 2- Owl species		2,50

Table 19: Updated Statements of Position for the ecosystem and taxa gains of Company X (direct operations)

	Ecosystem assets (Ha) (A accounts)	Accumulated positive impacts (Ha eq.) (B accounts)	Accumulated negative impacts (Ha eq.) (C accounts)
Ecosystem type 1 - Natural forest (4/5)	10,00	8,00	2,00
Ecosystem type 2 - Natural grassland (2/5)	0.50	0,20	0,30
Ecosystem type 2 - Natural grassland (0/5)	1,50	0,00	1,50
Total	12,00	8,20	3,80
	Taxon asset (Number of reproducing individuals) (A account: Target population size)	**Accumulated positive impacts (Number of reproducing individuals) (B accounts: Actual population size)**	**Accumulated negative impacts (Number of reproducing individuals) (C accounts: Gap to target population size)**
Taxon 1 - Plant species	250,00	50,00	200,00
	Taxon asset (Ha) (A account: Target habitat size)	**Accumulated positive impacts (Ha) (B accounts: Actual habitat size)**	**Accumulated negative impacts (Ha) (C accounts: Gap to target habitat size)**
Taxon 2 - Owl species	9,00	3,00	6,00

Moreover, while impact avoidance measures constitute the single most important set of activities within the mitigation hierarchy (i.e. they help you avoid negative impacts on biodiversity), they do lead to immediate changes in biodiversity so that no accounting journal entry is required. For the same reason, reduction measures do not lead to accounting journal entries[57]. However, for rehabilitation/restoration and offset measures (see examples in Tables 18 and 22), you should make sure that you only:

- Account for positive changes that have occurred;
- Account for positive changes that are reasonably likely to occur (e.g. learning from prior, similar experience[58]), all uncertainties considered and/or;
- After acquiring suitable evidence that they will materialise.

Accounting for losses

Accounting for biodiversity losses may be necessary for the following reasons:

- For negative impacts on ecosystems, which implies to record either:
  - Decreases in the condition/integrity of ecosystems already recorded within the biodiversity impact inventory of your business (e.g. increased resource use or extraction) (Tables 20 and 21), and;
  - New ecosystem assets, with condition/integrity score less than the maximum possible score (i.e. recording the gap to the reference state as the negative impact), which must be included in the biodiversity impact inventory of your company due to changes in its organisational (e.g. merger, purchase of a new business, purchase of new property for the purpose of securing specific offset measures) and value chain (e.g. new supplier) boundaries (NB use the same accounting journal entries as the ones for baseline impacts apply in this scenario – see Tables 14 and 15).
- For negative impacts on taxa, the need to record:
  - Decreases in the population or habitat size of taxa already recorded within the biodiversity impact inventory of your business (Tables 20 and 21), for instance due to changes in business activities leading to habitat loss;
  - New taxa assets, with available habitats or reproductive individuals which are less than their target habitat or population sizes, and therefore must be included in the biodiversity impact inventory of your company due to changes in its organisational (e.g. merger, purchase of a new business, purchase of new property for the purpose of securing specific offset measures) and value chain (e.g. new supplier) boundaries (NB the same accounting journal entries as the ones for baseline impacts apply in this scenario – see Tables 14 and 15).

57.However, impact avoidance, minimisation and reduction measures should be modelled to compare impact scenarios and select the most suitable solution for your business and its stakeholders.
58.For instance, when the same restoration measures have been applied to all surface areas of the same ecosystem type within a property, and condition improvements were confirmed, through appropriate sampling techniques, on a portion of these areas, it would be appropriate to record improvements in condition score for all these areas.

The BD Protocol further recommends that you only account for:

- Negative changes that have occurred;
- Negative changes that are reasonably likely to occur, all uncertainties considered and/or after acquiring suitable evidence that they will materialise (e.g. validated and fully financed facility expansion plan which will lead to habitat clearance).

For illustrative purposes, let's explore a scenario different from the previous one and account for the biodiversity losses of the direct operations of company X (i.e. no gain after baseline impacts accounted for in Section 3.3.4). The biodiversity features within its biodiversity impact inventory may have experienced negative changes as follows:

- Ecosystem type 1: 10 ha of natural forests, with a new condition score of 2 (i.e. 4 ha eq.), due to further wood extraction;
- Ecosystem type 2: No change (already fully transformed);
- Taxon 1: Highly threatened plant species has now no reproducing individual left (decrease of 15 in population size). Plants were destroyed were destroyed during the use of heavy machinery to extract wood;
- Taxon 2: Decrease of 0.5 ha in habitat size of owl species after further wood extraction.

The resulting accounting journal entries are shown in Table 20, and the associated Statement of Position is presented in Table 21. Although the total Biodiversity Footprint of company X has still not changed (12 ha of ecosystem assets), its Negative Biodiversity Footprint has increased to 8.00 ha eq., hence reducing by 2.00 ha eq. its Positive Biodiversity Footprint. In addition, company X has completely lost the two material taxa of its biodiversity impact inventory.

Table 20: Accounting journal entries for the ecosystem and taxa losses of Company X (direct operations)

