Singapore Green Finance Centre

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Biodiversity Impact of a Global Portfolio, Strategies and Insights

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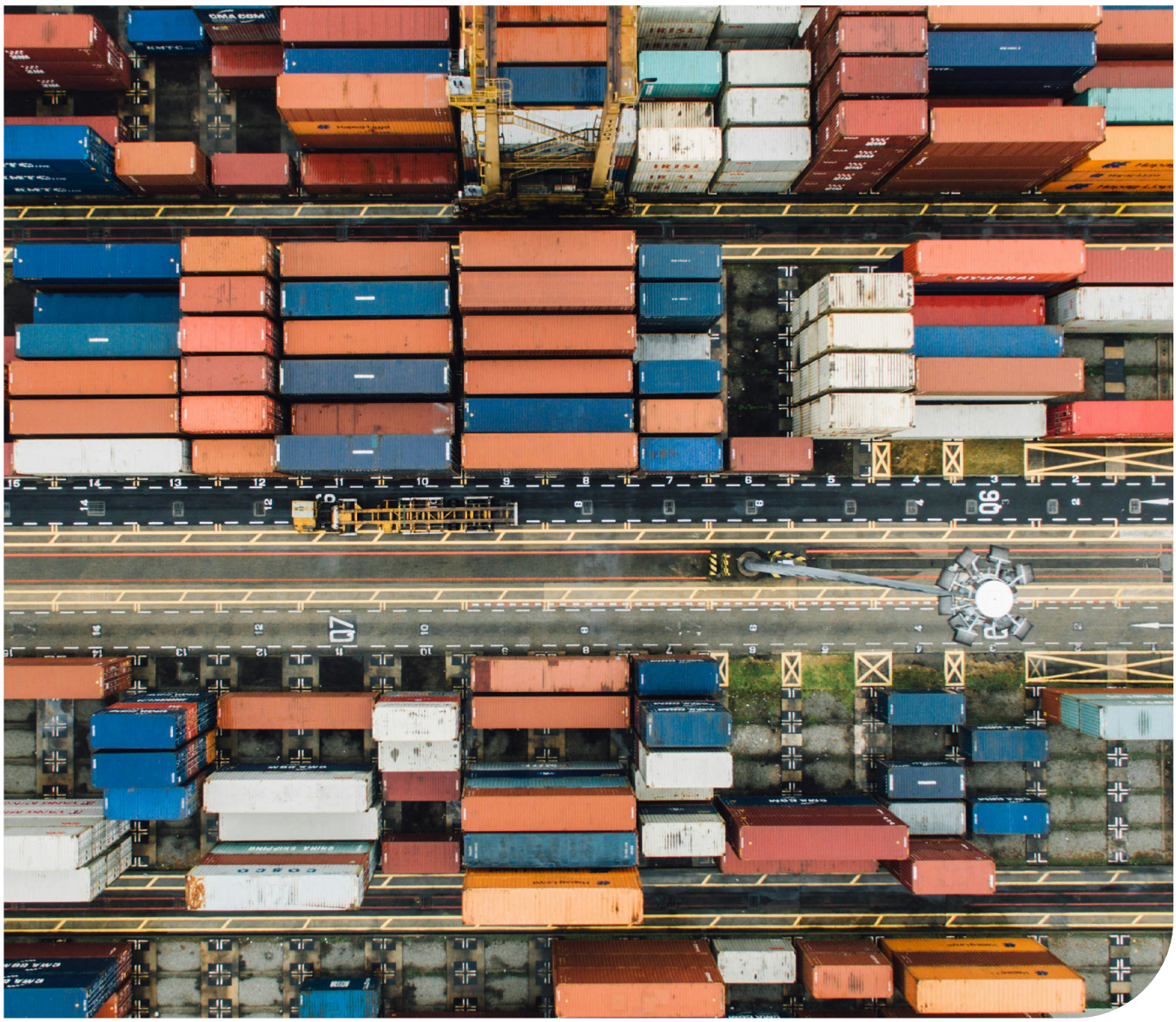

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This whitepaper is part of a broader series of (academic and industry) papers on the topic of biodiversity impact of business operations, stemming from the collaboration between the Singapore Green Finance Centre and Impact Institute.

IMPACT INSTITUTE

Table of Contents

Executive Summary

This white paper demonstrates how biodiversity impact assessment can be applied at the portfolio level and why it is relevant for financial institutions. For the purpose of this white paper, biodiversity impact refers to the measurable pressure that a company's activities and value chain place on ecosystems, quantified as the loss or degradation of species, habitats, and ecosystem services. By combining footprinting methodologies with impact monetisation, biodiversity loss can be expressed in financial terms and compared directly to investment returns. This provides portfolio managers with a practical tool to identify risks, prioritise engagement, and inform allocation decisions.

The analysis shows that for a USD 10 bln portfolio invested in global equities, the resulting attributed biodiversity impact is approximately USD 2.63 billion per year. This analysis highlights several key insights. Biodiversity impacts are heavily concentrated in a small number of holdings, meaning that focused engagement or reallocation can alter the overall portfolio impact and return profile. Most impacts arise in upstream and downstream value chains rather than in direct operations, underscoring the need for portfolio managers to seek greater transparency in sourcing and supply chains. Integrating biodiversity into return calculations shows that some assets with positive financial performance may become less attractive once ecological costs are taken into account.

For portfolio managers, these insights translate into four practical recommendations. First, monetise biodiversity impacts before allocating capital, to adjust for their most material effects on performance. Second, engage with investees both on operational practices and on supply chain transparency, as value chain impacts dominate. Third, develop sectoral policies and set time-bound targets, especially in high-impact industries where transition risks are growing. Fourth, leverage on best-in-class profiles and practices from investees as benchmarks to encourage broader improvement.

