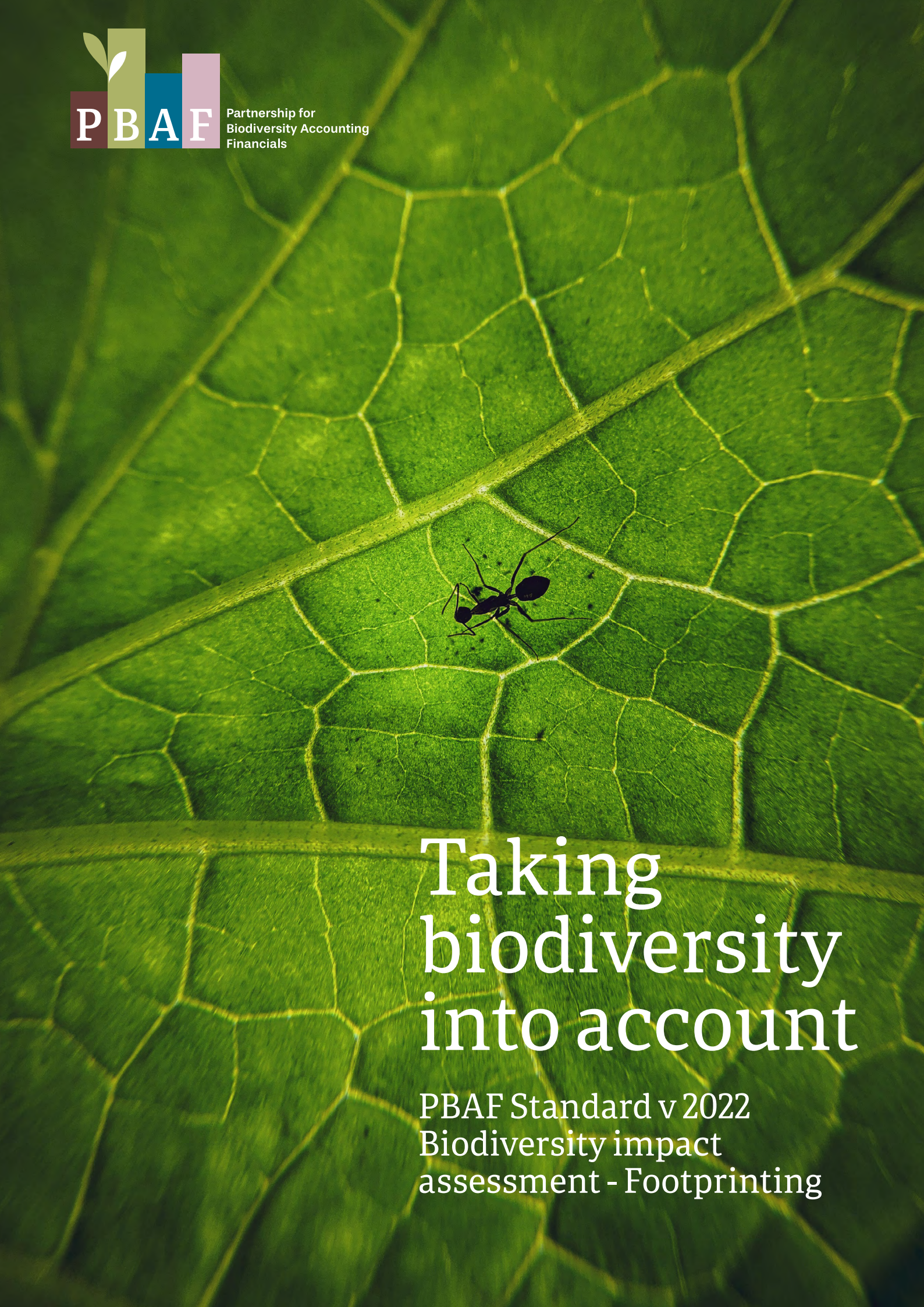
PBAF

Partnership for Biodiversity Accounting Financials



Taking biodiversity into account

PBAF Standard v 2022 Biodiversity impact assessment - Footprinting

Taking biodiversity into account

PBAF Standard v 2022
Biodiversity impact assessment - Overview of approaches

Through the PBAF Standard v2022, we share the results of discussions between PBAF Partners (financial institutions) on biodiversity impact assessment with other interested parties.
We encourage financial institutions to adopt biodiversity impact assessment as a positive step towards a biodiversity inclusive way of operating. We encourage methodology developers and data providers to align approaches, meeting the PBAF requirements and recommendations presented.

The PBAF Standard v2022 consists of three separate publications:
- PBAF Q&A – Introduction to biodiversity impact assessment
- PBAF Standard v2022 Biodiversity impact assessment – Overview of approaches
- PBAF Standard v2022 Biodiversity impact assessment – Footprinting

An overview of PBAF Partners and Supporters can be found on the PBAF website (**www.pbafglobal.com**)

PBAF is an independent foundation based in the Netherlands and is co-funded by the PBAF Partners and the IKEA Foundation.

We welcome financial institutions to join the PBAF initiative. For more information, visit the PBAF website (**www.pbafglobal.com**) or contact Roel Nozeman, Senior Advisor Biodiversity ASN Bank and PBAF Program Director (**roel.nozeman@asnbank.nl**)

Authors, buidling on the results of the PBAF Working groups:
Wijnand Broer – CREM
Daniël Kan – PRé Sustainability
Roel Nozeman – ASN Bank

Graphic design: Katja Visser **katjavisser.nl**

Please cite as: PBAF, Taking Biodiversity into account, PBAF Standard v2022 – Biodiversity impact assessment – Footprinting, June 2022.

Photo cover by Faris Mohammed on Unsplash

Foreword Martin Lok

In 2015, when I was leading the Green Growth project at the Netherlands' Ministry of Economic Affairs, I invited Piet Sprengers, today's Chairman of the Board of the PBAF Foundation, to speak at an informal round table discussion in the Ministry. It was a couple of weeks before the Climate Summit in Paris and the topic was innovation. To inspire policy makers, I wanted Piet to share his bank's carbon strategy.

"We have chosen an ambitious carbon target", he told the audience, "not because it is achievable, but because it's necessary." This boldness amazed the audience. Their eyes even widened further when he continued and said that the metrics to track progress where not yet available. "But we have developed a first attempt to calculate our carbon footprint and we are initiating a collaborative platform with like-minded financials to improve it" were his closing remarks.
The audience was flabbergasted, but many of them were also inspired. Doing what must be done and using collaboration to learn how to do it simply was a too compelling narrative not to be loved.

Since 2015, carbon accounting by financials accelerated enormously, and 269 financial institutions globally have now committed to measure and disclose the greenhouse gas emissions associated with their portfolio of loans and investments, using a methodology that was developed collectively. History is now repeating itself. We are witnessing the start of a similar acceleration for biodiversity and the Partnership Biodiversity Accounting Financials (PBAF) is acting to catalyze this. Again, the ingredients of success are the courage to do what must be done, flavored with a hefty pinch of collaboration to create standardized metrics for assessing the biodiversity footprint of a financial portfolio. Metrics that may not yet be perfect but are good enough to apply to direct action to deliver benefits for nature and investment.

To ensure that the PBAF collaboration is carefully crafted, fair, and fit for purpose, a legal entity has been established, the Partnership Biodiversity Accounting Financials Foundation, with a clear governance structure to clarify the responsibilities of all partners. And to provide the fuel that is necessary for a good collaborative process, financial support has been secured and kindly provided by the IKEA Foundation. A support for which the Board and the Partnership are grateful.

In the last year the PBAF community has gone from strength to strength, collaborating to identify, share and address challenges, building capacity to understand and apply biodiversity measurement and working to address gaps and improve the biodiversity measurement for the finance sector.
This has in turn has contributed to the outcome that is now available: The PBAF Standard v2022. Compared to 2015 we are ahead of the game. The first standard for biodiversity measurement by financials is now out, while the Nature Summit in Kunming (China) has yet to take place. Kunming will bring a new global biodiversity policy framework and increasing expectations of the finance sector to channel financial flows to deliver positive outcomes for nature. The standard – shaped with and by the industry and its stakeholders – gives a starting point for how finance institutions can understand the implications of the loss of nature for their investments and act to address it. The signal is clear: the finance community is ready for the great acceleration.

Martin Lok

Board Member of the PBAF Foundation

Foreword
Elizabeth Maruma Mrema

It is often said that you need measurement to manage effectively, and this is particularly true in the financial sector with its laser focus on risk and returns. It is therefore great to see the efforts of the Partnership for Biodiversity Accounting Financials, which is a major contribution from the financial sector to halting and reversing loss of biodiversity.

The PBAF Standard v2022 builds on the awareness in the financial sector that the loss of biodiversity constitutes a material risk, and the growing experience with risk and impact assessment among front runners. Many PBAF members have been using the framework in the agricultural lending, to move from assessing risks to generating positive impacts. The PBAF Standard vs2022 structures existing efforts and brings new thinking to the topic and provides valuable building blocks for further work in this field. It covers even further beyond the risk management angle to the opportunities for positive impact. It is particularly exciting to see that the standard is industry led, building on the practical experiences of 30 financial institutions in 7 countries. It feeds in concrete experiences to the development of the Taskforce on Nature-related Financial Disclosures (TNFD).

As co-chair of the TNFD, I am very pleased to see the close alignment between PBAF v2022 and the evolving TNFD framework, and I support further harmonization in this field of biodiversity impact assessment. This will prove to be an important prerequisite for the much-needed standardization, regulation and implementation of biodiversity accounting in the financial and business sector. Financial institutions should find the PBAF v2022 a very practical resource as they pilot test the TNFD beta framework in the year ahead.

This year is a particularly important year for biodiversity with the second part of the Conference of the Parties, or 'COP 15.2', due to take place. The Global Biodiversity Framework will emerge from this event to set out an ambitious plan to implement broad-based action to bring about a transformation in society's relationship with biodiversity. Through this, all parts of society need to work together in an integrated manner to ensure that by 2050 the shared vision of 'living in harmony with nature' is fulfilled. With transformative change needed on every single level of our economies, I appreciate the contributions of PBAF to this vision.

I hope and expect this publication will receive wide support and application and will trigger financial institutions to increase their efforts in assessing their impacts on biodiversity, and to join the TNFD Forum to contribute to industry-wide efforts for shifting finance away from nature-negative and towards nature-positive.

Sincerely,

Elizabeth Maruma Mrema

Co-Chair, Taskforce on Nature-Related Financial Disclosure (TNFD),
UN Assistant Secretary General & Executive Secretary, Secretariat of the Convention on Biological Diversity

Contents

About this document

Through their loans and investments, financial institutions can play a key role in the conservation and sustainable use of biodiversity, contributing not only to the goals and targets of the 'Post–2020 Global Biodiversity Framework' of the Convention on Biological Diversity (CBD), but also to a reduction of investment risks. To take up this role, science–based, reliable information on how finance impacts ánd depends on biodiversity is an important precondition.

It is against this background that the Partnership for Biodiversity Accounting Financials (PBAF), a partnership of financial institutions initiated in 2019, is developing the 'PBAF Standard'. The PBAF Standard aims to provide guidance to financial institutions on biodiversity impact and dependency assessment and to define what is needed for these assessments to deliver the right information to financial institutions. In the development of its Standard, PBAF aligns and cooperates with other key initiatives. This includes (but is not limited to) the Taskforce on Nature Related Financial Disclosures (TNFD), the European Align initiative and the Finance for Biodiversity Pledge.

The focus of the 'PBAF Standard v2022' is on impact assessment (with dependencies included in future revisions) and offers three separate publications: (1) a Q&A on impact assessment, (2) an Overview of impact assessment approaches and assessment of positive impact and (3) guidance, requirements, and recommendations on biodiversity Footprinting.
The latter is the focus of this publication.

A biodiversity footprint can provide valuable insights into the potential impact of loans and investments, and the impact drivers responsible for this impact. The result can be used, amongst others, to zoom in on potential impact hotspots in a portfolio (scoping step), to inform biodiversity policies and to engage with investees. However, a biodiversity footprint should be handled with care. Understanding methodological choices and how data are used is key to enable a just interpretation of quantified biodiversity footprint results. In practice, a biodiversity footprint will often be combined with other impact assessment approaches, as described in the Overview of approaches publication.

The four main steps of a 'biodiversity footprint' are:

- Step 1 Understand the investment
- Step 2 Analysis of environmental inputs and outputs of economic activities
- Step 3 Analysis of the impact on biodiversity
- Step 4 Interpretation of the footprint result

For each footprinting step, the PBAF Standard v2022 provides guidance on methodological choices and data quality issues and formulates footprinting requirements and recommendations. Moreover, descriptions are provided of footprinting approaches for different asset classes, including Sovereign bonds, Listed Equity and Corporate bonds, Project finance, Mortgages, Investments in green energy, Motor vehicle loans and Indirect investments. This information can be used by tool developers, data providers and financial institutions to decide on the footprinting approach for a specific asset class.

In this way, the PBAF Standard contributes to the understanding, quality and harmonisation of biodiversity footprinting. Ensuring that a biodiversity footprint can help financial institutions take biodiversity into account.

1 Introduction

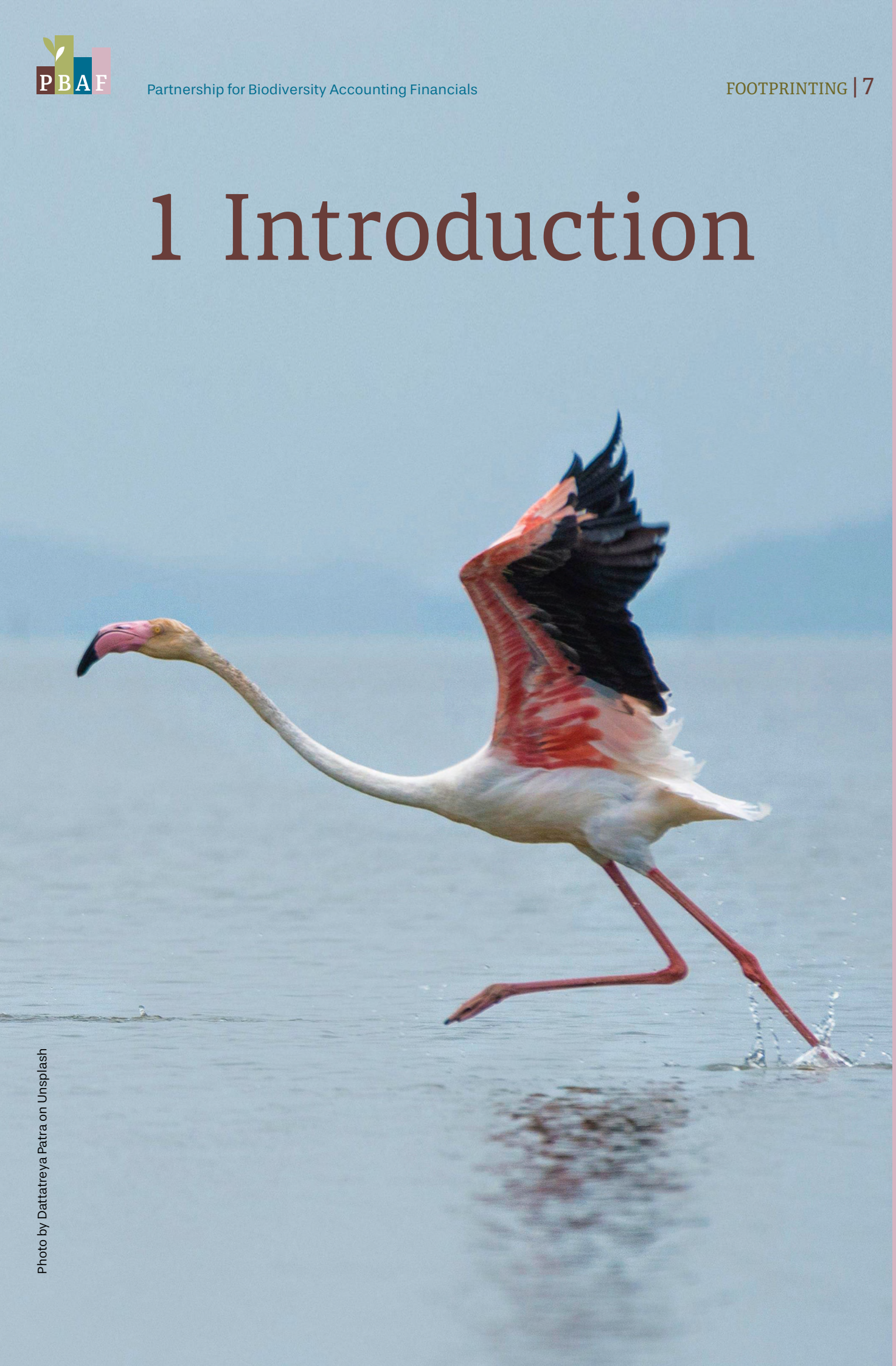


Photo by Dattatreya Patra on Unsplash

1.1 The Partnership for Biodiversity Accounting Financials

Background

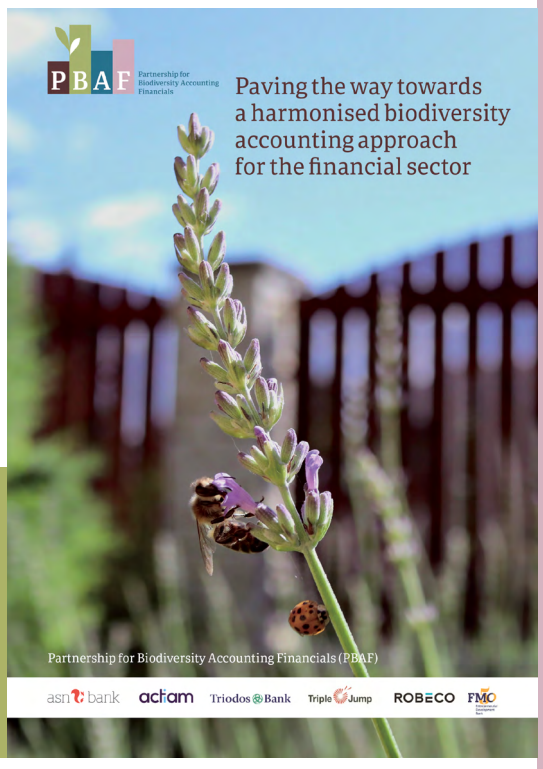
There is growing awareness among financial institutions that impacts and dependencies on biodiversity are highly relevant, both from a risk and an opportunity perspective. Almost all economic activities have an impact on biodiversity and many depend on the ecosystem services that nature provides. These services are increasingly at risk as a result of biodiversity loss. This loss presents financial institutions with increased risk, but also opportunities.

Through their investments, financial institutions can play an important role in reversing the loss of biodiversity and restoring ecosystems, contributing to the 2030 targets of the Convention on Biological Diversity (CBD)[1] (as laid down in the draft Global Biodiversity Framework[2]), thereby also contributing to a reduction of the growing financial risk following from the physical, transition and systemic risks that biodiversity loss presents.