Journal entries	Accounting events	Account type and unit	Account category in Statement of Position or Performance	Accounts details	DR	CR
16	Recording condition-adjusted losses for ecosystem type 1	Ecosystem asset (Ha)	**A** (Statement of Ecosystem Position)	Ecosystem type 1- Natural forest (2/5)	10,00	
16		Ecosystem asset (Ha)	**A** (Statement of Ecosystem Position)	Ecosystem type 1- Natural forest (3/5)		10,00
16		Accumulated negative impacts (Ha.eq)	**C** (Statement of Ecosystem Position)	Ecosystem type 1- Natural forest (3/5)	4,00	
16		Accumulated negative impacts (Ha.eq)	**C** (Statement of Ecosystem Position)	Ecosystem type 1- Natural forest (2/5)		6,00
16		Periodic losses (Ha.eq)	**Z** (Statement of Biodiversity Performance)	Ecosystem type 1- Natural forest (4/5)	2,00	
17	Recording decrease in the population seize of taxon 1	Periodic losses (Number of reproducing individuals)	**Z** (Statement of Biodiversity Position)	Taxon 1- Plant species	15,00	
17		Accumulated negative impacts (Increase in gap to target number of reproducing individuals)	**C** (Statement of Biodiversity Position)	Taxon 1- Plant species		15,00
18	Recording decrease in the habitat size of taxon 2	Periodic losses (Surface area in Ha)	**Z** (Statement of Biodiversity Position)	Taxon 2- Owl species	0,50	
18		Accumulated negative impacts (Increase in gap to target habitat size; Ha)	**C** (Statement of Biodiversity Position)	Taxon 2- Owl species		0,50
19	Closing the Statement of Ecosystem Performance to build the baseline Statement of Ecosystem Position	Accumulated positive impacts (Ha.eq)	**B** (Statement of Ecosystem Position)	Ecosystem type 1- Natural forest (3/5)	2,00	
19		Net impacts (Ha.eq)	**X** (Statement of Ecosystem Performance)	Net surface areas adjusted for condition		2,00
20	Closing the Statement of Taxon 1 Performance to build an updated Statement of Taxa 1 Position	Accumulated positive impacts (Number of reproducing individuals)	**B** (Statement of Taxon Position)	Taxon 1- Plant species	15,00	
20		Net impact (Number of reproducing individuals)	**X** (Statement of Taxon Performance)	Net population size		15,00
21	Closing the Statement of Taxon 2 Performance to build an updated Statement of Taxa 2 Position	Accumulated positive impacts (Surface area of habitat)	**B** (Statement of Taxon Position)	Taxon 2- Owl species	0,50	
21		Net impacts (Ha.eq)	**X** (Statement of Taxon Performance)	Net habitat size		0,50

Table 21: Updated Statements of Position for the ecosystem and taxa gains of Company X (direct operations)

	Ecosystem assets (Ha) (A accounts)	Accumulated positive impacts (Ha eq.) (B accounts)	Accumulated negative impacts (Ha eq.) (C accounts)
Ecosystem type 1 - Natural forest (2/5)	10,00	4,00	6,00
Ecosystem type 2 - Natural grassland (0/5)	2,00	0,00	2,00
Total	12,00	4,00	8,00
	Taxon asset (Number of reproducing individuals) (A account: Target population size)	**Accumulated positive impacts (Number of reproducing individuals) (B accounts: Actual population size)**	**Accumulated negative impacts (Number of reproducing individuals) (C accounts: Gap to target population size)**
Taxon 1 - Plant species	250,00	0,00	250,00
	Taxon asset (Ha) (A account: Target habitat size)	**Accumulated positive impacts (Ha) (B accounts: Actual habitat size)**	**Accumulated negative impacts (Ha) (C accounts: Gap to target habitat size)**
Taxon 2 - Owl species	9,00	0,00	9,00

Accounting for future impacts: The case of offset measures

Restoration measures require reassessing the condition/integrity of ecosystems or the habitat/population sizes of taxa and, hence, may lead to accounting journal entries for biodiversity gains when they are effective. Conversely, offset measures (see Section 3.1) may expand the biodiversity impact inventory of your business and call for baseline impact assessments. Here are scenarios where offset areas should be included in the biodiversity impact inventory of your business:

- Your business is directly responsible for the implementation and management of offset measures, so that new properties need to be purchased or leased: Accounting for the biodiversity features of offset areas is required.
- Offset areas are financed by your business, but their ownership/control and management are relinquished to a third party:
    - Biodiversity impact inventory limited to direct operations: No accounting for the biodiversity features of offset areas is required, which would be a missed opportunity for improving the overall biodiversity impacts of your business (i.e. offset areas are expected to have a greater share of positive impacts associated to their biodiversity features);
    - Biodiversity impact inventory includes the upstream value chain boundary (i.e. suppliers): You should account for the biodiversity features of the offset areas, managed by a third party, that your company has paid for.

When trying to account for, and adhere to, a company's no-net-loss policy targets, you should consider offset sizing requirements which would vary according to rules set out by the relevant authorities. There may be differences between mandated offset targets and those that have been achieved at the time of reporting or disclosure (see example in Table 20). These rules typically include (e.g. BBOP 2012; Laitila et al., 2014; Moilanen et al., 2009; Pilgrim & Esktrom, 2014):

- Additionality requirements, that confirm offset measures are additional to existing conservation activities (e.g. creation of a new protected area), so that biodiversity gains are higher than those in the expected business-as-usual scenario;
- Permanence requirements, that confirm that offset measures are viable or effective in the long term, so that offsetting gains must last at least as long as the impacts are expected to persist;
- Offset ratios or multipliers (i.e. the ratio of the biodiversity amount offset, and the biodiversity amount damaged), which are grounded in the precautionary principle and serve to increase the basic size of an offset, thereby helping to account for concerns that the planned offset may not be sufficient to deliver a no-net-loss outcome[59].

59.Sources of uncertainty may include uncertainties in the functioning of ecosystem itself (e.g. capacity for offset receiving ecosystems to reach the required gains), uncertainties in offset implementation (e.g. convincing all relevant stakeholders involved), and time-delays associated with offset delivery.

For illustrative purposes, let's account for the expected offset measures of a project contemplated by company X (i.e. accounting for the future biodiversity impacts of a development scenario):

- The biodiversity features which would be lost after land purchase and development and would require mandatory offsets are as follows:
  - Loss: 1 ha of wetlands of condition 3 (maximum score of 5: i.e. 0.6 ha eq.);
  - Loss of 1 ha of habitat for a small threatened mammal species.
- The offset requirements are as follows:
  - Wetlands: Offset ratio of 3:1 ha eq., which implies that company X needs to secure three times the surface area equivalents of lost wetlands;
  - Habitat of mammal species: Offset ratio of 2:1 ha., which means that company X needs to secure two times the surface area of lost habitat.
- The identified offset property (5 ha), to be purchased by company X, has currently the following biodiversity attributes:
  - 5 ha of wetlands of condition 3, with planned restoration measures expected to deliver improved condition rating (4) within the next two years;
  - 2 ha of for a small threatened mammal species, with planned restoration measures expected to deliver an additional 3 ha of habitats within the next two years.

