TOWARDS A PROTOCOL FOR ECOSYSTEM CONDITION ACCOUNTING – DRAFT FRAMING DOCUMENT

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This document has been prepared by CDC Biodiversité and I Care, two biodiversity footprinting tool developers aiming to capitalise on their experience to propose an accounting framework on ecosystem condition.

It is a scoping note introducing a more detailed content, currently under discussion. Further and extended collaboration is required to elaborate this content.

This note aims at being shared to relevant stakeholders, it can be circulated.

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1 INTRODUCTION

Companies and financial institutions are increasingly expected to measure, manage and mitigate their impacts on biodiversity. This requires a robust biodiversity accounting framework capable of addressing the complexity of biodiversity.

The document aims at defining **clear accounting principles** (*e.g.*, a protocol) tailored to companies and financial institutions to track impacts on biodiversity, thoroughly throughout the various scales of impact assessment (site, product, sourcing, corporate). The protocol should then allow trajectory development towards biodiversity goals from the Global Biodiversity Framework (GBF), or planetary boundaries, etc. The focus of this protocol will be the **impact on ecosystem condition** due to **pressures** exerted by economical activities.

The purpose of this framework is to propose the **required practices for an advanced framework of corporate biodiversity accounting**. It is not limited by what is currently implemented but rather seeks to define a model that reflects ecological realities and international goals. It acknowledges the implementation gaps while maintaining a forward-looking stance on what is ecologically necessary and scientifically justified.

The framework applies not only to direct operations but extends to impacts along the entire **value chain**, including suppliers or financed activities. Also, the protocol acknowledges the role of **positive biodiversity impacts**, and integrated mechanisms to account for these contributions alongside negative impacts.

Finally, it is important to emphasise that this protocol **does not prescribe a single metric** or a **specific tool** for biodiversity accounting. While references are made to existing methodologies, this ecosystem condition protocol remains intentionally tool and metric-agnostic. This flexibility ensures that the framework can be adapted to evolving scientific advances and diverse corporate contexts, while enabling companies to select or combine tools best suited to their operational needs and data availability. The references to these tools serve primarily to demonstrate how the principles outlined here can be practically implemented, rather than to limit the scope of application.

A growing number of initiatives aim at describing which indicators should be reported by companies to build biodiversity strategies: TNFD, SBTN, CSRD, Align, GRI, NPI … However, these initiatives do not detail how to build ecosystem condition indicators. The aim of this document is to bridge this gap to ensure the compatibility of reported indicators between companies and financial institutions.

1.1 CORE CONCEPTS AND INDICATORS FOR BIODIVERSITY ACCOUNTING

1.1.1 What are companies' and financial institutions' needs regarding biodiversity impact accounting?

To align with international goals on biodiversity, corporates and financial institution need to track their pressures (*e.g.*, impact drivers) and impacts on biodiversity. This monitoring must be the ground of response actions aiming at **contributing to the alignment with the Goal A of the Global Biodiversity Framework:**

"*The integrity, connectivity and resilience of all ecosystems are maintained, enhanced, or restored, substantially increasing the area of natural ecosystems by 2050. Human induced extinction of known threatened species is halted, and, by 2050, the extinction rate and risk of all species are reduced tenfold and the abundance of native wild species is increased to healthy and resilient levels; The genetic diversity within populations of wild and domesticated species, is maintained, safeguarding their adaptive potential*".

Tracking pressures enables companies and financial institutions to identify and **act on concrete levers** – for instance, reducing greenhouse gases (GHG) emissions or halting land-use conversion. **Pressure-level data are often available** and can be **operationalised**. Moreover, this level aligns with several GBF targets (*e.g.*, 1 to 8) and allows for policy monitoring.

These pressures contribute to the **biodiversity footprint** of organisations, defined by the Partnership for Biodiversity Accounting Financials (PBAF) as:

> *"Quantified impact of a portfolio, asset class, project or company measured in terms of biodiversity change as a result of production and consumption of particular goods and services."(PBAF 2022)*

The biodiversity footprint captures not only how much pressure a company exerts but what the associated impact on biodiversity state is. This can **enable verification of coherence and alignment with the Goal A of the GBF**. Footprinting also supports action **prioritization**: it provides a common metric to aggregate and compare the impacts of different types of pressures which considers co-benefits and antagonisms. Companies and financial institutions can use biodiversity footprint to prioritise reduction actions accordingly. Finally, footprinting is also the appropriate level to **measure positive impacts**, which are essential for meeting global biodiversity goals. Indeed, such impacts must be assessed at the level of biodiversity state (UNEP-WCMC et al. 2023).

