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Centre for Economic Policy Research
33 Great Sutton Street, London EC1V 0DX, UK
Tel: +44 (0)20 7183 8801
www.cepr.org

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JEL Classification: G12, G30, Q57

Keywords: Biodiversity, Stock returns

Alexandre Garel - agarel@audencia.com
Audencia Business School

Arthur Romec - arthur.romec@gmail.com
Toulouse Business School

Zacharias Sautner - Z.Sautner@fs.de
Frankfurt School of Finance and Management and CEPR

Alexander F. Wagner - alexander.wagner@bf.uzh.ch
University of Zurich, ECGI, Swiss Finance Institute and CEPR

Do Investors Care About Biodiversity?

Alexandre Garel* Arthur Romec† Zacharias Sautner‡

Alexander F. Wagner§

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Abstract

This paper introduces a new proprietary measure of a firm's negative impact on biodiversity, the corporate biodiversity footprint, and studies whether it is priced in the cross-section of stock returns. Using an international sample of firms, we find no evidence that the biodiversity footprint explains these returns, on average. However, event-study evidence shows that, following the UN Biodiversity Conference (COP15), which raised awareness of biodiversity issues, however, firms with larger corporate biodiversity footprints lost value. This response is consistent with investors revising their valuation of these firms downward upon the prospect that regulations to preserve biodiversity will become more stringent.

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*Audencia Business School - *agarel@audencia.com*

†Toulouse Business School - *arthur.romec@gmail.com*

‡Frankfurt School of Finance & Management and ECGI - *z.sautner@fs.de*

§University of Zurich, CEPR, ECGI, and Swiss Finance Institute - *alexander.wagner@bf.uzh.ch*

1 Introduction

Biodiversity, the variety of living organisms in all habitats, is deteriorating at an unprecedented and alarming level. Between 1970 and 2016, the world has seen a 68% loss of vertebrate species and an 84% loss of freshwater species (WWF 2020). According to recent estimates, 42,100 species, including 69% of recorded cycads, 41% of amphibians, 36% of reef corals, sharks, and rays, and 27% of mammals are now threatened with extinction (IUCN 2022). Global biodiversity collapse jeopardizes the goods and services humans obtain from ecosystems to ensure their well-being, including food, air and water quality, and landscape, with potentially far-reaching economic implications (World Bank 2020).[1] In addition, biodiversity loss may bring about a new "era of pandemics" (IPBES 2020). While the United Nations Convention on Biological Diversity (CBD) entered into force in 1993 and several Conferences of the Parties (COPs) to the CBD have adopted various plans to protect biodiversity, most goals have not been achieved (CBD Secretariat 2020); notably, the US has signed but not ratified the CBD. Recent globally coordinated steps toward protecting biodiversity include the Kunming Declaration of 2021, the Montreal Agreement of 2022, and the High Seas Treaty of 2023.

Given the potentially dramatic financial consequences of the loss of biodiversity, central banks and financial market supervisors are increasingly paying attention to the topic (e.g., NGFS and INSPIRE 2022). However, it is striking that the link between biodiversity and finance has received very little attention by academic researchers. As noted by Karolyi and Tobin-de la Puente (2023), no studies in the top ten finance journals reference biodiversity. As a result, important issues such as the risks related to biodiversity loss, how those risks are priced, or how financing flows need to be shifted toward biodiversity conservation remain underexplored.[2] In this paper, we take a first step toward filling this gap by introducing

1. The World Economic Forum (2022) estimates that half of the world's gross domestic product stems from industries that depend moderately to highly on nature and ecosystem services (e.g., construction, agriculture, and tourism).

2. By contrast, the economics of biodiversity have received early and substantial attention (e.g., Weitzman 1992, 1993; Metrick and Weitzman 1998; Heal 2003, 2004; Dasgupta 2021).

to the finance literature a new proprietary measure, the Corporate Biodiversity Footprint (CBF), and exploring whether investors price the biodiversity harm caused by firms.

Our measure was developed by Iceberg Data Lab and reflects the extent to which ecosystems affected by the business operations of a firm have been degraded from their pristine natural state.[3] To this end, the CBF metric aggregates the biodiversity loss caused by a firm's relevant annual activities and expresses this loss in terms of km^2MSA (Mean Species Abundance). A CBF score of 100km^2MSA corresponds to either the loss of all the original biodiversity over an area of 100km^2, or a reduction of 10% over 1,000km^2. The measure quantifies a firm's direct and indirect impacts on biodiversity from four sources: land use, greenhouse gas emissions, water pollution, and air pollution. On average, land use represents the source of environmental pressure with the greatest impact on biodiversity. Using the nomenclature of the climate finance literature, Iceberg Data Lab also decomposes the CBF metric into scope 1, 2, and 3 components.[4] Although we observe heterogeneity across industries, on average, about 81% of a firm's footprint is due to its scope 3 component.

Prior literature makes ambiguous predictions for how a firm's biodiversity footprint may affect its stock returns. The first possibility is that stocks of firms with a larger biodiversity footprint will earn higher returns. In line with evidence documenting the existence of a carbon premium (Bolton and Kacperczyk 2021) or a pollution premium (Hsu, Li, and Tsou 2023), the biodiversity footprint may represent a material risk for investors: Firms with larger footprints potentially face transition risks (e.g., compliance with an increasingly demanding regulatory environment regarding biodiversity preservation), as well as reputational risks. Investors, therefore, may require higher expected returns for holding large-CBF stocks. Beyond risk considerations, investors' preferences for green firms (those considered environmentally friendly and sustainable) may lead to divestment of those with larger biodi-

3. Iceberg Data Lab biodiversity data are used by major investors, including BNP Paribas Asset Management, AXA Investment Managers, Robeco, and Mirova.

4. Scope 1 measures the environmental pressure of the firm's direct activities, such as the area artificialized or occupied due to the business activity; scope 2 measures the pressures induced by the firm's purchase of electricity, heat, and cooling; and scope 3 measures all indirect pressures induced by the firm's activity, such as the products sold or investments made, as well as the products purchased by the firm.

versity footprints, depressing their stock prices and leading to higher expected returns (e.g., Pástor, Stambaugh, and Taylor 2021; Pedersen, Fitzgibbons, and Pomorski 2021).[5]

The second possibility is that stocks of firms with larger biodiversity footprints will earn lower returns. Recent theories and empirical evidence show that, despite having lower expected returns than brown (or not eco-friendly) stocks, green stocks can have higher realized returns due to unexpected shifts in investors' preferences for green stocks or customers' tastes for green products (e.g., Pástor, Stambaugh, and Taylor 2021, 2022). Other studies find that, when attention to climate change or other climate concerns increases, green stocks typically outperform brown stocks (e.g., Ardia et al. 2023; Choi, Gao, and Jiang 2020; Engle et al. 2020). To the extent that concerns about the global deterioration of biodiversity are recent and still developing, as investors' or customers' tastes shift, small-CBF stocks may see higher realized returns.

The third possibility is that a firm's biodiversity footprint does not affect the cross-section of returns. Investors may ignore the footprint for a variety of reasons. First, ways to measure and disclose a firm's impact on biodiversity are more complex and less well-developed than those for climate change.[6] Investors may be unable to discriminate between high versus low harm to biodiversity, even if they have preferences or anticipate risk. Second, there are no science-based policy goals for biodiversity (in contrast with the 1.5°-2.0°C warming target in the context of climate change). This lack of agreed-upon targets makes any collective action more difficult (Karolyi and Tobin-de la Puente 2023). Third, biodiversity loss is a "silent killer." The personal experience of phenomena attributable to climate change, such as abnormally hot temperatures, affects investors' perceptions of the problem (e.g., Choi,

5. Some institutional investors have started to apply exclusionary screening based on biodiversity impacts. For example, NBIM, Norway's sovereign wealth fund, divested from 60 investments due to deforestation risk, including 33 investments in palm oil plantations (Norges Bank 2018). In addition, several biodiversity funds investing in nature-based solutions have emerged (e.g., reforestation, ocean conservation, restoration of degraded land). Examples include Hermes and Mirova.

6. Ilhan et al. (2023) provide evidence that institutional investors value and demand climate risk disclosures. Demand for biodiversity harm disclosure is much less prevalent, and the quality of information is very poor. According to the head of Schroders, reporting on biodiversity is where reporting on climate change was five to ten years ago (Agnew 2022).

Gao, and Jiang 2020; Di Giuli et al. 2022). By contrast, signals of biodiversity loss are less salient at the personal level, likely leading to lower awareness of it among investors. Finally, even if investors have a sense of biodiversity harm, to the extent that they focus on the *financial materiality* of corporate environmental policies and ignore the *impact materiality* (i.e., the external impact on the environment), they are unlikely to price stocks based on firm's biodiversity footprint (e.g., Heeb et al. 2023).

Our analysis focuses on cross-sectional regression models relating the stock returns of individual firms to their biodiversity footprints. We follow Bolton and Kacperczyk (2023) in relying on a characteristics-based approach. A key advantage of this approach is that there is no need to make assumptions about the underlying asset pricing model.[7] Our global sample consists of data on 2,092 listed firms from 35 countries between 2019 and 2021. This sample represents the universe of public firms for which data on biodiversity footprints are available from Iceberg Data Lab over 2018-2020. While our sample period includes only a few years, the most important policy developments concerning biodiversity are also quite recent.[8]

Analyzing the determinants of a firm's biodiversity footprint, we find that it increases with firm size.[9] Unsurprisingly, it relates positively to a firm's carbon emissions, which represent one source of environmental pressure through which firms harm biodiversity. The biodiversity footprint also correlates positively with the environmental (E) score of Refinitiv, one of the leading vendors of ESG (Environmental, Social, and Governance) data (i.e., firms with a larger biodiversity footprint tend to have better E scores). To the extent firms with a higher biodiversity footprint face a stronger demand from investors and society to report on

7. Bolton and Kacperczyk (2023) argue that one basic conceptual difficulty with the choice of asset pricing models in the context of complex pricing problems (like climate risks) is that such models have not yet been formulated. The same argument applies to biodiversity footprints, since there is so far no research linking finance and biodiversity.

8. Positing that the biodiversity footprint is quite persistent, in one robustness test, we backfill the missing years between 2011 and 2021. Our conclusions for the relation between the biodiversity footprint and average returns are similar.

9. Therefore, we also consider scaled versions of the measure (by total assets, sales, or net property, plant, and equipment), analogous to the use of total emissions and emissions intensity to measure the carbon risk premium (e.g., Bolton and Kacperczyk 2021; Aswani, Raghunandan, and Rajgopal 2023; Zhang 2022).

their potential impact on the environment, one could expect such a correlation.[10] Finally, we demonstrate that country and industry fixed effects capture the substantial variation in biodiversity harm across firms. Firms from Finland, Brazil, and Germany, and in the Retail and Wholesale, Paper and Forest, and Food sectors, record the highest average biodiversity footprints.

Turning to the pricing analysis, our first result is that no robust evidence exists that the biodiversity footprint is priced in the cross-section of returns. This result is inconsistent with investors either having preferences for stocks with a lower impact on biodiversity or requiring higher returns for the regulatory and reputational risks associated with a higher impact. When we consider different countries, world regions, and industries, we continue to find no evidence of a link between biodiversity footprints and the cross-section of returns in any of these sample subsets. Several robustness tests show that the absence of a biodiversity premium is not due to our empirical choices. First, our results are unaffected if we exclude financial firms. This robustness test is especially useful as, through its investment in and financing of firms with potentially large biodiversity footprints, the finance industry is one of the sectors with the greatest, though indirect, impact on biodiversity. Second, weighted least-square regressions yield identical inferences, which ensures us that the nonresult is not driven by smaller stocks (smaller stocks tend to be more susceptible to outliers and volatile returns).

Our second result exploits the pricing impact of two recent biodiversity policy shocks that, plausibly, increased both investor awareness about the loss of biodiversity and the prospect of future regulations to preserve biodiversity. These events are the declarations adopted during the two parts of the United Nations Biodiversity Conference (COP15), which took

10. Refinitiv's ESG scores tend to be higher for firms that report more on ESG issues (disclosure is a key rating ingredient). There are also several reasons why a negative impact on biodiversity does not necessarily translate into a lower E score. First, most ESG ratings, including those of Refinitiv, focus on aspects material to shareholder value (i.e., on financial materiality), not on the impact materiality of ESG policies. Second, they are also more future-oriented (factoring in commitments, targets, or voluntary initiatives), which can contrast with the biodiversity footprint a firm currently has.

place in October 2021 (Kunming) and December 2022 (Montreal).[11] The Kunming Declaration calls for countries to act urgently to protect biodiversity through their decision-making and to recognize the importance of conservation in protecting human health. Analogous to the Paris Agreement for climate change, the Kunming Declaration stresses the need to align financial flows to support the conservation and sustainable use of biodiversity (Article 13) (Kunming Declaration 2020). The second part of the COP15, in Montreal, ended with a landmark agreement including 23 targets for achievement by 2030. The most prominent one, known as 30×30, places at least 30% of the world's land and ocean areas under protection. Another target adopted in the Montreal Agreement is to "require large and transnational companies and financial institutions to monitor, assess, and transparently disclose their risks, dependencies, and impacts on biodiversity through their operations, supply and value chains, and portfolios" (Montreal Agreement 2022). Because the outcomes of the two parts of COP15 were not determined beforehand, they qualify as plausible shocks to investors' expectations regarding the transition and regulatory risks faced by firms with large biodiversity footprints.[12]

If the COP15 raised their awareness of biodiversity issues and the prospect of future regulations aimed at preserving it, we would expect investors to revise downward their valuation of firms with larger biodiversity footprints. Indeed, we find that, in the three days following the announcement of the Kunming Declaration, relative to the three days before, large-CBF stocks experienced a stock price reaction of about -0.5 %, significant at the 1% level, relative to small-CBF stocks. Interestingly, we do not observe a similar negative reaction when we categorize stocks as large versus small biodiversity footprints based on intensity measures (i.e., CBF scaled by total assets or sales). This finding is consistent with the idea that investors anticipate that new regulations will target activities where the absolute level of

11. The central declarations were made on October 13, 2021 and December 19, 2022.

12. Both conferences were marked by tense talks and a deep divide between wealthy and developing countries, which made the final agreements uncertain until the day of their announcement (Eihorn 2022; Mychasuk 2022).

biodiversity harm is high.[13]

For the second part of the COP15 (Montreal), we do not detect negative stock price reactions, on average, for large-CBF firms. However, we do find economically important heterogeneity in the market reaction when we condition the analysis on country-level measures of biodiversity protection. Notably, we find a significant negative stock price reaction to the Montreal Agreement for firms located in countries with low levels of protection for biodiversity. The effects are particularly strong for firms with a large biodiversity footprint related to land use, which is plausible, given that the Montreal Agreement's 30×30 target is most relevant for firms with large land-use related biodiversity impacts.

Overall, we conclude that the biodiversity footprint has not, on average, affected stock returns in recent years, but that it is beginning to be priced by investors. While the first of our two results is negative, we believe it remains valuable. First, Hong, Karolyi, and Scheinkman (2020) emphasize that eliminating disincentives to publish negative or non-results was key to remedying the dearth of research on climate finance; the same argument applies to research on biodiversity finance. Second, as argued by Abadie (2020), although statistical significance is often interpreted as providing greater information, nonsignificance may be highly informative in empirical contexts with large datasets and few reasons to put substantial prior probability on a point null hypothesis; such contexts are common in economics. Third, we show that two recent events likely to raise investors' awareness of the prospect of regulatory interventions to preserve biodiversity are indeed associated with changes in the valuation of large-CBF stocks.