Accordingly, the resulting accounting journal entries are shown in Table 22. In this scenario, the offset measures are expected to generate significant positive biodiversity impacts in 2 years: i.e. 6,66 ha eq. of wetlands secured for 1 ha eq. lost and 5 ha of mammal habitat secured for 1 ha lost (see Table 23). However, it is important to remember that both the negative impacts of the project development and those of the biodiversity features of the offset property must be included in the Statements of Biodiversity Position for future impacts[60] (Table 24). This means that, although offset measures have exceeded offset requirements (i.e. net positive impacts from a project perspective on specific biodiversity features), from the perspective of the Biodiversity Accounting Framework, the biodiversity impact inventory of company X cannot be argued to be net positive. In fact, one third of its Biodiversity Footprint is negative while the other two thirds are positive.

60.NB: Future impacts need to be segregated from direct and indirect impacts – see Section 3.3.2.

Table 22: Accounting journal entries for the expected, future ecosystem and taxa impacts of the contemplated project development of Company X (direct operations)

	Journal entries	Accounting events	Account type and unit	Account category in Statement of Position or Performance	Accounts details	DR	CR
Prior to new project development (at time of land purchase)	**22**	Accounting for reference state of ecosystem assets of new project development, which underpins their subsequent condition scoring	Ecosystem asset (Ha)	**A** (Statement of Ecosystem Position)	Ecosystem type 3- Wetland (5/5)	1,00	
	22		Periodic gains (Ha.eq)	**Y** (Statement of Biodiversity Performance)	Ecosystem type 3- Wetland (5/5)		1,00
	23	Accounting for target habitat size of taxon related to the new project development (in this case, the target and expected habitat size are the same)	Taxon asset (Habitat in Ha)	**A** (Statement of Taxon Position)	Taxon 3- Mammal species	1,00	
	23		Periodic gains (Habitat in Ha)	**Y** (Statement of Taxon Performance)	Taxon 3- Mammal species		1,00
	24	Recording ecosystem assets according to their expected condition scores	Ecosystem asset (Ha)	**A** (Statement of Ecosystem Position)	Ecosystem type 3- Wetland (3/5)	1,00	
	24		Ecosystem asset (Ha)	**A** (Statement of Ecosystem Position)	Ecosystem type 3- Wetland (5/5)		1,00
	25	Recording condition-adjusted losses and gains associated to expected baseline ecosystem asset condition scores	Periodic losses (Ha.eq)	**Z** (Statement of Taxon Performance)	Ecosystem type 3- Wetland (5/5)	1,00	
	25		Accumulated negative impacts (Ha.eq)	**C** (Statement of Taxon Position)	Ecosystem type 3- Wetland (3/5)		0,40
	25		Periodic gains (Ha.eq)	**Y** (Statement of Taxon Performance)	Ecosystem type 3- Wetland (3/5)		0,60
After project development	**26**	Recording expected condition-adjusted losses for ecosystem type 3	Ecosystem asset (Ha)	**A** (Statement of Ecosystem Position)	Ecosystem type 3- Wetland (0/5)	1,00	
	26		Ecosystem asset (Ha)	**A** (Statement of Ecosystem Position)	Ecosystem type 3- Wetland (3/5)		1,00
	26		Accumulated negative impacts (Ha.eq)	**C** (Statement of Ecosystem Position)	Ecosystem type 3- Wetland (3/5)	0,40	
	26		Accumulated negative impacts (Ha.eq)	**C** (Statement of Ecosystem Position)	Ecosystem type 3- Wetland (0/5)		1,00
	26		Periodic losses (Ha.eq)	**Z** (Statement of Biodiversity Performance)	Ecosystem type 3- Wetland (3/5)	0,60	
	27	Recording expected decrease in the habitat size of taxon 3	Periodic losses (Habitat in surface area- Ha)	**Z** (Statement of Biodiversity Performance)	Taxon 3- Mammal species	1,00	
	27		Accumulated negative impacts (Increase in gap to target habitat size- Ha)	**C** (Statement of Biodiversity Position)	Taxon 3- Mammal species		1,00

Table 22: Cont

	Journal entries	Accounting events	Account type and unit	Account category in Statement of Position or Performance	Accounts details	DR	CR
Purchase of offset area	**28**	Accounting for reference state of ecosystem assets of offset area, which underpins their subsequent condition scoring	Ecosystem asset (Ha)	**A** (Statement of Ecosystem Position)	Ecosystem type 3- Wetland (5/5)	5,00	
	28		Periodic gains (Ha.eq)	**Y** (Statement of Biodiversity Performance)	Ecosystem type 3- Wetland (5/5)		5,00
	29	Accounting for target habitat size of taxon related to the offset area (in this case, the target habitat size is the surface area of the whole property)	Taxon asset (Habitat in Ha)	**A** (Statement of Taxon Position)	Taxon 3- Mammal species	5,00	
	29		Periodic gains (Habitat in Ha)	**Y** (Statement of Taxon Performance)	Taxon 3- Mammal species		5,00
	30	Recording ecosystem assets according to their expected condition scores	Ecosystem asset (Ha)	**A** (Statement of Ecosystem Position)	Ecosystem type 3- Wetland (3/5)	5,00	
	30		Ecosystem asset (Ha)	**A** (Statement of Ecosystem Position)	Ecosystem type 3- Wetland (5/5)		5,00
	31	Recording expected baseline habitat size of taxon	Periodic losses (Habitat in Ha)	**Z** (Statement of Taxon Performance)	Taxon 3- Mammal species	3,00	
	31		Accumulated negative impacts (Gap to target in surface area- Ha)	**C** (Statement of Taxon Position)	Taxon 3- Mammal species		3,00
	32	Recording condition-adjusted losses and gains associated to expected baseline ecosystem asset condition scores	Periodic losses (Ha.eq)	**Z** (Statement of Taxon Performance)	Ecosystem type 3- Wetland (5/5)	5,00	
	32		Accumulated negative impacts (Ha.eq)	**C** (Statement of Taxon Position)	Ecosystem type 3- Wetland (3/5)		2,00
	32		Periodic gains (Ha.eq)	**Y** (Statement of Taxon Performance)	Ecosystem type 3- Wetland (3/5)		3,00
After planned restoration measures within offset are (in 2 years)	**33**	Recording expected condition-adjusted gains for ecosystem type 3	Ecosystem asset (Ha)	**A** (Statement of Ecosystem Position)	Ecosystem type 3- Wetland (4/5)	5,00	
	33		Ecosystem asset (Ha)	**A** (Statement of Ecosystem Position)	Ecosystem type 3- Wetland (3/5)		5,00
	33		Accumulated negative impacts (Ha.eq)	**C** (Statement of Ecosystem Position)	Ecosystem type 3- Wetland (3/5)	2,00	
	33		Accumulated negative impacts (Ha.eq)	**C** (Statement of Ecosystem Position)	Ecosystem type 3- Wetland (4/5)		2,00
	33		Periodic gains (Ha.eq)	**Y** (Statement of Ecosystem Performance)	Ecosystem type 3- Wetland (4/5)		1,00
	34	Recording expected increase in the habitat size of taxon 3	Accumulated negative impacts (reduction of gap to target habitat size)	**C** (Statement of Biodiversity Position)	Taxon 3- Mammal species	3,00	
	34		Periodic gains (Surface area in Ha)	**Y** (Statement of Biodiversity Performance)	Taxon 3- Mammal species		3,00
Expected net impact of development project	**35**	Closing the Statement of Ecosystem Performance to build the Statement of Ecosystem Position	Net impacts (Ha.eq)	**X** (Statement of Ecosystem Performance)	Net surface areas adjusted for condition	4,00	
	35		Accumulated positive impacts (Ha.eq)	**B** (Statement of Ecosystem Position)	Ecosystem type 3- Wetland (4/5)		4,00
	36	Closing the Statement of Taxon 3 Performance to build the Statement of Taxa 3 Position	Net impact (Ha)	**X** (Statement of Taxon Performance)	Net habitat size	5,00	
	36		Accumulated positive impacts (Surface area of habitat)	**B** (Statement of Taxon Position)	Taxon 3- Mammal species		5,00