The key role of the financial sector is not only acknowledged by the sector itself, but emphasized by nature organisations and governments. Interaction with and between these actors is key to ensure that biodiversity related government policies, advocacy, field research and investment policies and procedures reinforce each other, creating synergies.

For financial institutions to take up their role, the availability of science-based, reliable data on the impacts on biodiversity is an important precondition.

It is against this background that the Partnership for Biodiversity Accounting Financials (PBAF) was initiated in 2019 by founding partners ASN Bank (part of de Volksbank), ACTIAM, FMO, Robeco, Triodos Bank and Triple Jump. Discussions by this group, building on previous work, including work by the Partnership for Carbon Accounting Financials (PCAF), resulted in the 2020 publication 'Paving the way towards a harmonised biodiversity accounting approach for the financial sector'.[3] This publication was the first step towards a *'PBAF Standard'.*



The PBAF Standard aims to provide *guidance* to financial institutions on biodiversity impact and dependency assessment and to *define what is needed* for these assessments, either or not conducted by data providers, to deliver the right information to financial institutions; information that financial institutions can use to effectively manage and report on biodiversity related risks and opportunities, and contribute to the conservation and sustainable use of biodiversity.

1 Convention on Biological Diversity, on the conservation of biodiversity, sustainable use of its components, and equitable sharing of benefits from the use of genetic resources. Signed by 150 government leaders at the 1992 Ro Earth Summit. The 15th Conference of Parties scheduled for Q4, 2022 in Kunming, China, is set to launch a 2030 Global Framework.

2 CBD, Open Working Group on the Post-2020 Global Biodiversity Framework, 'First draft of the post-2020 Global Biodiversity Framework', 5 July 2021.

3 PBAF, 'Paving the way towards a harmonised biodiversity accounting approach for the financial sector', 2020.

Scope of PBAF

PBAF focuses on all types of financial institutions, both private and public. The word 'Accounting' in PBAF refers to the fact that financial institutions should take into account (understand, manage, be accountable) both their impact and dependencies on biodiversity and ecosystem services. PBAF aims to support financial institutions in the assessment of their impacts and dependencies, with this year's report focusing on impact assessment first.

PBAF partners and supporters

PBAF, which in 2021 turned from a project into an independent foundation, has as of May 2022 34 partners and supporters from eight countries. PBAF partners share and discuss practical experiences, challenges and solutions in PBAF Working groups, jointly deciding on topics that should be addressed in the PBAF Standard and co-developing the Standard's contents.

PBAF Sounding Board

A PBAF Sounding Board with experts in the field of biodiversity impact and dependency assessment has been established to provide feedback on the draft guidance, requirements and recommendations included in the draft PBAF Standard. This feedback is taken into account to the extent possible in the PBAF Standard published. Feedback which cannot yet be taken into account feeds into the discussions in the PBAF Working groups. Outcomes of these working groups are taken up in future revisions of the PBAF Standard.

NB: All feedback by PBAF Sounding Board members is carefully considered, but not all feedback is integrated in the PBAF Standard. This also means that the PBAF Standard not necessarily reflects the opinion of the Sounding Board members.

1.2 Alignment and cooperation

The Partnership aligns and cooperates as much as possible with related initiatives in the financial sector, like the European 'Aligning accounting approaches for nature' ('Align') project, the Taskforce on Nature related Financial Disclosures (TNFD), the Finance for Biodiversity Pledge and the Science Based Targets Network (SBTN). The aim of PBAF is not to reinvent the wheel, but to build on the valuable work of these other initiatives and translate this into impact and dependency related guidance, requirements, and recommendations for the financial sector.

Since Align has a similar focus as PBAF and the TNFD provides a broader framework for nature related financial disclosures, the relation with these initiatives is elaborated in more detail below.

PBAF and TNFD

The TNFD "is a global, market-led initiative with the mission to develop and deliver a risk management and disclosure framework for organisations to report and act on evolving nature related risks, with the ultimate aim to support a shift in global financial flows away from nature negative outcomes and toward nature-positive outcomes. The TNFD framework is intended for use globally by corporates and financial institutions of all sizes."[4]

In the TNFD Nature-related Risk & Opportunity Management and Disclosure Framework, Beta v0.1, a Nature-related risk and opportunity assessment approach is introduced: LEAP (Locate, Evaluate, Assess, Prepare). This approach includes 4 phases broken down into 17 analytical components, see figure 1.

4 TNFD, 'The TNFD Nature-related Risk & Opportunity Management and Disclosure Framework, Beta v0.1 Release', March 2022

In addition to the 17 steps for corporates, the LEAP approach for financial institutions includes a preceding set of 4 guiding questions that consider the type of financial institution, type of product / asset class, level of aggregation and sector in which the institution allocates capital:

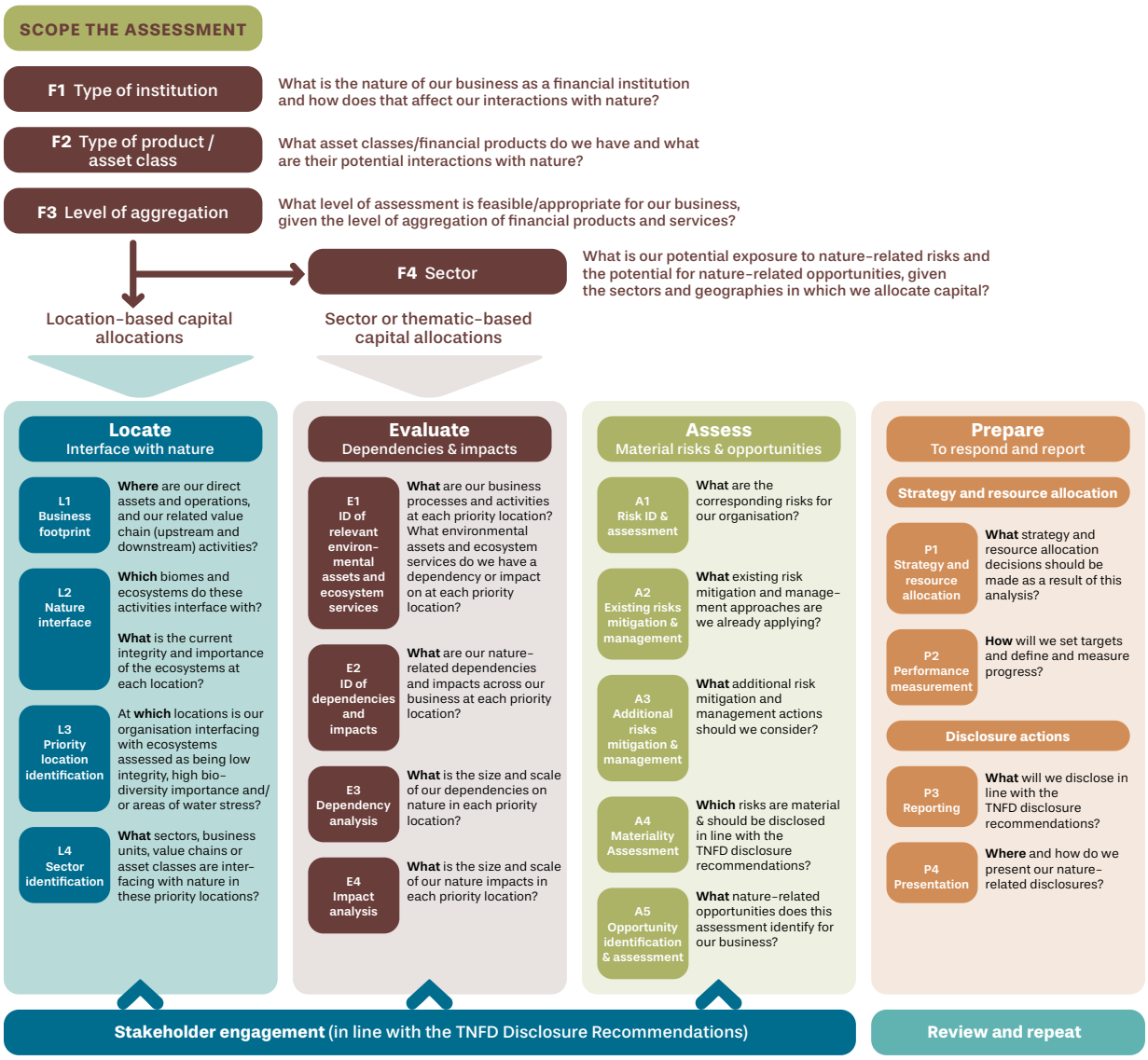


Figure 1: TNFD's LEAP approach: Locate, Evaluate, Assess, Prepare (TNFD, March 2022)

The work of PBAF is most closely linked to the 'Evaluate' phase. PBAF provides guidance specifically to the financial sector (TNFD is aimed at all corporates) and defines requirements and recommendations on biodiversity impact and dependency assessments.

In the financial sector, both initiatives will reinforce each other:

- The TNFD Framework shows where biodiversity impact and dependency assessment sits within the bigger picture of nature related risk management and disclosure, underlining the need for financial institutions to assess biodiversity impacts and dependencies.

While:

- PBAF provides guidance to financial institutions that want to analyse their biodiversity impacts and dependencies, generating the information and data needed to take the next steps in the TNFD framework.

PBAF and Align

The Align project will assist the European Commission's efforts to support businesses and other stakeholders in developing standardised natural capital accounting practices, including a standardised approach to biodiversity measurement. This will include[5]:

- Establishing and operating a dedicated natural capital management accounting platform for facilitating best practice exchange among business practitioners and relevant stakeholders.
- Establishing and operating a business driven discussion and alignment process that can streamline and strengthen existing methods and metrics for measuring the impacts and dependencies on biodiversity, including modules for inclusion in ongoing efforts to standardise natural capital management accounting practice.
- Defining needs and opportunities relating to education, training, and research, that are necessary for mainstreaming natural capital management accounting within the business community.

PBAF will translate the Align recommendations to the financial sector and adjust where necessary, in close cooperation with the PBAF Partners. PBAF and Align will cooperate in the development of sector-specific guidance.

Align is planning a public consultation of their first draft recommendations mid-2022. PBAF will ensure the 2023 revision of the PBAF Standard takes the Align recommendations into account.

1.3 The PBAF Standard v2022

Three publications

The PBAF Standard v2022 covers three separate publications:

1. PBAF Q&A on biodiversity impact assessment

Offering an introduction to biodiversity impact assessment for financial institutions in sixteen questions and answers.
Target group: Financial institutions & impact investors that are just starting to orientate themselves on biodiversity impact assessment.

2. PBAF Standard v2022 – Biodiversity impact assessment – Overview of approaches

Provides an overview of different biodiversity impact assessment approaches that can be used by financial institutions and includes a chapter on 'Positive impact'.
Target group: Financial institutions & impact investors that have limited knowledge and experience, to more experienced financial institutions & impact investors.

3. PBAF Standard v2022 – Biodiversity impact assessment – Footprinting

Presents PBAF's view on biodiversity footprinting: what does a biodiversity footprint need to comply with to provide the right information to financial institutions? Includes requirements and recommendations.
Target group: Financial institutions & impact investors with some experience on impact assessment, data providers and tool developers.

Building on the first publication but expanding the scope

The PBAF Standard v2022 builds on PBAF's first publication in 2020, which focused on the way a quantified biodiversity impact assessment or 'biodiversity footprint' should be conducted. However, discussions in the PBAF Working groups and feedback received at international meetings showed that the PBAF Standard should not be limited to biodiversity footprints. Rather, it

5 Align, 'Aligning biodiversity metrics for business and support for developing generally accepted accounting principles for natural capital', 2021.

should shed light on other types of impact assessment across the lending and investment process. Different impact assessment approaches answer different questions. These assessments are not necessarily quantified and include, among others, portfolio screening of impact and dependency risks using geospatial data (e.g., is an asset located in or close to a protected area?), satellite imaging (e.g. is deforestation taking place in the supply chain of a company invested in?) and new technologies such as eDNA and bioacoustics (what species are present in the area affected by the investment?).

By looking at different assessment approaches, the PBAF Standard v2022 aims for a broader picture of how financial institutions can assess impact on biodiversity, realising that:

- due to the increasing number of tools and initiatives and fast technological developments in this field, this picture is rapidly changing and evolving;
- the gap between current practice and the ideal situation is still large. For example, a biodiversity footprint at portfolio level may provide some direction on where in the portfolio impacts are likely to take place (and why), but is unable to take into account the complexities of biodiversity impact on the ground (and asset locations are often unknown).

This is also why this is the 'PBAF Standard v2022', with updates and revisions expected to follow in the years ahead.

Dependencies on ecosystem services

In the years to come, PBAF will also focus on the assessment of *dependencies* on biodiversity and ecosystem services. Although first discussions took place in the PBAF Working groups, the focus of this 2022 document is still on impacts. The focus of the next version of the PBAF Standard (v2023) will be expanded to include an assessment of dependencies (building on, amongst others, the work of Align and the TNFD). Until then, it is recommended to always verify whether information on ecosystem services and beneficiaries is available and to take this information into account in investment decisions. An example of an initiative already providing information on dependencies is the ENCORE knowledge base[6].

Balancing effectiveness, practicality and the end goal of biodiversity conservation

Many assessment approaches currently used do not yet result in an accurate picture of impacts and dependencies on biodiversity. The localised nature of biodiversity, and incomplete data on impact drivers and supply chains, constitute important challenges. Limited data and good but imperfect tools help prioritize, but with levels of uncertainty that need to be acknowledged. PBAF aims to balance the need for practical approaches that can be applied right now, with the need for results that help FIs move in the right direction: towards conservation and sustainable use of biodiversity. What is, at this point in time, best available practice, knowing that the topic is (even) more challenging than carbon? What guidance is needed for financial institutions to understand the value and limitations of impact assessment methodologies and data currently available? The PBAF Standard v2022 aims to provide answers to these questions.

A living document

Note that the PBAF Standard is a *living document*. The PBAF Standard v2022 will be subject to change, building on the output of PBAF Working groups, on publications of closely related initiatives, on changes in regulation and on the latest developments in the field of biodiversity impact assessment.

PBAF would like to thank all initiatives and experts in the finance and biodiversity and impact assessment space for the constructive cooperation leading up to the PBAF Standard v2022.

6 ENCORE = Exploring Natural Capital Opportunities, Risks and Exposure, https://encore.naturalcapital.finance/en.

1.4 The PBAF Standard vs 2022 – Footprinting

Establishing a baseline: Requirements and Recommendations

To increase the chances that a biodiversity footprint will result in the information financial institutions need to manage their impacts on biodiversity, PBAF provides *guidance* on how footprinting works and *definitions* of important footprinting concepts (note that most definitions are included in the publication 'PBAF Standard vs 2022 – Overview impact assessment approaches'), but also footprinting *principles* PBAF believes a biodiversity footprint should follow. A distinction is made between Requirements a footprint needs to comply with (indicated with an **R + number**) and Recommendations a footprint should preferably follow (indicated with an **A + number**, from Advice). In this way, footprinting methodologies can decide if they want to be 'PBAF aligned' or not.

Scope of the Standard

The PBAF Standard vs 2022 applies to footprints on different levels, including portfolio level, asset classes, companies and projects. Since the challenges and opportunities of footprinting on these different levels will differ (like the availability of primary and secondary data), the relevance of the different parts of guidance and the principles presented in this standard may also differ for footprints on different levels.

Methodological choices, data use and the footprint result

Understanding how methodological choices and data used may affect a quantified biodiversity footprint is key to enable a correct interpretation of footprint results and ask the right questions to data providers. In each footprinting step, methodological choices and data quality issues are discussed and footprinting requirements and recommendations are formulated. Note that this is not a comprehensive overview, but a selection of methodological and data quality issues frequently encountered in practice.

Footprinting approach per asset class

In addition to the explanation of the footprinting process and related guidance, requirements and recommendations, descriptions are provided of footprinting for different asset classes. These asset class specific descriptions build on the overarching guidance, requirements and recommendations and can be used by tool developers, data providers and financial institutions to decide on the footprinting approach for asset classes. The asset classes covered are:

- Sovereign bonds
- Listed Equity and Corporate bonds
- Project finance
- Mortgages
- Investments in green energy'
- Motor vehicle loans
- Indirect investments

NB: In practice, a footprinting methodology may not (yet) be able to fulfil all requirements presented. If this is the case, this will need to be considered in the interpretation and use of the results, including explicitly considering the level of (un)certainty. This is where the guidance comes in, i.e. explanations of the way footprinting works and how results may be affected

The definitions, requirements and recommendations presented here present PBAF's current thinking on the topic. Biodiversity footprinting is an evolving field, hence the definitions, requirements and recommendations may change over time as understanding changes and methodologies evolve. Moreover, definitions, requirements and recommendations may change dependent on context, such as changes in the availability of asset location data and supply chain data.

2 A Biodiversity Footprint

Photo by Sergi Ferrete on Unsplash

2.1 What is a biodiversity footprint?

One way to assess the biodiversity impacts of a loan or investment is to conduct a biodiversity footprint. There is, however, not one agreed definition for a 'biodiversity footprint'. The Institute for European Environmental Policy (IIEP) defines a biodiversity footprint as 'The impact of a commodity, company, person or community on global biodiversity, measured in terms of biodiversity change as a result of production and consumption of particular goods and services'[7].

In the PBAF Standard, a similar definition of a biodiversity footprint is used, stressing the fact that a footprint is a quantified impact: *The 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.*

In the case of a biodiversity footprint for financial institutions, the footprint may focus on the impact of the financial institution itself (e.g. impacts resulting from land use and energy use by a bank's buildings) and on the impact of the economic activities the financial institution invests in. The latter impact will generally be much larger. The PBAF Standard focuses on the biodiversity footprint of the loans and investments of a financial institution.

A biodiversity footprint can be used for different purposes, like gaining insight in biodiversity impact hotspots in an investment portfolio or to identify the main drivers of biodiversity loss in a project financed.

Complementary qualitative analysis

A qualitative analysis is often needed to complement a biodiversity footprint in order to analyse and address impacts not (yet) adequately covered by the quantitative footprint. The complementary use of both assessments enables a better interpretation of the footprinting results.

HANDLE WITH CARE

Conducting a biodiversity footprint has some clear advantages, but also some clear limitations resulting from the methodologies and data used. A biodiversity footprint results in an assessment of potential impact, mainly based on impact drivers (sometimes referred to as pressures) and 'pressure-impact models'. Especially where supply chains are concerned, a footprint needs to rely on secondary (often sector average) data from databases. Location specific ecosystem characteristics can only be taken into account to a very limited extent.

This means that financial institutions should carefully consider how footprinting results are used in policy development, decision making and target setting. Combining a biodiversity footprint with other (location explicit) impact assessment approaches (see *'PBAF Standard vs 2022 – Biodiversity impact assessment – Overview of approaches'*) is recommended. Moreover, since impacts on biodiversity (and on the ecosystem services and stakeholders affected) are *location specific*, financial institutions should strive for an improved disclosure of spatially explicit information on all material assets and activities.