Our results relate to several strands of the literature. First, we contribute to investigations of the asset pricing implications of a firm's environmental externalities, such as industrial pollution (Hsu, Li, and Tsou 2023) or carbon emissions (Bolton and Kacperczyk 2021; Bolton

13. The objectives of the COP15 do appear to primarily target the level of harm. For example, Article 13 of the Kunming Declaration commits to reforming incentive structures to eliminate, phase out, or reform subsidies and other incentives that are harmful to biodiversity and to aligning all financial flows in support of the conservation and sustainable use of biodiversity.

and Kacperczyk 2023).[14] Choi, Gao, and Jiang (2020) document that when the weather is abnormally warm, stocks of carbon-intensive firms underperform those of firms with low emissions. Ilhan, Sautner, and Vilkov (2021) show that carbon emissions increase tail risk, as reflected in option prices. Using earnings calls, Sautner et al. (2023a, 2023b) develop a firm-level measure of climate change exposure and show that it is priced in the stock market. We extend this literature by considering the asset pricing implications of a distinct and, so far, understudied environmental externality, namely the firm's impact on biodiversity. Despite the accumulation of scientific reports on the dramatic degradation of global biodiversity and its potentially economic and financial implications, there has been almost no research on the interplay between biodiversity and finance. To the best of our knowledge, the only two exceptions are contemporaneous papers by Flammer, Giroux, and Heal (2023), who provide evidence of the use of private capital to finance biodiversity conservation and restoration, and Hoepner et al. (2023), who study 68 infrastructure firms and show that firms with better biodiversity risk management have more favorable financing conditions as reflected in lower CDS slopes. Clearly, further work is necessary to better measure and understand firms' impacts on biodiversity and the associated financial risks for a broad set of firms.

Second, we contribute to studies documenting that an increased concern for environmental and social issues may lead to green stocks outperforming brown stocks (e.g., Pástor, Stambaugh, and Taylor 2022; Ardia et al. 2023). Consistent with green stocks outperforming when policy shocks kick in, we find that firms with larger biodiversity footprints experienced significantly lower returns in the days following the COP15 agreements. Our analysis of the COP15 is also related to work showing how climate policy shocks are priced by investors (see e.g., Ramelli et al. (2021) on the effects of the 2016 and 2020 US elections).

14. Some studies document mixed results or non-results regarding the existence of a carbon premium (Aswani, Raghunandan, and Rajgopal 2023; Zhang 2022).

2 Data and Variables

2.1 Data Sources and Sample Construction

We start our sample construction with all publicly listed firms for which data on biodiversity footprints are available from Iceberg Data Lab (IDL) over the period from 2018 to 2020.[15] IDL is an independent fintech firm that develops assessment tools and provides environmental data solutions to financial institutions.

We restrict the sample to firm-year observations for which we can compute monthly stock returns over 2019-2021, one-year lagged biodiversity footprints and our main control variables. We drop observations with a negative book or market value of equity and with absolute returns exceeding 100%. We also drop countries with fewer than ten unique firms.[16] Our primary sample consists of 61,364 firm-month observations, corresponding to 2,092 unique firms in 35 countries over the period from 2019 to 2021.

We obtain accounting and stock price data (in USD) from Refinitiv, and data on ESG scores, as well as on carbon emissions, from Refinitiv's Environmental, Social, and Corporate Governance database. Data on country-level biodiversity protection and preservation come from the Organisation for Economic Co-operation and Development (OECD). The Biodiversity and Habitat score, calculated by the Commonwealth Scientific and Industrial Research Organization, is downloaded from Yale's Environmental Performance Index web platform.

2.2 Corporate Biodiversity Footprint Measures

2.2.1 Overall Corporate Biodiversity Footprint

Our primary measure of a firm's impact on biodiversity is the Corporate Biodiversity Footprint (CBF) by IDL, which developed the measure to provide a science-based indicator to help financial institutions measure and manage their investments' impact on biodiversity.

15. Iceberg Data Lab coverage is close to the one of MSCI ACWI.

16. We also exclude the following island countries: "Netherlands Antilles", "Faroe Islands", "Guernsey", "Isle of Man", "Jersey", "Marshall Islands", "Bermuda", and "Cayman Islands".

The CBF metric reflects the extent to which ecosystems affected by a firm's business activities have been degraded from their pristine natural state. The score aggregates the biodiversity loss caused by annual firm activities resulting from environmental pressures (e.g., land use, nitrogen deposition, greenhouse gas emissions, and release of toxic compounds). The CBF metric is based on the concept of Mean Species Abundance (MSA), one of the key reference metrics used by the Convention on Biological Diversity (CBD) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).[17] MSA measures the relative abundance of native species in an ecosystem, compared to their abundance in undisturbed ecosystems. It therefore captures the conservation status of an ecosystem in relation to its original state, i.e., undisturbed by human activities and pressures. An area with an MSA of 0% will have completely lost its original biodiversity (or will be exclusively colonized by invasive species), whereas an MSA of 100% reflects a level of biodiversity equal to an original, undisturbed ecosystem. Figure 1 provides a photographic illustration of MSA variation for forest and grassland ecosystems.

– Figure 1 –

To capture the area over which MSA is affected by a firm's activities, the biodiversity footprint is expressed in terms of km^2MSA. The biodiversity footprint measures the potential negative change in MSA, due to a firm's activities, by translating its combined degradation of nature into square kilometers. In other words, if we combine all of the firm's negative impacts on biodiversity and express that total impact in terms of square kilometers, the CBF metric reveals how much "artificialized" or "denatured" land it represents. For example, a

17. MSA was proposed during the development of the GLOBIO3 model, the objective of which is to simulate the impact of different human pressure scenarios on biodiversity. GLOBIO3 calculates the local terrestrial biodiversity intactness, as expressed by the MSA indicator. The core of the model consists of quantitative pressure-impact relationships, based on extensive terrestrial biodiversity databases. The CBF methodology uses MSA to express its biodiversity score because: i) it offers the largest and most robust toolbox, in terms of damage functions, in the scientific literature; ii) it is a holistic approach that adapts well to appraising portfolios, unlike more microscopic indicators (e.g., endangered species, availability of specific ecosystem services, etc.) which are better-fitted to project analysis; and iii) it is endorsed by the international scientific community and multilateral organizations, such as the IPBES and IPCC, and recommended by the United Nations for the measurement of biodiversity.

CBF value of 100km^2 means that all the original biodiversity is lost over an area of 100km^2, or that a lower proportion of biodiversity (10%) is lost over the larger area of 1,000km^2.

Calculation of the biodiversity footprint is based on the following steps. First, based on its internal physical Input/Output model, IDL assesses the products purchased and sold by a firm throughout its value chain and allocates the firm's product flows by NACE sector (NACE 4). Second, it calculates the firm's environmental pressures based on its product flows. As mentioned previously, IDL considers four main environmental pressures: land use, greenhouse gas emissions, air pollution, and water pollution. These four pressures are calculated along the whole value chain of the firm, appraising its processes, products, and supply chains. Third, IDL translates these four environmental pressures, using a set of pressure-impact functions, into one biodiversity impact unit, expressed in km^{2}MSA. Finally, it aggregates the different impacts into an overall absolute impact.

Figure 2 illustrates the steps involved in the calculation of the biodiversity footprint and, in particular, how each environmental pressure is translated into a quantified impact on biodiversity, expressed in km^{2}MSA. As examples, Figures 3 and 4 illustrate the calculations of the 2021 biodiversity footprints for food producer Danone (-10,486 km^{2}MSA) and automotive manufacturer Stellantis (-2,539 km^{2}MSA), respectively. Large parts of Danone's footprint in Figure 3 originate from the firm's supply chain, in particular in relation to the land needed for the raw materials used to manufacture its products. The firm's largest impact on biodiversity originates from its dairy products, especially from use of the land needed to breed and feed the dairy cattle. In I.A. Figure 1, we provide for Danone more details on the different steps in the calculation of its biodiversity footprint.

– Figures 2, 3, and 4 –

Unlike green investments, for which the positive climate impact can be reduced to the carbon emissions not emitted, the positive biodiversity impact of various investments is more difficult to compare. For example, as discussed by Karolyi and Tobin-de la Puente (2023), it may be too complicated for investors to decide which of these three hypothetical investments will generate the greatest nonfinancial biodiversity returns: a project to prevent the extinction of a charismatic mega-vertebrate, one to prevent the deforestation of a unique area of tropical forest, and one to restore a degraded habitat. As discussed previously, one key advantage of IDL's biodiversity footprint measure is that it translates different environmental pressures into a single biodiversity impact unit: km^2MSA. It also makes comparing the impact on biodiversity across firms easier.

The CBF is a negative number that corresponds to the degradation of biodiversity caused by the firm. In our empirical analysis, we multiply this variable by minus one so that higher values indicate a greater impact on biodiversity. We label the resultant variable as CBF VALUE. For most of our tests, we take the natural logarithm of one plus CBF VALUE.

2.2.2 Source-Based Corporate Biodiversity Footprint

In some tests, we decompose the overall measure of CBF VALUE into its constituent sources. Specifically, we consider the impact on biodiversity from four sources of environmental pressure: i) land use, ii) greenhouse gas emissions, iii) water pollution, and iv) air pollution. We also decompose the biodiversity footprint into its scope 1, scope 2, and scope 3 dimensions. Similar to the measurements used for carbon emissions, the scope 1 footprint reflects the direct pressures generated by a firm, that is, the loss of biodiversity directly caused by the establishments owned or controlled by the firm. The scope 2 footprint, by contrast, captures an indirect effect, namely the loss of biodiversity caused by the generation of purchased heat, steam, and electricity consumed by the firm. Finally, the scope 3 footprint measures the loss of biodiversity caused by the operations and products of the firm, but coming from sources that the firm does not own or control. The Data Appendix provides detailed definitions of all variables.

3 Anatomy of the Corporate Biodiversity Footprint

3.1 Descriptive Evidence of the Corporate Biodiversity Footprint

Table 1 reports summary statistics for our main variable of interest, the corporate biodiversity footprint (Ln(CBF VALUE)). The mean and median values are 5.16 and 5.49, respectively, indicating that the average (median) firm in our sample has an impact on biodiversity corresponding to the complete loss of biodiversity over an area of 173 km^2 (241 km^2). We also observe large cross-section variation in firms's biodiversity footprints, as reflected in a standard deviation of Ln(CBF VALUE) of 2.71 and a maximum value of 13.78 in our sample.

In I.A. Table 1 and Figure 5, we decompose CBF VALUE into its four source-based subcomponents and report the average proportion (in %) of each subcomponent. The source with the greatest impact on biodiversity is land use, which accounts for more than 50% of the overall CBF VALUE, followed by greenhouse gas emissions (21%), water pollution (19%), and air pollution (8%).

– Figure 5 –

Figure 6 and I.A. Table 1 further show that the firms' scope 3 footprints contribute about 80% to the overall CBF VALUE, while the scope 1 and scope 2 footprints account for, on average, 13% and 6% only, respectively. Scope 3 is dominant in the overall biodiversity footprint because most large international firms either assemble and distribute products or provide services, implying that they usually do not have direct impacts on their environments (examples include retailers, banks, or tech firms). For such firms, the largest parts of the scope 3 footprints originate from upstream (e.g., providers of farming land or extracting raw materials) or downstream (e.g., usage of products and services by clients, financing activities by banks) activities. To the contrary, firms with large scope 1 footprints tend to operate in Paper & Forest or Metals & Mining, that is, with business models that have a much larger direct effect on the local biodiversity.

– Figure 6 –

In Tables 2 and 3, we present a ranking of industries[18] and countries, using various measures of the biodiversity footprint: the overall measure, the source-based measures, and the scope decomposition. We create the industry- and country-level rankings after averaging the biodiversity measures across all firms in an industry or country. The industries with the highest average CBF VALUE are Retail & Wholesale, Paper & Forest, and Food, consistent either with their intensive land use or their toxic emissions into air and water. These industries are followed by Asset Management and Thrifts & Mortgage Finance, consistent with scope 3 biodiversity harm (indirectly through financing, in this case) being a major component of the overall biodiversity footprint measure. Among the countries with firms that have the highest average biodiversity footprints, we find Finland, Brazil, Germany, the United Kingdom, and the United States.

– Tables 2 and 3 –

In I.A. Tables 2 and 3, we provide by country and industry a decomposition of the biodiversity footprints in terms of underlying sources and scopes 1 to 3. Interestingly, in I.A. Table 2 we do not observe significant variation across countries in terms of the two footprint decompositions. For example, in all countries, the source of environmental pressure contributing the most to biodiversiy impact is land use. Likewise, on average, the scope 3 footprint is dominant in all countries. Comparatively, in I.A. Table 3, there is much more variation across industries in terms of the the decomposition of the biodiversity footprints. For instance, for the Waste industry, scope 1 accounts for 92.4% of the total footprint, whereas in the Asset Management industry, scope 3 accounts for more than 99.9% of the total footprint. The Chemicals and Metal & Mining industries have an impact on biodiversity that mainly arises from the release of toxic compounds and land use, as one would expect. The main impact on biodiversity in the Power, Internet & Data, and Waste industries is

18. Iceberg Data Lab industry classification follows an approach similar to the Revere Business Industry Classification System (RBICS).

through greenhouse gas emissions. The Transportation industry is the sector for which the impact of air pollution is the strongest. In the Food, Beverages, Paper & Forest, and Tobacco industries, land use contributes more than 90% of the overall biodiversity footprint.

3.2 Determinants of the Corporate Biodiversity Footprint

In this section, we explore the link between the biodiversity footprint and its possible determinants in a regression setting, allowing us to control for broad sources of commonalities across firms (e.g., industry or country). We estimate the following pooled panel regression at the firm-year level over 2018-2020:

$$CBF_{i,t} = \beta_0 + \beta_1 \boldsymbol{X}_{i,t} + \gamma_t + \delta_c + \mu_j + \epsilon_{i,t} \, , \tag{1}$$

where $\text{CBF}_{i,t}$ is either the natural logarithm of one plus CBF VALUE (in km^2MSA) (Ln(CBF VALUE)) or a measure of footprint intensity (CBF VALUE/TOTAL ASSETS). The vector $\boldsymbol{X}_{i,t}$ contains a wide range of contemporaneous firm characteristics. We also include different sets of fixed effects, capturing time (γ_t), country (δ_c), and industry (μ_j) dimensions. We use the industry classification of Iceberg Data Lab. Some estimations also use interaction fixed effects at the level of the country-year ($\gamma_t \times \delta_c$), industry-year ($\gamma_t \times \mu_j$), or country-industry-year ($\gamma_t \times \delta_c \times \mu_j$). Standard errors are clustered by firm.

Table 4, Panel A, presents the results of estimating Equation (1) with different sets of fixed effects. The results indicate that a firm's size is positively associated with its biodiversity footprint. As the CBF measures the loss of biodiversity caused by the firm's activities expressed in km^2MSA, it is not surprising that larger firms have a greater negative impact on biodiversity (we use both the raw and scaled measures of the biodiversity footprint in our analysis of stock returns).

– Table 4 –

Our estimates also indicate that firms with larger book-to-market ratios and greater asset tangibility (PPE over assets) have larger biodiversity footprints. Both effects are plausible.