Table 23: The expected residual impacts, offset measures and net (project – offset) impacts of the contemplated project development of Company X

	Ecosystem type 3 - Wetland	Taxon 3 - Mammal species
Unit	Ha.eq	Ha
Expected residual impacts of development	0,6	1
Mandated offset ratio	3 units secured for 1 unit lost	2 units secured for 1 unit lost
Size of required offset measure	1,8	2
Expected offset measure (at purchase)	3	2
Expected net (project-offset) impact (at purchase)	2,4	1
Expected offset ratio achieved (at purchase)	5 units secured for 1 unit lost	2 units secured for 1 unit lost
Expected offset measures (in 2 years)	4	5
Expected net (project-offset) impact (in 2 years)	3,4	4
Expected offset ratio achieved (in 2 years)	6,66 units secured for 1 unit lost	5 units secured for 1 unit lost

Table 24: Statements of Position for the expected, future ecosystem and taxa impacts of the contemplated project development of Company X (direct operations; NB: offset area owned by the company)

	Ecosystem assets (Ha) (A accounts)	Accumulated positive impacts (Ha eq.) (B accounts)	Accumulated negative impacts (Ha eq.) (C accounts)
Ecosystem type 3 - Wetland (4/5)	5,00	4,00	1,00
Ecosystem type 3 - Wetland (0/5)	1,00	0,00	1,00
Total	6,00	4,00	2,00
	Taxon asset (Number of reproducing individuals) (A account: Target population size)	**Accumulated positive impacts (Number of reproducing individuals) (B accounts: Actual population size)**	**Accumulated negative impacts (Number of reproducing individuals) (C accounts: Gap to target population size)**
Taxon 3 - Mammal species	6,00	5,00	1,00

What triggers re-assessment of impacts?

Re-assessing impacts measured in previous accounting periods, including baseline assessments, is warranted in three main situations:

- Organisational changes in inventory boundary;
- Changes in impact assessment methods, and;
- Ecosystem type conversion and changes in the spatial distribution of taxa.

Organisational changes, the primary trigger, warrant modifications of your business' inventory because they involve the transfer of biodiversity impacts from one company to another (e.g. sale of property, purchase of business). You should not account for another business' biodiversity exposure and contribution to society.

The second trigger, changes in impact assessment methods (e.g. newer technology), may involve using new mapping, ecosystem categorisation, ecosystem condition/integrity rating, population/habitat size assessment techniques or methods. Re-assessing impacts according to new methods should ensure greater accuracy or consistency (see Section 2.4) throughout the inventory.

The final trigger, ecosystem type conversion and/or changes in the spatial distribution of taxa, involves recognising that global and local environmental and socio-economic conditions may have evolved to such an extent that some of the features of the biodiversity impact inventory of your business may need to be revised. For instance, a drier climate might have led to changes in the spatial distribution of ecosystems and material taxa. In such cases, it may be appropriate to replace some biodiversity assets of the inventory with more relevant ones.

Determining whether impacts should be re-assessed depends on the significance of the changes, and should be informed, at least partially, by your materiality assessment process (see Section 2.3.1). As for materiality assessment, the BD Protocol does not prescribe any rule for the determination of significance. However, it is worth noting that more accurate or new data input, required for the application of the selected methods, may not readily be available for all past accounting periods. Such limitations may be addressed by either back-casting data inputs, within reasonable uncertainty bounds, or simply changing the data sources, provided full disclosure is made in both cases. Such acknowledgements should be reflected in your biodiversity reporting or disclosure in order to enhance transparency and prevent information users from incorrectly interpreting the performance of your organisation.

4. VALIDATION, VERIFICATION, REPORTING AND DISCLOSURE

Biodiversity is a critical component of natural capital, one of the six capitals recognised by the International Integrated Reporting Council (IIRC 2013). The BD Protocol can help you improve the quality of biodiversity information available to all information users, notably to enable a more ecologically efficient allocation of capital. To that end, this section briefly presents key principles to help you validate and verify the scope and content of your biodiversity impact assessment. Section 4.2 then concludes the BD Protocol by providing guidance on how to present the results of your assessment for reporting and disclosure purposes.

Box 7: Key definitions:

Validation: Internal or external process(es) to check the quality of the assessment, including technical credibility, the appropriateness of key assumptions, and the strength of your results. This process may be formal or informal, and typically relies on self-assessment.

Verification: Independent process(es) involving expert review to check that the documentation of the assessment is complete and accurate and gives a true representation of the process and results. "Verification" is often used interchangeably with terms such as "audit" or "assurance".