1.1.2 Focus on ecosystem condition: definition & goals

The protocol answers the questions raised about impact on ecosystem condition during **Locate** and **Evaluate** phases of the **LEAP**-approach from the **Taskforce on Nature-related Financial Disclosures (TNFD)** (TNFD 2023), enabling tools to meet their expectations. It allows also an alignment on indicators used in Steps 1, 2 and 3 of the **Science Based Targets Network (SBTN)**. Finally, this protocol aims to inform **standards setters** about how to account for the impact on the ecosystem condition, drawing on the expertise of tool developers who have been working on the subject for several years.

Unlike climate change, which can be monitored through a single metric such as carbon emissions, biodiversity requires a **suite of indicators** to reflect its multi-dimensional nature. These indicators can range from simple measurements (*e.g.*, area coverage) to more complex indices (*e.g.*, average change in abundance of species). As one of the core components of biodiversity, alongside **species** and **genetic diversity**, ecosystem condition is essential for **understanding biodiversity state** and **aligning with international biodiversity targets**.

Ecosystem condition refers to the **quality of an ecosystem** measured in terms of its **abiotic** and **biotic characteristics**. It is assessed with respect to an ecosystem's **composition**, **structure** and **function** which, in turn, underpin the ecological **integrity** of the ecosystem, and support its capacity to supply **ecosystem services** on an ongoing basis (UNEP-WCMC et al. 2022).

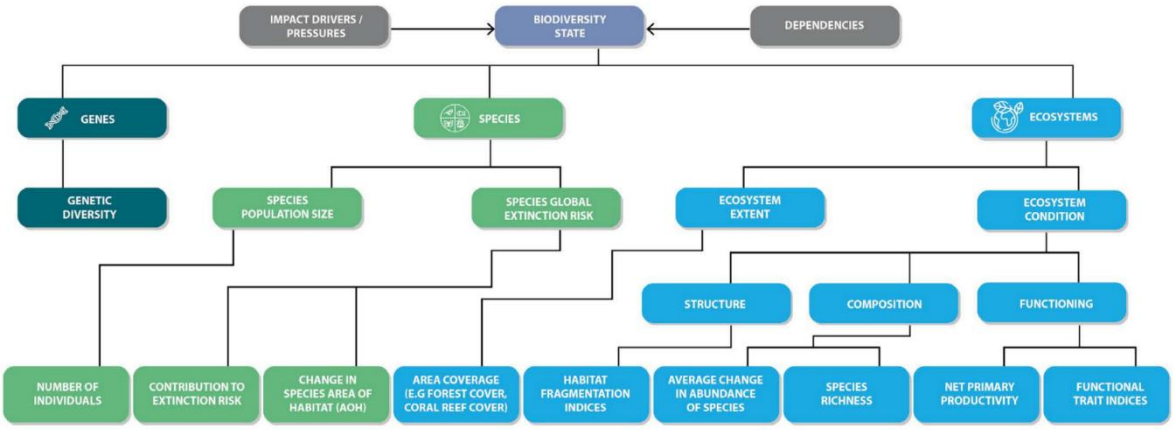

Figure 1: Components of biodiversity and example measurement indicators (UNEP-WCMC, Capitals Coalition, Arcadis, ICF, WCMC Europe (2022) Recommendations for a standard on corporate biodiversity measurement and valuation, Aligning accounting)

Ecosystem condition metrics offer the **most realistic level for assessing a company's impact**, including its **entire value chain**, thanks to the availability of mature and operational tools. Goal A being framed in terms of ecosystem condition, building a protocol on this metric provides ground to support companies in the assessment of their contribution to the Goal A. Finally, ecosystem condition is also **positively correlated with the capacity of ecosystems to provide services**, making it a meaningful indicator of both ecological health and human benefit (Smith et al. 2017), in connexion with the Goal B of the GBF:

"Biodiversity is sustainably used and managed and nature's contributions to people, including ecosystem functions and services, are valued, maintained and enhanced, with those currently in decline being restored, supporting the achievement of sustainable development for the benefit of present and future generations by 2050"

This protocol therefore focuses on this facet of biodiversity for impact accounting. However, ecosystem condition accounting must be completed by complementary biodiversity indicators to build adequate biodiversity strategies:

- Assessing biodiversity impacts through other lenses (*e.g.*, **species, genes**) is essential and encouraged. However, there is a lack of corporate tools at this level.

- **Biodiversity significance and state indicators** (IUCN STAR metric on species, Protected Areas, Key Biodiversity Areas, high or low condition surfaces, areas with high water stress, ecosystem services provision…) are essential to prioritise impacts reduction actions in areas with the most importance.
- Although this protocol focuses on modelled impact assessment, **field monitoring** must be used as much as possible to track whether response actions taken appear to have the expected results. A complementary protocol for verifying actions on the ground should be developed to provide clear guidance on how to assess whether implemented measures are delivering the intended biodiversity benefits.

1.1.3 Integrating responses, pressures, impacts, and state of biodiversity for effective biodiversity accounting

In a comprehensive ecosystem condition accounting framework, different levels play a distinct role, building a coherent chain from actions to ecological outcomes.

The **impact level** estimates how **pressures** are likely to alter the state of biodiversity. The **response level** represents the actions and practices undertaken by companies and financial institutions. These responses are designed to reduce **pressures**. The **pressure level** helps to attribute responsibility, identify and guide actionable responses. It also provides the input data necessary to model biodiversity impacts – feeding into the **impact level**. This tier is essential for quantifying and comparing expected effects, enabling prioritisation and ensuring alignment with global goals such as the Goal A of the GBF.

It is critical that **response actions can be integrated into impact models**, allowing organisations not only to act but to evaluate and optimise their strategies through measurable expected outcomes.

Finally, **field-based measurements** bridge the gap between theoretical models and ecological reality. Although not the primary focus of this protocol, their contribution is twofold. **Direct measurement of actual biodiversity state or effective impacts**, through ecological surveys, eDNA, bioacoustics, etc., is necessary to **challenge modelled trends**, ensuring consistency between theoretical gains and reality. This is especially important for measuring **positive impacts**, which should ideally be captured at the level of biodiversity state (UNEP-WCMC et al. 2022). However, since direct observation is rarely **exhaustive** or fully **reliable**, it must be used in combination with modelling to provide a robust and actionable assessment.

Field data is also essential for **calibrating and improving pressure-impact models**. Many pressure-impact models, such as GLOBIO or PREDICTS, are based on meta-analyses that synthesise studies across ecosystems and taxa to estimate average biodiversity responses to pressures.

These two functions form a **feedback loop**. Observed field trends **inform and refine the models**, while the models guide **where, when and how to reduce impacts**. Together, they create an iterative process in which field observations continuously inform and enhance modelling approaches, ensuring that footprinting remains scientifically robust and context sensitive.

The figure and table below summarise the role of different levels of assessment. While Figure 2 focuses on the feedback loop between them, Table 1 details the goals of each level of assessment and how they complement each other. Considering the advantages of both **pressure-level** and **impact-level** accounting for companies, this protocol frames guidelines to account at **both levels**.