Firms with greater book-to-market ratios are generally firms with more assets in place, which are likely to have a greater impact on biodiversity than are growth opportunities. Likewise, to the extent that the main source of the biodiversity footprint is land use, firms with more tangible assets are likely to contribute more to the degradation of biodiversity. Consistent with Bolton and Kacperczyk (2021) for carbon emissions, the biodiversity impact is smaller for firms with higher capital expenditures.[19]

Our results further indicate that firms with higher carbon emissions have larger biodiversity footprints. This result is explained by the fact that greenhouse gas emissions are one of the sources of environmental pressure considered when computing the impact of a firm's activities on biodiversity. Perhaps more surprisingly, we also find that firms with higher E scores have larger biodiversity footprints. To the extent that firms with a higher biodiversity footprint face a stronger demand from investors and society to report on their potential impact on the environment, one may indeed expect this positive correlation between environmental scores and the biodiversity footprint.[20] There are also several reasons why a negative impact on biodiversity does not necessarily translate into a lower E score. First, most ESG ratings, including those of Refinitiv, focus on aspects material to shareholder value (i.e., on financial materiality), not on the impact materiality of ESG policies.[21] Second, there is a distinction between the current biodiversity footprint and a firm's environmental responsibility, which typically captures the firm's future-oriented strategies and voluntary initiatives to reduce its impact on the environment and to prepare its transition to a low-carbon economy. Finally, Refinitiv's ESG ratings measure relative performance within an industry; a

19. I.A. Table 4 reports pair-wise correlations between the biodiversity measures and firm characteristics.

20. Refinitiv's ESG scores are designed such that firms that report more on ESG issues tend to get more favorable scores as disclosure is a key rating ingredient. Specifically, one of the indicators used by Refinitiv to compute the E score is biodiversity impact reduction, which is a dummy variable equal to one if a firm reports its impact on biodiversity or on activities to reduce its impact. Unlike this indicator, which mainly captures whether a firm discloses biodiversity-related information, IDL's biodiversity metric is a more direct measure of the impact of a firm on biodiversity. In unreported tests, we find that Refinitiv's biodiversity indicator positively correlates with CBF VALUE, indicating that firms with larger biodiversity footprints indeed disclose more.

21. For example, Refinitiv's E score reflects how a firm uses best management practices to avoid environmental risks and capitalizes on environmental opportunities to generate long-term shareholder value.

firm belonging to a "dirty" industry with greater environmental externalities may therefore earn a high E score if it performs better than its peers.

In Table 4, Panel B, we examine the determinants of the scaled measure of the biodiversity footprint (CBF VALUE/TOTAL ASSETS). The determinants of CBF intensity are roughly the same as for the absolute measure, although their statistical significance is lower. Not surprisingly, one notable exception is firm size, which is negatively related to CBF intensity.[22]

4 Biodiversity Footprint and Stock Returns

4.1 Biodiversity Footprint and the Cross-Section of Returns

In this section, we present our findings on the pricing of the biodiversity footprint. Our empirical analysis relies on cross-sectional regression models relating individual firms' returns to their biodiversity footprints. Following Bolton and Kacperczyk (2023), we take a firm characteristic-based approach, rather than a factor-based model; this approach is well suited, given the rich cross-sectional variation in firm characteristics in our sample. In particular, it allows us to take full advantage of fixed effects along time, country, and industry dimensions. Moreover, with a characteristics-based approach, there is no need to make assumptions about the underlying asset pricing model.[23] Specifically, we link a firm's monthly returns from January to December of year t to its corresponding biodiversity footprint reported by Iceberg Data Lab for the year *t-1.* We estimate the following pooled panel regression at the firm-month level:

$$RET_{i,t} = \beta_0 + \beta_1 CBF_{i,t-1} + \beta_1 \boldsymbol{X}_{i,t-1} + \gamma_t + \delta_c + \mu_j + \epsilon_{i,t}\,, \tag{2}$$

22. In unreported tests, we find that the determinants of the subcomponents of the biodiversity footprint are generally the same.

23. As explained by Bolton and Kacperczyk (2023), a basic conceptual difficulty with the choice of asset pricing model, in the context of a complex pricing problem such as climate change risk, is that no such model has yet been formulated. The same argument applies to the biodiversity footprint and its associated risks, especially since biodiversity issues are more recent and have received less attention than carbon emissions.

where $\text{RET}_{i,t}$ is the stock return of firm i in month t, and $\text{CBF}_{i,t-1}$ corresponds to one of our raw or scaled measures of the firm's biodiversity footprint. Through the vector $\boldsymbol{X}_{i,t-1}$, we control for for a large number of firm characteristics, following prior studies on the asset pricing implications of environmental externalities such as carbon emissions or pollution (e.g., Bolton and Kacperczyk 2023; Aswani, Raghunandan, and Rajgopal 2023; Zhang 2022). Specifically, $\boldsymbol{X}_{i,t-1}$ includes firm size[24], leverage, book-to-market ratio, asset tangibility, capital expenditures over assets, return on assets, asset growth, momentum, and volatility. We also control for time, industry, and country fixed effects (as well as their interactions).

Table 5, Panel A, Column 1 reports the results of estimating Equation (2). The coefficient on Ln(CBF VALUE) is negative, but not statistically significant, indicating that a larger biodiversity footprint is not associated with a greater (or lower) stock return. This suggests that investors did not price the impact of firms on biodiversity within our sample period, or did not see biodiversity harm as a material risk. In Columns 2 through 6, we consider stricter sets of fixed effects and alternative clusterings of the standard errors. In particular, we successively add country × time fixed effects, industry × time fixed effects, and country × industry × time fixed effects. In all columns, the coefficients on Ln(CBF VALUE) continue to be statistically insignificant, confirming our previous result that the biodiversity footprint is not priced in the cross-section of stock returns.

– Table 5 –

In Table 5, Panel B, we reestimate Equation (2) using CBF VALUE/TOTAL ASSETS, the measure of footprint intensity. The coefficient on the scaled measure is once again not statistically significant, indicating that a greater intensity of the biodiversity footprint is not associated with a greater stock return.

In I.A. Table 5, we present numerous robustness tests. First, we exclude financial firms

24. Our results are similar if, instead of using the logarithm of total assets, we use the logarithm of market capitalization.

from our sample. As mentioned earlier, financial firms operate in one of the sectors with the largest biodiversity footprints, but this impact is mostly indirect (i.e., scope 3), due to their investment in or financing of firms with large biodiversity footprints. Second, we run weighted-least-squares regressions instead of ordinary-least-squares (OLS) regressions. As discussed by Zhang (2022), OLS regressions tend to overweight smaller stocks, because they are more susceptible to outliers, and volatile returns, which most likely belong to smaller stocks. Third, we perform Fama-MacBeth regressions. Fourth, we restrict our sample to firms for which data on their biodiversity footprints is available for all three years. Fifth, we extend our time scale in the following way: Given that the biodiversity footprint metric is recent, measurements are available only for three years; however, given that the biodiversity footprint is likely to be persistent at the firm level, we take the firm's mean CBF VALUE over the 2018-2020 time period and extrapolate those values back to 2011. Sixth, we consider alternative ways to scale our measure of the biodiversity footprint, i.e., by sales or property plant and equipment. In all these tests, the biodiversity footprint is not associated with stock returns, confirming that investors do not price the impact of firms on biodiversity.

Table 5, Panel C, links firms' monthly stock returns to the different source components of their biodiversity footprints. To this end, we estimate Equation (2) again, this time replacing the overall CBF VALUE with those resulting from different sources of environmental pressures, namely i) land use, ii) greenhouse gas emissions, iii) water pollution, and iv) air pollution. Our results indicate that none of these four components are associated with stock returns.[25]

Finally, we explore in I.A. Table 6 whether the (absence of) pricing of the biodiversity footprint differs across countries, world regions, or industries. For the sake of brevity, we report only the coefficient on the variable Ln(CBF VALUE). Our results show that the biodiversity footprint is not statistically associated with returns in any of the world's geographical

25. The absence of results for the two pollution components is not inconsistent with recent papers documenting the existence of a pollution premium (Hsu, Li, and Tsou 2023). Our results do not imply that there is no pollution premium, but rather that the loss of biodiversity resulting from a firm's pollution is not priced by investors.

areas, countries, or industries. The only exception is the Metals & Mining industry, for which the coefficient on Ln(CBF VALUE) is positive and weakly significant at the 10% level.

Overall, our results provide robust evidence that the biodiversity footprint is *not* associated in a statistically significant manner with the cross-section of stock returns. This finding indicates that investors do not pay attention to the biodiversity loss caused by a firm's activities or that they do not consider it to be a material risk.

4.2 Stock Price Reactions to Biodiversity Policy Shocks

4.2.1 Institutional Details and Estimation Design

Our results so far suggest that investors do not price the harm to biodiversity caused by firms' activities. One possible reason is that public awareness of biodiversity loss and its consequences are relatively recent, especially when compared to that of carbon emissions and air pollution. To explore this possibility, we examine the price reactions to two international biodiversity policy shocks, the Kunming Declaration and the Montreal Agreement, which together have been hailed as being the biodiversity equivalent of the climate-focused Paris Agreement.[26]

The Kunming Declaration was adopted at the 15th Conference of the Parties of the CBD

26. The international biodiversity conservation agenda dates back to the 1980 "World Conservation Strategy" commissioned by the United Nations Environment Programme (UNEP) and the International Union for Conservation of Nature (IUCN). The UN Convention on Biological Diversity (CBD) was opened for signature at the Earth Summit in Rio de Janeiro on June 5, 1992 and entered into force on December 29, 1993. Since then, 15 Conferences of the Parties to the CBD (COPs) have been held, though success has been limited. None of the 20 targets set at COP 10, for the period 2011-2020 (Aichi targets), have been fully reached (CBD Secretariat 2020). While we focus on global developments in this paper, important region- and country-specific developments are motivated in part by the economic and financial consequences of biodiversity loss. For example, in the European Union, the 2018 Action Plan on Financing Sustainable Growth has led to the establishment of a taxonomy of sustainable activities (which mostly concerns non-financial companies) and the consequent obligations of financial companies to disclose the "sustainable" part of their activities. The EU has also recently adopted regulatory technical standards for disclosures under the Sustainable Finance Disclosure Regulation (SFDR). Moreover, central banks and financial market supervisors are increasingly paying attention to the topic (see, e.g., NGFS and INSPIRE (2022)). Finally, various initiatives at the intersection of corporations and the public sector have emerged. For example, "Business for Nature" has called for nature assessment and disclosure to be mandatory. The Taskforce on Nature-related Financial Disclosures (TNFD) proposes a framework for financial institutions and companies, analogous to the Task Force on Climate-related Financial Disclosures (TCFD). French SIF and Iceberg Data Lab (2022) provide an overview of these policy developments and initiatives.

(COP15) in October 2021. More than 100 countries committed to developing, adopting, and implementing an effective post-2020 global framework to put biodiversity on a path to recovery by 2030 at the latest (the United States, not being a member of the CBD, was not formally involved in this or the later Montreal agreement, but participated in the discussions). Analogous to the Paris Agreement, the Kunming Declaration stresses the need to align all financial flows in support of the conservation and sustainable use of biodiversity (Article 13). The second part of COP15, held in December 2022, resulted in the landmark Montreal Agreement to protect 30% of the planet's lands, coastal areas, and inland waters by the end of the decade.

We examine the daily stock returns of firms with large versus small biodiversity footprints around the COP15 dates. Specifically, we estimate the following panel regression at the firm-day level over a window of three days before and after each event:

$$RET_{i,t} = \beta_0 + \beta_1 LARGE\ \ CBF_i \times POST_t + \gamma_t + \delta_i + \epsilon_{i,t}\,, \tag{3}$$

where $\text{RET}_{i,t}$ is the stock return of firm i in day t, LARGE CBF_i is a dummy variable equal to one if the firm has a large biodiversity footprint (CBF VALUE is above the median), POST_t is a dummy variable equal to one after the event. In both cases, we consider the event date to be the last day of the conference (i.e., October 13, 2021 for Kunming and December 19, 2022 for Montreal). We define the event day as the first day of the post-event window and denote it as t = 0 (the event window is in turn labeled as [-3,2], covering three days before the event date and three days following the event date (the event date plus two further days). We control for firm (δ_i) and day (γ_t) fixed effects. The firm fixed effects, in particular, control for any firm characteristics or potential determinants of stock returns that are fixed around the days of the events.[27] The coefficient of interest (β_1) captures the differential in stock returns for firms with large biodiversity footprints in the days following the Kunming and Montreal COP15 conferences, relative to firms with small footprints. To

27. The standalone variables LARGE CBF_i and POST_t are absorbed by, respectively, the firm and time fixed effects.

the extent that either part of COP15 contributed to increasing awareness about biodiversity issues and the prospect of future regulations aimed at preserving it, we expect investors to have revised downward their valuation of firms with large biodiversity footprints.

4.2.2 Stock Price Reactions to the Kunming Declaration

Table 6 reports the results of estimating Equation (3) around the Kunming Declaration. In Column 1, we find that the coefficient on the interaction term LARGE CBF $\times$ POST is negative and statistically significant at the 1% level, indicating that firms with large biodiversity footprints experienced statistically lower returns than firms with small footprints. On average, in the three days following the October 13 announcement, the daily returns of large-CBF firms were 0.5% below those of small-CBF firms. In Column 2, to check for parallel trends, we decompose the POST variable into dummies capturing the days surrounding the Kunming event. Importantly, before the declaration, we observe no statistically significant difference in the returns of large- and small-CBF stocks. This result, consistent with the outcome of the conference being uncertain and unanticipated by investors, supports our interpretation that the differential in daily returns following the event was due to the announcement. We also find that the negative stock price reaction for large-CBF firms mostly spans the day of the Kunming Declaration and the following day.

– Table 6 and Figure 7 –

Figure 7 visualizes the main result of effects of the Kunming Declaration, by plotting the difference in daily stock returns between firms with large versus small biodiversity footprints in the days surrounding the event date. Using the estimates from Table 6, Column 2, we report the coefficients on the interactions terms between LARGE CBF and dummies capturing the days around the Kunming Declaration and the associated 95% confidence intervals.

The next two columns in Table 6 address concerns that results are driven by unobserved effects at the country or industry level. In Columns 3 and 4 of Table 6, when we control for any country-wide or industry-wide reactions to the Kunming Declaration, the coefficient on the interaction term continues to be negative and statistically significant at the 1% level. In Columns 5 through 8, we reestimate the same regressions using abnormal daily stock returns as the dependent variable (i.e., returns in excess of the return of the domestic MSCI stock-market index). We continue to find that large-CBF firms experienced negative returns in the days following the Kunming Declaration.[28]

In I.A. Table 7, we reestimate differerent variants of our baseline specification (Table 6, Column 1). We report only the coefficients on the interactions between LARGE CBF_i and POST_t. The estimates show that the coefficients on the interaction terms are negative and statistically significant for three of the four sources of environmental pressures, with water pollution being the exception. Importantly, we do not observe a negative reaction when we categorize stocks as large- versus small-CBF based on the intensity measures (independently of whether we scale by assets, sales, or PPE). This result is consistent with the idea that investors anticipate that future regulations will target activities with a high level of harm to biodiversity. Therefore, firms with larger absolute biodiversity footprints are the most exposed to the costs of any such future regulations. We also find that the negative stock price reaction for large-CBF firms is observed in all geographical areas except for South America and Oceania (which are also the areas with the lowest number of observations). Our results are unchanged if we remove observations for which the absolute value of daily returns is higher than 5%. They are also unchanged if we define large-CBF firms as those with a CBF score in the top quartile, if we use the continuous measure of CBF, or if we consider a larger time window around the event.

28. In unreported tests, we obtain similar results if we control for a measure of biodiversity disclosure, namely the biodiversity impact reduction indicator from Refinitiv. Hence, the negative stock price reactions for large-CBF firms are not affected by differences in biodiversity disclosures across firms (as measured by the Refinitiv indicator).

4.2.3 Stock Price Reactions to the Montreal Agreement

Table 7 reports the results of estimating Equation (3) around the Montreal Agreement. Different from Table 6, we observe that the coefficient on the interaction between LARGE CBF_i and POST_t is not statistically significant and much smaller in magnitude, independent of whether we consider raw or abnormal stock returns. The average zero-return effect in Table 7 may, however, mask heterogeneity in the stock price reactions depending on a country's level of biodiversity protection. The reason is that, with the prominent 30×30 target, the Montreal Agreement places emphasis on the protection of land and marine areas. This agreement may, therefore, trigger different market reactions across countries depending on their pre-existing level of biodiversity protection. As a matter of fact, country-level biodiversity protection varies greatly across the globe. This is illustrated by the summary statistics reported in I.A. Table 8, which lists three country-level measures of the protection of biodiversity around the world (higher values indicate better biodiversity protection in a country). The first indicator is the Biodiversity and Habitat Score developed by Yale University, which assesses countries' actions toward retaining natural ecosystems and protecting the full range of biodiversity within their borders. The second and third indicators are, respectively, the extent to which a country's territorial and marine areas are protected. For our subsequent analysis, we in turn create three dummy variables, which each equal one if the level of biodiversity protection in a firm's country falls in the bottom quartile of the distribution.