Measurement: For the purpose of the BD Protocol, measurement is defined as the process of assessing/estimating, in physical metrics, the extent and condition/integrity of ecosystems and the target and actual population/habitat size of material taxa within the biodiversity impact inventory of your business.

Valuation: Biodiversity valuation is the process of estimating the relative importance, worth, or usefulness of biodiversity to a business and/or its stakeholders, in a particular context. Valuation may involve some combination of qualitative, quantitative or monetary approaches.

Reporting: Reporting refers to the preparation of a formal written document for a specific business purpose. Effective and transparent business reporting allows organisations to present a cohesive explanation of their business and helps them engage with internal and external stakeholders, including customers, employees, shareholders, creditors, and regulators. Organisations conduct a wide range of reporting for both internal (e.g. management reports, expense trends, failure rates, detailed sales data, employee turnover) and external audiences. Examples of the latter include financial and regulatory reporting, environmental, social, and governance (ESG) reporting (or sustainability reporting), and, increasingly, integrated reporting. Biodiversity reporting can target both internal and external stakeholders and should involve both biodiversity measurements (i.e. how much impact) and values (i.e. what is the importance of these impacts to target stakeholders).

Disclosure: Disclosure refers to the voluntary or required/statutory release of any information relevant to a company, security, fund or anything third party. In financial accounting, disclosure refers to a statutory or good faith revelation of a material fact (or an item of information that is not generally known) on a financial statement or in the accompanying notes (footnotes). Biodiversity disclosures refer to the voluntary or required/statutory release of any biodiversity-related information to external stakeholders.

4.1 Validation and verification

Once you have recorded the accounting journal entries of the biodiversity impact inventory of your business and established the corresponding Statements of Biodiversity Position and Performance, you should consider testing whether these present a credible and unbiased representation of the company's true biodiversity impacts. This should be undertaken to improve inventory quality (Section 2.5) and may involve undertaking validation and verification procedures. The seven accounting and reporting principles of the BD Protocol (Section 2.4), which underpin all aspects of biodiversity impact measurement, accounting and reporting, also underpin any validation and verification process. This means that you may check whether your assessment is relevant, based on ecological equivalency, complete, consistent, transparent and accurate, and this across accounting periods. This will help provide confidence to users that the reported information and associated statements represent a credible and unbiased account of your company's biodiversity impacts.

As outlined in the Natural Capital Protocol (2016), "different types of checks require different levels of effort (e.g. systematic or random, process audits, external validation), so you need to decide what levels of validation and/or verification are required for your assessment, and the desired level of credibility." This means considering the needs of information users, both internal and external to the company, in line with the goals of your biodiversity strategy.

Validation and verification may cover either the assessment process or the results, or both together. There are two main options:

- Internal reviews or "self-checks", which are relatively easy to undertake and are carried out within the company, ideally by involving colleagues who were not directly involved in the assessment (e.g. internal audit department);
- External reviews, which typically involve independent parties, and aim to enhance the credibility of the assessment process and results but are more expensive and time consuming than self-checks.

Ensuring transparency and verifiability of the inventory data is crucial for both internal and external reviews. The more transparent, controlled, and documented your company's inventory system and associated impact data are, the more efficient the validation or verification process will be.

Assessing the risk of material discrepancy

Building on Section 2.3.1 for identifying material taxa, an impact on biodiversity is understood as material if consideration of its importance to internal and/or external stakeholders, as part of the set of information used for decision making, has the potential to alter that decision. In order to express an opinion on data or information, a reviewer would need to decide on the materiality of all identified errors or uncertainties. While some value judgment is unavoidable, the point at which a discrepancy becomes material (materiality threshold) should be pre-defined. While the BD Protocol does not prescribe any materiality threshold, various dimensions of your assessment may be validated or verified for both direct and indirect impacts (see Section 2.3.2), including:

- The chosen biodiversity impact inventory boundary, and its relevance given the business context;
- Specific geographic locations, business units, facilities, and type of impacts;

- The implementation of the inventory quality management and biodiversity accounting system, managerial awareness, availability of resources, clearly defined responsibilities, and segregation of duties;
- The reliability and availability of input data;
- The assumptions, methods and estimations applied;
- Methods and information systems to aggregate and present data from different parts of the inventory.

Given the breadth and depth of biodiversity information, suitable review expertise should be sought, and site visits should be integral to your validation or verification process. A statistically appropriate sample of sites should form part of this process in order to provide sufficient, appropriate evidence over the completeness, accuracy and reliability of reported information. In the end, you should view validating and verifying your impact assessment as essential to continuously improving your company's biodiversity accounting and reporting system, irrespective of whether it is undertaken for the purposes of internal validation, public reporting or to certify compliance with a specific biodiversity programme.

4.2 Reporting and disclosing net biodiversity impacts

Now that you have secured your required level of confidence for your assessment results, you may start consolidating the information in the right format for internal purposes or external disclosure. Companies use four main, often complementary, approaches to report on natural capital impacts and dependencies to date (Houdet et al., 2016):

- Narratives about the company's management approach are used to explain how reporting organisations deal with a specific natural capital issue;
- Financial information may be disclosed to explain the financial implications or consequences of a specific event (e.g. mine closure liability, oil spill fines);
- Quantitative non-monetary information is disclosed to express how the reporting organisation uses and/or impacts natural capital, typically in the context of applying or GRI guidelines ;
- Information on natural capital externalities is used to present the external costs or benefits on society generated by the reporting organisation (e.g. economic costs of company air emissions).