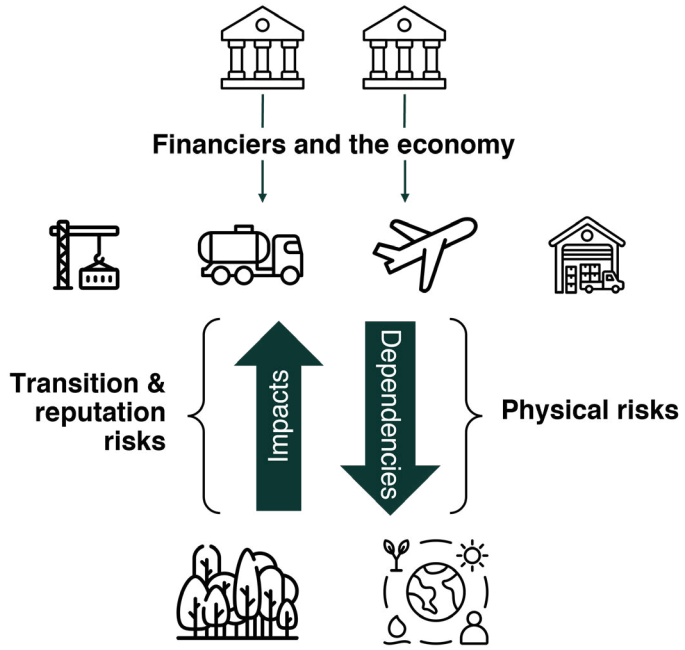
Taken together, these findings show that biodiversity assessment can be a powerful tool for portfolio managers to implement strategies that balance financial returns and biodiversity impact. In this whitepaper, we demonstrate that integrating biodiversity impact assessment into portfolio management is not only feasible but necessary to manage long-term risks, strengthen engagement strategies, and align investment decisions with sustainability goals.

1. Introduction

Biodiversity, the living part of nature, is defined by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) as the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part. This includes diversity within species, between species and of ecosystems (IPBES, 2019). Biodiversity is not only an abstract concept. It underpins the stability of ecosystems and the flow of ecosystem services on which societies and economies depend. It provides food, clean water, climate regulation, soil fertility, flood protection, cultural value, and many other valuable services.

Yet the world is facing an unprecedented decline in biodiversity. According to the World Wildlife Fund (WWF)'s Living Planet Index, global vertebrate populations have fallen by more than 70% since 1970, and 14 out of 18 categories of ecosystem services are in decline (WWF, 2024). What this decline means for businesses is highlighted by The World Economic Forum (WEF), in its New Nature Economy Report. Estimates show that approximately US$44 trillion of annual economic value (more than half of global GDP) is moderately or highly dependent on nature and its services (WEF, 2020).

Figure 1: Relationship between financial sector, economy, biodiversity and ecosystem services. Adapted from: DNB, 2020: Indebted to Nature Report



From an impact perspective, business activities are directly linked to biodiversity loss. Land use change, resource extraction, pollution, and greenhouse gas emissions are driven by economic production and consumption patterns. Financial institutions play a central intermediary role in this chain. By financing companies through debt, equity, or other mechanisms such as insurance, they enable the continuation or transformation of real world activities. This creates both impact pathways (where financial flows support activities that harm or restore biodiversity) and dependency pathways (where financial returns rely on the continued provision of ecosystem services such as water regulation, pollination, or fertile soils). This concept is referred to as double materiality: financial institutions are not only exposed to biodiversity loss through their clients and investee companies but also contribute to it through the capital they allocate.

For financial institutions, the consequences of biodiversity loss materialise as distinct categories of risk. The Dutch Central Bank's Indebted to Nature report highlights three in particular. Physical risks arise when the degradation of ecosystems disrupts economic activity - for instance, reduced crop yields from soil erosion or water scarcity undermining industrial production. Transition risks stem from policy, regulatory, or market changes as societies shift toward nature-positive practices, potentially stranding assets in sectors such as fossil fuels, intensive agriculture, or infrastructure. Finally, Reputational risks (commonly considered a sub-category of transition risk) emerge when stakeholders, clients, or the public hold financial institutions accountable for financing harmful practices (DNB, 2020). Together, these risks demonstrate that biodiversity loss is not a distant environmental issue but a material financial risk that can affect portfolio performance and systemic stability.

This paper aims to demonstrate the value of integrating biodiversity impact considerations in portfolio management for financial institutions. It details an applied assessment of the biodiversity impact of a global investment portfolio worth $10 billion, invested across 13 companies operating in diverse sectors and geographies. Section 2 introduces the type of analysis conducted and outlines the portfolio composition. Section 3 details the methodology, using the Global Impact Database Biodiversity (GID Biodiversity) footprinting tool combined with the Partnership for Biodiversity Accounting Financials (PBAF) attribution approach to quantify and monetise biodiversity impacts. Section 4 presents the impact assessment results,

highlighting the footprint of individual companies. Section 5 expands the impact analysis by integrating financial returns in the picture. Section 6 distils key findings into practical recommendations for portfolio managers, covering engagement strategies, sector policies, divestment considerations, and the use of integrated value in selection processes. Section 7 concludes and details limitations of the approach.

2. Type of Analysis and Portfolio Composition

This paper presents a biodiversity impact assessment of a global equity portfolio. The analysis is designed to demonstrate how financial institutions and portfolio managers can evaluate the biodiversity implications of their investment choices. The focus is not only on quantifying impacts but also on providing actionable insights for investment decision-making. Key stakeholders of this analysis are the portfolio managers, the investment clients, the management team of the investee companies and finally nature as a silent stakeholder.

The type of analysis conducted is a portfolio-level footprinting exercise, following the Partnership for Biodiversity Accounting Financials (PBAF) standard. It applies the Global Impact Database Biodiversity (GID Biodiversity hereafter) to map portfolio company yearly revenues to sector- and country-level environmental data. From there, biodiversity impacts are assessed across three parts of the value chain: upstream activities (suppliers and raw material production), direct operations (company-owned activities), and downstream activities (distribution, use, or disposal of products). The scope of this analysis spans the fiscal year 2024, with US$ impact as a functional unit of the analysis.