– Table 7 –

In Table 8, we explore the possibility that firms located in countries with low levels of biodiversity protection experienced negative stock prices reactions to the Montreal Agreement, relative to firms from high-protection countries. In Columns 1 through 3, we report regressions of daily stock returns around the Montreal announcement on the three interactions terms between the country-level proxies for low biodiversity protection (LOW BIODIVERSITY PROTECTION) and the post-Montreal-Agreement dummy (POST). Independent of the proxy for biodiversity protection, the estimates show that firms located in countries with low protection experienced lower stock returns in the days following the Montreal Agreement. On average, in the three days following the December 19 announcement, the daily returns of firms located in countries with low levels of biodiversity protection were 1.4% below those of firms located in countries with high levels of biodiversity protection. These results suggest that investors revised downward their valuations for firms located in these laggard countries.

– Table 8 –

In Columns 4 through 6, we refine the estimation and examine whether large-CBF firms from countries with low biodiversity protection experienced more negative stock price reactions to the Montreal announcement. The main variable of interest in these columns is the triple interaction between LARGE CBF LAND USE, POST, and LOW BIODIVERSITY PROTECTION. We focus on the CBF land use, rather than the overall biodiversity footprint measure, because the most prominent target of the Montreal Agreement was to place 30% of land and sea under protection. We therefore expect investors to react in particular for firms with a large land use impact on biodiversity. For two out of the three proxies for biodiversity protection, we indeed find that the coefficient on the triple interaction is negative and statistically significant. Among firms located in countries with low levels of biodiversity protection, those with large land-use related biodiversity footprint experience an additional decrease in daily returns of about 0.3% in the three days following the Montreal announcement.

5 Conclusion

Biodiversity loss and climate change are two of the major crises of our era. Research on climate finance has grown rapidly over the past years and has improved our understanding of the potential consequences of climate change for financial markets. By stark contrast, there has been very little research on biodiversity finance. Although the two crises are related, biodiversity preservation can clash with actions taken to address climate change. For example, renewable energy and electric cars require lithium, cobalt, magnesium, and nickel, the mining of which comes with severe impacts on biodiversity (and on the human communities that rely on biodiversity). Therefore, it is important to separately analyze finance's role in the loss of biodiversity. Our paper offers a first step toward understanding the interplay between finance and biodiversity by introducing a measure of the corporate biodiversity footprint and exploring whether it is priced by investors.

Examining a large sample of international stocks, we find no evidence that the biodiversity footprint affects the cross-section of stock returns. This result is inconsistent with investors seeing harm to biodiversity as a material risk for a firm or with investors preferring firms that do the least harm. Conversely, it also suggests that, on average, investors are able to invest in firms with a small biodiversity footprint without losing out on returns compared to otherwise similar firms. Put differently, it suggests that, within our sample period, investors did not care about the impact of firms on biodiversity. However, things appear to be changing, as we also document a negative stock price reaction for firms with large biodiversity footprints following COP15, which raised investors' awareness about biodiversity issues. Disclosure and measurement of the biodiversity footprint is still at an early stage, and further work is needed to improve the reporting of firms' impacts on biodiversity, as well as to explore the consequences of biodiversity loss for financial markets and investors.

Data Appendix. Variable Definitions

Variables	Definitions	Sources
CBF VALUE	This variable measures the absolute biodiversity loss caused by the firm's annual activities. It results from the addition of four environmental pressures: land use transformation, emission of greenhouse gases, emission of nitrogen oxides, and release of toxic compounds into the environment. It is expressed in km^2MSA, which is equivalent to the pristine natural area destroyed by the firm's annual activities. MSA(Mean Species Abundance) is a metric characterizing the level of biodiversity in an ecosystem. The CBF value provided by IDL is negative. We use the logarithm of one plus -1 $\times$ CBF value.	Iceberg Data Lab
CBF VALUE/TOTAL ASSETS	CBF VALUE scaled by total assets in USD. Winsorized at the 2.5% and 97.5% levels.	Iceberg Data Lab
CBF VALUE/PPE	CBF VALUE scaled by net property, plant, and equiment in USD. Winsorized at the 2.5% and 97.5% levels.	Iceberg Data Lab
CBF VALUE/SALES	CBF VALUE scaled by revenue in USD. Winsorized at the 2.5% and 97.5% levels.	Iceberg Data Lab
CBF GHG	This variable measures a firm's responsibility for greenhouse gas (GHG) emissions, an important driver of biodiversity loss. In addition to direct GHG emissions due to the firm's energy consumption, GHG emissions resulting from the electricity consumption and emissions of products purchased in the firm's upstream supply chain are taken into account. We use the logarithm of one plus -1 $\times$ CBF GHG value.	Iceberg Data Lab
CBF LAND USE	This variable measures the firm's responsibility for the transformation of pristine land into agricultural land or artificialized areas. The firm's direct pressures on land use, such as its physical assets, buildings, or plantations, are factored in. The land use impact of the firm's upstream supply chain (i.e., purchased products) is also taken into account. We use the logarithm of one plus -1 $\times$ CBF LAND USE value.	Iceberg Data Lab
CBF WATER POLLUTION	This variable measures the firm's responsibility for the release of toxic compounds into the water. Release of substances due to the firm's direct activity (e.g., processing food or fertilizing crops) are taken into account, as well as those of the firm's upstream supply chain. We use the logarithm of one plus -1 $\times$ CBF WATER POLLUTION value.	Iceberg Data Lab
CBF AIR POLLUTION	This variable measures the firm's responsibility for the release of nitrogen oxides (NOx) into the air, a major factor in biodiversity loss. Direct pressures coming from the firm, such as NOx emissions arising from its fuel consumption, are taken into account, as are NOx emissions arising from the electricity consumption and emissions of products purchased in the firm's upstream supply chain. We use the logarithm of one plus -1 $\times$ CBF AIR POLLUTION value.	Iceberg Data Lab
CBF SCOPE 1	This variable measures the impact on biodiversity due to the firm's direct activities (i.e., surface artificialized or occupied). We use the logarithm of one plus -1 $\times$ CBF SCOPE 1 value.	Iceberg Data Lab

CBF SCOPE 2	This variable measures the environmental pressures of a firm due to its purchase of electricity, heat, and cooling. We use the logarithm of one plus -1 × CBF SCOPE 2 value.	Iceberg Data Lab
CBF SCOPE 3	This variable measures all indirect pressures due to the firm's activities (such as its products sold or investments made, or products purchased by the firm). We use the logarithm of one plus -1 × CBF SCOPE 3 value.	Iceberg Data Lab
TOTAL ASSETS	Total assets. Winsorized at the 1% and 99% levels.	Refinitiv
BOOK-TO-MARKET	Ratio of book equity to market capitalization. Winsorized at the 1% and 99% levels.	Refinitiv
CAPEX/TOTAL ASSETS	Capital expenditures divided by total assets.Winsorized at the 1% and 99% levels.	Refinitiv
ROA	Net income after tax, divided by total assets. Winsorized at the 1% and 99% levels.	Refinitiv
PPE/TOTAL ASSETS	Net property, plant, and equipment, divided by total assets. Winsorized at the 1% and 99% levels.	Refinitiv
LEVERAGE	Total debt, divided by total assets. Winsorized at the 1% and 99% levels.	Refinitiv
ASSET GROWTH	Percentage change in total assets. Winsorized at the 1% and 99% levels.	Refinitiv
VOLATILITY (%)	Standard deviation of the monthly returns over the twelve preceding months. Winsorized at the 1% and 99% levels.	Refinitiv
MOMENTUM (%)	Average monthly return over the twelve preceding months. Winsorized at the 1% and 99% levels.	Refinitiv
E SCORE	Score that reflects how a firm uses best management practices to avoid environmental risks and to capitalize on environmental opportunities to generate long-term shareholder value. Winsorized at the 1% and 99% levels.	Refinitiv
CO2 EMISSIONS	Natural total CO2 and CO2 equivalent emissions, in tonnes. It encompasses direct (scope 1) and indirect (scope 2) emissions. Winsorized at the 1% and 99% levels.	Refinitiv
MONTHLY RETURN	Total return, incorporating any price change and any relevant dividend for the period covered (one month). Winsorized at the 1% and 99% levels.	Refinitiv
DAILY RETURN	Total return, incorporating any price change and any relevant dividend for the period covered (one day). Winsorized at the 1% and 99% levels.	Refinitiv
PROTECTED TERRESTRIAL AREA (%)	Country-level terrestrial protected area coverage, calculated from the World Database on Protected Areas (WDPA). Measured as of 2020.	OECD
PROTECTED MARINE AREA (%)	Country-level marine protected area coverage, calculated from the World Database on Protected Areas (WDPA).Measured as of 2020.	OECD
BIODIVERSITY & HABITAT SCORE	The Biodiversity and Habitat Score assesses countries' actions toward retaining natural ecosystems and protecting the full range of biodiversity within their borders. It consists of seven indicators: terrestrial biome protection (weighted for the national and global rarity of biomes), marine protected areas, Protected Areas Representativeness Index, Species Habitat Index, Species Protection Index, and Biodiversity Habitat Index. Measured as of 2020.	Yale Center for Environmental Law & Policy

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Figure 1. Illustration of MSA Variation

This figure illustrates the variation in Mean Species Abundance (MSA) for forest and grassland ecosystems. Source: GLOBIO, 2019.

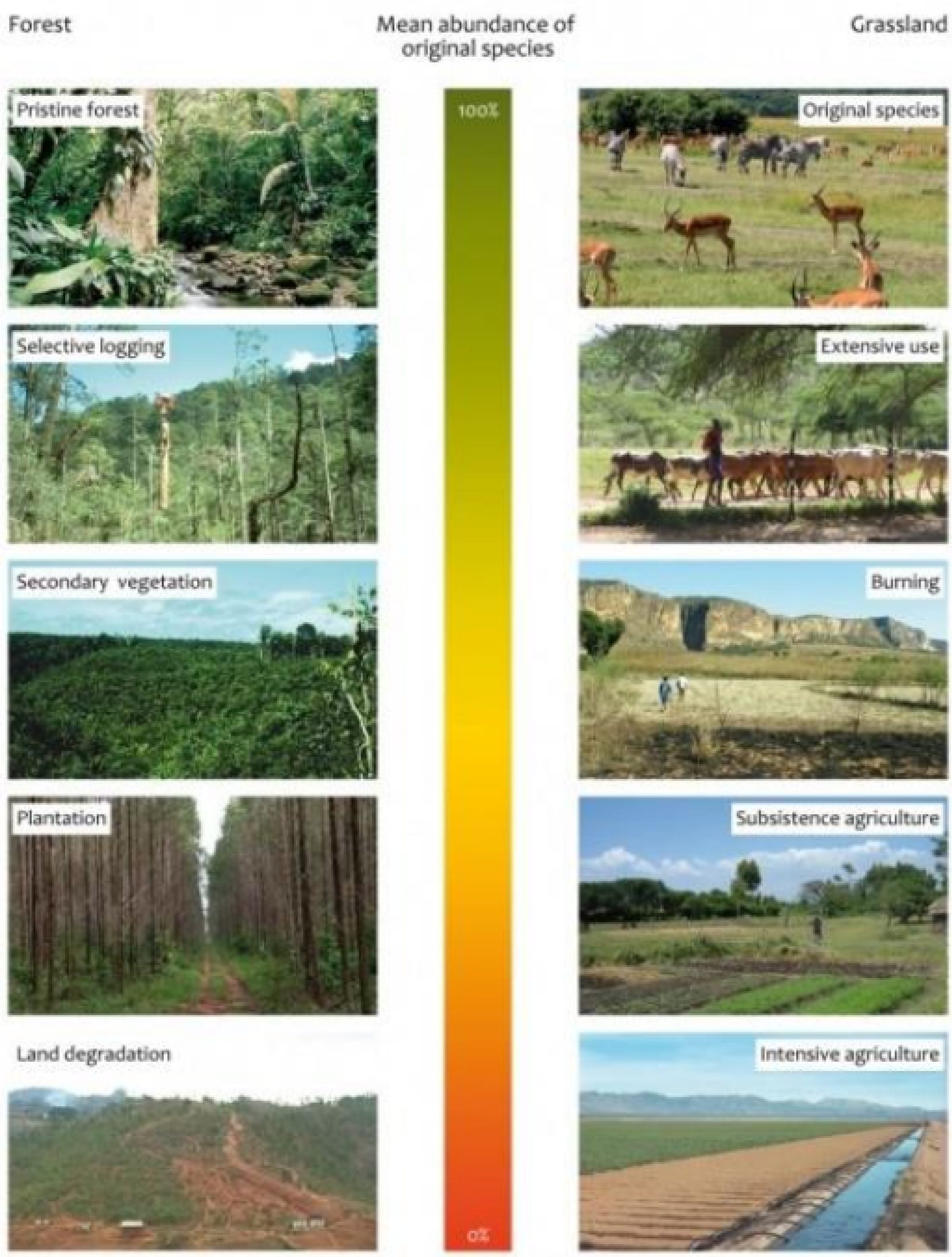


Figure 2. Calculation of the Biodiversity Footprint

This figure illustrates the methodological steps used to calculate the biodiversity footprint. Source: Iceberg Data Lab.

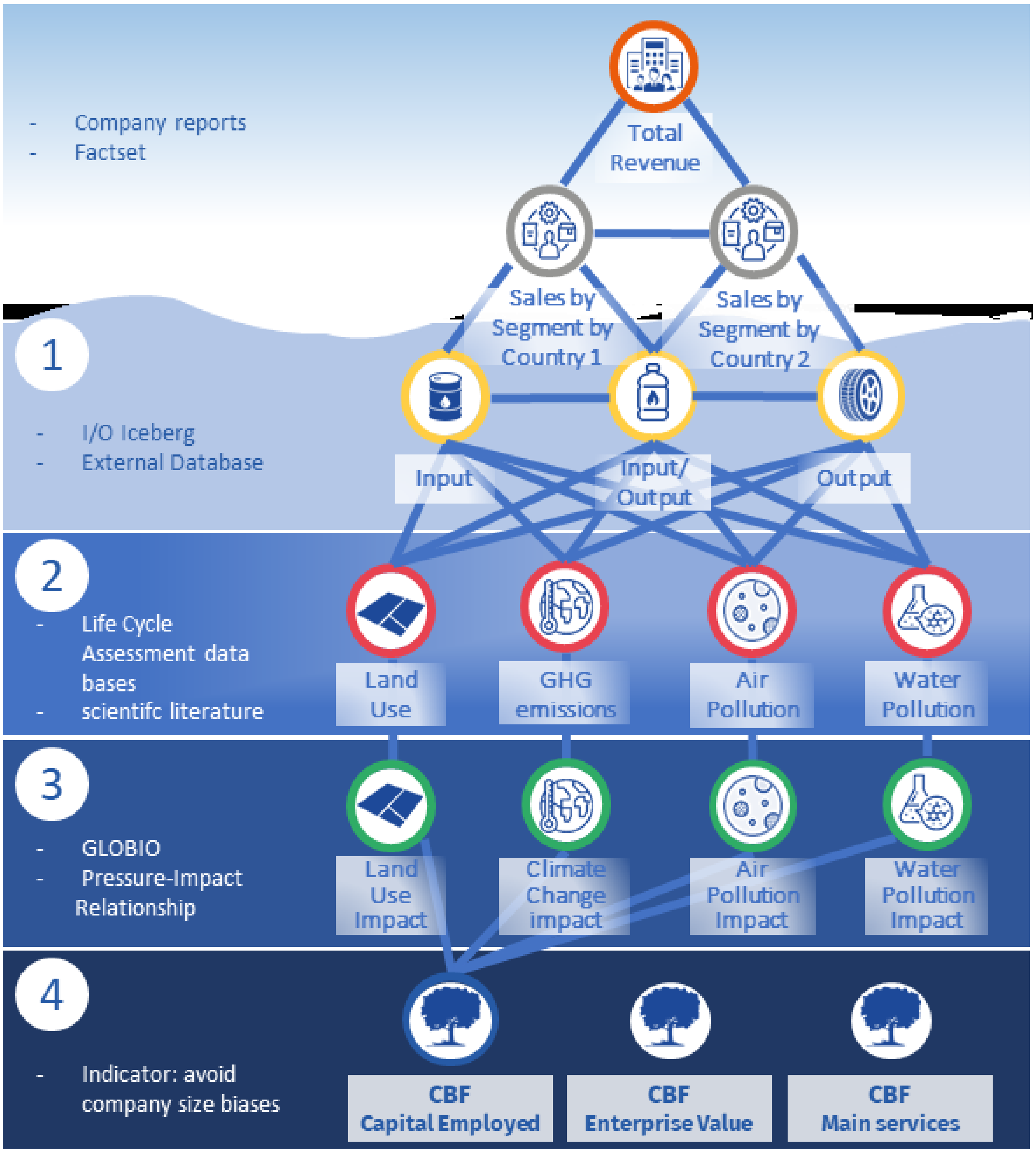


Figure 3. Biodiversity Footprint Calculation for Danone

This figure illustrates the calculation of the biodiversity footprint for the food producer Danone for the year 2021. Source: Iceberg Data Lab.