Still, a biodiversity footprint can provide valuable insights into the potential impact of loans and investments and the drivers behind this impact, which can be used as a scoping step. By understanding how a biodiversity footprint works and what the value and the limitations of biodiversity footprint are, financial institutions can decide if, when and how they will use biodiversity footprinting in their biodiversity strategy.

7 IEEP, 'Biodiversity footprints in policy and decision-making: Briefing on the state of play, needs and opportunities and future directions', Policy report, Institute for European Environmental Policy, 2021

2.2 How does a biodiversity footprint relate to other footprints?

A biodiversity footprint is in some ways similar to carbon or water footprinting. However, contrary to carbon or water footprinting, there is no broadly accepted metric for a biodiversity footprint yet; there is no equivalent of an Intergovernmental Panel on Climate Change (IPCC) endorsed carbon metric.

Since the impact on biodiversity is the result of several impact drivers, like climate change and land use, financial institutions that have already gathered data or conducted a footprint for carbon, water or other impact drivers can and should use this data in the assessment of the impact on biodiversity to ensure consistency.

An important extra value of conducting a biodiversity footprint is the fact that the footprint will provide insight into potential trade-offs between policies addressing one or more of the underlying impact drivers. For example, the biodiversity footprint will show if the climate benefits of the use of biomass as an energy source leads to trade-offs with land use and water use. In other words, a biodiversity footprint allows a financial institution to make more balanced investment decisions considering all underlying environmental issues.

2.3 Steps and metrics in a biodiversity footprint

A biodiversity footprint can be conducted at the level of a single loan or investment, but also at the level of an asset class or an investment portfolio. The steps included in the footprint will be similar, but data use may differ. For example, in case of a footprint on a portfolio level the feasibility of using primary data will be more limited than in case of an investment in a single project.

The four main steps of a biodiversity impact assessment or 'biodiversity footprint' for a loan or investment are as follows:

- Step 1 Understand the investment
- Step 2 Analysis of environmental inputs and outputs of economic activities
- Step 3 Analysis of the impact on biodiversity
- Step 4 Interpretation of the footprint result

Most of the biodiversity footprinting methodologies developed so far, like the Corporate Biodiversity Footprint (CBF), the Biodiversity Footprint Financial Institutions (BFFI) and the Biodiversity Impact Analytics-Global Biodiversity Score (BIA-GBS) / Global Biodiversity Score-Financial Institutions (GBS FI)[8], include these or similar steps (see figure 1).

8 CDC Biodiversité, Berger, J. et al, 'Global Biodiversity Score – 2021 update – Establishing an ecosystem of stakeholders to measure the biodiversity performance of human activities', 2021.

Steps in a biodiversity footprint

The figure below shows the four steps generally included in a biodiversity footprint and the type of data used in each step.

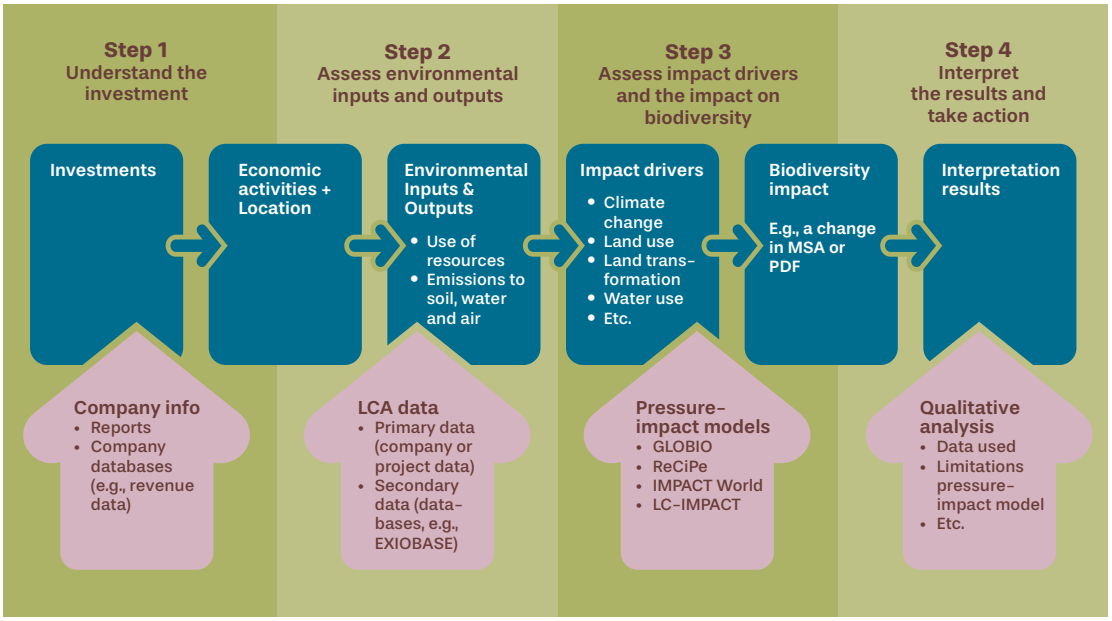


Figure 1: Common impact assessment steps in a biodiversity footprint

Each of the footprinting steps is further explained in chapter 3, including guidance on methodological and data related challenges, requirements and recommendations.

Metrics to express an impact on biodiversity

In biodiversity impact assessment, widely used metrics include the 'Mean Species Abundance' (MSA) metric and the 'Potentially Disappeared Fraction of Species' (PDF) metric. The PDF is a measure of species richness used in the ReCiPe, IMPACT WORLD+, and LCIMPACT pressure-response model (see also paragraph 3.4) as an indicator for ecosystem quality. The MSA is used as an indicator for biodiversity intactness. Impacts are described by means of an increase or decrease in the number of species, taking into account a spatial factor (the area where the impact takes place) and a time factor (the assessment period). Both MSA and PDF can be used across all sectors and across all countries and (eco)regions.

Overviews of biodiversity impact assessment metrics can be found in the 'Guide on biodiversity measurement approaches' by the Finance for Biodiversity Pledge and EU Business @ Biodiversity Platform (January 2022) and the 'Assessment of biodiversity measurement approaches for businesses and financial institutions; update report 3' by the EU Business @ Biodiversity Platform (March 2021).

2.4 Basic concepts in a biodiversity footprint

In order to be clear about the meaning of terms like 'impact', 'impact drivers', 'value chain', 'reference situation' and 'primary/secondary data' etc., *reference is made to the definitions included in the PBAF overview of impact assessment approaches* ('PBAF Standard vs 2022 – Biodiversity impact assessment – overview of approaches'). This includes an explanation and definitions for the following terms/concepts:

1. Biodiversity
2. Impact and impact drivers
3. Negative impact, avoided impact, positive impact, net impact, cumulative impact
4. Direct operations and value chain
5. Reference situation
6. Data use: primary and secondary data, ex ante and ex-post data

To some of these concepts requirements and/or recommendations may apply when conducting a biodiversity footprint. These requirements and recommendations will be covered in the next chapter, linked to the different footprinting steps.

3 Footprinting guidance, requirements and recommendations

Photo by Martin Sanchez on Unsplash

3.1 Introduction

In this chapter, the four steps in a biodiversity footprint are briefly explained, including guidance on methodological and data related challenges, requirements and recommendations.

Note that step 4, Interpretation of the footprint result, includes an overview of information on the methodology and data used that needs to be submitted with the footprinting results. This overview includes the transparency requirements defined in the first 3 steps.

Building on this information, chapter 4 provides an overview of the biodiversity footprinting approach for a selection of asset classes.

3.2 Step 1 Understand the investment

Investments to be defined in terms of economic activities

Each investment in a business, organization or project needs to be defined in terms of the economic activities linked to the investment and the region, country or location where these activities take place. This can be quite straightforward, e.g. in case of an investment in a mining or agricultural company, but can also be more challenging, e.g. in case of an investment in a company producing or selling a wide range of products or services.

Linking an investment to economic activities can be based on information included in public reports of companies or projects invested in, identifying the economic activities and the location where these activities take place. An alternative to this approach is the use of revenue data, specified per sector and country or region, offered by data providers. Combinations of the two approaches are also possible. The use and limitations of such data is described in the 'Data quality' section at the end of the paragraph.

R1: *Since the link between a loan or investment and economic activities determines what environmental inputs and outputs will be included in the footprint calculation, transparency about this step is required. If full transparency is not possible due to data related legal restrictions, the step and possible limitations needs to be explained.*

Scope: covering the entire value chain

An important question when calculating the biodiversity footprint of an investment is to what extent the financial institution takes responsibility for the impacts in the investees' value chain(s). For example, an investment in a sportswear brand selling sportwear, may be treated as an investment in a retailer when the sportswear brand does not produce the products itself. However, one might also argue that by investing in the brand, the financial institution is indirectly also responsible for the production of the sportswear products and the materials used in these products.

R2: *In a biodiversity footprint, the full scope 1 (impact of the company itself), scope 2 (impact of the energy companies the company sources its energy from) and scope 3 (impact upstream and downstream) shall be included.*

Inclusion of scope 3 upstream is important since the impact on biodiversity is typically highest upstream in the supply chain: raw material production and processing, like agriculture and

mining, mainly due to land use intensity and land use changes. Inclusion of scope 3 downstream can also be important but can be complex since the use and disposal of products and services can vary widely and cannot always be controlled. For this reason, most footprinting methodologies do not (yet) include scope 3 downstream or only partly address this scope. In future revisions of the PBAF Standard, further guidance on the inclusion of scopes for different sectors may be developed, e.g. building on the work of ENCORE and SBTN regarding the materiality of impact drivers in different scopes.

R3: *Transparency is required regarding the inclusion of the different scopes and the potential consequences for the footprinting results of not (fully) including one or more of the scopes.*

Identifying indirect activities (activities in the value chain) can be a challenge, depending on the data made available by investees. When data on supply chains is lacking, sourcing countries and locations will not be known. If this is the case, footprinting methodologies may use databases with trade-flow data between sectors and countries to model 'average' supply chains.

R4: *Transparency is required regarding the way in which supply chain impacts are included in the biodiversity footprint, related limitations and the potential consequences for the biodiversity footprint.*

Attribution of impact

The impacts on biodiversity of the economic activities identified will need to be attributed to the financial institution investing or providing a loan. The rules for this attribution are similar to the rules applied in carbon footprinting and are based on the 'follow the money' principle.

R5: *The following applies to the attribution of impacts on biodiversity, based on the PCAF attribution principles (PCAF, 2020)[9]:*

1. *Financed impact is calculated by multiplying an attribution factor (specific to the asset class) by the impact of the borrower or investee.*
2. *The attribution factor is defined as the share of total impact of the borrower or investee that is allocated to the loans or investments.*
3. *The attribution factor is calculated in line with the calculation method defined per asset class (see footprinting per asset class).*

The use of this common denominator, including both equity and debt funding, is important because (PCAF, 2020):

1. It ensures the use of one common denominator across all asset classes, which is in line with leading practices in the financial sector.
2. It does not differentiate between equity and debt as both contribute to total finance of the borrower or investee (and indirectly their impact) and are, therefore, deemed equally important.
3 It ensures 100% attribution of impact over equity and debt providers and avoids double counting of impact between equity and debt providers. This is specifically important for financial institutions that hold both equity and debt positions within the same companies or projects.

Data quality and footprint result

To understand what type of economic activities an investee is involved in, a footprint may rely on data from data providers showing in what sectors and what countries a company is generating its revenue. In a next step, this data can be linked to country/sector-specific environmental input and output data (see step 2). Such databases with revenue data rely on the data published by

9 PCAF, 'The global GHG accounting & reporting standard for the financial industry. First Edition', 2020.

companies in annual reports and questionnaires. The level of granularity and accuracy of this revenue data varies and will influence the footprint result.

DATA QUALITY ISSUE	HOW CAN THIS AFFECT A FOOTPRINT RESULT?
Division of revenue across countries When a company is reporting on revenue in regions (e.g. 'Europe') rather than countries, this revenue may need to be divided across countries manually in order to enable a link to country/sector-specific environmental input and output data. Different data providers will make different decisions in the way revenue is divided.	A different division of revenue across countries will lead to different environmental inputs and outputs attributed to the company, resulting in a different footprint.
Division of revenue across sectors Reporting of the revenue per sector can take place using different sector classifications, like NACE, ICB or GICS codes. Data providers will bring the data together in one sector classification using a crosswalk table (or 'concordance' table), translating one classification into another. Different data providers will use different tables and different classifications, resulting in different divisions of revenue across sectors. So called 'Crosswalk tables' are being developed by the EU Technical Export Group on Sustainable Finance and will be made publicly available in the future.	A different division of revenue across sectors will lead to different environmental inputs and outputs attributed to the company, resulting in a different footprint.

3.3 Step 2 Analysis of environmental inputs and outputs

Biodiversity focus of a biodiversity footprint

Biodiversity is valued as the life support system for society and its intrinsic value. There are several reasons why it makes sense to seek to protect all biodiversity and not just endangered species, charismatic species or species supporting specific ecosystem services:

- Biodiversity supports ecosystem resilience, thereby securing the future of current ecosystem services and contains an 'option' on ecosystem services that have yet to be discovered or used.
- Ecological functionality depends on common as well as charismatic or endangered species. It is therefore necessary to assess the changes in the populations of common species to maintain these functions. Focusing only on species extinction risk overlooks rapid declines in the number of individuals of species that are not at risk of extinction.
- The intrinsic value of biodiversity prevents a focus on ecosystem services only.

R6: *In case of a quantified biodiversity footprint, the focus shall be on biodiversity as a whole, not on specific species (like endangered species) only. However, it is recognised that a focus on endangered species can be part of other types of biodiversity impact assessment and can be part of investment decisions aiming for a positive impact. The focus on biodiversity should not only cover terrestrial, but also fresh water and marine biodiversity.*

For a definition of 'biodiversity', see chapter 2 in the publication 'PBAF Standard vs 2022 Biodiversity Impact Assessment – Overview of approaches'.

Impact drivers and environmental inputs and outputs covered

Environmental inputs ((use of resources, like land use and water use) and outputs (emissions) of an economic activity will result in impact drivers, like climate change, which may result in an impact biodiversity. In order for a biodiversity footprint to be relevant it is key that the most important environmental inputs and outputs linked to the main drivers of biodiversity loss are covered. The main drivers of biodiversity loss are (IPBES, 2019)[10]:

- Land- and sea-use change
- Direct exploitation (also referred to as 'Resource extraction')
- Climate change
- Pollution
- Invasive alien species

R7: *For the biodiversity footprint to be relevant, the main impact drivers shall be covered in the impact assessment / footprint, as well as the most important environmental inputs and outputs linked to these impact drivers. Impact drivers and related key environmental inputs and outputs that cannot be included in the quantitative impact assessment shall be covered by means of a complementary qualitative analysis.*

Moreover, a biodiversity footprint should cover the three realms also distinguished in IPBES: terrestrial, freshwater and marine ecosystems.

R8: *A biodiversity footprint should cover terrestrial, freshwater and marine impacts on biodiversity. Realms that cannot (yet) be fully included in the quantitative impact assessment shall be covered by means of a complementary qualitative analysis.*

COMPONENTS OF NATURE - TNFD

The TNFD distinguishes land, ocean, freshwater and atmosphere as "major components of the natural world that differ fundamentally in their organisation and function". Atmosphere was added "to reflect the close association between climate- and nature-related risks and opportunities, while also while also acknowledging that links with climate mitigation and adaptation occur across all realms". According to the TNFD, "the four realms provide an entry point for understanding how organisations and people depend on, and have impacts on, the natural capital that provides the resources and services from which business and societies benefit". [11]

To link economic activities to these impact drivers, the environmental inputs and outputs of economic activities need to be identified. This data can either be primary data from investees or secondary data from databases, often country specific sector average data (see the example of the EXIOBASE database below, frequently used by existing tools[12]). This environmental data will determine what impact drivers are relevant to assess the (potential) impact on biodiversity. For example, emissions of greenhouse gasses will contribute to climate change, which leads to an impact on biodiversity. The relation between environmental inputs and outputs, impact drivers and biodiversity is illustrated in figure 2 for the ReCiPe pressure-impact model.

10 S. Díaz et al., IPBES, 'Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services', 2019.
11 TNFD, 'The TNFD Nature-related Risk & Opportunity Management and Disclosure Framework; Beta v0.1 Release', March 2022.
12 Examples of such tools include the Corporate Biodiversity Footprint (CBF), the Biodiversity Footprint Financial Institutions (BFFI) and the Global Biodiversity Score Financial Institutions.

EXIOBASE

The **EXIOBASE database** is a public database covering 43 countries, that together represent 90% of the World's economy and 5 'Rest of the World' regions that cover the remaining 10% of the economy. It has collected data for all 48 regions on economic activities, environmental inputs (like resource use, land use) and outputs (like emissions) and some social aspects. The database distinguishes 163 industrial and service sectors. The trade flows between these sectors are also specified, which leads to millions of trade flows. There are also some special categories, like the activities caused by the total consumption in a country and the impacts of government expenditure and purchases.

EXIOBASE can be used to assess the environmental inputs and outputs of an investment in a sector, in a specific country. Since the trade flows of the sector are included in the database, the indirect impacts of supply chains (linked to this sector) can be included. This also means that if a company is defined by the revenue it realises in different sectors, the environmental impact of the company can be calculated.

There are some important limitations to this approach. First, EXIOBASE provides average input/output data for a sector in a country, not for individual companies. Secondly, dividing an economy in 163 sectors provides a rather coarse classification of economic activities. If an investment is made in a specific industrial activity, it may not always be clear to which sector it belongs. For companies active in sectors with very heterogeneous products, the EXIOBASE dataset might not be very representative for the products manufactured by the company under assessment.

Although the EXIOBASE database has its limitations, it can be used in a footprint calculation to gain insight in the most likely location of biodiversity impact hotspots in an investment portfolio. Based on the result, the next step could be a more detailed assessment for these impact hotspots, based on more specific, primary data (when available).

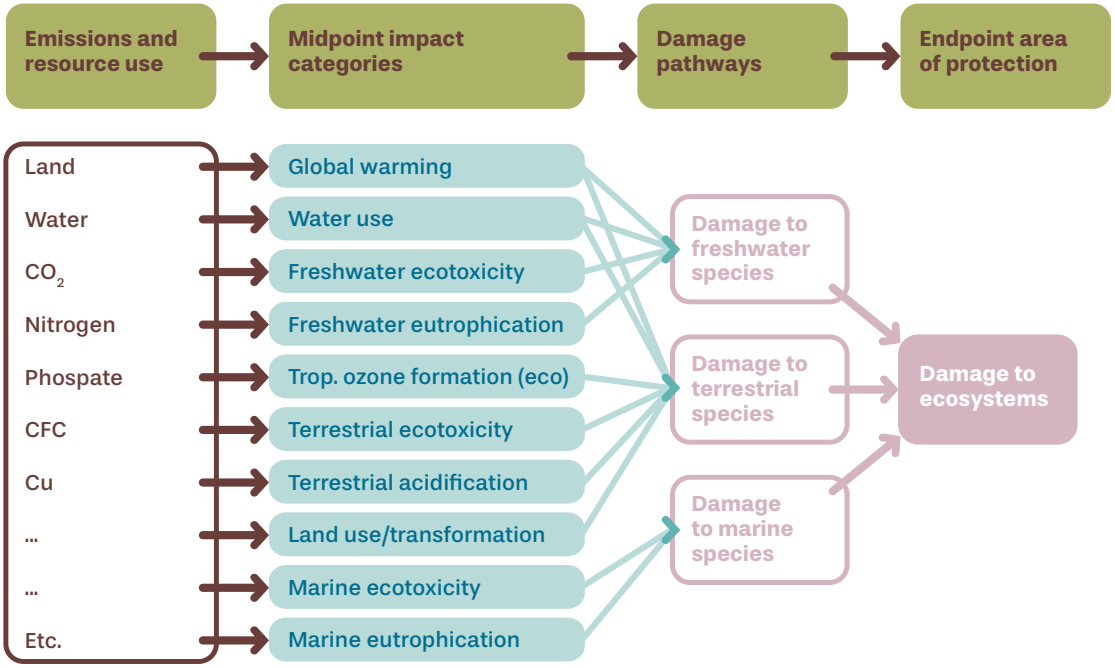


Figure 2: Environmental inputs and outputs, impact drivers (midpoint impact categories) and the impact on biodiversity/damage to ecosystem quality in the ReCiPe model

An overview of impact drivers covered by different pressure–impact models is included in paragraph 3.4.