The portfolio under review is a fictitious portfolio of US$ 10 billion and consists of 13 global listed companies operating across diverse sectors and geographies. The composition was selected to reflect the spread of the global economy, with revenues spanning Asia, the Americas, Europe, and Africa. The weight of the portfolio in the investee companies was randomised. Companies included in the portfolio range from food production and water transport to motor vehicles, gas manufacturing, and warehousing. This variety allows the analysis to capture a broad set of biodiversity impact drivers across different value chains.

Table 1: Portfolio composition: investees' sector of operation and % weight in portfolio

Company #	Sectors	% of portfolio
Company 1	Beverages	9.00%
Company 2	Motor vehicles and parts	9.00%
Company 3	Chemical products	9.00%
Company 4	Food products	8.45%
Company 5	Machinery and equipment	10.00%
Company 6	Electrical equipment	15.00%
Company 7	Gas manufacture, distribution	1.00%
Company 8	Basic pharmaceutical products	14.00%
Company 9	Water transport	4.00%
Company 10	Rubber and plastic products	0.05%
Company 11	Machinery and equipment	8.00%
Company 12	Motor vehicles and parts	0.50%
Company 13	Warehousing and support activities	12.00%

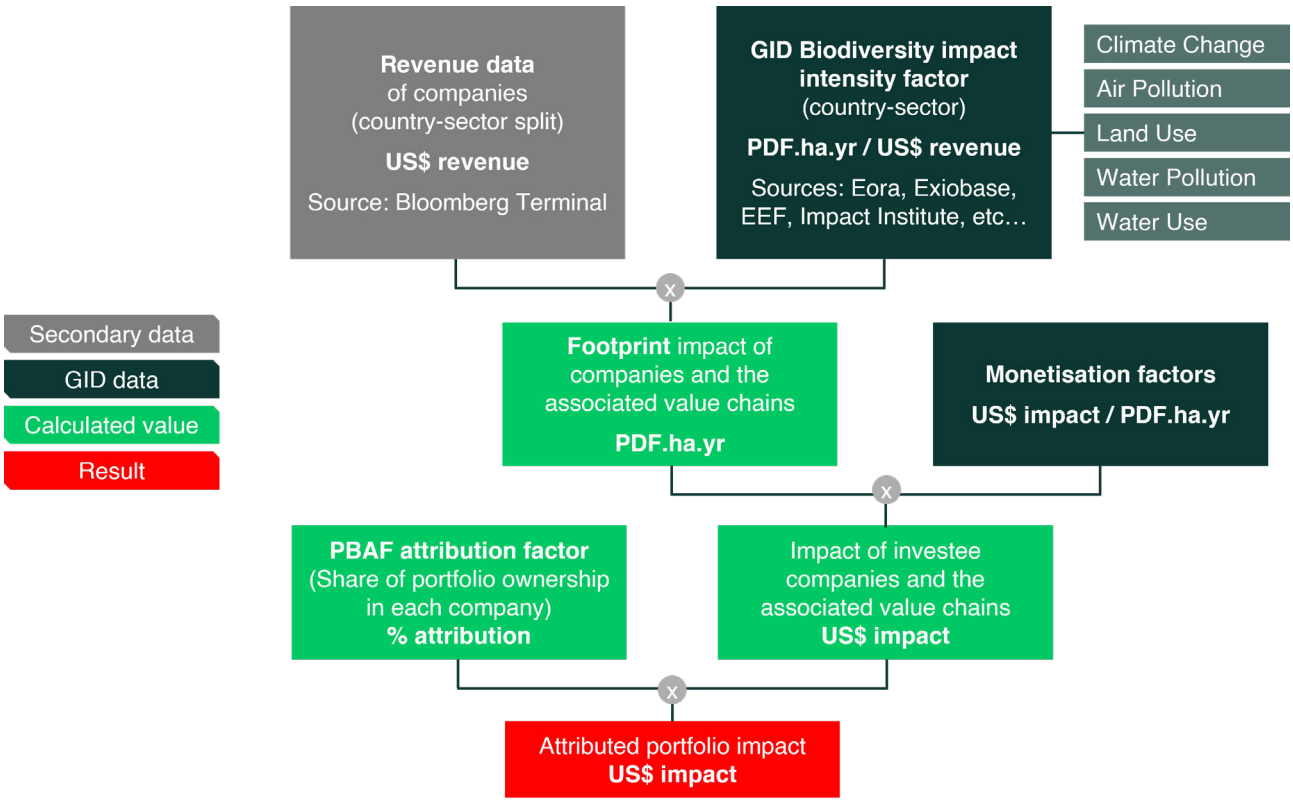
3. Methodology: GID Biodiversity Footprinting Analysis and Monetisation

The portfolio footprinting analysis in this whitepaper has been conducted using the GID Biodiversity, proprietary database owned by Impact Institute. GID Biodiversity uses top-down country sector analysis to provide granular quantitative impact estimates across the global economy (5M+ data points). Results cover both direct and upstream / downstream impacts in the value chain. It builds on input-output matrices that show the interconnectedness of industries and their environmental and financial performance.

Five drivers of biodiversity impact are included. These drivers are an aggregation of relevant indicators and are measured as either a direct physical footprint on biodiversity or an indirect loss of biodiversity. These values are converted to measure of the state of ecosystems, in PDF.ha.yr (see explanation box 1). All impact results are also monetised. This is done based on the value of the ecosystem service loss associated with the original state of biodiversity for a given area of land (for more detail on monetisation, see explanation box 2).

During the analysis, we combine company revenue data with GID Biodiversity factors to estimate the impact of the investee companies and the related value chains. We then use the investment amounts in each of the companies to attribute the impact to the portfolio using PBAF attribution (for more information on PBAF attribution, see explanation box 3).