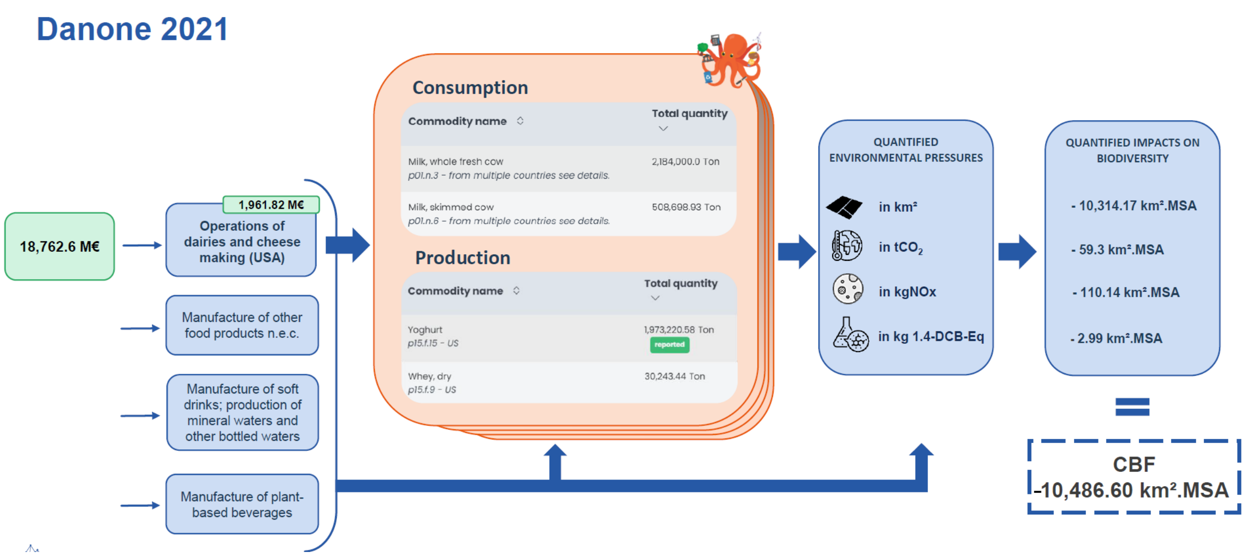


Figure 4. Bioviversity Footprint Calculation for Stellantis

This figure illustrates the calculation of the biodiversity footprint for the automotive manufacturer Stellantis for the year 2021. Source: Iceberg Data Lab.

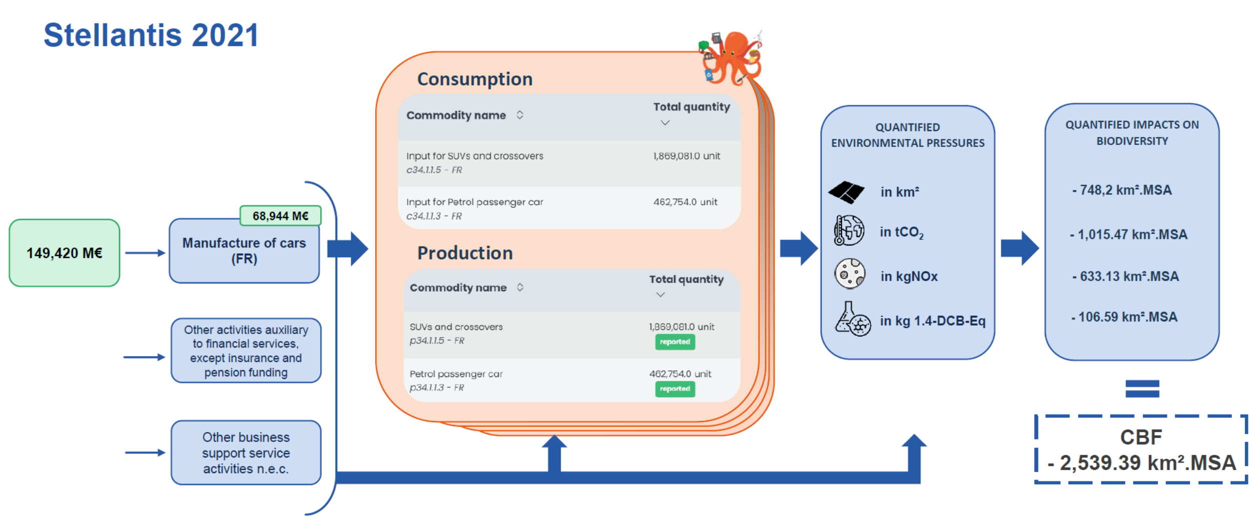


Figure 5. Source-Based Decomposition of the Biodiversity Footprint

This figure decomposes the biodiversity footprint into its constituent topical subcomponents or sources.

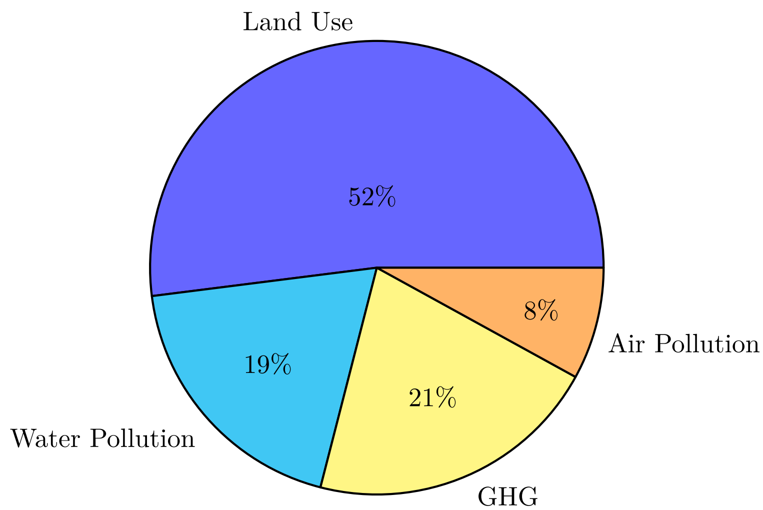


Figure 6. Scope 1, 2, and 3 Decomposition of the Biodiversity Footprint

This figure decomposes the biodiversity footprint into its scope 1, scope 2, and scope 3 dimensions. Scope 1 measures the environmental pressure of the firm's direct activities (e.g., the area artificialized or occupied due to the firm's business activity); scope 2 measures the pressures induced by the firm's purchase of electricity, heat, and cooling; and scope 3 measures all indirect pressures induced by the firm's activity (e.g., products sold, investments made, and products purchased by the firm).

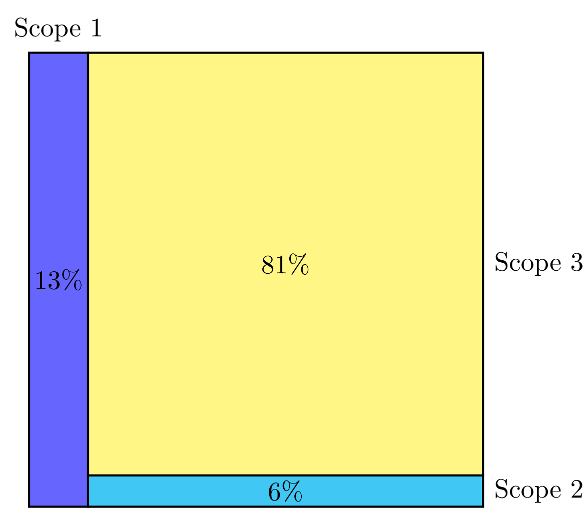


Figure 7. Stock Return Differences around the Kunming Declaration

This figure reports the coefficients and their associated 95% confidence intervals on the time dummy variables interacted with a variable coding for whether a company has an-above-median CBF, estimated in column 2 of Table 6.

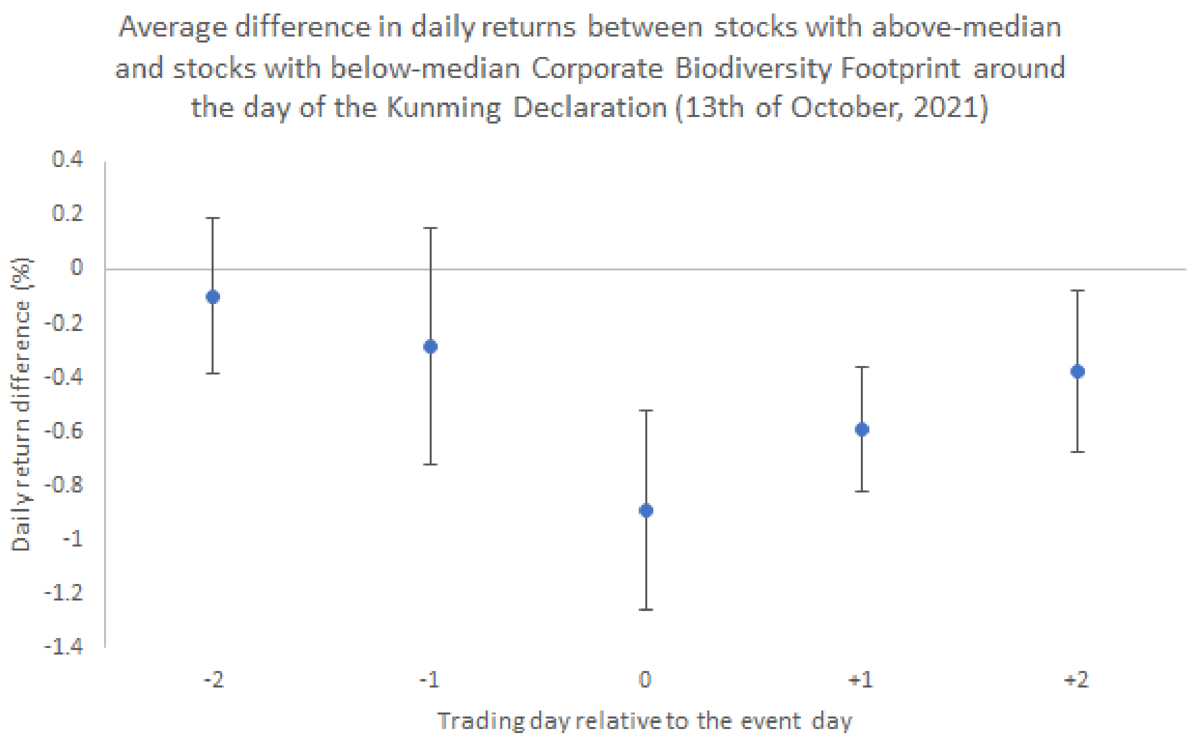


Table 1. Summary Statistics

This table presents the summary statistics. The sample period is 2019-2021, at monthly frequencies. CBF, accounting, ESG, and CO2 variables are lagged by one year. The Data Appendix provides variable definitions.

Variables	#Obs.	Mean	S.D.	Min	0.25	Mdn	0.75	Max
Ln(CBF VALUE)	61,364	5.16	2.71	0.00	3.35	5.49	7.18	13.78
Ln(CBF GHG)	61,364	2.96	2.19	0.00	0.93	2.82	4.57	10.08
Ln(CBF LAND USE)	61,364	4.31	2.74	0.00	2.11	4.44	6.38	13.77
Ln(CBF WATER POLLUTION)	61,364	2.87	2.51	0.00	0.26	2.63	4.76	11.34
Ln(CBF AIR POLLUTION)	61,364	2.44	1.98	0.00	0.58	2.24	3.82	8.70
Ln(CBF SCOPE 1)	61,364	2.04	2.37	0.00	0.06	0.96	3.61	13.77
Ln(CBF SCOPE 2)	61,364	0.47	0.84	0.00	0.00	0.06	0.57	6.57
Ln(CBF SCOPE 3)	61,364	4.91	2.77	0.00	3.02	5.24	7.00	12.11
CBF VALUE/TOTAL ASSETS	61,364	3.66	9.01	0.00	0.02	0.28	2.14	45.50
CBF VALUE/SALES	61,232	7.05	14.83	0.00	0.05	0.84	5.59	72.20
CBF VALUE/PPE	61,364	33.17	82.94	0.00	0.17	2.43	18.00	420.71
RET (%)	61,364	1.91	10.48	-75.94	-3.89	1.42	6.92	99.80
VOLATILITY (%)	61,364	9.50	4.25	3.08	6.50	8.60	11.56	25.59
MOMENTUM (%)	61,364	1.65	3.90	-4.56	-0.83	0.93	3.10	18.70
Ln(TOTAL ASSETS)	61,364	25.08	2.49	20.55	23.21	24.64	26.67	32.00
BOOK-TO-MARKET	61,364	22.90	2.76	16.63	20.98	22.72	24.63	30.13
LEVERAGE	61,364	0.60	0.52	0.03	0.22	0.46	0.82	2.76
CAPEX/TOTAL ASSETS	61,364	0.26	0.17	0.00	0.12	0.25	0.38	0.69
PPE/TOTAL ASSETS	61,364	0.04	0.04	0.00	0.01	0.03	0.06	0.19
ROA	61,364	0.25	0.23	0.00	0.05	0.19	0.40	0.85
ASSET GROWTH	61,364	0.13	0.18	-0.50	0.06	0.11	0.18	1.02
Ln(CO2 EMISSIONS)	40,825	12.68	2.56	2.66	10.95	12.58	14.42	19.67
E SCORE	52,956	54.15	27.10	0.00	33.79	58.76	76.88	99.21
PROTECTED TERRESTRIAL AREA (%)	58,283	14.44	9.71	0.93	11.58	11.75	21.37	39.57
PROTECTED MARINE AREA (%)	57,071	15.22	14.26	0.06	0.89	12.09	19.11	45.57
BIODIVERSITY & HABITAT SCORE	61,364	56.09	27.52	5.8	51.4	60.6	80.8	88.5

Table 2. Corporate Biodiversity Footprint by Industry

This table reports different rankings of the corporate biodiversity footprint across industries (reported vertically). The different footprint measures are reported horizontally. Lower numbers (red colors) indicate larger biodiversity footprints. The rankings are based on mean values as of 2020. The Data Appendix provides variable definitions.