R9: *Transparency is required regarding the inclusion of the five main drivers of biodiversity loss and gain in the biodiversity footprint. If one or more drivers are not (fully) included in the footprint, the (expected) relevance and significance of these impact drivers needs to be described by means of a complementary qualitative analysis.*

Data quality and footprint result

A. Use of primary data

In case of an impact assessment for a specific company, environmental data from sustainability reports can be used or data directly requested from a company by means of questionnaires. This primary data will normally be more accurate than secondary data from databases (often sector averages). However, also the accuracy of primary data should be verified.

DATA QUALITY ISSUE	HOW CAN THIS AFFECT A FOOTPRINT RESULT?
Accuracy of primary data Primary data from companies tends to be more accurate than data from background databases. However, the level of accuracy of primary data may be reduced for several reasons, including a lack of clarity why specific data needs to be collected, mistakes in data gathering and a lack of verification of the data provided. Moreover, it must be realised that data provided by companies can (partly) be modelled/calculated instead of measured, resulting in data-limitations which are similar to the limitations of secondary data.	The use of inaccurate primary data can lead to the misconception that the footprint is relatively accurate since primary data was used instead of data from databases. The use of inaccurate data will result in a footprint result which is too high or too low for the drivers of biodiversity linked to this data.

B. Use of secondary data: sector average data from databases

Primary environmental data from companies is not always available or may be too time consuming to collect in case of large numbers of companies involved in a footprint (also including companies in supply chains). In such cases, environmental data from databases can be used. This is often (country specific) sector average data from a specific year.

DATA QUALITY ISSUE	HOW CAN THIS AFFECT A FOOTPRINT RESULT?
Responsiveness to company action and investment criteria The use of sector averages affects the responsiveness of a footprint. Best in class companies from a biodiversity point of view will score the same as underperforming companies in the same sector. It also means that investment criteria addressing drivers of biodiversity loss or gain, filtering out worst in class performers in sectors or only including best in class performers, are not reflected in the footprint calculation. Sector average data used in a footprint can be replaced by company-specific data, for example when carbon data on a company level is available. Some methodologies will also adjust sector average data when a company has (biodiversity relevant) certifications in place or has implemented specific biodiversity relevant best practices.	The use of sector averages may lead to a footprint which is too high or too low, when the company invested in actually performs better or worse than the sector average. In the case of financial institutions that have strict biodiversity related investment criteria, the footprint result may be more negative than the actual impact. This means that such investment criteria are not rewarded via the footprint.

Responsiveness to technological development and innovation The use of 'outdated' data may result in environmental inputs and outputs which are not in line anymore with current company/sector practices, especially in sectors where the innovation rate is high.	The use of old data may lead to a footprint result which is either too high (innovation has contributed to a reduction in resource use and emissions) or too low (innovation has resulted in an increase in resource use and emissions).
Data from databases with 'rest of the world regions' Databases offering data on environmental inputs (like land-use and water use) and environmental outputs (emissions) are often based on environmental statistics from different countries around the world. Not all countries offer the same quality of data where it comes to such statistics. For this reason, databases may use a 'rest of the world' category with very rough data, not differentiating between the countries in this category.	The accuracy of data from 'rest of the world regions' will be quite limited. This will affect the accuracy of the footprint, depending of the significance of this data in the total footprint.
Limited granularity of sectors in databases The level of granularity of the sectors in background databases may differ. For example, a sector 'textiles' does not differentiate between textiles from cotton or textiles from polyester or other fibres.	The lower the granularity of the sector differentiation, the less accurate the data will be when this data is used to calculate the footprint of a specific sub-sector or company. This means that the actual impact may be higher or lower than calculated.

C. Supply chain modelling of scope 3 upstream

Data on the suppliers to a company (scope 3 upstream) and their locations is often not available. Data from databases can alternatively be used in footprint calculations. An example is the use of trade flow data from the EXIOBASE database showing what trade is taking place between sectors and between countries. This data can be used to model the *average supply chains* of a company in a specific country. This modelling of supply chains enables the identification of environmental inputs and outputs linked to a company through its supply chains.

DATA QUALITY ISSUE	HOW CAN THIS AFFECT A FOOTPRINT RESULT?
Responsiveness to companies' procurement policies and investment criteria The use of 'average supply chain' data affects the responsiveness to supply chain actions implemented by a company. Best in class companies from a supply chain policy point of view (e.g. the company has a no-deforestation sourcing policy in place) will score the same as underperforming companies in the same sector and country.	The use of sector average supply chains may lead to a footprint which is too high or too low, when the companies invested in actually perform better or worse in their supply chains than the sector average. Especially in case of financial institutions that have strict biodiversity related investment criteria, filtering out worst in class performers in sectors, the footprint result may be worse than the actual performance of the companies invested in.
Identification of countries sourced from Modelling of the average supply chains for companies in a specific sector also means that the countries in those supply chains will be the average countries, not the actual countries a company is sourcing from.	A footprint based on modelled supply chains will show in what countries the potential impacts on biodiversity on average take place. Since this is not necessarily in line with the reality for a specific company, the options to act on the geographic spread of impacts is limited.

D. Value chain data scope 3 downstream

Data on the environmental pressures downstream are often difficult to gather or model. An important reason is the fact that many products and services can be used in a variety of ways by consumers. This is one of the reasons why the scope of a biodiversity footprint is sometimes limited to scope 3 upstream or only includes part of scope 3 downstream.

DATA QUALITY ISSUE	HOW CAN THIS AFFECT A FOOTPRINT RESULT?
Limited accuracy or exclusion of scope 3 downstream data Data on the environmental inputs and outputs in scope 3 downstream is sometimes left out of a biodiversity footprint or needs to be modelled affecting the level of accuracy.	Exclusion of scope 3 downstream from a footprint can have a significant effect on footprint. When a large part of the environmental pressures materialise in scope 3 downstream (e.g. through energy use), the total footprint result will be too low and miss out on important drivers of biodiversity loss. Similarly, the total footprint may be too high if avoided impacts or positive impacts take place in scope 3 downstream.

E. Reflecting the use of certification standards

Many financial institutions refer to the use of certification standards in their investment criteria. Some of the certification standards are widely considered to be potentially beneficial to biodiversity, like the FSC certification standard. The way certifications standards address the topic of biodiversity differs per standard and a number of initiatives have developed overviews of the ways in which specific certification standards include biodiversity related certification criteria. Examples include the work of the Global Nature Fund (GNF) on biodiversity in standards and labels for the food industry[13] and work by the International Institute for Sustainable Development (IISD) on the criteria of 15 major agricultural voluntary sustainability standards[14].

The use of these certification standards is preferably reflected in the assessment of a biodiversity footprint, in order to award and stimulate the use of the standard. However, data on the impact of certification standards is often still limited or lacking. Moreover, impact assessments can be based on sector average environmental input and output data (like data from the EXIOBASE database), not reflecting the use of a certification standard by individual companies (the sector average of the environmental inputs and outputs will be based on the combination of certified and non-certified companies).

There are three ways to deal with this

1. **Calculate a more detailed footprint with additional primary data.**
   The expected better performance of investments in companies or projects outperforming the sector average can best be dealt with by using more primary data on direct emissions, resource use and supply chain data. For example, in case of certified organic farming, a reduced use (or no use at all) of fertilizers and pesticides is expected. In this case, sector average input data can be adjusted with the company specific fertilizer use and pesticide input data. The same holds for other inputs such as water use and energy use. Including this data will show the reduction in potential biodiversity impact compared to the sector average.

2. **Calculate a proxy for specific certifications**
   This proxy can be based on company specific footprints as described in option 1, assuming that companies with the same certification have a comparable (reduction in) footprint. The proxy can be based on the average emissions and average resource use of farms with, in this example, organic farming certification. The drawback of this approach is that there are many certifications on the market, and not all certification schemes have data available on average (reductions in) inputs and emissions.

3. **Estimate the biodiversity impact**
   If the integration of certification standards in a footprint calculation based on primary data (option 1) or a proxy based on company specific footprints (option 2) is not possible, the

13 GNF et al, 'Biodiversity in standards and labels for the food sector, Baseline report', 2017.
14 Jason Potts, Vivek Voora, Matthew Lynch, Aynur Mammadova, 'Standards and Biodiversity: Thematic review', June 2017.

impact from certification standards (the reduction in impact for a certified company compared to the sector average) can be estimated. For this option, the following requirements apply:

R10: *If a certification standard includes measures, captured in certification criteria, aimed at reducing specific environmental pressures compared to standard (sector average) practices, these reductions in pressures may be translated into one or more 'impact correction factors' to correct a footprint based on sector average environmental data, provided that:*

a) The certification standard is a voluntary, criteria based, third-party assessed program, based on life cycle considerations.
b) There is no evidence of net negative impacts associated with the certification.
c) The certification standard includes criteria which explicitly address one or more drivers of biodiversity loss and/or the enhancement of biodiversity.
d) The impact correction factor takes into account potential differences in the certification criteria in different countries.
e) The impact correction factor is limited to the criteria mentioned under (c) and to those criteria that need to be implemented before certification can be obtained. No voluntary criteria or criteria which can, but do not have to be selected from a long list of criteria and no criteria with a non-compliance.
f) The impact correction factor is preferably based on quantified changes in environmental inputs and outputs required by and specified in the certification standard.
g) The impact correction factor takes into account the percentage of produce which has been certified according to the certification standard when applying the correction factor to assess the impact of a production company.
h) The impact correction factor takes into account the effect the certification standard already has on the sector average which is adjusted.
i) The certifications for which correction factors have been applied is disclosed with the result of the footprint. The correction factors shall be available to the financial institution using the footprint, but are not necessarily disclosed in public reports.

The development of a set of agreed correction factors for certification standards, to be used by all footprinting methodologies, could be an important next step.

FSC CERTIFICATION AND LAND USE

In case of FSC (Forest Stewardship Council) certification, average impact data for forestry-related land use can be replaced by impact data reflecting the type of forest management required by FSC certification. To do this, data can be used from the publication 'Impact of Forest Management on Species Richness' from Chaudhary et al[15].

3.4 Step 3 Analysis of the impact on biodiversity

An important characteristic of a biodiversity footprint is the fact that the link between environmental inputs/outputs and impact drivers, as well as the link between impact drivers and impact on biodiversity is quantified. At the same time, it is important to recognise that a quantification

15 Chaudhary et al., 'Impact of Forest Management on Species Richness', 2016.

of potential impact may not yet be possible for all impact drivers. This limitation will need to be addressed in a qualitative way, for example in the interpretation of the footprinting results (see paragraph 3.5).

R11: *In the quantified part of a biodiversity footprint, changes in impact drivers need to be translated into changes in impact on biodiversity and the linkages need to be explicit, quantitative, transparent and science based. This ensures that the impact assessment is responsive to change, results are replicable and results are relevant to companies and investors.*

To translate impact drivers into an expected or potential impact on biodiversity or ecosystem quality (potential, since the impact is calculated and not measured), footprinting methodologies use 'pressure–impact' models (following the terminology explained, these could also be referred to as 'driver–impact' models, but the term 'pressure–impact' model is more common). These models include modelled relations between impact drivers and impact, based on scientific data from field studies. A number of different models is currently used, including ReCiPe 2016, GLOBIO, IMPACT WORLD and LCIMPACT. The impact drivers covered by these models varies and is included in table 3.

The table shows that the number of impact drivers included in the models varies and invasive alien species is not (yet) covered by any of these models. Moreover, the marine environment is still largely missing from the models. This also means that footprinting methodologies will often combine one or more of these models with a qualitative assessment in order to cover the five main drivers of biodiversity loss or gain and terrestrial, freshwater and marine impacts.

Table 3: Pressure–impact models and impact drivers covered

IMPACT DRIVER (IPBES)	RECIPE2016	GLOBIO	IMPACT WORLD+	LCIMPACT
Land- / Sea-use change	Land use Land use change	Land use Infrastructure Habitat fragmentation Human encroachment	Land use Land use change	Land use Land use change
Resource extraction / Overexploitation	Water scarcity	Implicitly in land-use intensity class	Water availability	Water stress
Invasive alien species	–	–	–	–
Pollution	Acidification Ecotoxicity Eutrophication Photochemical ozone formation	N-deposition	Acidification Ecotoxicity Eutrophication Photochemical ozone formation Ionizing radiation	Acidification Ecotoxicity Eutrophication Photochemical ozone formation
Climate change	Climate change	Climate change	Climate change	Climate change
Indicator	PDF.ha.yr	MSA or MSA.ha.yr (in LCA)	PDF.m2.yr	PDF

DIRECT AND INDIRECT IMPACTS ACCORDING TO THE TNFD

With respect to the impacts on nature, the TNFD distinguished between:

- **Direct impacts: a change in the state of nature caused by a business activity with a direct causal link (like land-use).**
- **Indirect impacts: a change in the state of nature caused by a business activity with an indirect causal link (e.g. a change indirectly caused by climate change, to which an organisation's greenhouse gas emissions contributed).**

Note that, as with impact drivers, definitions may vary. For example, the term 'indirect impacts' can also be used for impacts in supply chains, whereas 'direct impacts' may refer to the impact of the company's direct operations (site level impacts).

Negative, avoided and positive impact

The footprint can result in a negative impact, avoided impact or positive impact. Summing positive, avoided and negative impacts to calculate a net impact is highly debatable, since impacts often take place at different locations and even in different regions and may involve different ecosystems, species and genes (no 'ecological equivalence'), see also 'PBAF Standard vs 2022 Biodiversity impact assessment – Overview of approaches'. This means that negative, avoided and positive impact need to be reported separately.

R12: *Negative, avoided and positive impacts shall be reported separately.*

Although negative, avoided and positive impacts cannot just be added up to calculate a net impact, in practice the calculation of a net impact is sometimes used as a way to compare investments in different companies, projects and asset classes.

R13: *Even when a net impact is calculated or communicated for specific purposes, negative impact, avoided impact and positive impact shall (also) be reported separately. Moreover, when a net impact is communicated by a financial institution, the use and interpretation of this net impact by the financial institution shall be explained.*

Monitoring of actual changes in biodiversity

Instead of calculating a potential impact on biodiversity using pressure-impact models, the impact of economic activities can also be measured by monitoring of actual changes in biodiversity on the ground (ex-post monitoring data). Although this may result in more accurate data on changes in biodiversity, attributing this change to the economic activities under investigation may prove to be a challenge, especially when impact drivers from other activities contribute to this change. In this case modelling may still be needed. When measurements of actual changes in biodiversity become available, this data can be compared with the estimated impact (ex-ante data).

R14: *When ex-post monitoring data of actual changes in biodiversity become available (e.g. during the implementation of a project), these data shall be compared with the ex-ante data on estimated impact. In case of significant differences between actual impact and estimated impact, these differences shall be analysed. The result shall be used to either adjust the estimated impact, the attribution of impact or improve the quality of monitoring.*

A1: *In those cases where a loan is paid back or an exit is made before the impact has (fully) materialized, the investor preferably uses ex-post monitoring data available at the time of the exit and ex-ante data on estimated impact from that date onwards to assess the impact.*

The spatial dimension of impact

Biodiversity impact assessment has a spatial dimension in the sense that emissions and resource use take place in a specific area and the impact can be local, regional or global.

- **Local**
  An example of a localised effect is the emission of excess nutrients such as nitrogen. An emission of 1 kg of a nitrogen compound has a different effect in ecosystems with taxa that require low nutrient levels than ecosystems with vegetation that flourishes with high nutrient levels. This means that is important to know where emissions take place and where the emission ends up.
- **Regional**
  The emission of non-persistent toxic substances may have a localised effect, while toxic impacts of more persistent substances may spread over a wider area and have a regional impact.
- **Global**
  Emissions contributing to climate change will have a global effect: it does not matter where on earth a kg of CO_2 is emitted.

This spatial dimension of impact means that, in order to assess the impact on biodiversity of a specific impact driver, knowledge of the impact area is needed. However, although this may be feasible for scope 1 environmental inputs and outputs (like emissions at site level), this will be much more challenging for impacts taking place upstream or downstream in value chains. Moreover, monitoring actual impact can be time consuming and costly. For this reason, biodiversity impacts with varying spatial dimensions are often included in a biodiversity footprint by means of pressure–impact models in which this spatial dimension is modelled.

The time dimension of impact

Time plays a role in two different ways in a biodiversity footprint: the time period covered by the impact assessment and the time during which an environmental input or output will impact on biodiversity. The time period covered by an impact assessment is often a one year period to allow reporting of an annual footprint. This annual footprint will be based on the impacts resulting from the economic activities linked to a loan or investment during one year of a company's operations or a project.

The time during which an environmental input or output will impact on biodiversity will vary for different inputs and outputs. For example, land use may take place during a certain period of time and converted land may at some point in time become nature again. This time dimension is taken into account in a footprint calculation. The time dimension also plays a role in emission related pressures. An emission does not cause an impact for eternity; it will, at a certain time, vanish or be converted in a less harmful substance. For instance, a methane emission will be converted into CO_2 after one or two decades, and this CO_2 will be absorbed by plants and oceans in one or two centuries. Likewise, many toxic substances will often have an impact during a few days or weeks before they break down.

This time dimension of impact can be dealt with in different ways, influencing the footprint result. The mainstream approach in life cycle assessment to deal with future impacts of emissions is 'time integration', an approach which is also used by the IPCC. In the case of time integration, future impacts are treated like they are taking place at the time the footprint is calculated: the impacts are added up in and are included in the footprint. Because future impacts are immediately accounted for, an incentive is created to address these future impacts.

Note that the time integration approach is also used for claiming avoided negative impacts or positive impacts in a footprint: the impact is claimed in the footprint when the investment has

been made, even if the actual impact may take several years to materialise (no discounting of future positive and negative impacts as of yet; this could however be part of future discussions). For example, in case of an investment in a water treatment plant, the expected/estimated long term impact on biodiversity is included in the footprint, even if this impact takes 10 years to materialise.