Figure 2: Visual representation of calculation steps performed in the analysis



Explanation Box 1: PDF.ha.yr

What is a PDF.ha.yr?
PDF.ha.yr is a footprint measure to quantify the biodiversity impact on the state of an ecosystem. PDF stands for Potentially Disappeared Fraction, the proportion of species expected to be lost in an area due to human pressures (such as land use, emissions, water use, or pollution).

How to interpret a PDF.ha.yr?
It indicates the fraction of species lost (or at risk of loss) in one hectare of land over the course of one year due to human pressures.1 PDF.ha.yr can be interpreted as a 100% loss of one species across one hectare for one year, or a 10% loss across ten hectares, or equivalent combinations.

Explanation Box 2: Monetisation Through Ecosystem Services

What is Monetisation?
Impact monetisation (or impact valuation) is the process of expressing environmental and social impacts into financial terms. For biodiversity, it means expressing ecological changes such as habitat loss or pollution in dollar values that reflect the cost of damage, restoration, or lost benefits. This allows impacts to be compared with financial performance and made visible in business decisions.

What are Ecosystem Services?
Ecosystem services are the benefits people gain from nature, supported by biodiversity. They are classified in four kinds:

- Provisioning services (food, water, materials),
- Regulating services (carbon storage, water purification),
- Supporting services (soil formation, nutrient cycling),
- Cultural services (recreation, heritage).

Businesses depend on these services for inputs, stability, and resilience—making their loss a direct financial risk.

This approach values biodiversity loss by estimating the economic cost of reduced ecosystem services. For example, deforestation may be valued through the cost of (man-made) water purification facilities or restoration per hectare. Databases such as the Ecosystem Services Valuation Database (ESVD) provide benchmarks that allow biodiversity loss to be expressed in dollars and compared to returns.

How to Interpret Results
Biodiversity impact expressed in monetary terms represents the US$ of forgone benefits that ecosystem services could have provided if the activity generating the impact didn't take place – and the surrounding nature would be allowed to grow back to its pristine state.

Why Use Monetisation?
Monetisation puts biodiversity in the language of finance, enabling comparison with other impacts, prioritisation of hotspots, and clearer engagement with stakeholders. It supports compliance with frameworks like TNFD and the Global Biodiversity Framework (Target 15), which require disclosure and management of biodiversity risks. Above all, it bridges science and finance, helping practitioners integrate biodiversity into strategy and capital allocation.

In the following section, we will present and comment the results of the analysis.

4. Impact Assessment Results

The biodiversity footprint of the portfolio is expressed in **PDF.ha.yr**, which stands for potentially disappeared fraction of species per hectare per year. This unit expresses the potential extent to which species are lost as a result of environmental pressures such as land use, climate change, air pollution, water use, and water pollution. In the portfolio analysis, the companies and related value chains together account for approximately 909,000 PDF.ha.yr, of which 4.4% are linked to direct operations and 95.5% to value chain activities. This distribution illustrates that the majority of biodiversity pressures arise indirectly through supply chains rather than within the listed companies' own facilities.

Table 2: Attributed impact assessment results of portfolio, in PDF.ha.yr and US$ impact

Company name	Sector	Investment per company (US$ mln)	Direct attributed impact (PDF.ha.yr)	Value Chain attributed impact (PDF.ha.yr)	Direct attributed impact ($M)	Value Chain attributed impact ($M)	Total attributed impact ($M)
Company 4	Food products	845	5,000	660,400	-21	-1,746	-1,770
Company 9	Water transport	400	29,800	64,800	-124	-219	-343
Company 2	Motor vehicles and parts	900	300	25,000	-1	-92	-93
Company 13	Warehousing and support activities	1,200	200	25,300	-0.8	-90	-91
Company 1	Beverages	900	750	24,300	-3	-76	-79
Company 3	Chemical products	900	1,300	23,500	-5	-73	-77
Company 5	Machinery and equipment	1,000	200	13,400	-0.9	-48	-49
Company 8	Basic pharmaceutical products	1,400	400	12,000	-2	-37	-39
Company 11	Machinery and equipment	800	200	10,300	-0.7	-38	-39
Company 6	Electrical equipment	1,500	70	7,500	-0.3	-28	-28
Company 7	Gas manufacture, distribution	100	2,500	1,400	-10	-6	-16
Company 12	Motor vehicles and parts	50	40	4,400	-0.1	-15	-15
Company 10	Rubber and plastic products	5	3	250	-0.01	-1	-1
	Total	**10,000**	**40,600**	**867,000**	**-170**	**-2,460**	**-2,630**

The monetised biodiversity impact assessment of the portfolio indicates a **total attributed direct and indirect biodiversity loss** of approximately **USD 2.63 billion per year**, compared to a portfolio value of USD 10 billion[1]. This number represents the share of the impact that the financier is allocated yearly from the actual effects on the ground from the investee companies and their related value chains. This figure suggests that biodiversity impacts, when monetised, represent a material factor that is comparable in scale to financial returns.

The first insight from the assessed portfolio is that approximately **5 percent** of the biodiversity footprint (around 40,000 PDF.ha.yr, or 170 mln US$) originates from companies' **direct operations**, while the remaining **95 percent** (around 867,000 PDF.ha.yr, or 2.5 bln US$) arises from their **value chains**. This distribution indicates that biodiversity pressures are largely embedded in upstream and downstream activities, such as raw material production, energy use, and product distribution, rather than in the firms' own facilities. For portfolio managers, this suggests that **engagement strategies focused solely on direct operations are unlikely to deliver substantial impact reductions**. Addressing biodiversity risk requires attention to value chain practices and sector-wide standards, as well as collaboration with suppliers, customers, and industry bodies.

Another insight arising from table 2 is the concentration of impacts on a minority of portfolio hotspots. One company in the food products sector **(Company 4)** is responsible for **more than two-thirds** of the portfolio's biodiversity footprint, with an attributed impact of USD 1.77 billion. The driver of this impact lies almost entirely in the value chain, where agricultural activities upstream generate extensive land-use and climate-related pressures on ecosystems. This demonstrates how biodiversity risk in portfolios is often hidden in supply chains rather than in direct company operations[1].