	Ln(CBF VALUE)	CBF VALUE/TOTAL ASSETS	CBF VALUE/SALES	Ln(CBF AIR POLLUTION)	Ln(CBF GHG)	Ln(CBF LAND USE)	Ln(CBF WATER POLLUTION)	Ln(CBF SCOPE 1)	Ln(CBF SCOPE 2)	Ln(CBF SCOPE 3)
Asset Management	4	31	35	8	6	5	5	28	34	4
Automotive & Logistics	17	19	13	6	7	17	20	19	14	17
Beverages	13	23	22	27	27	9	26	21	22	13
Building products	29	13	10	25	22	27	23	18	17	29
Chemicals	10	33	31	16	17	11	4	11	5	9
Construction & Real Estate	24	14	20	13	20	18	25	7	25	25
Defense	20	18	11	12	13	29	6	32	29	19
Education	28	22	19	34	36	24	36	36	36	28
Electrical Equipment	8	32	28	3	2	22	3	17	19	6
Electronics	26	12	8	20	16	25	18	23	18	26
Financial Services	9	10	27	15	11	6	8	33	28	8
Food	3	34	34	11	15	3	7	6	13	3
Healthcare	25	17	16	26	29	21	15	25	23	24
Hotel and accommodation	21	20	33	22	26	16	19	20	11	20
Household goods	18	26	12	9	14	15	17	14	16	18
Industrial Equipment	23	24	18	17	9	26	10	22	31	21
Insurance	16	11	14	18	18	13	12	12	30	16
Internet & Data	31	4	5	30	23	30	29	27	12	30
Leisure	32	8	9	32	34	28	30	26	27	31
Materials	15	21	24	14	10	12	31	5	3	15
Media	36	2	1	35	35	36	27	34	21	34
Metals & Mining	7	30	30	4	4	14	1	2	7	10
Oil & Gas	6	28	29	1	1	7	11	3	4	7
Paper and Forest	2	36	36	23	24	2	21	1	9	2
Pharmaceutical	11	27	25	24	25	19	2	15	32	11
Power	19	16	21	7	5	20	14	4	2	23
Retail and Wholesale	1	35	32	2	8	1	24	10	1	1
Services	35	5	4	31	33	34	33	30	24	32
Software	27	3	3	21	21	33	13	31	35	27
Telecommunications	34	1	2	33	31	35	32	29	10	33
Textiles	12	29	26	19	28	8	28	8	33	12
Thrifts & Mortgage Finance	5	7	15	5	3	4	9	35	15	5
Tobacco	14	25	23	36	30	10	22	24	26	14
Transportation	22	15	17	10	12	23	16	13	8	22
Waste	30	9	6	29	19	31	34	9	6	35
Water	33	6	7	28	32	32	35	16	20	36

Table 3. Corporate Biodiversity Footprint by Country

This table reports different rankings of the corporate biodiversity footprint across countries (reported vertically). The different measures of the footprint are reported horizontally. Lower numbers (red colors) indicate larger biodiversity footprints. The rankings are based on mean values as of 2020. The Data Appendix provides variable definitions.

	Ln(CBF VALUE)	CBF VALUE/TOTAL ASSETS	CBF VALUE/SALES	Ln(CBF AIR POLLUTION)	Ln(CBF GHG)	Ln(CBF LAND USE)	Ln(CBF WATER POLLUTION)	Ln(CBF SCOPE 1)	Ln(CBF SCOPE 2)	Ln(CBF SCOPE 3)
Australia	27	24	27	21	25	21	23	19	11	25
Belgium	22	29	26	33	34	17	21	33	27	21
Brazil	2	18	24	5	11	2	17	1	25	3
Canada	6	30	33	3	4	6	5	6	14	7
Chile	18	20	22	29	27	11	34	28	31	18
China	9	11	9	4	7	5	11	12	9	8
Denmark	30	19	21	25	30	25	24	27	10	28
Finland	1	35	35	17	5	1	27	2	21	1
France	13	25	25	6	6	13	12	17	4	11
Germany	3	34	29	15	3	14	1	15	7	2
Hong Kong	33	4	6	23	19	33	29	21	3	34
India	23	2	2	12	12	28	10	13	24	24
Indonesia	16	21	17	11	17	16	20	20	23	16
Ireland	31	26	20	27	16	30	30	25	2	31
Israel	35	15	12	34	35	32	35	35	35	35
Italy	21	14	28	16	9	24	22	18	30	22
Japan	19	1	1	18	18	22	9	23	12	20
Korea	28	3	3	14	15	29	18	11	15	30
Malaysia	32	9	18	35	33	31	32	24	26	32
Mexico	14	17	16	19	24	12	7	5	5	17
Netherlands	17	33	32	7	20	19	14	30	32	15
Norway	34	13	13	20	22	34	26	22	29	33
Philippines	24	5	7	24	29	18	33	31	28	23
Poland	11	28	15	2	1	15	19	4	20	14
Saudi Arabia	7	12	14	1	2	7	13	3	1	10
Singapore	15	16	19	28	28	10	28	34	22	13
South Africa	25	10	8	22	23	26	15	8	8	29
Spain	10	23	31	9	13	23	3	10	19	9
Sweden	26	8	10	32	31	20	25	16	33	26
Switzerland	8	31	30	26	21	9	4	26	17	6
Taiwan	20	7	5	31	32	35	2	32	16	19
Thailand	12	6	4	10	8	8	31	9	13	12
Turkey	29	22	11	30	26	27	16	29	34	27
United Kingdom	4	32	34	13	10	3	6	7	18	5
United States	5	27	23	8	14	4	8	14	6	4

Table 4. Determinants of the Corporate Biodiversity Footprint

This table reports panel regressions of the corporate biodiversity footprint in year *t* on firm characteristics in year *t*. The data frequency is yearly. In panel A, the dependent variable is ln(CBF VALUE), and in panel B it is CBF VALUE/TOTAL ASSETS. Standard errors are clustered at the firm level. Intercepts are not reported. *, **, and *** represent significance levels of 0.10, 0.05, and 0.01, respectively. The Data Appendix provides variable definitions.

Panel A. Absolute CBF Value (Unscaled)

Ln(CBF VALUE)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ln(TOTAL ASSETS)	0.246***	0.245***	0.674***	0.495***	0.328***	0.624***	0.621***	0.625***	0.699***
	(0.026)	(0.026)	(0.045)	(0.047)	(0.051)	(0.057)	(0.058)	(0.058)	(0.076)
BOOK-TO-MARKET	0.546***	0.551***	0.352***	0.383***	0.209	0.346***	0.333***	0.337***	0.512***
	(0.127)	(0.127)	(0.133)	(0.135)	(0.137)	(0.121)	(0.125)	(0.125)	(0.173)
LEVERAGE	-0.331	-0.331	-0.810**	-1.090***	-1.233***	-1.164***	-1.184***	-1.210***	-1.594***
	(0.388)	(0.388)	(0.373)	(0.372)	(0.392)	(0.323)	(0.328)	(0.326)	(0.416)
CAPEX/TOTAL ASSETS	-10.062***	-10.088***	-5.671***	-6.442***	-10.883***	-3.656**	-3.739**	-3.459**	-4.457**
	(1.743)	(1.747)	(1.730)	(1.817)	(2.268)	(1.578)	(1.606)	(1.600)	(1.995)
PPE/TOTAL ASSETS	3.679***	3.675***	3.936***	3.593***	0.849**	-0.730**	-0.734**	-0.748**	-0.862**
	(0.264)	(0.265)	(0.258)	(0.270)	(0.384)	(0.332)	(0.339)	(0.336)	(0.436)
ROA	1.429	1.418	3.407***	2.528***	1.141	0.092	0.031	0.003	1.269
	(0.942)	(0.946)	(0.875)	(0.950)	(1.248)	(0.908)	(0.944)	(0.923)	(1.139)
E SCORE				0.027***	0.023***	0.011***	0.011***	0.011***	0.008***
				(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)
Ln(CO2 EMISSIONS)					0.390***	0.195***	0.197***	0.192***	0.169***
					(0.033)	(0.036)	(0.036)	(0.036)	(0.046)
#Obs.	5,137	5,137	5,137	4,430	3,412	3,412	3,406	3,411	2,849
R-squared	0.153	0.154	0.255	0.304	0.325	0.607	0.611	0.612	0.713
Year Fixed Effects	No	Yes	Yes	Yes	Yes	Yes	No	No	No
Country Fixed Effects	No	No	Yes	Yes	Yes	Yes	Yes	No	No
Industry Fixed Effects	No	No	No	No	No	Yes	No	Yes	No
Country-Year Fixed Effects	No	No	No	No	No	No	No	Yes	No
Industry-Year Fixed Effects	No	No	No	No	No	No	Yes	No	No
Country-Industry-Year Fixed Effects	No	No	No	No	No	No	No	No	Yes

Panel B. Relative CBF Value (Scaled)

CBF VALUE/TOTAL ASSETS	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ln(TOTAL ASSETS)	-0.932***	-0.933***	-0.405***	-0.792***	-1.275***	-0.962***	-0.970***	-0.965***	-0.727***
	(0.074)	(0.074)	(0.154)	(0.179)	(0.214)	(0.202)	(0.204)	(0.204)	(0.202)
BOOK-TO-MARKET	0.255	0.252	0.131	0.205	-0.167	0.245	0.125	0.219	0.505
	(0.304)	(0.304)	(0.388)	(0.415)	(0.436)	(0.359)	(0.372)	(0.366)	(0.392)
LEVERAGE	-0.464	-0.455	-0.703	-0.948	-3.183**	-1.930	-1.963	-2.104	-3.783**
	(1.061)	(1.060)	(1.063)	(1.175)	(1.451)	(1.313)	(1.333)	(1.330)	(1.508)
CAPEX/TOTAL ASSETS	-19.539***	-19.935***	-9.484*	-10.654*	-15.916**	-2.059	-1.965	-1.707	-2.708
	(5.186)	(5.196)	(5.151)	(5.854)	(7.688)	(7.120)	(7.232)	(7.242)	(8.563)
PPE/TOTAL ASSETS	7.326***	7.376***	7.074***	6.785***	2.217	-1.254	-1.376	-1.258	-0.497
	(0.963)	(0.966)	(0.990)	(1.099)	(1.684)	(1.809)	(1.849)	(1.838)	(2.266)
ROA	6.549**	6.229**	10.351***	7.827**	5.076	5.250	4.375	4.622	11.273**
	(2.953)	(2.965)	(2.960)	(3.294)	(4.535)	(3.848)	(3.980)	(3.957)	(4.473)
E SCORE				0.053***	0.048***	0.023**	0.024**	0.024**	0.010
				(0.008)	(0.010)	(0.009)	(0.010)	(0.010)	(0.009)
Ln(CO2 EMISSIONS)					0.728***	0.539***	0.553***	0.538***	0.398**
					(0.134)	(0.146)	(0.149)	(0.148)	(0.168)
#Obs.	5,137	5,137	5,137	4,430	3,412	3,412	3,406	3,411	2,849
R-squared	0.090	0.090	0.142	0.165	0.189	0.417	0.427	0.423	0.668
Year Fixed Effects	No	Yes	Yes	Yes	Yes	Yes	No	No	No
Country Fixed Effects	No	No	Yes	Yes	Yes	Yes	Yes	No	No
Industry Fixed Effects	No	No	No	No	No	Yes	No	Yes	No
Country-Year Fixed Effects	No	No	No	No	No	No	No	Yes	No
Industry-Year Fixed Effects	No	No	No	No	No	No	Yes	No	No
Country-Industry-Year Fixed Effects	No	No	No	No	No	No	No	No	Yes

Table 5. Corporate Biodiversity Footprint and Stock Returns

Panel A of this table reports regressions of monthly stock returns on ln(CBF VALUE). Panel B replicates Panel A with the measure of CBF scaled by total assets (CBF VALUE/TOTAL ASSETS). Panel C reports regressions of monthly stock returns on the subcomponents of CBF VALUE using the specification of Panel A, column 3. The right-hand variables are measured as of the last fiscal year. Standard errors are clustered at the year or year and firm level (indicated accordingly). Intercepts are not reported. *, **, and *** represent significance levels of 0.10, 0.05, and 0.01, respectively. The Data Appendix provides variable definitions.

Panel A. Baseline Results

RET (%)	(1)	(2)	(3)	(4)	(5)	(6)
Ln(CBF VALUE)	-0.021	-0.021	-0.021	-0.023	-0.022	-0.031
	(0.022)	(0.042)	(0.043)	(0.041)	(0.043)	(0.061)
Ln(TOTAL ASSETS)	-0.283***	-0.283**	-0.283**	-0.251**	-0.273**	-0.202*
	(0.037)	(0.037)	(0.037)	(0.042)	(0.035)	(0.048)
BOOK-TO-MARKET	0.316***	0.316	0.316	0.243	0.263	0.129
	(0.102)	(0.720)	(0.719)	(0.717)	(0.706)	(0.827)
LEVERAGE	0.345	0.345	0.345	0.332	0.344	0.386
	(0.267)	(0.757)	(0.774)	(0.730)	(0.751)	(0.631)
CAPEX/TOTAL ASSETS	6.021***	6.021	6.021	6.299*	5.548	5.665*
	(1.449)	(2.105)	(2.380)	(2.102)	(2.339)	(1.455)
PPE/TOTAL ASSETS	0.212	0.212	0.212	0.205	0.283	0.477
	(0.293)	(0.338)	(0.354)	(0.328)	(0.403)	(0.278)
ROA	-0.939	-0.939	-0.939	-0.592	-0.889	-0.591
	(0.779)	(1.700)	(1.773)	(1.747)	(1.766)	(2.106)
ASSET GROWTH	-0.059	-0.059	-0.059	-0.045	0.001	0.139
	(0.169)	(0.800)	(0.801)	(0.793)	(0.782)	(0.683)
VOLATILITY	0.123***	0.123	0.123	0.126	0.109	0.109
	(0.011)	(0.070)	(0.071)	(0.070)	(0.075)	(0.077)
MOMENTUM	0.012	0.012	0.012	0.028*	0.029	0.035
	(0.012)	(0.008)	(0.011)	(0.008)	(0.015)	(0.021)
#Obs.	61,364	61,364	61,364	61,364	61,352	53,775
Year-Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year-Month Fixed Effects	No	No	No	Yes	No	No
Industry-Year-Month Fixed Effects	No	No	No	No	Yes	No
Country-Industry-Year-Month Fixed Effects	No	No	No	No	No	Yes
SE Clustering (Year)	No	Yes	No	No	No	No
SE Clustering (Year, Firm)	No	No	Yes	Yes	Yes	Yes
R-squared	0.203	0.203	0.203	0.299	0.269	0.501