The BD Protocol recommends that your biodiversity impact report includes:

- Narratives about your company's approach to managing biodiversity, notably:
  - Its biodiversity policies, strategies, action plans, targets and key performance indicators, notably with regards to implementing the mitigation hierarchy of each component of its biodiversity impact inventory (see Section 3.1).
  - Its actual and planned contributions to international and national biodiversity targets (e.g. CBD's post-2020 Biodiversity Framework, SDG 15 "Life on Land" and SDG 14 "Life under Water"); for instance, its contributions (including cost savings) to society realised through either the mere management/control of biodiversity assets (see example of company X in Table 25) or, ideally, through long-term positive biodiversity gains (i.e. set-up and management of a private protected area, formally declared under the applicable legislation).
- Quantitative, non-monetary information about the scale of your biodiversity positive and negative impacts, as per the Biodiversity Accounting Framework of the BD Protocol, which implies producing Statements of Position and Performance segregated as follows (see example in Tables 26 and 27):
  - Per accounting period;
  - Per selected value chain boundary (i.e. direct operations, upstream and/or downstream);
  - Per type of impact (i.e. direct, indirect and/or future);
  - Per biodiversity feature (i.e. aggregable ecosystem accounts and distinct accounts for each material taxon).
- Financial information on its expenses and liabilities associated with the implementation of the mitigation hierarchy (see Section 3.1), notably no-net-loss/net-gain legal requirements (e.g. capital and operation expenditures of offset requirements); which may be expressed in any relevant currency as per International Financial Reporting Standards and generally accepted accounting practices, and broken down per biodiversity unit (e.g. Euro or US $/ha of ecosystem type or taxon) (see example of company X in Table 28);

61.See GRI sustainability reporting standards.
62.In economics, an externality is the cost or benefit that affects a party who did not choose to incur that cost or benefit. Hence, by definition, externalities are not financial values.

Table 25: Example of biodiversity contributions to society of company X (direct operations: "gains scenario" and "future impacts" included)

		Direct impacts				Future Impacts	
		Ecosystem type 1- Natural forests (10 Ha)	Ecosystem type 2- Natural grasslands (0,5 Ha)	Taxon 1- Plant spcies (50 reproducing individuals)	Taxon 2- Owl species (Habitat of 3Ha)	Ecosystem type 3- Wetland (5 Ha)	Taxon 3- Mammal species (Habitat of 5 Ha)
	Accumulated positive impacts of company X	8,00 Ha.eq	0,20 Ha.eq	50	3,00 Ha	4,00 Ha.eq	5,00 Ha
Regional scale	Total equivalent biodiversity feature remaining	5000 Ha.eq	600,00 Ha.eq	120	1200,00 Ha	385,00 Ha.eq	725,00 Ha
	Share of total biodiversity feature managed by company X	0,16%	0,03%	41,67%	0,25%	1,04%	0,69%
Nationwide	Total equivalent biodiversity feature remaining	75000,00 Ha.eq	7700,00 Ha.eq	2500	12500,00 Ha	8300,00 Ha.eq	5300,00 Ha
	Share of total biodiversity feature managed by company X	0,01%	0,00%	2,00%	0,02%	0,05%	0,09%

Table 26: Statement of Biodiversity Position for company X (direct operations)

Statement of Biodiversity Position for company X (controlled operations: Baseline impacts)

	Ecosystem assets (HA) (A accounts) (Total Biodiversity Footprint)	Accumulated positive impacts (Ha eq.) (B accounts) (Positive Biodiversity Footprint)	Accumulated negative impacts (Ha eq.) (C accounts) (Negative Biodiversity Footprint)
Ecosystem type 1 - Natural forest (3/5)	10,00	6,00	4,00
Ecosystem type 2 - Natural grassland (0/5)	2,00	0,00	2,00
Total	12,00	6,00	6,00
	Taxon asset (Number of reproducing individuals) (A account: Target population size)	**Accumulated positive impacts (Number of reproducing individuals) (B accounts: Actual population size)**	**Accumulated negative impacts (Number of reproducing individuals) (C accounts: Gap to target population size)**
Taxon 1 - Plant species	250,00	15,00	235,00
	Taxon asset (Ha) (A account: Target habitat size)	**Accumulated positive impacts (Ha) (B accounts: Actual habitat size)**	**Accumulated negative impacts (Ha.eq) (C accounts: Gap to target habitat size)**
Taxon 2 - Owl species	9,00	0,50	8,50

Table 26: Statement of Biodiversity Position for company X (direct operations) Cont.

Statement of Biodiversity Position for company X (controlled operations: "Gains" scenario)

	Ecosystem assets (HA) (A accounts) (Total Biodiversity Footprint)	Accumulated positive impacts (Ha eq.) (B accounts) (Positive Biodiversity Footprint)	Accumulated negative impacts (Ha eq.) (C accounts) (Negative Biodiversity Footprint)
Ecosystem type 1 - Natural forest (4/5)	10,00	8,00	2,00
Ecosystem type 2 - Natural grassland (2/5)	0.50	0,20	0,30
Ecosystem type 2 - Natural grassland (0/5)	1,50	0,00	1,50
Total	12,00	8,20	3,80

	Taxon asset (Number of reproducing individuals) (A account: Target population size)	Accumulated positive impacts (Number of reproducing individuals) (B accounts: Actual population size)	Accumulated negative impacts (Number of reproducing individuals) (C accounts: Gap to target population size)
Taxon 1 - Plant species	250,00	50,00	200,00

	Taxon asset (Ha) (A account: Target habitat size)	Accumulated positive impacts (Ha) (B accounts: Actual habitat size)	Accumulated negative impacts (Ha) (C accounts: Gap to target habitat size)
Taxon 2 - Owl species	9,00	3,00	6,00

Table 26: Statement of Biodiversity Position for company X (direct operations) Cont.

Statement of Biodiversity Position for company X (controlled operations: "Losses" scenario)

	Ecosystem assets (HA) (A accounts) (Total Biodiversity Footprint)	Accumulated positive impacts (Ha eq.) (B accounts) (Positive Biodiversity Footprint)	Accumulated negative impacts (Ha eq.) (C accounts) (Negative Biodiversity Footprint)
Ecosystem type 1 - Natural forest (2/5)	10,00	4,00	6,00
Ecosystem type 2 - Natural grassland (0/5)	2,00	0,00	2,00
Total	12,00	4,00	8,00
	Taxon asset (Number of reproducing individuals) (A account: Target population size)	**Accumulated positive impacts (Number of reproducing individuals) (B accounts: Actual population size)**	**Accumulated negative impacts (Number of reproducing individuals) (C accounts: Gap to target population size)**
Taxon 1 - Plant species	250,00	0,00	250,00
	Taxon asset (Ha) (A account: Target habitat size)	**Accumulated positive impacts (Ha) (B accounts: Actual habitat size)**	**Accumulated negative impacts (Ha.eq) (C accounts: Gap to target habitat size)**
Taxon 2 - Owl species	9,00	0,00	9,00

Table 26: Statement of Biodiversity Position for company X (direct operations) Cont.