[1] The method of impact estimation used for the analysis acknowledges shared responsibility for impact in the value chain. This entails that in certain cases impact can be overestimated. For more information, see the limitation section of this paper.

Another interesting case includes the water transport company (**Company 9**, USD 343 million attributed impact). In this case, the impacts arise for around **one third from direct operations** – such as the use of polluting maritime fuels – and the remaining **two thirds from extensive upstream and downstream** value chains. These results point to the challenge of addressing investee companies directly.

Finally, the analysis shows that the first three companies in the portfolio account for the majority of the biodiversity footprint. Together, these holdings are responsible for approximately **85 percent of the total attributed impact**, despite representing a much smaller share of the portfolio's financial value. This concentration illustrates that **biodiversity risk within portfolios is often highly unevenly distributed**, with a small number of holdings driving most of the impact. For portfolio managers, this underscores the importance of hotspot analysis, as targeted engagement or divestment in a limited set of companies can substantially alter the portfolio's biodiversity profile. It also shows the importance of focused engagement action, which will be illustrated in the next section.

Explanation Box 3: PBAF Attribution

What is Attribution?
Attribution is the process of linking a company's biodiversity impact to the share that a financial institution is responsible for through its investment or lending. Without attribution, the same biodiversity footprint could be counted multiple times by different investors or banks. Attribution ensures that biodiversity impacts are allocated fairly and consistently across financiers.

PBAF Attribution
The Partnership for Biodiversity Accounting Financials (PBAF) has developed a standard to guide how financial institutions attribute biodiversity impacts. It builds on the approach of the Partnership for Carbon Accounting Financials (PCAF) and applies the same principle: impacts are allocated in proportion to the financial institution's exposure to a company relative to its total financing base. The attribution factor is defined as:

PBAF attribution ratio: investment (equity or debt) / (total equity + total debt of company)
The company's total biodiversity impact (quantified and monetised) is then multiplied by this factor to yield the portion attributable to the investor. For example, if an asset manager holds USD 100 million in a company with USD 1 billion total financing, 10% of the company's biodiversity impact is attributed to that portfolio.

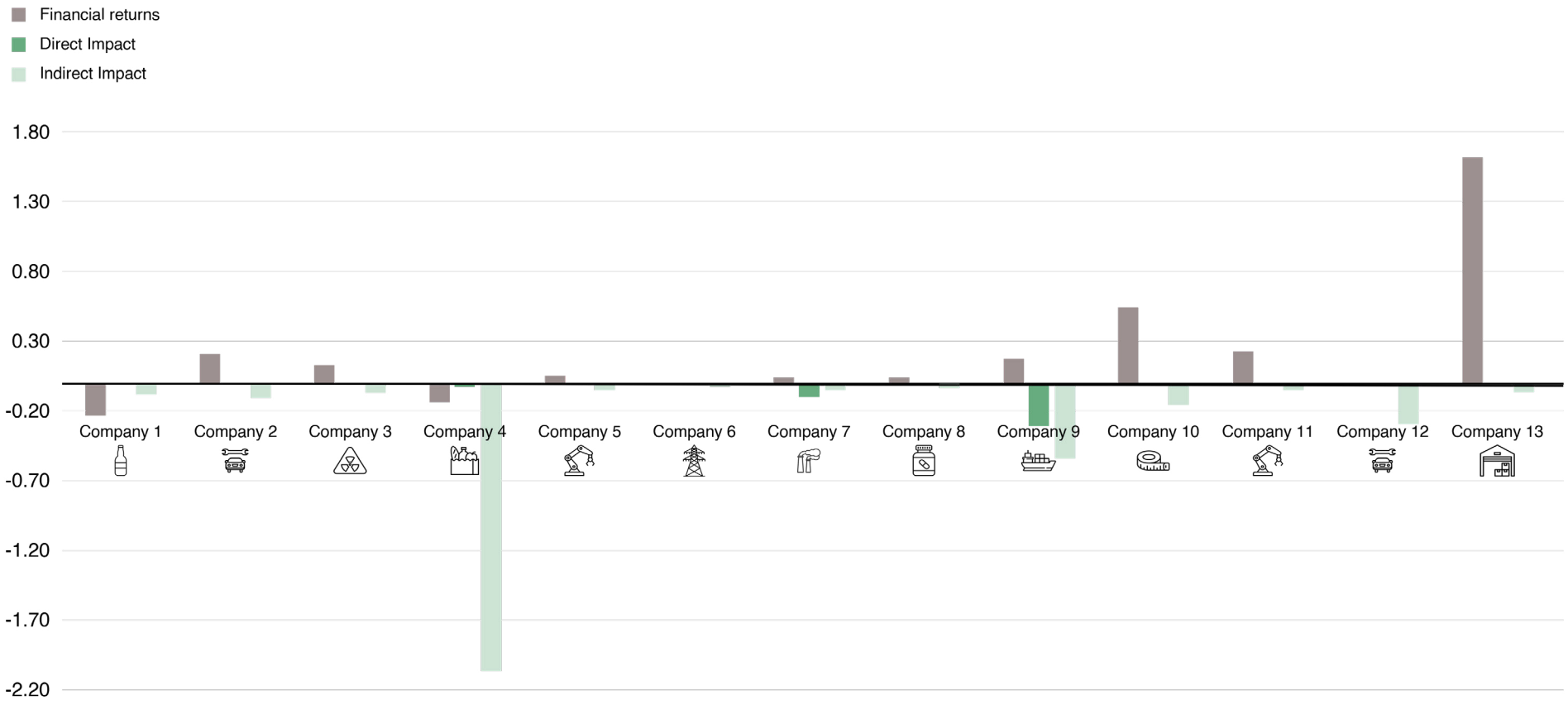
5. Integrating Returns and Impacts

Additional insights on portfolio management strategies can be drawn from the results displayed in figure 3. In this graph, yearly financial returns[2] are compared to attributed direct and indirect biodiversity impact generated by the economic activities of the investee companies. which we define as “impact adjusted returns”. I**mpact-adjusted returns refer to the financial returns of an investment or activity that have been adjusted to account for the positive or negative societal and environmental impacts it generates**. By incorporating biodiversity externalities into the return calculation, impact-adjusted returns enable investors and organizations to assess the true cost of their activities, aligning financial performance with sustainability and societal goals. In the following paragraphs, we will single out the companies from an impact-adjusted returns perspective and highlight the insights that can be used for portfolio management.