Panel B. CBF Scaled by Total Assets

RET (%)	(1)	(2)	(3)	(4)	(5)	(6)
CBF VALUE/TOTAL ASSETS	-0.005	-0.005	-0.005	-0.005	-0.005	-0.017
	(0.005)	(0.003)	(0.004)	(0.004)	(0.003)	(0.006)
Ln(TOTAL ASSETS)	-0.302***	-0.302**	-0.302**	-0.271*	-0.292**	-0.234*
	(0.032)	(0.065)	(0.064)	(0.065)	(0.065)	(0.059)
BOOK-TO-MARKET	0.309***	0.309	0.309	0.235	0.256	0.120
	(0.102)	(0.739)	(0.741)	(0.735)	(0.727)	(0.853)
LEVERAGE	0.367	0.367	0.367	0.356	0.367	0.398
	(0.266)	(0.706)	(0.728)	(0.687)	(0.698)	(0.565)
CAPEX/TOTAL ASSETS	6.044***	6.044	6.044	6.324*	5.576	5.700*
	(1.449)	(2.133)	(2.156)	(2.062)	(2.154)	(1.479)
PPE/TOTAL ASSETS	0.211	0.211	0.211	0.204	0.282	0.490
	(0.293)	(0.344)	(0.367)	(0.336)	(0.417)	(0.270)
ROA	-0.915	-0.915	-0.915	-0.568	-0.866	-0.479
	(0.780)	(1.719)	(1.800)	(1.770)	(1.759)	(2.061)
ASSET GROWTH	-0.057	-0.057	-0.057	-0.042	0.003	0.133
	(0.169)	(0.816)	(0.817)	(0.809)	(0.795)	(0.695)
VOLATILITY	0.123***	0.123	0.123	0.126	0.109	0.109
	(0.011)	(0.070)	(0.071)	(0.070)	(0.074)	(0.077)
MOMENTUM	0.012	0.012	0.012	0.028*	0.029	0.034
	(0.012)	(0.007)	(0.010)	(0.008)	(0.013)	(0.021)
#Obs.	61,364	61,364	61,364	61,364	61,352	53,775
Year-Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year-Month Fixed Effects	No	No	No	Yes	No	No
Industry-Year-Month Fixed Effects	No	No	No	No	Yes	No
Country-Industry-Year-Month Fixed Effects	No	No	No	No	No	Yes
SE Clustering (Year)	No	Yes	No	No	No	No
SE Clustering (Year, Firm)	No	No	Yes	Yes	Yes	Yes
R-squared	0.203	0.203	0.203	0.299	0.269	0.501

Panel C. Subcomponents of CBF

RET (%)	(1) ln(CBF GHG)	(2) ln(CBF LAND USE)	(3) ln(CBF WATER POLLUTION)	(4) ln(CBF AIR POLLUTION)
CBF Subcomponent	0.002	0.007	-0.013	-0.003
	(0.046)	(0.042)	(0.047)	(0.036)
#Obs.	61,364	61,364	61,364	61,364
Controls	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes
Year-Month Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
SE Clustering (Year, Firm)	Yes	Yes	Yes	Yes
R-squared	0.203	0.203	0.203	0.203

Table 6. Market Reaction to COP15 - Kunming

This table reports the market reaction to the first part of the COP15 (Kunming), with the focal date of the event being October 13, 2021. We report results for firms with large versus small CBFs. The event window consists of the [-3,2]-day window around the focal date. The market reaction is computed as the within-firm difference in daily returns between the three trading days before versus after the event. LARGE CBF equals one for firms where CBF VALUE is higher than the median (as of the beginning of the year). POST equals one in the three days after the event (days t= 0 to t = 2), with day t = 0 being the event date. Abnormal returns are returns in excess of their domestic stock market index returns (using MSCI domestic indices). Standard errors are clustered at the country level. Intercepts are not reported. *, **, and *** represent significance levels of 0.10, 0.05, and 0.01, respectively. The Data Appendix provides variable definitions.

	DAILY RETURN (%)				ABNORMAL DAILY RETURN (%)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LARGE CBF × POST	-0.491***		-0.457***	-0.300***	-0.429***		-0.457***	-0.323***
	(0.060)		(0.055)	(0.087)	(0.063)		(0.055)	(0.083)
LARGE CBF × t = -2		-0.098				-0.128		
		(0.147)				(0.153)		
LARGE CBF × t = -1		-0.287				-0.280		
		(0.223)				(0.197)		
LARGE CBF × t = 0		-0.890***				-0.855***		
		(0.187)				(0.177)		
LARGE CBF × t = +1		-0.592***				-0.487***		
		(0.119)				(0.106)		
LARGE CBF × t = +2		-0.374**				-0.350**		
		(0.153)				(0.151)		
Observations	10,765	10,765	10,765	10,764	10,765	10,765	10,765	10,764
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Day Fixed Effects	Yes	Yes	No	No	Yes	Yes	No	No
Country-Day Fixed Effects	No	No	Yes	No	No	No	Yes	No
Industry-Day Fixed Effects	No	No	No	Yes	No	No	No	Yes
R-squared	0.223	0.225	0.322	0.286	0.212	0.214	0.282	0.269

Table 7. Market Reaction to COP15 - Montreal

This table reports the market reaction to the second part of the COP15 (Montreal), with the focal date of the event being the December 19, 2022. We report results for firms with large versus small CBFs. The event window consists of the [-3,2]-day window around the focal date. The market reaction is computed as the within-firm difference in daily returns between the three trading days before and after the event. LARGE CBF equals one for firms where CBF VALUE is higher than the median value (as of the beginning of the year). POST equals one in the three days after the event (days t= 0 to t = 2), with day t = 0 being the event date. Abnormal returns are returns in excess of their domestic stock market index returns (using MSCI domestic indices). Standard errors are clustered at the country level. Intercepts are not reported. *, **, and *** represent significance levels of 0.10, 0.05, and 0.01, respectively. The Data Appendix provides variable definitions.

	DAILY RETURN (%)			ABNORMAL DAILY RETURN (%)		
	(1)	(2)	(3)	(4)	(5)	(6)
LARGE CBF × POST	0.008	0.020	0.022	0.019	0.020	-0.066
	(0.099)	(0.063)	(0.089)	(0.074)	(0.063)	(0.064)
Observations	11,102	11,102	11,102	11,102	11,102	11,102
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Day Fixed Effects	Yes	No	No	Yes	No	No
Country-Day Fixed Effects	No	Yes	No	No	Yes	No
Industry-Day Fixed Effects	No	No	Yes	No	No	Yes
R-squared	0.258	0.467	0.311	0.209	0.394	0.264

Table 8. Market Reaction to COP15 - Montreal: Low Country Biodiversity Protection & Large CBF Land Use

This table further reports the market reaction to the second part of the COP15 (Montreal), focusing on CBF Land Use; the focal date of the event remains December 19, 2022. We report results for large versus small CBF Land Use firms. The event window consists of the [-3,2]-day window around the focal date. The market reaction is computed as the within-firm difference in daily returns between the three trading days before and after the event. The dummy variable LARGE CBF LAND USE equals one for firms where CBF LAND USE is higher than the median value (as of the beginning of the year). POST equals one in the three days after the event (days t= 0 to t = 2), with day t = 0 being the event date. LOW BIODIVERSITY PROTECTION equals one when a firm is located in a country that ranks in the bottom quartile for odifferent proxies of domestic biodiversity protection: Biodiversity & Habitat Score (Columns 1 and 4), Terrestrial Protected Areas (Columns 2 and 5), and Maritime Protected Areas (Columns 3 and 6). Abnormal returns are returns in excess of their domestic stock market index returns (using MSCI domestic indices). Standard errors are clustered at the country level. Intercepts are not reported. *, **, and *** represent significance levels of 0.10, 0.05, and 0.01, respectively. The Data Appendix provides variable definitions.

	DAILY RETURN (%)			DAILY RETURN (%)		
	(1)	(2)	(3)	(4)	(5)	(6)
Biodiversity Protection Proxy:	Biodiversity & Habitat Score	Terrestrial Protected Areas	Marine Protected Areas	Biodiversity & Habitat Score	Terrestrial Protected Areas	Marine Protected Areas
LOW BIODIVERSITY PROTECTION × POST	-1.411**	-1.292**	-1.458**	-1.209**	-1.233**	-1.272**
	(0.519)	(0.594)	(0.538)	(0.573)	(0.590)	(0.568)
LARGE CBF LAND USE × POST				0.021	-0.012	0.045
				(0.088)	(0.084)	(0.100)
LOW BIODIVERSITY PROTECTION × LARGE CBF LAND USE × POST				-0.367**	-0.109	-0.363**
				(0.164)	(0.136)	(0.138)
Observations	11,102	10,602	10,362	11,102	10,602	10,362
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Day Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.287	0.303	0.304	0.288	0.303	0.305

Internet Appendix

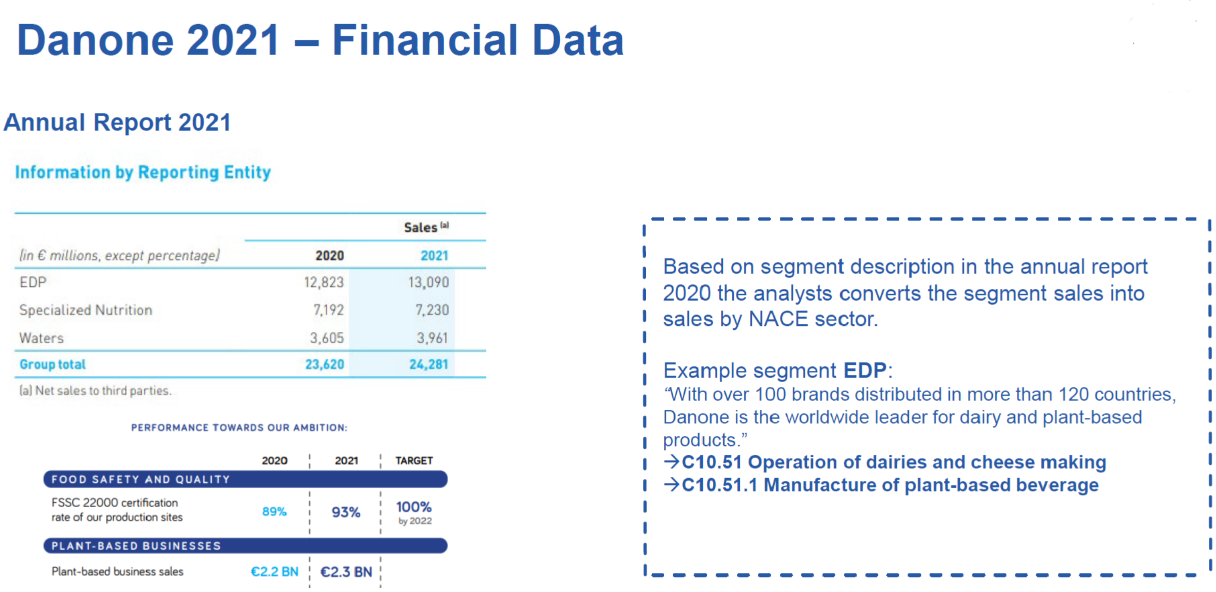
for

Do Investors Care About Biodiversity?

I.A. Figure 1. Biodiversity Footprint Calculation: Step-by-Step Analysis for Danone

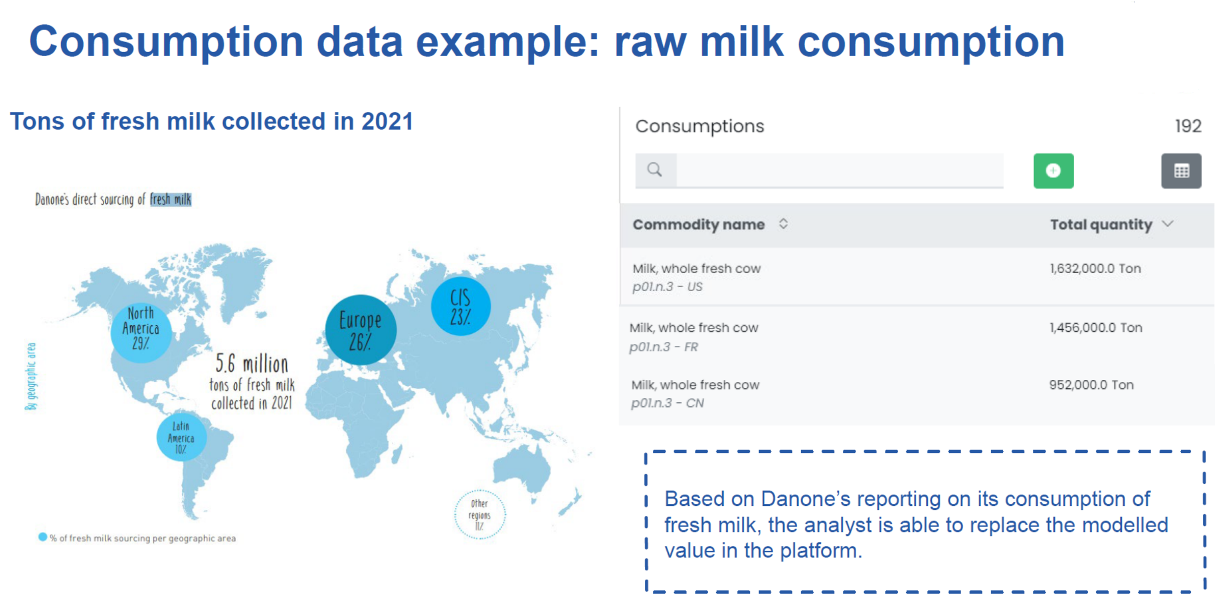
Panel A. Annual Report Data

This figure illustrates how data from Danone's annual report are used to determine its sales by NACE sector, which constitutes one step in calculating the firm's biodiversity footprint for the year 2021. Source: Iceberg Data Lab.



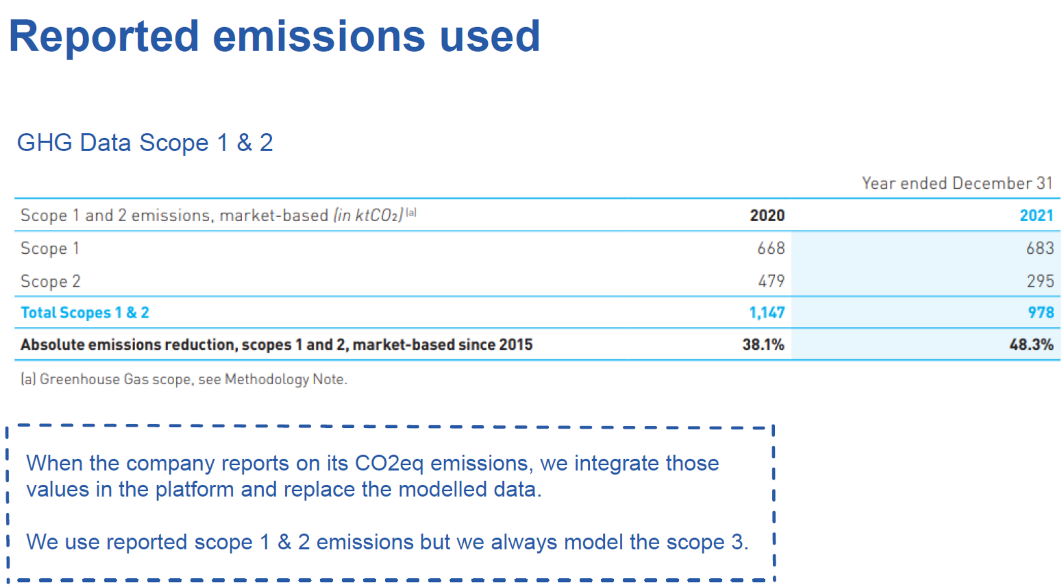
Panel B. Raw Milk Consumption

This figure illustrates how Danone's raw milk consumption, per geographical area, is used to calculate the firm's biodiversity footprint for the year 2021. Source: Iceberg Data Lab.



Panel C. Reported Emissions Used

This figure illustrates how the data on carbon emissions are used to calculate Danone's biodiversity footprint for the year 2021. Source: Iceberg Data Lab.