Statement of Biodiversity Position for company X (controlled operations: "Future impacts" scenario)

	Ecosystem assets (HA) (A accounts) (Total Biodiversity Footprint)	Accumulated positive impacts (Ha eq.) (B accounts) (Positive Biodiversity Footprint)	Accumulated negative impacts (Ha eq.) (C accounts) (Negative Biodiversity Footprint)
Ecosystem type 1 - Wetland (4/5)	5,00	4,00	1,00
Ecosystem type 2 - Wetland (0/5)	1,00	0,00	1,00
Total	6,00	4,00	2,00
	Taxon asset (Ha) (A account: Target habitat size)	**Accumulated positive impacts (Ha) (B accounts: Actual habitat size)**	**Accumulated negative impacts (Ha.eq) (C accounts: Gap to target habitat size)**
Taxon 3 - Mammal species	6,00	5,00	1,00

Table 27: Statement of Biodiversity Performance for company X (direct operations)

Statement of Ecosystem Performance for company X

Controlled operations: Baseline Impacts	
Periodic gains	
Ecosystem type 1- Natural forest (5/5)	10,00
Ecosystem type 2- Natural grassland (5/5)	2,00
Ecosystem type 1- Natural forest (3/5)	6,00
Periodic losses	
Ecosystem type 1- Natural forest (5/5)	10,00
Ecosystem type 2- Natural grassland (5/5)	2,00
Net Impacts (Gains - Losses) (Ha.eq)	6,00

Controlled operations: "Gains" scenario	
Periodic gains	
Ecosystem type 1- Natural forest (4/5)	2,00
Ecosystem type 2- Natural grassland (2/5)	0,20
Periodic losses	
None	
Net Impacts (Gains - Losses) (Ha.eq)	2,20

Controlled operations: "Losses" scenario	
Periodic gains	
None	
Periodic losses	
Ecosystem type 1- Natural forest (4/5)	2,00
Net Impacts (Gains - Losses) (Ha.eq)	-2,00

Controlled operations: "Future Impacts" scenario	
Periodic gains	
Ecosystem type 3- Wetland (5/5)	1,00
Ecosystem type 3- Wetland (3/5)	0,60
Ecosystem type 3- Wetland (5/5)	5,00
Ecosystem type 3- Wetland (3/5)	3,00
Ecosystem type 3- Wetland (4/5)	1,00
Periodic losses	
Ecosystem type 3- Wetland (5/5)	1,00
Ecosystem type 3- Wetland (3/5)	0,60
Ecosystem type 3- Wetland (5/5)	5,00
Net Impacts (Gains - Losses) (Ha.eq)	4,00

Table 27: Statement of Biodiversity Performance for company X (direct operations) Cont.

Statement of Taxa Performance for company X

Controlled operations: Baseline Impacts	
Periodic gains	
Taxon 1- Plant species	250,00
Periodic losses	
Taxon 1- Plant species	235,00
Net Impacts (Gains - Losses) (Ha.eq)	15,00
Periodic gains	
Taxon 2- Owl species	9,00
Periodic losses	
Taxon 2- Owl species	8,50
Net Impacts (Gains - Losses) (Ha.eq)	0,50

Controlled operations: "Gains" scenario	
Periodic gains	
Taxon 1- Plant species	35,00
Periodic losses	
None	
Net Impacts (Gains - Losses) (Ha.eq)	35,00
Periodic gains	
Taxon 2- Owl species	2,50
Periodic losses	
None	
Net Impacts (Gains - Losses) (Ha.eq)	2,50

Controlled operations: "Losses" scenario	
Periodic gains	
None	
Periodic losses	
Taxon 1- Plant species	15,00
Net Impacts (Gains - Losses) (Ha.eq)	-15,00
Periodic gains	
None	
Periodic losses	
Taxon 2- Owl species	2,50
Net Impacts (Gains - Losses) (Ha.eq)	-2,50

Controlled operations: "Future Impacts" scenrio	
Periodic gains	
Taxon 3- Mammal species	1,00
Taxon 3- Mammal species	5,00
Taxon 3- Mammal species	3,00
Periodic losses	
Taxon 3- Mammal species	1,00
Taxon 3- Mammal species	3,00
Net Impacts (Gains - Losses) (Ha.eq)	5,00

Table 28: Example of financial implications of the different biodiversity impact scenarios of company X (direct operations)

	Direct impacts								Future impacts	
Type of Biodiversity management activity	**Ecosystem type 1- Natural forest (10 Ha)**		**Ecosystem type 2- Natural grasslands (0,5 Ha)**		**Taxon 1- Plant species (50 reproducing individuals)**		**Taxon 2- Owl species (Habitat of 3 Ha)**		**Ecosystem type 3- Wetland (5 Ha)**	**Taxon 3- Mammal species (Habitat of 5 Ha)**
	Accounting gains	Accounting for losses	Accounting gains	Accounting for losses	Accounting gains	Accounting for losses	Accounting gains	Accounting for losses		
Impact avoidance	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Impact minimisation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Restoration/ rehabilitation measures	€800k of expenses (€80k/ha)	N/A	€1M of expenses (on 0,5 Ha) & €50k of liabilities (on 0,5 Ha)	N/A	€25k of expenses (€0,5k per individual) & €125k of liabilities (€25k per individual)	N/A	€50k of expenses (€17k/ha) & €200k of liabilities (€67k/ha)	N/A	€2M of expenses (€500k/ha) & €1M of liabilities (€200k/ha) (somemeasures put in place to benefit both the ecosystem type and taxon)	
Mandatory offset measures	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	€10M of expenses (land purchase and works) & €1M of liabilities (contractors)	
Voluntary offset measures	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Additional voluntary conservation measures	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

From an integrated management and reporting perspective, your business should also explore reporting or disclosing productivity/efficiency ratios (e.g. business output per unit of biodiversity impact, such as production volume/total sales divided by the Total, Positive and/or Negative Biodiversity Footprints of your business) and should consider valuing the costs and benefits of your biodiversity impacts on your business and society. The Biodiversity Supplement to Natural Capital Protocol (2016) may provide useful guidance to that end.