In the following paragraphs, we will provide actionable insights on the integration of impact and financial returns, starting with the companies in which these insights are most material.

[2] For the purpose of this exercise financial returns are calculated based on anonymised listed companies.

Figure 3: Financial returns, direct and indirect biodiversity impact per $ invested for the 13 investee companies



Food Products (Company 4) generates the **highest biodiversity loss** in the portfolio while also providing negative financial returns. Approximately **99 percent of its biodiversity impact** arises in the **upstream value chain** through agricultural activities, due to the use of land for pasture and crops and agricultural pollution and CO2 emissions from cattle. While this impact is not directly generated by the investee company, value chain impact is a shared responsibility among the companies in the same production chain and can turn into reputational or transition risks. Given the limited potential for investee engagement to reduce these impacts, this type of holding represents a challenge for portfolio construction, as **both financial and impact performance are misaligned**.

Water Transport (Company 9) provides strong financial returns, yet it also displays one of the worst biodiversity impact profiles in the portfolio, with **more than one third of its attributed impact occurring in direct operations**. This impact is mainly generated by the air pollution and climate change emissions from the fuels deployed for boat transport. In such cases, portfolio managers may consider starting dialogues with the investee company to collect more in-depth information on the location and nature of their impacts. That can then be used to **negotiate time bound and clear biodiversity targets with the investee**. This approach allows continued exposure to financial performance while pressing for measurable improvements in environmental outcomes.

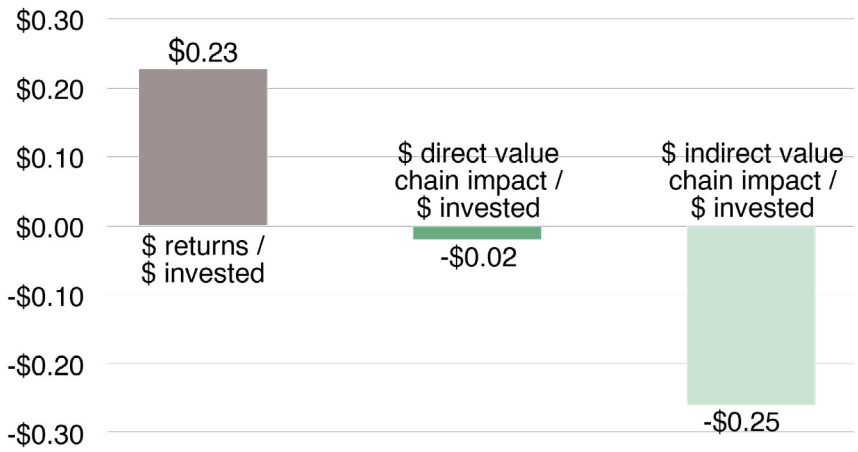
Motor Vehicles and Parts (Companies 2 and 12) illustrate the importance of intra-sector comparison. Company 12 generates biodiversity losses without providing good financial returns, while Company 2 performs better in relative terms within the same sector. Benchmarking peers in this way enables portfolio managers to prioritise engagement based on industrial practices or reallocation based on combined financial and biodiversity performance.

Gas Manufacture and Distribution (Company 7) contributes to biodiversity loss through direct operations – from the release of methane and other greenhouse gases during the production and transportation of gas[3] - while delivering average returns. For the gas sector, the societal pressure for a low carbon energy increases the importance of assessing whether such holdings can transition toward lower-impact business models. In this case, **a plan for de-carbonisation of the portfolio can also deliver biodiversity benefits**. Engaging with Company 7 to transition towards low-impact business model can deliver benefits on both fronts. If not, divestment may be considered as part of building a future-proof portfolio.

Beverages (Company 1) demonstrates weak biodiversity and financial performance simultaneously. With biodiversity impacts spread across the value chain and negative financial returns, this type of company should be carefully monitored or potentially excluded from portfolio.

Warehousing and Support Activities (Company 13), by contrast, combines high financial returns with an average biodiversity impact. Companies in this position are important engagement targets, as they have the **financial capacity to adopt biodiversity policies and can set best practice examples for their sector**.

Figure 4: Portfolio returns, direct and indirect biodiversity impact per dollar invested



[3] For more information on the impact of the gas sector on biodiversity, see *The Singapore Electricity Sector and Biodiversity* paper from the same series.

When focusing on the aggregated biodiversity portfolio impact per dollar of asset, the analysis shows that the portfolio's **impact due to the investee's direct operations is approx. two cents per dollar**. These impacts are generated by the companies' own facilities and operations, such as emissions, energy use, or land occupation. While relatively modest in scale compared to overall financial returns, they demonstrate that biodiversity loss directly attributable to company operations already carries a measurable cost.

When the analysis is expanded to include value chain impacts, the picture changes significantly. Integrating **upstream and downstream impacts** into the **portfolio's return profile results in a net negative return**, indicating that the production systems of investee companies are not operating within the limits of biosphere integrity. Given the importance of indirect impacts, excluding value chain considerations risks underestimating the systemic exposure that financial institutions face.

Taken together, these results show that the integration of biodiversity impacts into portfolio analysis not only highlights absolute hotspots but also reveals **relative performance within and across sectors**. This provides portfolio managers with a risk-returns matrix useful for decisions, as shown in the next section.