Not all footprinting methodologies use time integration and limit the inclusion of future impacts to a predefined time period. This can be the reporting period (one year), but can also be the impact caused by a future point in time, like the impact caused by 2030. A reason to focus on a future point in time can be the use of the footprint in a scenario analysis (e.g. the state of biodiversity in 2030 taking into account all impacts until 2030).

R15: *Since the choice to use time integration or alternative approaches to deal with the time dimension of impacts will influence the footprint result, this choice needs to be explained and reported with the footprint result.*

TIME AND SPACE DIMENSION IN THE METRICS PDF AND MSA

Both the spatial and time dimension of impacts on biodiversity are taken into account in a biodiversity footprint. Both MSA (Mean Species Abundance) and PDF (Potentially Disappeared Fraction of species) have a composition of a spatial and a time dimension: MSA.m^2.yr and PDF.m^2.yr. In this composition, area and time are interchangeable, as long as the multiplication of MSA/PDF, area and time results in the same score. For example, a footprint of 5000 PDF.m^2.yr can have the following meanings:

- **50% species loss in 10 000 m^2 during 1 year or**
- **50% species loss in 1 000 m^2 during 10 years or**
- **5% species loss in 100 000 m^2 during 1 year.**

Note that MSA expresses the abundance of species remaining and PDF expresses the (potential) loss of species. For this reason, in case of the MSA metric, a negative impact on biodiversity (MSA loss) is often expressed as 1-MSA.m^2.yr.

Data quality and footprint result

Three important limitations of the pressure–impact models commonly used are (1) the calculation of potential impact instead of actual impact, (2) the fact that not all drivers of biodiversity loss or gain may be included in a pressure–impact model and (3) the limited responsiveness to local characteristics of ecosystems. These limitations are explained below (see the 'PBAF Standard vs 2022 Biodiversity impact assessment – Overview of approaches' for a definition of potential impact and actual impact).

A. Potential impact versus actual impact

A biodiversity footprint can be based on a calculation of the potential impact on biodiversity, focusing on changes in drivers of biodiversity loss and gain, on an assessment of actual impacts on biodiversity (which requires monitoring data) and on a combination of both. In case of a biodiversity footprint of an investment portfolio, the assessment of actual impact will often not be feasible, which means that the potential impact is calculated.

B. Drivers of biodiversity loss not (yet) included in pressure impact models

Not all drivers of biodiversity loss are fully covered by current pressure–impact models. Examples are the introduction of invasive species, disturbance and over-exploitation. For these drivers, a quantitative footprint will need to be complemented by a qualitative or semi-quantitative (like a scoring system) analysis.

C. No or limited responsiveness to location specific characteristics of ecosystems
The same impact drivers can lead to different impacts in different locations. The ability of footprinting methodologies to take into account location specific ecosystem characteristics will vary between methodologies and is often limited. This means that the potential impact calculated must be interpreted with care. At the same time it must be realised that, although the actual impact on biodiversity will depend on the impact location, from a precautionary perspective the reduction of drivers of (potential) negative impact is always a good idea. For this reason, knowledge of the impact drivers of potential impact can be used by financial institutions to zoom in and, for example, engage with companies.

3.5 Step 4 Interpretation of the footprint result

In the interpretation step of the footprint results, two important questions need to be answered:
1. What is the level of accuracy of the footprint result and how does this influence the interpretation and use?
2. What reference can be used to put the result in perspective? Is the result acceptable or (too) high and compared to what?

Complementary qualitative analysis
Any quantitative biodiversity footprint will have its limitations from the viewpoint of the characterisation of the economic activities invested in, the data available to assess the environmental pressures and the pressure–impact models used to calculate the impact on biodiversity. A *qualitative analysis* serves to complement a quantitative analysis in order to address all impact related issues which cannot yet be covered by the quantitative footprint, like specific impact drivers or scopes not yet included or the use of biodiversity-relevant certification standards not yet reflected by the quantitative footprint. Moreover, a qualitative analysis can be used to put the quantitative results into perspective, discuss methodological limitations and provide an assessment (quantitative and/or qualitative) of uncertainty.

***R16:** A qualitative analysis shall accompany a quantitative footprint in order to complement impact assessment results, to recognise and report on limitations and to take these limitations into consideration in the interpretation and use of the footprint results.*

CASE STUDY: ASN BANK: A QUANTITATIVE AND QUALITATIVE ASSESSMENT OF BIODIVERSITY IMPACT ON PORTFOLIO LEVEL

ASN Bank is using the Biodiversity Footprint Financial Institutions (BFFI) to calculate the biodiversity impact of the bank's investment portfolio since 2015. This methodology uses the ReCiPe pressure–impact model. When the first biodiversity footprint was executed in 2016, also a qualitative analysis was conducted of the methodology, including an analysis of the limitations of the pressure–impact model used (ReCiPe), the effect these limitations can have for the footprint results, the relevance/significance of this effect for the bank's investments and how these limitations can be addressed.
An example of the limitations discussed is the fact that the introduction of exotic invasive species is not included in the ReCiPe model. Because the introduction of invasive species can be an important driver of biodiversity loss, an analysis was made of the relevance/significance of this limitation looking at the sectors ASN Bank invests in. For

example, sectors like aquaculture, agriculture and forestry are high-risk sectors from the viewpoint of invasive species, meaning that the footprint result (the calculated potential impact) of direct or indirect investments in these sectors is an underestimation of the actual impact.

In a next step an analysis was made of how this limitation can be addressed. One option that was explored is to see if this driver of biodiversity loss can be taken 'out of the footprint equation' through the use of an invasive species related policy and investment criteria for companies in or linked to high risk sectors. By requiring proper management of the risk of introducing invasive species or by requiring certification with a sustainability standard that addresses the introduction of invasive species. For example, in case of forestry related sectors (like the paper industry), an investment criterion requiring FSC certification of forest or plantation will mitigate the risk. Since FSC certification is included in ASN Bank's sustainability policy and criteria, the introduction of invasive species is expected to play a limited role in the bank's investments in forestry related sectors (realising that international transport of forestry related products also needs attention from an invasive species point of view).

Other limitations of the ReCiPe pressure-impact model and the data used were analysed in a similar way, resulting in insight in the footprint limitations and ways to deal with these limitations.

More information is available in the publication 'Towards ASN Bank's Biodiversity footprint; A pilot project', CREM, PRé and ASN Bank, 2016. (available through ASN Bank)

Data use and data transparency

The type of data used (e.g. primary versus secondary data) will highly influence the way a footprint result should be interpreted. Transparency on data use is therefore key. The following general requirements and recommendations apply with regard to data use:

R17: *Regardless of the type of data that is being used to assess the impact on biodiversity, data use (including data sources and their limitations) should be fully transparent to allow for a traceable and replicable assessment and to allow for correct interpretation on the impact assessment results.*

R18: *Financial institutions and data providers shall use the most recent data available to them. Any deviations shall be reported explicitly, including the reasons why. PBAF recognizes there is often a lag between financial reporting and required environmental data, such as borrower or investee environmental data. In these instances, it is acceptable that the data represents different years, as long as the years are expected to be broadly comparable. If this is not the case, the differences must be explained and taken into account in the data used.*

A2: *Financial institutions and data providers should use the highest quality data available for each asset class for calculations and, where relevant, improve the quality of the data over time. This includes the use of primary data instead of secondary data when (part of) such data is available.*

However, data limitations should not deter financial institutions from taking the first steps towards preparing their inventories, as even estimated or proxy data can help them identify biodiversity impact hot-spots in their portfolios, which can inform their biodiversity strategies. Where data quality is low, financial institutions can design approaches to improve it over time.

A3: *Since it is the responsibility of the investee to provide the data required to assess the impact on biodiversity, it is recommended to always ask investees for biodiversity impact data and provide support where possible.*

Reporting on methodology and data use

In order to enable a correct interpretation of the footprint results, transparency regarding the methodology and data is essential (and can be included in a discussion of the results in a qualitative analysis). The way in which this transparency is provided may differ, but information needs to be provided on, for example, scopes included in the footprint, the modelling of economic activities, the use of primary or secondary data, etc. The table below provides an overview of the information that needs to be provided. This information can be provided in different forms, like a separate explanation of the methodology used, an annex explaining the assumptions used per asset class and/or a data quality score for different asset classes (explaining how this score is calculated).

Key is that it is also made clear how the methodology and data used might affect the footprint result and what this means for the use of the footprint results.

R19: *The following information on the methodology and data used to calculate the footprint shall be reported per asset class:*

FOOTPRINT APPROACH AND DATA QUALITY	DESCRIPTION	LIMITATIONS	HOW COULD THIS AFFECT THE FOOTPRINT RESULT?
1. Scopes included			
Scope 1			
Scope 2			
Scope 3 upstream			
Scope 3 downstream			
2. Expected impacts covered in the footprint Qualitative description of the main impacts expected and how these are included in the footprint: quantitatively or qualitatively			
3. Modelling of economic activities Description of the way the economic activities of companies have been identified/assessed, including sector classifications used			
4. Impacts in supply chains Description of how data on supply chains have been included in the footprint, including potential modelling			
5. Environmental data used			
Primary data: Reported environmental inputs and outputs, including source(s), year(s) and means of verification			
Secondary data: Physical activity–based (⋆) environmental inputs and outputs, including source(s), year(s) and level of consistency with the primary business activity (⋆⋆)			

Secondary data: Economic activity-based (⋆) environmental inputs and outputs, including source(s), year(s) and level of consistency with the primary business activity (⋆⋆)			
Responsiveness of data to company action (⋆⋆⋆)			
6. Pressure - impact model used			
Name of the pressure-impact model			
Drivers of biodiversity loss included in the model			
Drivers of biodiversity loss not included in the model and how these drivers are addressed			
Extent to which local biodiversity data and ecosystem characteristics were taken into account in the impact calculation			
Was time integration used to account for future impacts? If not, what other approach was used regarding the time dimension of impacts and why?			
7. Main limitations of the footprint and what this means for the footprint result and its use			

(⋆): Financial institutions and data providers should use environmental data as consistent as possible with the primary business activity. For example, for a business loan to a paddy rice farmer, the financial institution / data provider should seek to find and use sector-specific average environmental factors for the paddy rice sector and not environmental factors for the agricultural sector in general.

(⋆⋆): Physical activity-based environmental data are (secondary) environmental data on the actual physical activities a company is involved in; economic activity-based environmental data are environmental data on the sectors in which a company is creating its revenue.

(⋆⋆⋆): To what extent are actions by companies to mitigate negative impacts reflected in the data used in the footprint calculations? How is this effectuated (e.g. by taking into account a reduction in environmental inputs and outputs required by certifications)?

References used in interpretation

The result of a quantified impact assessment or biodiversity footprint is often interpreted using a reference, something to compare the results with. Ideally this is reference is the 'safe operating space' at the impact location, the level of impact which does not yet affect the ecosystem's ability to provide the ecosystem services it provides (including ecological services supporting biodiversity). However, knowledge of this safe operating space requires knowledge of the impact location, the state of the ecosystem and other impacts in the area lading to a cumulative impact. As yet, this data is rarely available (see also the information below on the Science Based Targets for Nature), resulting in the use of alternative references.

In the interpretation of an impact assessment result or footprinting score, absolute impact scores are often translated in *impact intensity* to enable a comparison of companies and asset

classes. For example, a comparison between companies can be made by looking at the impact 'per euro revenue' and a comparison of investments in different sectors and companies can be made by looking at the impact 'per euro invested'. Such comparisons enable a comparison of the 'impact intensity' of companies and sectors, but do not answer the question if the impact is acceptable from the viewpoint of ecosystem quality and resilience; is the impact still within the planetary boundaries and within the safe operating space?

The use of impact intensity to compare and interpret results needs to be done with care. For example, when biodiversity impact results are divided by a company's revenue to calculate the 'impact per euro revenue' in order to account for differences in company size, the result can be misleading if a high revenue is the result of high value products, not of company size. For this reason, calculating an impact intensity based on *physical units* (like the production of a ton of soy) instead of monetary units (like revenue made or the market capitalisation of a company) can be a better choice.

SECTOR BENCHMARKS CDC BIODIVERSITÉ

To support the interpretation of a footprint result calculated using the Global Biodiversity Score (GBS), CDC Biodiversité developed a number of sector specific factsheets that companies can use to compare their impacts to the sector average or to estimate their impact and main pressures on biodiversity. Factsheets were developed for 'Agriculture and Agrifood' and the 'Chemical sector'.[16] [17]

No detailed PBAF guidance and requirements on the use of references in the interpretation of footprinting results have been formulated yet and will be included in a next revision of the PBAF Standard, based on continued discussions in the PBAF Working groups.

R20: *Transparency is required regarding the references used to interpret footprinting results, including potential limitations to these references.*

The role of Science Based Targets for Nature

The Science Based Target Network (SBTN) uses the following definition of science-based targets[18]: "Measurable, actionable, and time-bound objectives, based on the best available science, that allow actors to align with Earth's limits and societal sustainability goals". As can be read from the objective, target ambition levels need to be tied to the Earth's limits. To achieve this, SBTN aims to build on the work by 'The Earth Commission', a group of leading social and natural scientists convened by Future Earth to provide a global-scale assessment of the conditions that define a stable and resilient planet. The translation of the science into targets will be jointly developed by the SBTN and the Earth Commission.

When the work of the Earth Commission and SBTN progresses, this can offer valuable input to the interpretation of biodiversity impact assessment results in the financial sector. However, it must be realised that these science based targets for nature will be 'spatially specific'; the location of impacts (and dependencies) must be known (SBTN states: *"Location-specific or spatial data is at the core of understanding nature risk and impacts")*. This need for location specific information is underlined by the TNFD in the first beta version of the TNFD framework.

16 CDC Biodiversité, 'Factsheet: Agriculture and Agrifood', October 2021.
17 CDC Biodiversité, 'Factsheet: Chemical', October 2021.
18 Science Based Targets Network, 'Science-based targets for nature; Initial guidance for business', September 2020.

In summary, when science-based targets for nature become available, these targets are expected to play an important role in the interpretation of biodiversity impact assessments (and impact/dependency related risks), provided location specific information on the impacts (and dependencies) is available. The fact that access to location specific data is a key challenge for companies with complex value chains and financial institutions is recognized by both SBTN and TNFD. To address this challenge, TNFD states in the beta version of the TNFD Framework: *"Financial institutions encourage their clients (recipients of financial capital) to go through the LEAP[19] approach for corporates and provide information in line with the TNFD disclosure recommendations".*

The availability of location specific data is likely to differ across asset classes and will be higher for loans and investments with a more direct relation to investees (see figure 3).

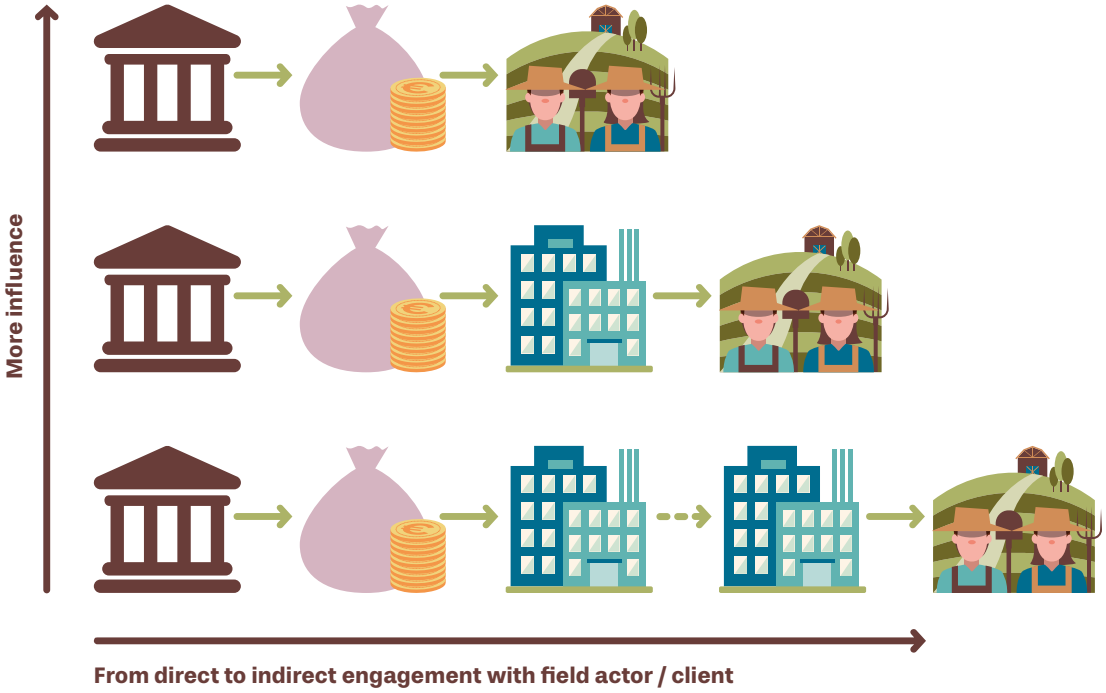


Figure 3: Financial institutions' direct and indirect engagement with clients (source: A Guideline on the use of Deforestation Risk Mitigation Solutions for Financial Institutions, Sustainable Finance Platform, 2021)

***A4:** The importance of location specific data in the assessment of impact and dependency related (financial) risks stresses the need to ask clients/investees for such data and maybe even set targets for 'asset location transparency' and 'supply chains transparency' on the level of a loan and investment portfolio.*

19 LEAP (Locate, Evaluate, Assess, Prepare) is an integrated assessment process for nature-related risk and opportunity management introduced in the beta version of the TNFD Framework (2022).

4 Footprinting approach per asset class

Photo by Sebastian Pena Lambarri on Unsplash

Introduction

This annex describes the biodiversity footprinting approach for different asset classes. All approaches build on the guidance, requirements and recommendations outlined in the previous chapter. The asset classes covered are:

- Sovereign bonds
- Listed Equity & corporate bonds
- Project finance
- Mortgages
- Investments in green energy
- Motor vehicle loans
- Indirect investments

Each of the sections below covers an asset class and includes a table with a fixed format (see below). First, a definition of the asset class is provided. In the table, the footprinting requirements are outlined, enabling a direct comparison between asset classes.

	REQUIREMENT
Scopes covered	Decision on minimum requirements.
Portfolio coverage	Decision on minimum requirements.
Attribution	How is the investor's share of the total impact of the investee attributed?
Data	What data to use? What considerations are important for this decision?
Reference situation	What is the reference situation for the impact assessment?
Absolute impact vs. impact intensity	What type of impact metric needs to be presented and how should the reporting institution arrive at this? An example of an absolute impact metric is the impact of an investment expressed as the percentage or fraction of species that are no longer found due to a man-made impact of some kind (PDF = potentially disappeared fraction of species), calculated with the surface area or water volume and the time. An example of an impact intensity is the impact on biodiversity per euro invested.
Avoided impact	A description of how to account for avoided impact when applicable.
Asset class specific considerations	Room for additional, asset class-specific considerations.
Limitations	The limitations of the proposed methodology are briefly discussed.