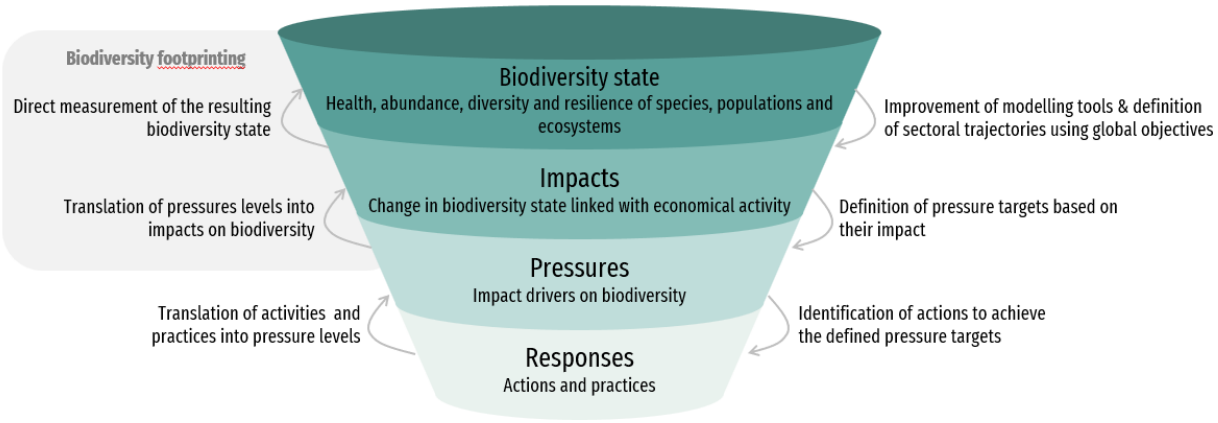

Figure 2: The feedback loop between pressures, impacts, biodiversity state and response

This level allows to...		Pressures	Impacts	State of biodiversity
1 - Assess	Account for an organisation's impacts on biodiversity	Yes, through the lenses of a set of metrics, yet not considering the sensitivity of the ecosystems concerned.	Yes.	No, state indicators do not allow to identify the responsibility of an organisation in the observed state of biodiversity.
	Estimate the contribution of an actor to the state of nature	No, the same pressure can have vastly different consequences depending on local ecological conditions.	Yes.	No. State of nature is the result of multiple actor's contributions. Individual actor's contributions are not reflected by state of nature indicators.
2 – Prioritize, 3 – Set targets, and 4 - Act	Set actions and measure their effectiveness	Mostly yes, pressure-level data can often be operationalised into levers of action (*e.g.*, reducing GHG emissions, halting land conversion). Yet some pressure indicators remain disconnected from actionable business practices (*e.g.*, quantity of nitrogen discharged). Companies need to link interventions (*e.g.*, establishing buffer strips, optimising fertiliser application) to biodiversity outcomes.	Yes, if the chosen method allows it. It is directly correlated to the ability of the chosen method to capture the link between changes in business practices and associated pressures. The level of accuracy of the results will depend on the quality of the meta-analysis underlying the pressure-impact model used.	Depends on the responsiveness of the indicator chosen: some state indicators are evolving quite rapidly; some others are not. Moreover, the responsibility can be hard to define at the state level.

	Compare pressures to prioritise response actions	No, different pressures' units make it difficult to compare or prioritise them, even when they occur in the same location. This hampers the ability to identify which pressures are most critical to address and limits the demonstration of progress towards global objectives beyond the specific pressure addressed.	Yes, footprinting supports action prioritisation. It provides a common metric to aggregate and compare the impacts of different types of pressures, allowing companies and financial institutions to weigh these pressures by their actual severity and strategically prioritise reduction actions accordingly.	No, the responsibility of one pressure compared to another in a same place cannot be identified through state indicators.
5 - Track progress	Assess the alignment with the Goal A of the GBF by reflecting ecological outcome	No, meeting all pressure-based targets alone would still fall short of achieving the overarching goal (Kok et al. 2024). Moreover, a reduction in one pressure does not guarantee a stable or improving state of nature.	Yes, footprinting aggregates the effects on nature of several pressures, considering their ecological contexts, allowing to conclude on potential losses or gains in biodiversity and contribution to international trajectories at the corporate or portfolio level.	Yes, state of biodiversity is the core of the Goal A. However, global monitoring of the state of biodiversity is to be conducted by public authorities.
	Assess alignment with GBF targets and policy monitoring (EU, etc.)	Yes, this level aligns with several GBF targets (*e.g.*, 1 to 8)) and allows for policy monitoring.	Yes, it allows businesses to answer to the Target 15. Reaching this Target is a necessary step to monitor progress towards the achievement of Goal A.	