6. Learnings for Practitioners

The monetised biodiversity footprint provides a tool for portfolio managers that go beyond financial analysis. By translating ecological impacts into monetary terms, they can compare financial returns with biodiversity performance across assets. In the following paragraphs, we suggest four learnings from our analysis to the benefit of investment practitioners.

Learning #1: Monetise to integrate hidden risks in portfolio construction

Monetising biodiversity impacts allows portfolio managers to rank companies by integrated financial and biodiversity performance. Where a company's biodiversity-adjusted returns are negative (meaning that the attributed biodiversity loss exceeds financial returns) reallocation of capital can be considered.

This ensures that portfolio construction integrates not only financial risk-adjusted performance but also environmental externalities that may translate into future liabilities, such as transition and reputation risks.

Learning #2: Adjust your engagement strategy based on where investees procure and sell

The analysis highlights that the majority of impacts occur in value chains rather than in direct operations. For companies with significant direct impacts, engagement can be effective since management has more control over operational practices and implementation of changes within the company can be effective in shorter times.

Where impacts are primarily value chain-related, engagement strategies can focus on encouraging improved sourcing, supplier standards, product design and critical market research. These insights help prioritise where and how engagement is likely to have the most impact.

Learning #3: Strengthen sector-level investment policies

Sectors with substantial transition risks (e.g. energy, mining) can already benefit from dedicated sector-level policies, often focused on carbon and/or social issues. Adding biodiversity-related conditions to such policies can lead to more resilient portfolios, less exposed to both transition and compliance risks in upcoming years.

Quantitative biodiversity footprint data allows for example to define time-bound reduction targets. Where investee companies are unable or unwilling to meet such targets, divestment can be considered as part of a strategy to mitigate long-term risks and align the portfolio with sustainability objectives.

Learning #4: Define what is best-in-class, communicate on this benchmark

Positive outliers, companies that combine strong financial returns with average or better biodiversity performance, should be seen as a best-in-class benchmark for the rest of the portfolio. Close collaboration with such companies can help disseminate good practices across one's portfolio: their performance can raise expectations for other investees and demonstrate what is achievable within high-impact industries.

7. Limitations of the Analysis and Conclusions

The first limitation relates to the sample size of companies that compose the portfolio. The analysis explores 13 companies whose activities have been classified according to one sector of economic activity. Additionally, regionally classified revenues have been mapped to one country, namely, the country with highest GDP in the region of interest. This can be a simplification of the modelling exercise, as in reality certain conglomerates diversify their activities across different economic sectors and countries. While these limitations can render the portfolio less realistic, they can only lead to simplified insights but will not change their essence.

The second limitation is inherent to the footprinting approach. GID Biodiversity, like many footprinting assessment databases, relies on aggregated data at the level of countries and sectors. This can reduce the granularity and specificity of its impact assessments. GID Biodiversity uses input-output models and global databases to estimate environmental and economic impacts. While this provides comprehensive coverage, it also means that the results are based on averages for each country-sector combination, rather than specific data for individual companies, regions, or activities. Therefore, companies performing activities more sustainably will still present a similar impact profile to less sustainable companies active in the same country and sector. Final limitation of GID Biodiversity is its reliance on source data that is not always updated frequently, for example databases on environmental impacts and biodiversity metrics.

Finally, there can be limitations associated to the impact attribution method. The method used in this assessment might lead to overestimation in case two of the investee companies are part of the same value chain: if the portfolio invests in company A which is part of the supply chain of investee company B, that impact is double counted as both direct impact of company A and indirect impact of company B. While this can be considered a limitation, it is common practice to acknowledge shared responsibility for value chain impact among all the companies active in the value chain. In fact, the same happens in corporate GHG accounting when reporting on scope 3 emissions.

To conclude, this white paper has demonstrated how biodiversity impacts can be quantified and monetised at the portfolio level, using a $10 billion global equity portfolio as a case study. The analysis highlights that the bulk of biodiversity loss stems from value chain activities rather than direct operations, with a small number of holdings responsible for a disproportionately large share of the total footprint. When expressed in monetary terms, the results show that biodiversity impacts are comparable in scale to financial returns, underscoring the materiality of nature-related impacts for financial institutions.