1. Sovereign bonds

A sovereign bond is a 'debt security' issued by a national government. Sovereign bonds can be denominated in a foreign currency or the government's domestic currency. The biodiversity footprinting requirements regarding sovereign bonds are outlined in the table below.[20]

TOPIC	REQUIREMENT
Scopes covered	A sovereign bond is considered to be a debt security issued by a central government to support government spending. As such, the sovereign bond lead to impacts caused by the central government's own operations, predominantly by how the government finances other sectors within the country. According to the follow the money principle, scopes 1, 2, and scope 3 purchased goods and services of the government are covered. For steering and risk mapping purposes it is useful to see what parts of governmental spending are most exposed to biodiversity impacts. A separation of scopes will allow government decision makers to draw informed conclusions
Portfolio coverage	All bonds should be covered.
Attribution	Attribution is proportional to the exposure of the financial institution (the sum invested in a sovereign bond) to the government debt plus equity. As government equity is often not disclosed and a financial institution cannot invest in government equity, only government debt can be used as a denominator.
Data	eurostat provides up-to-date and credible data on a country's gross debt. By dividing a financial institution's investment in a country's sovereign bonds by the country's gross debt, the attribution factor can be calculated. The biodiversity impact of government expenditure can be calculated using EXIOBASE data for 'Final consumption expenditure by government'.
Reference situation	The reference situation or baseline in case of sovereign bonds is the situation in which the economic activities linked to the government's spending would not have taken place. When green bonds are issued by a government, underlying projects may aim for avoided negative impacts or positive impacts. The impact of such projects will be assessed using a business-as-usual situation as a reference.
Absolute impact vs. impact intensity	By using the total government spending, the methodology results in an absolute impact on biodiversity for each country. This information can be translated into an impact intensity to report the impact on biodiversity per euro invested in sovereign bonds, by dividing the absolute impact with the government debt. The latter enables a comparison of impact intensity between countries and between different asset classes, showing where impact hotspots in an investment portfolio are (likely to be) located.
Avoided impact	Green bonds issued by a government could lead to avoided impact. How this should be accounted for will need to be assessed on a case-by-case basis (also see 'reference situation').
Asset class specific considerations	State-owned companies are not included in this analysis. Their impact could be attributed to scope 3 of government bonds but it is not certain if state-owned companies are already taken into account in the money flows of economic input-output tables. There is also no publicly available database with state-owned enterprises per country. Including state-owned enterprises is recommended but requires governments to disclose this information.
Limitations	No specific limitations, other than limitations resulting from the quality of the data used.

20 Feedback from the PBAF Sounding board has shown that this approach might be subject to change in a next version of the PBAF Standard. Potential changes will first be discussed in the PBAF Working groups.

2. Listed equity & corporate bonds

Equity[21] is typically referred to as shareholders' equity (or owners' equity for privately held companies), representing the amount of money that would be returned to a company's shareholders if all of the assets were liquidated and all of the company's debt was paid off in the case of liquidation. In the case of acquisition, it is the value of company sales minus any liabilities owed by the company not transferred with the sale. A (publically) listed[22] company issues shares of its stock for trading on a stock exchange.

Corporate bonds[23] are defined as "a type of debt security that is issued by a firm and sold to investors."

The biodiversity footprinting requirements regarding listed equity are outlined in the table below.

TOPIC	REQUIREMENT
Scopes covered	The biodiversity footprint should cover scope 1, 2 and 3 upstream. Including scope 3 is important since many impacts on biodiversity will originate in primary production, like agriculture and mining. The impacts on biodiversity from the production of raw materials purchased, product or service use and the product end-of-life phase are often significant and higher than the direct impact of a company's operations. Assessing the impacts throughout the entire value chain is therefore critical to properly account for impacts and look for actions that can effectively reduce these impacts, like engagement and the use of biodiversity related investment criteria. Scope 3 downstream impacts can be added to include the impact of the use and end-of-life of the products. Those impacts should be reported separately.
Portfolio coverage	Ideally, 100% of the investment portfolio is covered. If this is not feasible, at least the majority of the portfolio should be covered and an indication should be provided for a pathway to full coverage. Provide an explanation of which financial product types (futures, ETFs, fund of funds, external mandates, prefs) were included or excluded and what the main method was for estimating missing portfolio data. Cash positions can be considered as having zero impact. Short positions can be ignored.
Attribution	Impacts are attributed by dividing the total footprint of a listed company with the enterprise value including cash. This way the share of impact attributed to one euro investment via listed stocks is calculated. For corporate bonds, the total equity + debt should be used to calculate the financed emissions[24]
Reference situation	The reference situation in case of listed equity is the level of biodiversity when the economic activities linked to the equity would not have taken place. In those case where listed equity is focusing on business activities aiming to avoid negative impacts on biodiversity, the business as usual situation shall be used as a reference to calculate the avoided impacts. For example, in case of listed equity of a company producing meat substitutes, the avoided impact on biodiversity is calculated using the impact of meat consumption in the business as usual situation. The net avoided impact is calculated by also taking into account the negative impacts of producing these substitutes.

21 More information on equity is described on Investopedia.
22 More information on listed is described on Investopedia.
23 More information on corporate bonds is described on Investopedia.
24 Using total enterprise value and total equity + debt is in line with the PCAF standard. More information about the reasoning can be found in paragraph 5.1 of PCAF (2020) The Global GHG Accounting and Reporting Standard for the Financial industry.

Data	No preferred resource is recommended. Data should be transparent, consistent, fit for purpose and as much as possible broadly accepted by the scientific community. Actual, primary data provided by companies should be preferred over secondary, estimated or averaged data from databases. If actual, primary data are not available or the use of primary data is not feasible (e.g. due to the amount of data needed in case of footprint on portfolio level), the use of secondary data is accepted provided that this is reported explicitly and taken into account in the interpretation of the footprint results.
Absolute impact vs. impact intensity	The methodology results in an absolute impact on biodiversity for each listed company. Using the attribution rules defined in this table, the impact per invested euro (listed equity), or euro on loan (corporate bond) is calculated. The impact per invested euro is multiplied with the size of the investment in a specific company. The impact of all investment in, and loans to, companies in a portfolio, can be aggregated as total impact for the listed equity portfolio. This information can be translated into an impact intensity to report the impact on biodiversity per euro invested in listed equity. The latter enables a comparison of impact intensity between different asset classes, showing where impact hotspots in an investment portfolio are (likely to be) located.
Avoided impact	If the impact of a company is positive because of avoided impacts, for example in case of the production of 'green energy' (avoided greenhouse gas emissions), the avoided impact can be included in the overall footprint on a portfolio level. This avoided impact should be reported separately from negative impacts and biodiversity positive impacts.
Other considerations	When it is clear that the companies invested in have taken specific measures to limit their impact on biodiversity, e.g. by sourcing certified raw materials/produce, such measures should be taken into account as much as possible. When secondary, estimated or averaged data are used, impact correction factors may be considered to take account of these measures. The footprint should be fully transparent about the steps taken.
Limitations	In case of the use of secondary data from databases, the footprint will not be responsive to biodiversity action by the companies involved in the listed equity invested in. When the footprint shows that the listed equity invested in constitutes a potential biodiversity impact hotspot, it is advised to zoom in on the companies concerned and assess to what extent these companies have addressed the drivers of biodiversity loss responsible for the impact calculated. The result should be integrated in the footprint to the extent possible.

CASE STUDY: BIODIVERSITY FOOTPRINT OF AN INVESTMENT IN A METALS & MINING COMPANY USING THE CORPORATE BIODIVERSITY FOOTPRINT (CBF)

The Corporate Biodiversity Footprint (CBF) models the impact of corporates through four main environmental pressures on species and habitats and is based on the GLOBIO3 pressure–impact model. These pressures are calculated along the whole value chain of the corporate. In the case study below, the CBF is used to calculate the biodiversity impact of a listed metals & mining company, based on data reported externally by the company and data from publicly available datasets.

The first step is to assess the products purchased and sold by the company throughout its value chain, based on CBF's physical Input/Output model and to allocate these product flows to sectors and subsectors. The second step is to assess the environmental inputs/outputs and impact drivers resulting from these product flows. The impact drivers are translated into an impact on biodiversity using pressure–

impact relations. The impact of each driver is expressed in the same biodiversity impact unit, which is Km^2.MSA.

The next step is to aggregate the different impacts into an overall absolute impact and calculate several 'ratios' or impact intensities, both physical and financial ones. This allows a comparison of the company to its peers in the same sector, ranked by intensity.

The result can be visualized by product, pressure and scope. The split of the biodiversity footprint by the main products of the company reveals the weight of the different products in the footprint result (see figure 1). Iron ore represents the bulk of the volumes of the company but has a lower biodiversity footprint than the other non-ferrous metals. Coal has a significant downstream footprint related to its combustion.

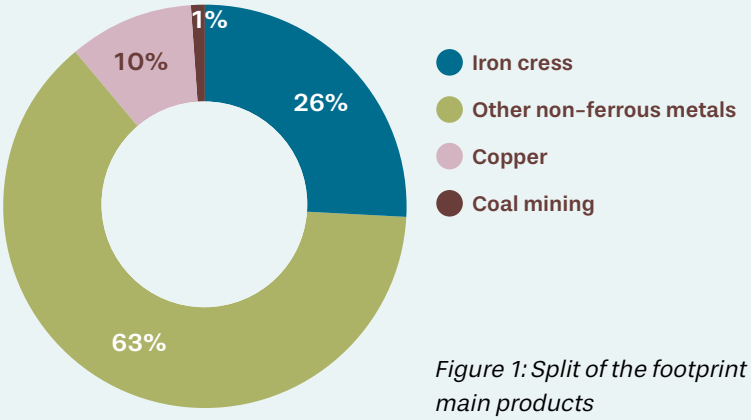


Figure 1: Split of the footprint by main products

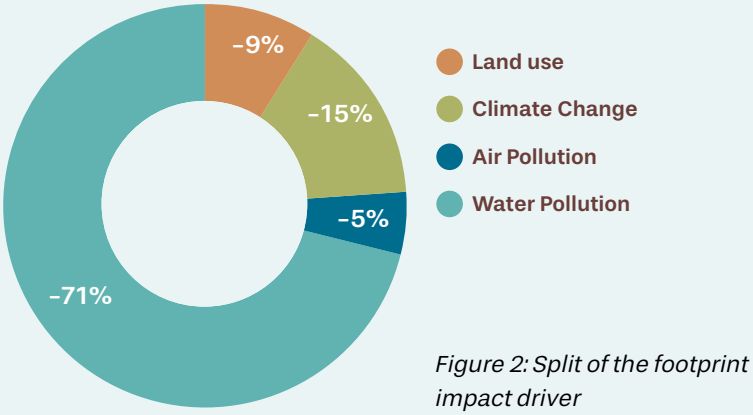


Figure 2: Split of the footprint by impact driver

The split of the biodiversity footprint by impact driver shows the significance of water pollution (more specifically the impact of 'ecotoxicity'), due to the emissions of substances having an impact on freshwater biodiversity, both at the mining and metal processing phase (see figure 2). Other significant pressures are land use, resulting from the mining process, and climate change, related to metal processing and the (downstream) combustion of coal.

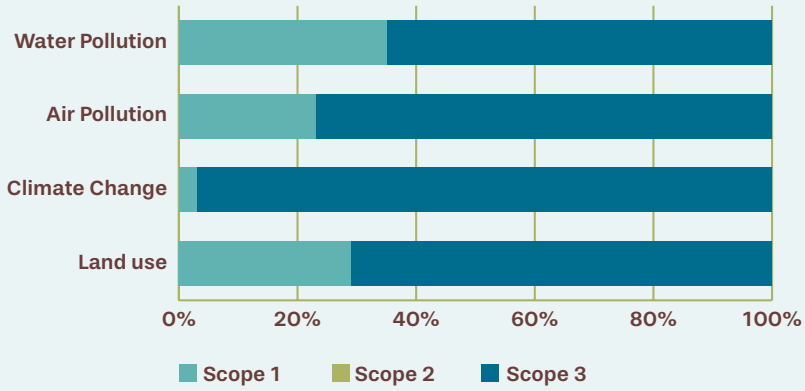


Figure 3: Split of the footprint by scope

The split of the biodiversity footprint by scope reveals the importance of scope 3 impacts downstream (see figure 3). This is especially true for climate change, resulting from the downstream processing phase of metallic ores and the downstream combustion of coal.

Note that all footprinting tools have certain limitations. One of the limitations of the CBF tool is the fact that the impact of invasive species and direct exploitation of species cannot be included yet in the footprint, since these impact drivers are not yet part of the GLOBIO 3 pressure-impact model.

3. Project finance

The biodiversity footprinting requirements regarding project finance are outlined in the table below.

TOPIC	REQUIREMENT
Scopes covered	The biodiversity footprint should cover scope 1, 2 and 3 upstream. Including scope 3 is important since many impacts on biodiversity will originate in primary production, like agriculture and mining. The impacts on biodiversity from the production of raw materials purchased, product or service use and the product end-of-life phase are often significant and higher than the direct impact of a company's operations. Assessing the impacts throughout the entire value chain is therefore critical to properly account for impacts and look for actions that can effectively reduce these impacts, like engagement and the use of biodiversity related investment criteria. Scope 3 downstream impacts can be added to include the impact of the use and end-of-life of the products. These impacts should be reported separately.
Portfolio coverage	In case of an assessment of the biodiversity impact of an investment portfolio, ideally 100% of all project finance is covered. In practice, an assessment of biodiversity impact may also take place to decide on an investment in a specific project.
Attribution	Impacts are attributed to the total value of equity and outstanding debt[25]. This basic attribution principle reflects the responsibility of financial institutions as investors, as equity owners and as providing project finance loans.
Data	Within the due diligence and monitoring of a project finance transaction, the availability of project-specific data is generally good. As a result, higher quality data on pressures can be obtained than would be available through generic input/output models, without adding an unrealistic amount of additional work to the process. Therefore, it is proposed that impact data for project finance should not be based on generic input-output models, but on project-specific source data. However, since an impact assessment at the start of a project investment needs to be based on expected/estimated impact data, a combination may be necessary of project-specific source data (like area size and interventions foreseen) and secondary, estimated or averaged data from databases, scientific studies and/or case studies of comparable interventions. The type of data used shall be reported and shall be taken into account in the interpretation of the footprint results.
Reference situation	The avoided negative or positive impact on biodiversity of projects is calculated using a business as usual situation as a reference (the project does not take place). The negative impact of project implementation is calculated using the situation without the activities needed to implement the project (like the use of land and resources) as a reference.
Absolute impact vs. impact intensity	The methodology results in an absolute impact on biodiversity for each project invested in. The result can be used to decide on the investment, investment criteria, engagement with the project owners and monitoring requirements. The results can also be aggregated as total impact for the project finance portfolio. The absolute impact can also be translated into an impact intensity to report the impact on biodiversity per euro invested in projects. This enables a comparison of different projects within project finance and, on a portfolio level, a comparison of different asset classes, showing where impact hotspots in an investment portfolio are (most likely to be) located.

25 Using total enterprise value and total equity + debt is in line with the PCAF standard. More information about the reasoning can be found in paragraph 5.3 of PCAF (2020) The Global GHG Accounting and Reporting Standard for the Financial industry.

Avoided impact	If the investment in a project results in avoided negative impact, this avoided impact can be included in the overall footprint on a portfolio level. For the calculation of avoided impact for green energy projects: see 'Investments in green energy'. Avoided impact should be reported separately from negative impacts and biodiversity positive impacts.
Other considerations	In case of an earmarked impact investment in an intervention/project with the aim to avoid negative impact, it shall be clear how the investment intends to deliver the avoided impact, the investment shall be earmarked exclusively to the intervention which is expected to lead to this avoided impact and there shall be a mechanism in place for verifying that the capital invested has been used for the intervention and that the intervention has taken place. Certification standards can play an important role in projects which intend to deliver a positive outcome for biodiversity (either a positive impact or avoided negative impact). Under certain conditions, the use of biodiversity-relevant sustainability standards (e.g. an investment in a paper company is only made when the wood used is FSC certified) may be rewarded by using an impact correction factor for the certified resource until more accurate data are available. The decision to reward a standard/certification with an impact correction factor will be made on a case-by-case basis. In case such impact correction factors are used, this is reported explicitly.
Limitations	At the time of the investment in a project, the actual impact on biodiversity has yet to take place. This means that an expected/estimated impact is calculated. When monitoring of the impact following the investment shows that the actual impact is significantly different from the expected/estimated impact, these differences shall be analysed and processed (e.g. to adjust the footprint score and/or to revise engagement activities or monitoring requirements.

4. Mortgages

The biodiversity footprinting requirements regarding mortgages are outlined in the table below.

TOPIC	REQUIREMENTS
Scopes covered	The biodiversity footprint should cover scope 1 and scope 2, including land occupation and energy use resulting from having a house occupied. Whether impacts related to the construction of the housing (scope 3) need to be included is subject to discussion. Including these impacts might lead to double counting with investments in construction. For this 2022 version of the standard the approach of PCAF is followed, and scope 3 is excluded. Future changes may be possible.
Portfolio coverage	Ideally, 100% of the mortgage portfolio should be covered. If this is not feasible, at least the majority of the portfolio should be covered, and an indication should be provided for a pathway to full coverage.
Attribution	The share of impact assigned to the financial institution providing a mortgage is dependent on the outstanding amount of the mortgage and the property value of the mortgage at origination[26]. The share of impact attributed to the financial institution providing the mortgage is calculated by dividing the outstanding amount with the property value of the mortgage at origination.

26 Using this loan-to-value approach is in line with the PCAF standard. More information about the reasoning can be found in paragraph 5.4 of PCAF (2020) The Global GHG Accounting and Reporting Standard for the Financial industry.

Data	Actual data on the energy consumption of the properties should be used, if available. For the Netherlands, PCAF are in contact with Netbeheer Nederland to provide actual energy consumption data. An alternative approach is to use the average use of electricity and natural gas of the energy labels of the housing for which the mortgages are provided. Actual data on the land use of the properties should be used, if available. If such data are not available, the average land use of housing in the country or region considered can be used. This average land use should at least include the housing itself. If data are not available in such detail, the land use can also include the garden, communal spaces and roads. The latter would be based on the average number of houses per hectare in suburban areas.
Reference situation	The reference situation in case of mortgages is the situation in which the land occupation and energy use resulting from having a house occupied would not have taken place.
Absolute impact vs. impact intensity	The methodology results in absolute land use and emissions per household, which can be aggregated as total impact for the mortgages portfolio. This information can be translated into an impact intensity to report the impact on biodiversity per euro invested in mortgages. The latter enables a comparison of impact intensity between different asset classes, showing where impact hotspots in an investment portfolio are (likely to be) located.
Avoided emissions	A mortgage on a house that is climate-positive, i.e. generating more energy than it consumes, can be seen as avoided greenhouse gas emissions. Such avoided emissions, reducing one of the drivers of biodiversity loss, can be included in the calculation of the biodiversity footprint of the mortgage.
Other considerations	Land transformation that may have occurred before construction of the housing does not have to be taken into account, since information on this transformation, including the biodiversity value of the land before transformation, will often not be available.
Limitations	No specific limitations, other than limitations resulting from the quality of the data used.