While Statements of Biodiversity Position show accumulated impact data (Table 26), from the time of baseline assessments up to the time of reporting/disclosure, Statements of Biodiversity Performance express periodic net impacts on biodiversity (i.e. your biodiversity performance over the past accounting period) (Table 27). To enable meaningful comparative/trend analysis by stakeholders, your company might show previous Statements of Biodiversity Position and Performance. Notably, it is critical to consolidate ecosystem impacts into three key performance indicators, your company's total Biodiversity Footprint, its Negative Biodiversity Footprint, and its Positive Biodiversity Footprint (e.g. see examples in Table 26). Comparing changes in Biodiversity Footprints over time will be critical to provide internal and/or external stakeholders with the evidence that your business' biodiversity performance is going in the right direction.

Consolidated statements are useful to obtain a rapid understanding of your company's biodiversity impacts. However, it may be worth disclosing disaggregated ecosystem accounts in cases where consideration of their importance to internal and/or external stakeholders, as part of the set of information used for decision making, has the potential to alter that decision. Accordingly, Statements of Ecosystem Position and Performance may be further organised per ecosystem type and according to any geographical classification system, for instance per operation, site, geographic location, business process, or legal entity.

Reporting impact data on material taxa is very different to reporting ecosystem impacts, as you cannot aggregate impact data across species or sub-species. For habitat-based impact measurement approaches, you cannot add up the surface area of habitats of distinct species, as their habitat may overlap, leading to double counting. For population-based impact measurement approaches, it makes very little sense to add up populations of different taxa as what matters is the viability of individual taxon. This is why reporting and disclosing impacts on taxa should only be undertaken for material impacts (see Section 2.3.2).

5. APPENDIXES

5.1 List of figures

5.2 List of tables

5.3 Biodiversity elements excluded from the BD Protocol

The BD Protocol focuses on providing standardised guidance on how to measure changes in the state of biodiversity features which belong to the ecological production function of the environment/ecosystem – human well-being continuum[63]. Biodiversity elements in which labour and capital goods are, routinely or exceptionally, required for their renewal/reproduction or existence/persistence as part of business operations or activities are excluded from the scope of the BD Protocol (e.g. crops). An exception to this general rule is the case of wild, threatened species or ecosystems requiring labour and financial support for their survival or recovery.

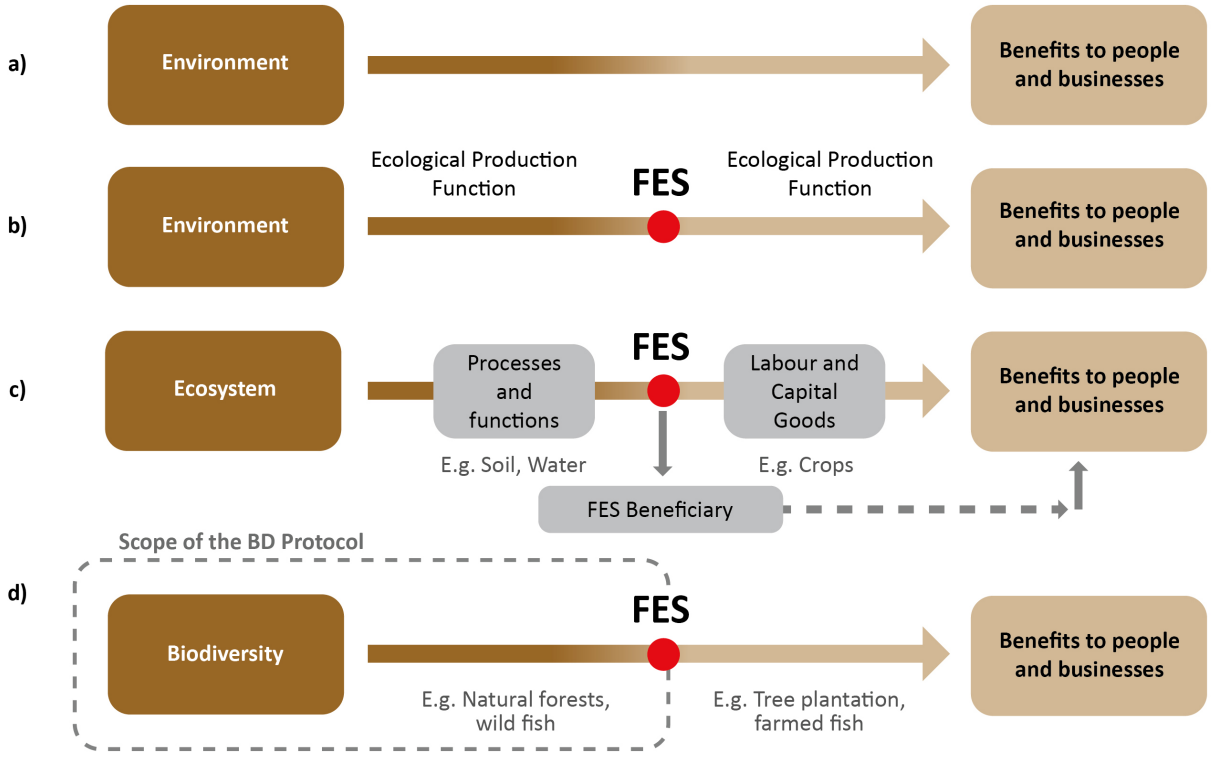


Illustration of a) a production function between the environment and human well-being; b) how Final Ecosystem Services (FES) can be used to delineate the ecological production function from the economic production function, and; c) the different types of inputs (i.e. ecosystem processes and functions versus labour and capital goods) for both production functions. The BD Protocol only includes biodiversity elements (ecosystem types, taxa) which can persist in nature without labour or capital input (d). Exceptions to this general rule are biodiversity components which require targeted expenditures for conservation or recovery purposes. This is adapted from Landers & Nahlik (2013) and US EPA (2015).

63.The environment/ecosystem – human wellbeing continuum holds together due the concept of final ecosystem services (FES). FES are the "components of nature, directly enjoyed, consumed or used to yield human wellbeing" which can be used to delineate the ecological production function from the economic production function.

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5.5 Disclaimer

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