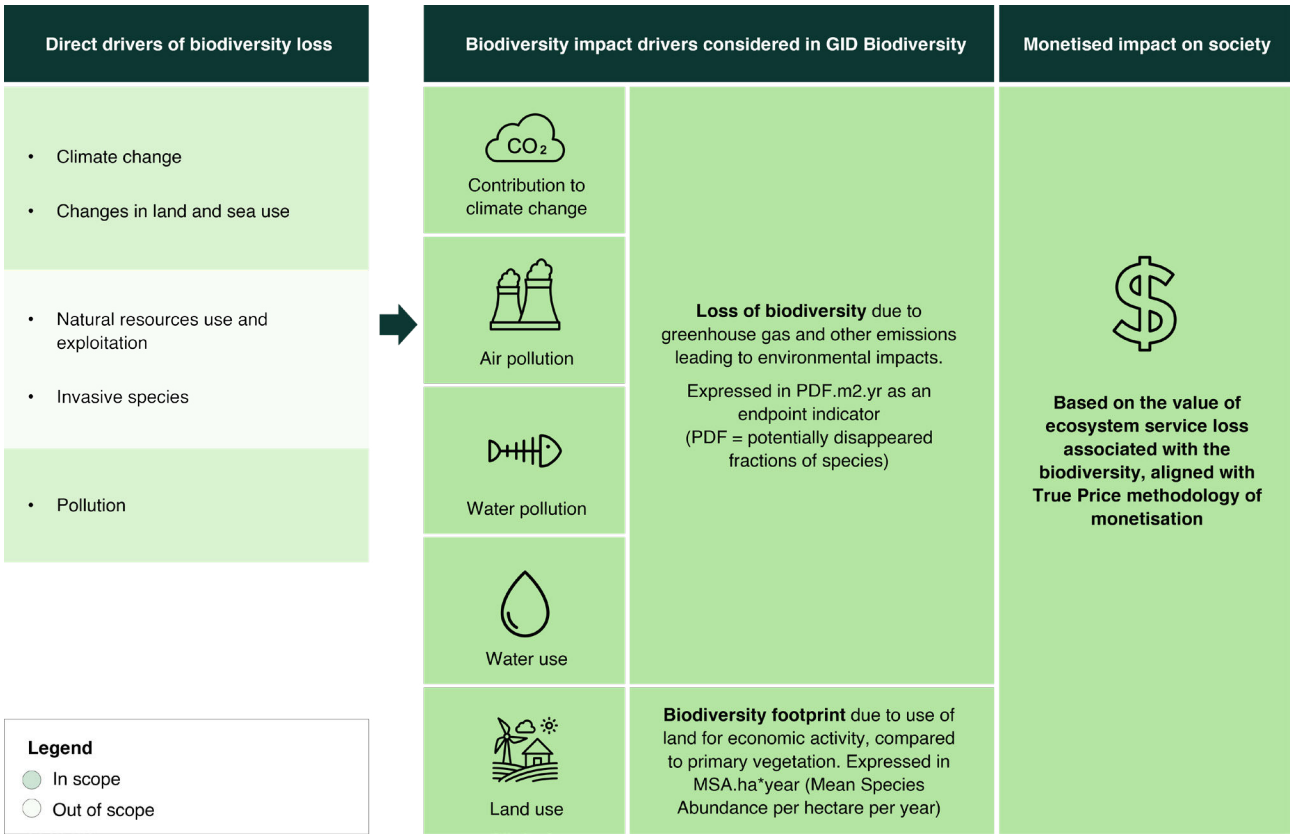
The findings suggest learnings for portfolio managers. Integrating biodiversity impact into financial decision-making allows investors to identify hotspots, compare performance across sectors, and evaluate trade-offs between returns and ecological costs. Effective responses range from reallocating capital away from biodiversity-negative holdings to targeted engagement with investees, to setting sector-wide policies that align with transition pathways.

Appendix

A. Methodology: The Global Impact Database

The Global Impact Database Biodiversity (GID Biodiversity) provides a comprehensive framework for assessing biodiversity impacts across value chains, leveraging both quantitative and monetized approaches. The methodology integrates data from global databases, such as GTAP, FAOSTAT, and GIS sources like GLOBIO and WWF, to evaluate the interconnectedness of industries and their environmental performance across 140 countries and 65 sectors. Biodiversity loss is quantified using indicators such as Mean Species Abundance (MSA) and Potentially Disappeared Fractions (PDF), which measure the reduction in species abundance or probability of occurrence compared to undisturbed habitats. These indicators are then converted to a common unit in PDF. The drivers of biodiversity loss included in the database are land use, climate change, air pollution, and water pollution and water use.

The GID Biodiversity methodology employs a full chain impact (FCI) approach to attribute biodiversity impacts across the entire value chain, ensuring a holistic assessment. It uses Multi-Regional Input-Output (MRIO) analysis to link economic activities to environmental impacts, translating emissions and land use into relative species loss across terrestrial, freshwater, and marine ecosystems. The methodology also incorporates monetization by valuing ecosystem services (ESS) such as carbon storage, air purification, and water regulation. This allows biodiversity impacts to be expressed in monetary terms, providing a tangible measure of the economic magnitude of biodiversity loss.



Explanation Box 4: Calculation Example

In this box, we display an example of the calculation that we have performed across the board to generate the results of the analysis.

The example pertains to the attributed direct value chain climate change impact for Company 3, active in the chemicals sector, in the USA.

1. Calculate footprint impact
As a first step we take the revenue generated by company 3 in the USA in 2024 and we multiply it with the impact factor from GID Biodiversity for the chemicals sector, USA, for the impact of climate change, direct value chain:

$$\text{(US\$) Revenue}_{\text{Company3}} \text{ x (PDF.ha.yr/US\$) GID Biodiversity}_{\text{Climate Change, Chemicals, USA, VC Direct}}$$
$$= 43{,}700{,}000{,}000.000 \text{ x } 0.0000025 = \textbf{109,256 PDF.ha.yr}$$

2. Monetise impact
Second step is to monetise the footprint that we have calculated.

$$\text{(PDF.ha.yr) Footprint impact x (US\$/PDF.ha.yr) Monetisation factor}_{\text{Climate Change}}$$
$$= 109{,}256 \text{ x } -4273 = \textbf{- 466,849,048 US\$}$$

3. Calculate PBAF attribution factor
We then calculate the PBAF attribution factor for this company. For this we first need to calculate the amount invested in company 3:

$$\text{(US\$) Total portfolio amount x (\%) weight}_{\text{Company 3}}$$
$$= 10{,}000{,}000{,}000 \text{ x } 9\% = \textbf{900,000,000 US\$}$$

And we need to research the enterprise value of company 3:

$$\text{Enterprise value}_{\text{Company 3}} = \textbf{413,812,600,000 US\$}$$

We can now calculate the PBAF attribution factor, that is the share of impact of company 3 that is attributed to the portfolio:

$$\text{(US\$) Investment / (US\$) enterprise value}$$
$$= 900{,}000{,}000 / 413{,}812{,}600 = \textbf{0.22\%}$$

4. Calculate attributed monetised impact
We have now all the elements to calculate attributed monetised impact for the portfolio:

$$\text{(US\$) monetised impact Company 3 x (\%) PBAF attribution factor Company 3}$$
$$= -466{,}849{,}048 \text{ x } 0.22 = \textbf{-1,015,349 US\$}$$

This calculation is performed across the board for all impacts and value chain parts, for all investee companies, to build the impact profile of the portfolio.

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