5. Investment in green energy

Investments in green energy may overlap with project finance and indirect investments. The biodiversity footprinting requirements regarding investments in green energy are outlined in the table below.

TOPIC	REQUIREMENTS
Scopes covered	The biodiversity footprint should cover scope 1, 2 and 3, including the use phase.
Portfolio coverage	Ideally, 100% of the green energy portfolio should be covered. If this is not feasible, at least the majority of the portfolio should be covered, and an indication should be provided for a pathway to full coverage.
Attribution	Impacts are attributed to investors as 'owners' of the green energy projects. In other words, attribution in this case is the ratio of invested value per project over the total investments in the project.
Data	Data should be transparent, consistent, fit for purpose and as much as possible broadly accepted by the scientific community. Since an impact assessment at the start of a project investment needs to be based on expected/estimated impact data, a combination may be necessary of actual, primary data provided by projects (like electricity production data) and secondary, estimated or averaged data from databases, scientific

	studies and/or case studies of comparable interventions. Ideally project specific electricity production data will be used. The type of data used shall be reported explicitly and shall be taken into account in the interpretation of the footprint results.
Reference situation	The avoided negative impact of investments in green energy is calculated using a business as usual situation (the production and use of 'grey' energy from the grid) as a reference. The negative impact of the production of green energy (like material use for the production of wind mills and solar panels) is calculated using the situation without these activities as a reference. Positive and negative impacts which cannot yet be quantified, like the creation of new habitats by off-shore wind mills and impacts of wind mills on birds and bats shall be included in the qualitative analysis.
Absolute impact vs. impact intensity	The methodology results in an absolute impact on biodiversity for each project invested in. The result can be used to decide on the investment, investment criteria, engagement with the project owners and monitoring requirements. The results can also be aggregated as total impact for the green energy portfolio. The absolute impact can also be translated into an impact intensity to report the impact on biodiversity per euro invested in green energy projects. This enables a comparison of different green energy projects. On a portfolio level, a comparison can be made of different asset classes, showing where impact hotspots in an investment portfolio are (most likely to be) located.
Avoided emissions	Investments in renewable energy can take into account the avoided electricity production from grey electricity sources, as renewable energy replaces grey electricity from the grid. This can be done using the average grid mix from the country where the renewable energy is produced. Since the share of renewables in the electricity mixes worldwide is growing, the avoided emissions will decrease over time. The avoided impact can be included in the overall footprint on a portfolio level. This avoided impact should be reported separately from negative impacts and biodiversity positive impacts.
Other considerations	For investments in renewable energy funds with multiple projects across different countries, the impact can be calculated based on the technological spread (wind, solar, hydro) and the regional spread of the fund.
Limitations	The assumption that renewable energy replaces grey electricity from the grid (see 'reference situation') will not always reflect reality. However, investments in renewable energy should be rewarded in a biodiversity footprint, since climate change is one of the main drivers for biodiversity loss. For this reason, technologies that facilitate low-carbon electricity production will contribute to a reduction of further biodiversity loss.

CASE STUDY: BIODIVERSITY FOOTPRINT FOR INVESTMENTS IN RENEWABLE ENERGY

Climate change is one of the main drivers for biodiversity loss and the use of fossil fuels for energy is a key source of GHG emissions contributing to climate change. Investments in green electricity can contribute to a reduction of this pressure on biodiversity. The following case study illustrates a biodiversity footprint calculation for a solar PV project using the BFFI methodology.

Solar PV energy projects

When calculating the impact from solar energy projects, the first step is to translate the investment in euro, into the annual production of energy in MJ (or kWh). To do so, the expected installed capacity from an investment in solar energy is calculated. This is done by multiplying the value of the investment by the investment costs in euro per kW. These costs differ per country (and project). Unless project specific values for installed capacity, or annual electricity production data are available, data on an "average" solar energy project in a country can be used.

For the calculation of all inputs and emissions of the supply chain, construction, maintenance and operation of solar PV projects, the 'Production of electricity by solar photovoltaic' from the corresponding country in EXIOBASE was used. In order to incorporate the benefits of renewable energy compared to the current electricity mix, the avoided emissions were calculated using the EXIOBASE dataset 'Electricity Mix' for the corresponding country. It is assumed that the energy produced will displace the average grid mix electricity in that country. The 'avoided' impacts were subtracted from the negative impacts of producing solar energy.

The assumption that solar energy replaces a national grid mix is compatible with the PBAF guidelines, but is in fact a conservative way to calculate this. When we look what actually happens in the energy market we will see that if more solar or wind energy enters the grid, the market will switch off those energy generation plants that have the highest marginal costs. Hydropower and nuclear energy plants are characterized by high investment costs and very low operating costs, so these will almost never be switched off. Fossil energy plants have relatively low investment, but high operating costs because they use much fuel. It is therefore much more logical that these will be switched off first, and thus one can safely assume that solar and wind energy replaces fossil fuel based power generation. This also applies in a country like France, that hardly has any fossil fuel based electricity production. France is a relatively high exporter of electricity in Europe (because of the low costs of nuclear energy), so a surplus production will lead to a reduction of fossil fuel in other countries.

The following chart shows the biodiversity impact of solar PV projects in the Netherlands, Belgium, and France. The benefit of renewable energy sources is highest in countries with a carbon intensive energy mix, as the production of renewable energy will replace the average grid mix. In France we find that the grid mix has a relatively low carbon intensity due to the high share of nuclear energy in the French grid mix, which causes significantly less climate change than other fossil energy sources. The results are expressed in hectares where all biodiversity is lost during one year. This unit is derived from the PDF.m2.yr unit from the ReCiPe pressure-impact model. This unit is a multiplication of the potential disappeared fraction of species (PDF), the area where they are lost and the duration of the loss. For simplicity the disappeared fraction is set to 100% and since the reporting period is one year, the duration time is fixed to 1 year. This allows us to report in hectares where all biodiversity is lost during one year. Note that a negative value is in fact a negative loss of biodiversity and therefore positive.

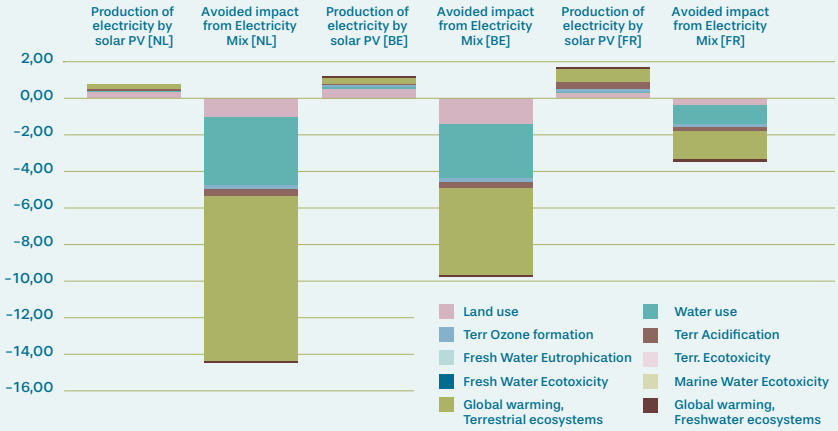


Figure: Biodiversity impact from investing 1MEUR in Solar PV in The Netherlands, Belgium and France. The chart shows the biodiversity loss from PV production and the avoided impact from the grey electricity mix in PDF.ha.yr (expressed in Ha where all biodiversity is lost during one year)

In the case study, the negative impact on biodiversity from an investment of 1 million euro in solar PV varies between 1 and 2 ha, depending on the country. The *avoided* negative impact from solar energy compared to the grid mix (the 'business as usual' situation) varies between –3 and –15 ha. The main drivers of negative impact are climate change, land use and water use. Other drivers such as eutrophication, acidification and ecotoxicity are less important in this case study.

N.B.: it must be realized that not all impacts of investments in green energy can be captured by the ReCiPe model. For example, negative impacts of windmills on birds and bats are not included in the ReCiPe methodology. The same is true for potential positive impacts of offshore wind parks (like the creation of artificial reefs). This is the reason why the quantitative analysis is accompanied by a qualitative analysis. This qualitative analysis provides input for a correct interpretation of the results and for biodiversity relevant investment criteria (e.g. no investments in wind parks close to bird migrating routes) or engagement with investees.

6. Motor Vehicle loan

A motor vehicle loan is a loan provided to purchase a car or another type of vehicle. Motor vehicle loans can be provided to companies or to individuals. The PCAF standard provides the following list of vehicles. This list serves as an example, it is not exhaustive

- Passenger car
- Motorcycle
- Light commercial truck (e.g., vans)
- Medium/heavy commercial truck
- Recreational vehicles
- Bus
- Snowmobiles/all-terrain vehicles
- Boats, including outboard motors
- Yellow equipment (i.e., earth-moving vehicles for mining and construction)

The biodiversity footprinting requirements regarding motor vehicle loans are outlined in the table below.

TOPIC	REQUIREMENT
Scopes covered	The biodiversity footprint should cover scope 1, 2 and 3 upstream. Including scope 3 is important since many impacts on biodiversity will originate in the production of vehicles. Assessing the impacts throughout the entire value chain is therefore critical to properly account for impacts and look for actions that can effectively reduce these impacts, like engagement and the use of biodiversity related investment criteria. It is crucial to include scope 3 downstream impacts to include the fuel or electricity consumption during the lifetime of the vehicle.
Portfolio coverage	All motor vehicle loans should be covered.
Attribution	In line with the PCAF standard, the attribution of impact is calculated using the outstanding amount of the loan and the total value at origination[27]
Data	
Reference situation	The reference situation or baseline in case of motor vehicle loans is the situation in which the economic activities linked to the loan would not have taken place.
Absolute impact vs. impact intensity	The methodology results in an absolute impact on biodiversity for each loan. The result can be used to decide on the investment, investment criteria, engagement with the project owners and monitoring requirements. The results can also be aggregated as total impact for the motor vehicle loan. The absolute impact can also be translated into an impact intensity to report the impact on biodiversity per euro invested in motor vehicle loans. This enables a comparison of different motor vehicle loans. On a portfolio level, a comparison can be made of different asset classes, showing where impact hotspots in an investment portfolio are (most likely to be) located.
Avoided impact	
Asset class specific considerations	Emissions can be calculated depending on the level of data available. The options are presented in descending order of preference: Option 1: actual vehicle-specific emissions and resource use. This can be based on actual fuel consumption. The fuel consumption can also be estimated based on actual vehicle model and actual distance travelled.

27 Using this loan-to-value approach is in line with the PCAF standard. More information about the reasoning can be found in paragraph 5.6 of PCAF (2020) The Global GHG Accounting and Reporting Standard for the Financial industry.

	Option 2: Estimated vehicle-specific emissions and resource use. This can be baes on actual vehicle model and estimated local or regional travel distances. Option 3: Estimated average vehicle emissions and resource use based on average travel distances. Option 4: Estimated emissions and resource use based on input-output databases such as EXIOBASE. Option 1-3 are in line with the PCAF standard[28], option 4 is added as the least preferred option in case no specific data is available.
Limitations	No specific limitations, other than limitations resulting from the quality of the data used.

7. Indirect investments, e.g. in green bonds and investment funds

The biodiversity footprinting requirements regarding indirect investments are outlined in the table below.

TOPIC	REQUIREMENTS
Scopes covered	Regardless of the nature of the underlying assets of the indirect investments, the biodiversity footprint should cover scope 1, 2 and 3.
Portfolio coverage	Ideally, 100% of the indirect investments should be covered. If this is not feasible, at least the majority of the portfolio should be covered and an indication should be provided for a pathway to full coverage. Examples of indirect investments include: • Equity vehicles, like investment funds (including ETFs and fund of funds) in public and private markets. • Bond vehicles, like green bonds, covered bonds and asset-backed securities. • Derivatives, like FX forwards, IRS, Options, Futures, CDS • Collateral, like pledged for derivates (cleared and OTC), securities lending, or reinsurance.
Attribution	Attribution is based on the PCAF approach: The attributed impacts of the underlying assets for indirect investments should be aggregated and calculated according to the methodology for each specific asset class, such as sovereign bonds, listed equities or mortgage loans. Cash holdings are considered as having zero emissions. Impacts of the underlying assets in an indirect investment are proportionally attributed to the investor's share in the total vehicle The approach for the most common used derivates by financial institutions is the following: • FX forwards: indirect exposure to cash, so no impacts • Interest rate swaps: indirect exposure to cash, so no impacts • Options: impacts of the underlying assets are proportionally attributed using the market value of the option • Futures: not decided yet • Credit Default Swaps: impacts of the underlying assets are proportionally attributed using the market value As pledged collateral is typically not owned, no impacts are attributed. We promote as best practice to (1) restrict acceptable collateral with additional guidelines in line with the SRI policy of the financial institution, and (2) attribute the impact of the collateral for informational purposes.

28 The options 1-3 are described in the PCAF standard. More information about the reasoning can be found in paragraph 5.6 of PCAF (2020) The Global GHG Accounting and Reporting Standard for the Financial industry.

Data	The first and most reliable source for the emissions of an indirect investment should be the asset manager or issuer, following the existing PBAF guidelines and independently verified. Investors should engage with these asset managers and issuers to disclose the attributable impacts of these indirect investments. If not provided, impact data could be made available by other providers, like public data sources or designated data vendors. Investors could engage with data vendors to provide these data. Finally, the investor could assess the indirect investment impacts by capturing the underlying portfolio (look through) and calculating the pro rata impacts with his own PBAF models and data sources. Investors should engage with asset managers and issuers to fully disclose the holdings of their investment funds. This approach is only realistic for underlying assets in public markets.
Reference situation	The choice of the reference situation in case of indirect investments depends on the underlying assets. See also the choice of reference situation for the other asset classes discussed.
Absolute impact vs. impact intensity	The methodology results in an absolute impact on biodiversity for indirect investments. The result can be used to decide on the investment, investment criteria, engagement with the asset manager or issuer and monitoring requirements. The absolute impact can be translated into an impact intensity to report the impact on biodiversity per euro invested in indirect investments. This enables a comparison of different indirect investments. On a portfolio level, a comparison can be made of different asset classes, showing where impact hotspots in an investment portfolio are (most likely to be) located.
Avoided impact	If indirect investments result in avoided negative impact (e.g. in case of green bonds), this avoided impact can be included in the overall footprint on a portfolio level. This avoided impact should be reported separately from negative impacts and biodiversity positive impacts.
Other considerations	See 'project finance' for considerations regarding the reference situation in case of impact investments and the role of certification standards in projects. See 'investments in green energy' for considerations regarding green energy bonds.
Limitations	See 'project finance' and 'investments in green energy' for limitations regarding footprint calculations for projects and investments in green energy. General limitations in case of indirect investments (also mentioned in PCAF): • Not all providers of indirect investments disclose biodiversity impacts according to the PBAF methodology. • Not all providers of indirect investments disclose the relevant biodiversity impacts for investors. • Not all providers of indirect investments disclose their full underlying portfolio, so investors cannot calculate the impacts themselves. • Indirect investments may have an international universe and part of that can be in private markets. It will be challenging (or impossible) for the investor to make the PBAF calculation with a look through approach, because of the required biodiversity impact data for the underlying assets.

5 Glossary

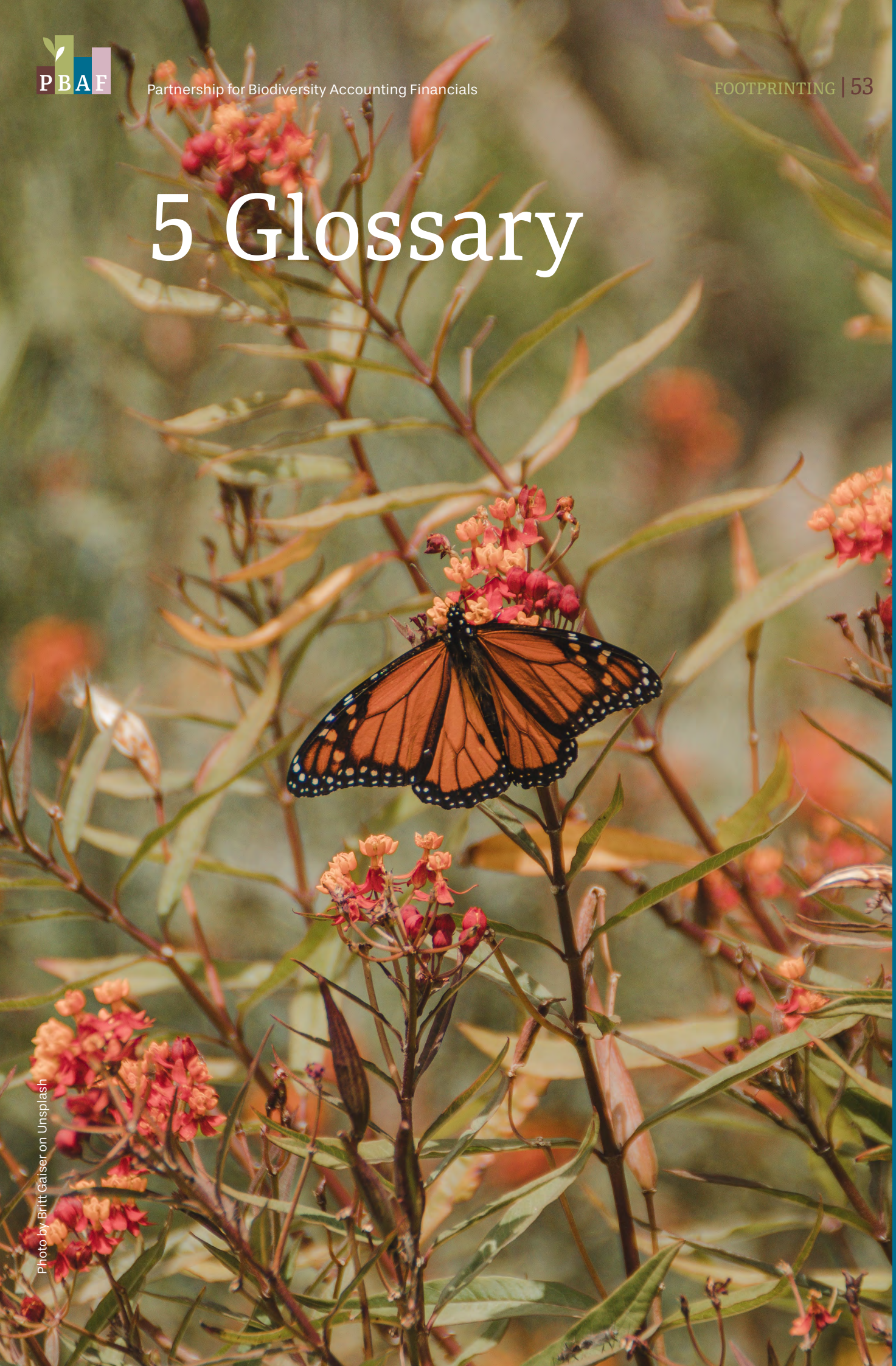


Photo by Britt Gaiser on Unsplash

An overview of selected terms frequently used in footprinting is presented below, as well as definitions of the asset classes included in this standard. In the PBAF Standard v2023, definitions will be further aligned with the definitions recommended by the 'Align' initiative.