Table 1: The role of pressures, impact and state measurement within biodiversity accounting

1.2 FROM IMPACT ACCOUNTING TO TRAJECTORY ALIGNMENT: THE OBJECTIVES OF THIS PROTOCOL

This protocol is needed to address specific challenges proper to biodiversity accounting:

- An impact (and thus, a degradation in biodiversity state, *e.g.*, a decrease in at least one specie's abundance) somewhere may not be equivalent to the same decrease of the same specie or similar elsewhere: in order to aggregate impacts on biodiversity throughout geographies, **ecological equivalencies** must be considered.
- Some impacts are **local** (like the ones due to land conversion), some other are very **diffuse** (like pollutants released into soil or freshwater contaminating whole water basins): although not present in one geography, organisations may impact them.
- Some impacts are immediate, some others are latent: the **duration** of the impact on biodiversity, linked to the maintenance and acuteness of the related pressures, must be considered.

This protocol aims to provide concrete and precise ways to deal with these specific issues, as well as more traditional accounting rules such as how to take the value chain into account. Iterations of this document will be published as the authors make progress to provide standards setters and tool developers with clear proposals.

Concretely, it will propose guidelines on:

- Definitions of concepts for measuring the **impact on the condition of ecosystems** of corporates and financial institutions, **based on existing literature and tools** (footprint, pressures, etc.);
- **Scopes definitions** adapted to issues specific to biodiversity;
- Common rules for computation of pressures and impacts, including different possibilities to **account biodiversity impacts over time and their implications**;
- Common rules for considering **local specificities** while accounting for pressures and impacts;
- Common rules for setting a **reference state** for impact measurement;
- Possible approaches to build **state improvement and impact reduction trajectories**, at country, financial institutions and company levels.

2 APPENDIX

2.1 DEFINITIONS

To enable a consistent and transparent understanding of the framework, some key terms are clarified below, using various sources such as the IPBES Conceptual Framework (Díaz et al. 2015) and the DPSIR model (Driver-Pressures-State-Impact-Response) (Smeets et al. 1999). Other definitions are suggestions from the authors of this document.

Ecosystem condition: describes the overall quality of an ecosystem measured in terms of its biotic (living) and abiotic (physical rather than biological) characteristics (UNEP-WCMC et al. 2023).

Driver: drivers are factors that initiate change in nature and biodiversity. In this protocol, the word "pressure" is preferred.

Impacts: Impacts are the ecological changes that result from pressures. They describe how the state of biodiversity is altered, positively or negatively, by human activity. Impacts can be modelled using known relationships between pressures and expected ecosystem responses or observed through direct monitoring techniques.

Pressure: a pressure is a factor that initiates change in nature and biodiversity Pressures are classified into:

- **Direct pressures**: natural or anthropogenic processes that directly alter nature. In the IPBES framework, these are called direct drivers of change, while the DPSIR model refers to them as pressures or impact drivers. Examples include land use change, direct exploitation, climate change, pollution and invasive alien species.
- **Indirect pressures**: underlying societal causes such as demographic, economic, socio-political or technological factors that influence the direct drivers. Indirect drivers correspond to the "Drivers" in the DPSIR model.

A pressure generally has three main characteristics: magnitude (*e.g.*, amount of contaminant, noise intensity), spatial extent of the impact driver (*e.g.*, area of land changed) and temporal extent (*e.g.*, duration of persistence of contaminant). They are neutral, i.e. they may result in both positive and negative changes in the state of biodiversity and associated impacts on business or society (*e.g.*, impacts on human wellbeing). Several pressures, either from one company or combined with those of other organisations, can result in cumulative impacts.

Responses and actions: Responses refer to societal or organisational actions aimed at addressing biodiversity loss. These can include regulatory interventions, corporate practices, conservation programs, or ecosystem restoration. Effective responses reduce pressures, mitigate impacts, and improve ecological conditions.

Robust response indicators should be actionable (tied to specific levers of influence); specific (targeted to pressures or impacts) and verifiable (measurable over time and across scales) . The effectiveness of responses is ultimately judged by their influence on pressure levels, ecological

impacts, or improvements in biodiversity state. The IPBES conceptual framework refers more broadly to actions, rather than responses.

State of biodiversity: The state refers to the current condition of biodiversity and ecosystems, including their structure, function, and composition. It captures both the present status and temporal trends in ecological integrity.

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