Impact on biodiversity	An impact on biodiversity is defined as a change in biodiversity resulting from impact drivers.
Actual impact	An *actual* impact on biodiversity is an *observed* change in biodiversity resulting from impact drivers. The assessment of actual impacts on biodiversity will require measurement/monitoring of changes in biodiversity over a longer period of time. A challenge in assessing actual impact is the fact that observed changes in biodiversity will need to be attributed to the impact drivers.
Potential impact	A *potential* impact on biodiversity is the impact on biodiversity that *might* take place as a result of changes in the drivers of biodiversity loss and gain. Whether this potential impact will result in an actual impact also depends on the characteristics of the impact location. For example, water use is an important driver of biodiversity loss. Therefore, the use of water has a potential impact on biodiversity. The actual impact of water use will depend on site specific characteristics of the ecosystems, like the level of water scarcity in the impact area.
Negative impact	A negative impact means a (potential) loss of biodiversity resulting from interventions (like economic activities) compared to a reference situation. A negative impact may be the direct result of an economic activity (site level impacts) and/or take place in the supply chains and use phase of a product/service.
Avoided (negative) impact	The avoidance of negative impact on biodiversity refers to the prevention of negative impacts resulting from an intervention/economic activity by means of, for example, better management practices. The reference situation in case of an avoided impact is an alternative scenario, often the situation without the intervention ('business as usual'). The avoided negative impact can also refer to future, expected impacts. An example of such a future avoided impact is the gathering/production of non-timber forest products (the intervention) which may prevent deforestation (future impact) by adding value to a forest.
Positive impact	A positive impact on biodiversity means more animals, plants and/or microbes, improving the health of a natural ecosystem, in a specific location and timeframe, as a result of a human intervention. Examples of such interventions are reforestation (if executed properly) or nature restoration, but also the installation of a water treatment facility. *Note that the concept of 'positive impact' is still being discussed internationally, which means that definitions may change.*
Reference situation	The situation which is used as the baseline against which the impact of an investment is assessed.
Absolute impact	Impact attributed to an investment or investor. The term 'absolute impact' is also used to indicate the calculation of the impact of an activity, using the situation in which the activity does not take place as a baseline.
Impact intensity: impact per invested value	The absolute impact of a company can be divided by the market capitalization, or the enterprise value to get the impact per invested euro. The absolute impact can also be divided by the revenue of a company to calculate the impact intensity per euro revenue. Impact intensities allow for better comparison of companies with different sizes.
Metric	A unit of measurement capturing changes in biodiversity.
PDF	Potentially disappeared fraction of species, a metric used to assess the potential decline in species richness in an area over a time period. Larger PDF values indicate a higher level of impact for the activity

MSA	Means Species Abundance, a metric used to measure biodiversity intactness or the remaining level of biodiversity in an impact area. MSA offers a value from 0 (completely destroyed ecosystem with no original species) to 1 (species abundance is unchanged).
Sovereign bond	A sovereign bond is a 'debt security' issued by a national government to support government spending. Sovereign bonds can be denominated in a foreign currency or the government's domestic currency.
Project finance	The financing of infrastructure projects, industrial projects and other projects, like ecotourism, species protection, etc.
Investments in green energy	Investments in the production of energy from sustainable (green) resources, like wind energy and solar energy, resulting in avoided greenhouse gas emissions compared to the production of fossil-based energy.
Indirect investments	Indirect investments are characterised by having an investment exposure through a 'vehicle', ideally with a look through for the underlying or ring-fenced assets where the financial institution is ultimately invested in. The exposure can consist of a single asset, a local or international universe, and listed as well as private markets.
Mortgages	A mortgage is a debt instrument, secured by the collateral of specified real estate property, that the borrower is obliged to pay back with a predetermined set of payments.
Motor vehicle loan	A motor vehicle loan is a loan provided to purchase a car or another type of vehicle. Motor vehicle loans can be provided to companies or to individuals.
Listed equity	Equity is typically referred to as shareholder equity, which represents the amount of money that would be returned to a company's shareholders if all of the assets were liquidated and all of the company's debt was paid off.
Corporate bonds	Corporate bonds are defined as "a type of debt security that is issued by a firm and sold to investors."
Investment	The term 'investment' (unless explicitly stated otherwise) is used in the broad sense: 'putting money into activities or organisations' with the expectation of making a profit'. This in contradiction to the more narrow definition sometimes used within for example a bank: as one of several financing options, besides e.g. debt finance, equity finance. Most forms of investment involve some form of risk taking, such as investment in equities, debt, property, projects, and even fixed interest securities which are subject to inflation risk, amongst other risks.

References

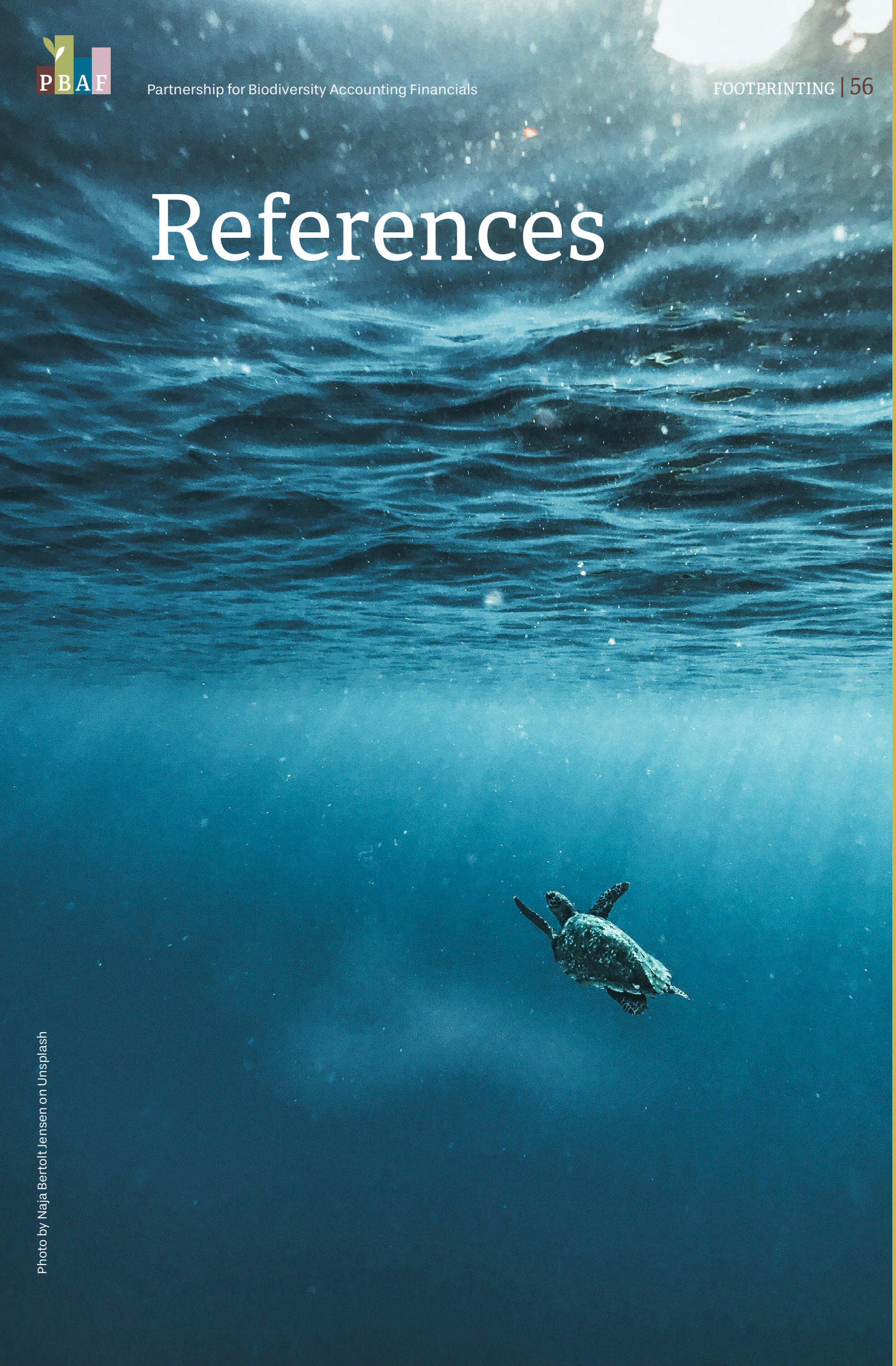


Photo by Naja Bertolt Jensen on Unsplash

CDC Biodiversité, Berger, J. et al, 'Global Biodiversity Score – 2021 update – Establishing an ecosystem of stakeholders to measure the biodiversity performance of human activities', 2021.

CDC Biodiversité, 'Factsheet: Agriculture and Agrifood', October 2021.

CDC Biodiversité, 'Factsheet: Chemical', October 2021

Chaudhary et al., 'Impact of Forest Management on Species Richness', 2016.

ENCORE, **https://encore.naturalcapital.finance/en**.

GNF et al, 'Biodiversity in standards and labels for the food sector, Baseline report', 2017.

IEEP, 'Biodiversity footprints in policy and decision-making: Briefing on the state of play, needs and opportunities and future directions', Policy report, Institute for European Environmental Policy, 2021.

Investopedia: **Investopedia**.

IPBES, S. Díaz et al., 'Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services', 2019.

Jason Potts, Vivek Voora, Matthew Lynch, Aynur Mammadova, 'Standards and Biodiversity: Thematic review', June 2017.

PBAF, 'Paving the way towards a harmonised biodiversity accounting approach for the financial sector', 2020.

PCAF, 'The global GHG accounting & reporting standard for the financial industry. First Edition', 2020.

Science Based Targets Network, 'Science-based targets for nature; Initial guidance for business', September 2020.

Sustainable Finance Platform, 'A Guideline on the use of Deforestation Risk Mitigation Solutions for Financial Institutions', 2021.

TNFD, 'The TNFD Nature-related Risk & Opportunity Management and Disclosure Framework; Beta v0.1 Release', March 2022.

Annex 1 Overview footprinting requirements and recommendations

Photo by Lukasz Szmigiel on Unsplash

In this Annex, an overview is provided of the PBAF requirements and recommendations formulated for biodiversity footprinting.

PBAF Requirements (R) and Recommendations (A) Biodiversity footprinting

Requirements

R1: *Since the link between a loan or investment and economic activities determines what environmental inputs and outputs will be included in the footprint calculation, transparency about this step is required. If full transparency is not possible due to data related legal restrictions, the step and possible limitations needs to be explained.*

R2: *In a biodiversity footprint, the full scope 1 (impact of the company itself), scope 2 (impact of the energy companies the company sources its energy from) and scope 3 (impact upstream and downstream) shall be included.*

R3: *Transparency is required regarding the inclusion of the different scopes and the potential consequences for the footprinting results of not (fully) including one or more of the scopes.*

R4: Transparency is required regarding the way in which supply chain impacts are included in the biodiversity footprint, related limitations and the potential consequences for the biodiversity footprint.

R5: *The following applies to the attribution of impacts on biodiversity, based on the PCAF attribution principles (PCAF, 2020)[29]:*

4. *Financed impact is calculated by multiplying an attribution factor (specific to the asset class) by the impact of the borrower or investee.*
5. *The attribution factor is defined as the share of total impact of the borrower or investee that is allocated to the loans or investments.*
6. *The attribution factor is calculated in line with the calculation method defined per asset class (see footprinting per asset class).*

R6: *In case of a quantified biodiversity footprint, the focus shall be on biodiversity as a whole, not on specific species (like endangered species) only. However, it is recognised that a focus on endangered species can be part of other types of biodiversity impact assessment and can be part of investment decisions aiming for a positive impact. The focus on biodiversity should not only cover terrestrial, but also fresh water and marine biodiversity.*

R7: *For the biodiversity footprint to be relevant, the main impact drivers shall be covered in the impact assessment / footprint, as well as the most important environmental inputs and outputs linked to these impact drivers. Impact drivers and related key environmental inputs and outputs that cannot be included in the quantitative impact assessment shall be covered by means of a complementary qualitative analysis.*

R8: *A biodiversity footprint should cover terrestrial, freshwater and marine impacts on biodiversity. Realms that cannot (yet) be fully included in the quantitative impact assessment shall be covered by means of a complementary qualitative analysis.*

R9: *Transparency is required regarding the inclusion of the five main drivers of biodiversity loss and gain in the biodiversity footprint. If one or more drivers are not (fully) included in the foot-*

29 PCAF (2020), The global GHG accounting & reporting standard for the financial industry. First Edition.

print, the (expected) relevance and significance of these impact drivers needs to be described by means of a complementary qualitative analysis.

***R10:** If a certification standard includes measures, captured in certification criteria, aimed at reducing specific environmental pressures compared to standard (sector average) practices, these reductions in pressures may be translated into one or more 'impact correction factors' to correct a footprint based on sector average environmental data, provided that:*

j) The certification standard is a voluntary, criteria based, third-party assessed program, based on life cycle considerations.
k) There is no evidence of net negative impacts associated with the certification.
l) The certification standard includes criteria which explicitly address one or more drivers of biodiversity loss and/or the enhancement of biodiversity.
m) The impact correction factor takes into account potential differences in the certification criteria in different countries.
n) The impact correction factor is limited to the criteria mentioned under (c) and to those criteria that need to be implemented before certification can be obtained. No voluntary criteria or criteria which can, but do not have to be selected from a long list of criteria and no criteria with a non-compliance.
o) The impact correction factor is preferably based on quantified changes in environmental inputs and outputs required by and specified in the certification standard.
p) The impact correction factor takes into account the percentage of produce which has been certified according to the certification standard when applying the correction factor to assess the impact of a production company.
q) The impact correction factor takes into account the effect the certification standard already has on the sector average which is adjusted.
r) The certifications for which correction factors have been applied is disclosed with the result of the footprint. The correction factors shall be available to the financial institution using the footprint, but are not necessarily disclosed in public reports.

***R11:** In the quantified part of a biodiversity footprint, changes in impact drivers need to be translated into changes in impact on biodiversity and the linkages need to be explicit, quantitative, transparent and science based. This ensures that the impact assessment is responsive to change, results are replicable and results are relevant to companies and investors.*

***R12:** Negative, avoided and positive impacts shall be reported separately.*

***R13:** Even when a net impact is calculated or communicated for specific purposes, negative impact, avoided impact and positive impact shall (also) be reported separately. Moreover, when a net impact is communicated by a financial institution, the use and interpretation of this net impact by the financial institution shall be explained.*

***R14:** When ex-post monitoring data of actual changes in biodiversity become available (e.g. during the implementation of a project), these data shall be compared with the ex-ante data on estimated impact. In case of significant differences between actual impact and estimated impact, these differences shall be analysed. The result shall be used to either adjust the estimated impact, the attribution of impact or improve the quality of monitoring.*

***R15:** Since the choice to use time integration or alternative approaches to deal with the time dimension of impacts will influence the footprint result, this choice needs to be explained and reported with the footprint result.*

R16: *A qualitative analysis shall accompany a quantitative footprint in order to complement impact assessment results, to recognise and report on limitations and to take these limitations into consideration in the interpretation and use of the footprint results.*

R17: *Regardless of the type of data that is being used to assess the impact on biodiversity, data use (including data sources and their limitations) should be fully transparent to allow for a traceable and replicable assessment and to allow for correct interpretation on the impact assessment results.*

R18: *Financial institutions and data providers shall use the most recent data available to them. Any deviations shall be reported explicitly, including the reasons why. PBAF recognizes there is often a lag between financial reporting and required environmental data, such as borrower or investee environmental data. In these instances, it is acceptable that the data represents different years, as long as the years are expected to be broadly comparable. If this is not the case, the differences must be explained and taken into account in the data used.*

R19: *The following information on the methodology and data used to calculate the footprint shall be reported per asset class:*

FOOTPRINT APPROACH AND DATA QUALITY	DESCRIPTION	LIMITATIONS	HOW COULD THIS AFFECT THE FOOTPRINT RESULT?
1. Scopes included			
Scope 1			
Scope 2			
Scope 3 upstream			
Scope 3 downstream			
2. Expected impacts covered in the footprint Qualitative description of the main impacts expected and how these are included in the footprint: quantitatively or qualitatively			
3. Modelling of economic activities Description of the way the economic activities of companies have been identified/assessed, including sector classifications used			
4. Impacts in supply chains Description of how data on supply chains have been included in the footprint, including potential modelling			
5. Environmental data used			
Primary data: Reported environmental inputs and outputs, including source(s), year(s) and means of verification			
Secondary data: Physical activity-based (⋆) environmental inputs and outputs, including source(s), year(s) and level of consistency with the primary business activity (⋆⋆)			

Secondary data: Economic activity–based (⋆) environmental inputs and outputs, including source(s), year(s) and level of consistency with the primary business activity (⋆⋆)			
Responsiveness of data to company action (⋆⋆⋆)			
6. Pressure – impact model used			
Name of the pressure–impact model			
Drivers of biodiversity loss included in the model			
Drivers of biodiversity loss not included in the model and how these drivers are addressed			
Extent to which local biodiversity data and ecosystem characteristics were taken into account in the impact calculation			
Was time integration used to account for future impacts? If not, what other approach was used regarding the time dimension of impacts and why?			
7. Main limitations of the footprint and what this means for the footprint result and its use			

(⋆): Financial institutions and data providers should use environmental data as consistent as possible with the primary business activity. For example, for a business loan to a paddy rice farmer, the financial institution / data provider should seek to find and use sector–specific average environmental factors for the paddy rice sector and not environmental factors for the agricultural sector in general.

(⋆⋆): Physical activity–based environmental data are (secondary) environmental data on the actual physical activities a company is involved in; economic activity–based environmental data are environmental data on the sectors in which a company is creating its revenue.

(⋆⋆⋆): To what extent are actions by companies to mitigate negative impacts reflected in the data used in the footprint calculations? How is this effectuated (e.g. by taking into account a reduction in environmental inputs and outputs required by certifications)?

R20: *Transparency is required regarding the references used to interpret footprinting results, including potential limitations to these references.*

Recommendations

A1: *In those cases where a loan is paid back or an exit is made before the impact has (fully) materialized, the investor preferably uses ex-post monitoring data available at the time of the exit and ex-ante data on estimated impact from that date onwards to assess the impact.*

A2: *Financial institutions and data providers should use the highest quality data available for each asset class for calculations and, where relevant, improve the quality of the data over time. This includes the use of primary data instead of secondary data when (part of) such data is available.*

A3: *Since it is the responsibility of the investee to provide the data required to assess the impact on biodiversity, it is recommended to always ask investees for biodiversity impact data and provide support where possible.*

A4: *The importance of location specific data in the assessment of impact and dependency related (financial) risks stresses the need to ask clients/investees for such data and maybe even set targets for 'asset location transparency' and 'supply chains transparency' on the level of a loan and investment portfolio.*