Reported emissions used

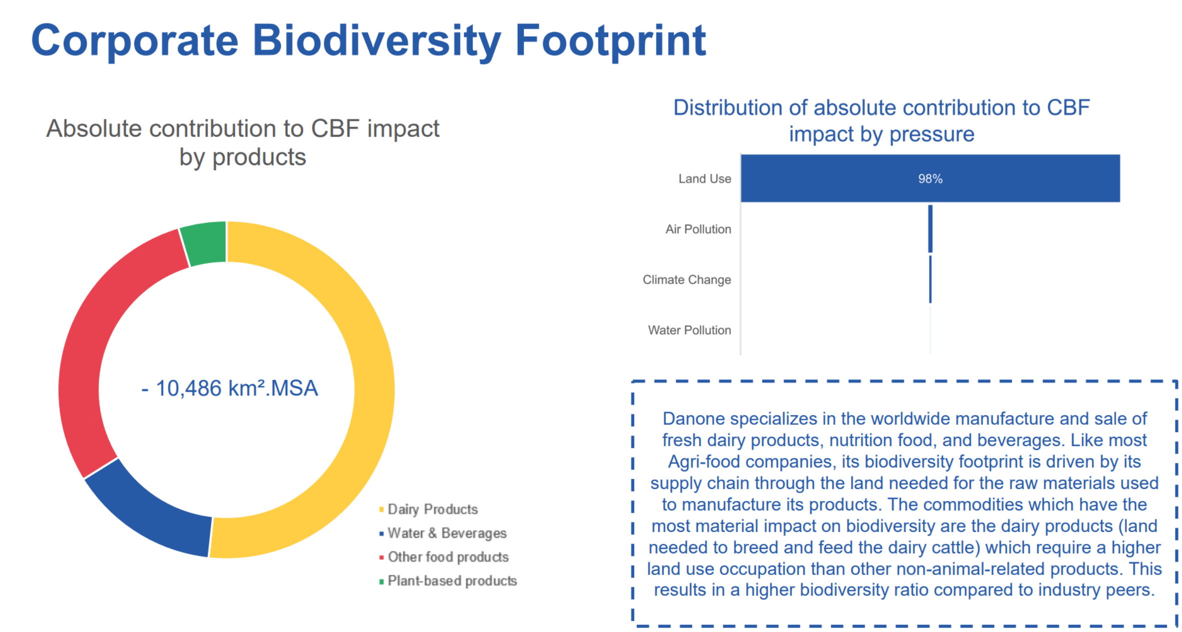
GHG Data Scope 1 & 2

		Year ended December 31
Scope 1 and 2 emissions, market-based *(in ktCO2)* [(a)]	**2020**	**2021**
Scope 1	668	683
Scope 2	479	295
Total Scopes 1 & 2	**1,147**	**978**
Absolute emissions reduction, scopes 1 and 2, market-based since 2015	**38.1%**	**48.3%**

(a) Greenhouse Gas scope, see Methodology Note.

Panel D. Biodiversity Impact by Product

This figure illustrates the contribution to biodiversity footprint by products and by sources of environmental pressures for Danone for the year 2021. Source: Iceberg Data Lab.



I.A. Table 1. Decomposition of the Corporate Biodiversity Footprint: Summary Statistics

This table reports the average proportion of each biodiversity footprint subcomponent (land use, air pollution, water pollution, and GHG emissions) and the average proportion of scope 1, scope 2, and scope 3 in our measure of the corporate biodiversity footprint (CBF VALUE). The Data Appendix provides variable definitions.

Variable	#Obs.	Mean	S.D.	Min	2%5	Mdn	7%5	Max
Pct. CBF AIR POLLUTION	61,364	0.08	0.10	0.00	0.02	0.04	0.11	0.78
Pct. CBF GHG	61,364	0.21	0.23	0.00	0.03	0.10	0.36	1.00
Pct. CBF LAND USE	61,364	0.52	0.32	0.00	0.21	0.54	0.80	1.00
Pct. CBF WATER POLLUTION	61,364	0.19	0.26	0.00	0.01	0.07	0.22	1.00
Pct. CBF SCOPE 1	61,364	0.13	0.22	0.00	0.00	0.03	0.14	1.00
Pct. CBF SCOPE 2	61,364	0.06	0.19	0.00	0.00	0.00	0.00	1.00
Pct. CBF SCOPE 3	61,364	0.81	0.28	0.00	0.71	0.97	1.00	1.00

I.A. Table 2. Decomposition of the Corporate Biodiversity Footprint by Country

This table reports the average proportion, by country, of each biodiversity footprint subcomponent (land use, air pollution, water pollution, and GHG emissions) and the average proportion of scope 1, scope 2, and scope 3 in our measure of the corporate biodiversity footprint (CBF VALUE). The Data Appendix provides variable definitions.

	Pct. CBF AIR POLLUTION	Pct. CBF GHG	Pct. CBF LAND USE	Pct. CBF WATER POLLUTION	Pct. CBF SCOPE 1	Pct. CBF SCOPE 2	Pct. CBF SCOPE 3
Australia	10.96%	21.49%	49.11%	18.43%	19.00%	6.56%	74.44%
Belgium	7.18%	19.91%	53.36%	19.56%	10.09%	7.84%	82.07%
Brazil	10.82%	25.19%	53.71%	10.28%	33.35%	2.68%	63.96%
Canada	9.40%	29.58%	42.35%	18.67%	28.69%	4.23%	67.09%
Chile	7.48%	17.92%	66.08%	8.53%	10.74%	0.24%	89.02%
China	7.79%	17.00%	53.68%	21.53%	12.57%	4.36%	83.07%
Denmark	7.91%	14.37%	53.90%	23.83%	16.19%	2.79%	81.02%
Finland	6.64%	22.14%	55.15%	16.08%	7.53%	2.89%	89.58%
France	10.20%	27.85%	49.41%	12.54%	11.45%	6.57%	81.98%
Germany	7.09%	25.10%	47.16%	20.66%	13.44%	6.54%	80.02%
Hong Kong	11.52%	30.68%	46.96%	10.84%	15.99%	18.85%	65.15%
India	8.38%	23.57%	49.31%	18.75%	12.57%	6.35%	81.08%
Indonesia	4.35%	14.06%	65.38%	16.21%	8.70%	0.47%	90.83%
Ireland	7.40%	27.98%	51.05%	13.57%	12.95%	4.55%	82.50%
Israel	9.96%	12.97%	67.57%	9.50%	6.92%	2.87%	90.21%
Italy	9.60%	26.89%	50.36%	13.15%	9.94%	7.71%	82.35%
Japan	6.78%	19.59%	52.46%	21.17%	8.09%	4.70%	87.22%
Korea	11.18%	23.54%	45.64%	19.64%	17.61%	7.38%	75.01%
Malaysia	6.61%	14.39%	69.75%	9.25%	17.73%	0.35%	81.92%
Mexico	5.97%	22.58%	52.65%	18.80%	17.85%	10.25%	71.89%
Netherlands	7.42%	19.02%	55.02%	18.54%	7.14%	7.62%	85.23%
Norway	13.76%	29.99%	38.39%	17.85%	20.35%	0.71%	78.94%
Philippines	12.11%	15.14%	68.15%	4.59%	3.58%	9.81%	86.61%
Poland	11.80%	31.24%	45.62%	11.34%	24.50%	19.06%	56.43%
Saudi Arabia	7.56%	19.13%	45.71%	27.61%	16.50%	5.43%	78.07%
Singapore	9.90%	25.24%	54.72%	10.13%	11.73%	8.90%	79.37%
South Africa	4.47%	13.13%	49.99%	32.41%	23.95%	1.68%	74.37%
Spain	12.70%	24.67%	45.08%	17.54%	24.50%	5.99%	69.51%
Sweden	6.86%	16.26%	55.00%	21.88%	8.24%	2.52%	89.24%
Switzerland	6.21%	17.81%	50.64%	25.34%	6.18%	8.21%	85.61%
Taiwan	8.90%	28.55%	41.90%	20.65%	14.02%	7.83%	78.15%
Thailand	7.20%	18.37%	69.17%	5.26%	7.48%	6.23%	86.29%
Turkey	7.34%	15.88%	53.05%	23.73%	13.31%	8.12%	78.57%
United Kingdom	5.80%	19.91%	55.42%	18.87%	13.40%	6.04%	80.56%
United States	8.16%	23.94%	49.93%	17.97%	12.88%	9.49%	77.63%

I.A. Table 3. Decomposition of the Corporate Biodiversity Footprint by Industry

This table reports the average proportion, by industry, of each biodiversity footprint subcomponent (land use, air pollution, water pollution, and GHG emissions) and the average proportion of scope 1, scope 2, and scope 3 in our measure of the corporate biodiversity footprint (CBF VALUE). The Data Appendix provides variable definitions.

	Pct. CBF AIR POLLUTION	Pct. CBF GHG	Pct. CBF LAND USE	Pct. CBF WATER POLLUTION	Pct. CBF SCOPE 1	Pct. CBF SCOPE 2	Pct. CBF SCOPE 3
Asset Management	2.35%	6.97%	68.79%	21.89%	0.03%	0.01%	99.96%
Automotive & Logistics	14.59%	32.91%	43.98%	8.52%	4.83%	0.61%	94.56%
Beverages	0.71%	1.85%	96.46%	0.98%	1.02%	0.20%	98.77%
Building products	7.63%	17.28%	54.82%	20.27%	20.70%	0.86%	78.44%
Chemicals	5.57%	9.21%	53.05%	32.17%	7.17%	1.05%	91.78%
Construction & Real Estate	11.87%	15.83%	68.89%	3.41%	16.97%	1.73%	81.29%
Defense	8.38%	13.93%	24.20%	53.49%	0.33%	0.14%	99.53%
Education	2.19%	2.63%	94.99%	0.19%	1.10%	0.39%	98.50%
Electrical Equipment	10.14%	29.09%	12.16%	48.60%	1.36%	0.08%	98.56%
Electronics	5.59%	44.32%	28.87%	21.22%	8.42%	14.89%	76.68%
Financial Services	6.91%	20.85%	60.49%	11.75%	1.97%	18.07%	79.96%
Food	2.85%	3.26%	91.43%	2.47%	3.71%	0.12%	96.17%
Healthcare	1.50%	1.84%	68.23%	28.43%	0.89%	0.36%	98.76%
Hotel and accommodation	3.46%	3.41%	85.84%	7.29%	4.16%	0.66%	95.18%
Household goods	10.60%	14.53%	45.13%	29.73%	11.02%	1.03%	87.95%
Industrial Equipment	7.88%	25.73%	26.29%	40.09%	2.41%	0.12%	97.47%
Insurance	8.41%	26.79%	50.13%	14.67%	7.59%	20.63%	71.78%
Internet & Data	10.90%	44.59%	39.36%	5.15%	4.19%	10.04%	85.77%
Leisure	5.23%	17.28%	64.94%	12.54%	8.53%	6.59%	84.88%
Materials	9.41%	21.05%	68.87%	0.67%	28.94%	0.83%	70.23%
Media	8.62%	32.24%	33.44%	25.69%	3.53%	22.16%	74.32%
Metals & Mining	7.23%	14.17%	27.43%	51.17%	42.72%	0.45%	56.82%
Oil & Gas	10.47%	38.85%	45.84%	4.83%	26.18%	0.57%	73.25%
Paper and Forest	1.10%	2.98%	92.30%	3.62%	19.12%	0.47%	80.41%
Pharmaceutical	0.95%	1.77%	19.80%	77.49%	2.18%	0.05%	97.77%
Power	15.12%	46.59%	22.03%	16.25%	50.09%	2.34%	47.58%
Retail and Wholesale	2.54%	6.12%	90.25%	1.09%	3.72%	0.20%	96.08%
Services	12.22%	40.15%	42.21%	5.43%	9.54%	34.83%	55.63%
Software	7.54%	31.02%	55.83%	5.61%	9.73%	8.20%	82.07%
Telecommunications	10.57%	50.11%	34.88%	4.43%	11.03%	38.54%	50.43%
Textiles	2.96%	2.09%	93.13%	1.82%	21.13%	0.06%	78.81%
Thrifts & Mortgage Finance	2.82%	8.55%	79.20%	9.43%	0.02%	0.04%	99.95%
Tobacco	0.19%	0.84%	96.15%	2.81%	1.24%	0.08%	98.67%
Transportation	25.50%	36.08%	27.02%	11.40%	36.82%	4.35%	58.83%
Waste	7.06%	78.80%	13.60%	0.53%	92.44%	2.19%	5.37%
Water	13.62%	9.68%	74.80%	1.90%	86.66%	3.10%	10.23%

I.A. Table 4. Correlation Matrix

This table presents correlations for our main measures of the corporate biodiversity footprint (CBF), as well as for our control variables. The sample period is 2019-2021, at monthly frequencies. The Data Appendix provides variable definitions.

	Ln(CBF VALUE)	CBF VALUE/TOTAL ASSETS	VOLATILITY	MOMENTUM	Ln(TOTAL ASSETS)	BOOK-TO-MARKET	LEVERAGE	CAPEX/TOTAL ASSETS	PPE/TOTAL ASSETS	ROA	ASSET GROWTH	Ln(CO2 EMISSIONS)	E SCORE
Ln(CBF VALUE)	1.00												
CBF VALUE/TOTAL ASSETS	0.45	1.00											
VOLATILITY	-0.06	-0.02	1.00										
MOMENTUM	-0.10	-0.01	0.25	1.00									
Ln(TOTAL ASSETS)	0.28	-0.26	-0.09	-0.15	1.00								
BOOK-TO-MARKET	0.23	-0.12	0.03	-0.15	0.51	1.00							
LEVERAGE	0.02	0.04	0.03	0.00	-0.06	-0.02	1.00						
CAPEX/TOTAL ASSETS	0.01	0.07	0.12	0.06	-0.13	-0.16	0.14	1.00					
PPE/TOTAL ASSETS	0.22	0.15	0.07	0.02	-0.03	0.00	0.26	0.60	1.00				
ROA	-0.07	0.08	-0.15	0.01	-0.22	-0.38	-0.22	0.15	0.00	1.00			
ASSET GROWTH	-0.15	-0.02	0.17	0.18	-0.17	-0.17	0.00	0.07	-0.09	0.01	1.00		
Ln (CO2 EMISSIONS)	0.43	0.16	-0.01	-0.08	0.16	0.13	0.22	0.38	0.63	-0.08	-0.15	1.00	
ENV. SCORE	0.36	0.13	-0.15	-0.12	0.22	0.19	0.04	0.01	0.11	-0.06	-0.24	0.24	1.00

I.A. Table 5. Corporate Biodiversity Footprint and Stock Returns: Robustness

This table reports the robustness tests of the regression reported in Column 3 of Table 5, Panel A. The table reports regressions of monthly stock returns on different measures of the corporate biodiversity footprint. Standard errors are clustered at the firm and year level. Intercepts are not reported. *, **, and *** represent significance levels of 0.10, 0.05, and 0.01, respectively. The Data Appendix provides variable definitions.

RET (%)	(1) Drop Financials	(2) Value-Weighted Least Square	(3) Fama-McBeth Regression	(4) Requiring Three Years of Data	(5) Extrapolating Over 2011-2021	(6) CBF VALUE/ SALES	(7) CBF VALUE/ PPE
CBF Measure	-0.048	0.009	-0.043	-0.007	-0.010	-0.001	0.001
	(0.030)	(0.049)	(0.027)	(0.042)	(0.017)	(0.003)	(0.000)
#Obs.	49,770	61,364	61,364	48,721	233,294	61,232	61,364
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.187	0.258	0.089	0.200	0.158	0.202	0.203

I.A. Table 6. Corporate Biodiversity Footprint and Stock Returns: Results by Country, Region, and Industry

This table reports regressions of monthly stock returns on ln(CBF VALUE) by country, world region, and industry. We use the specification in Column 3 of Table 5, Panel A. We report results for countries and industries for which we have at least 1,000 observations. Standard errors are clustered at the firm and year level. *, **, and *** represent significance levels of 0.10, 0.05, and 0.01, respectively. The Data Appendix provides variable definitions.

	Coefficient on Ln(CBF VALUE)	#Obs.	R-squared
Panel A: Countries (if #Obs.>1,000)			
Australia	0.109	1,812	0.333
Canada	-0.041	1,931	0.313
China	0.097	7,877	0.182
France	-0.05	2,016	0.489
Germany	-0.037	1,929	0.324
Hong Kong	0.125	1,020	0.300
India	-0.163	3,442	0.340
Japan	-0.046	7,776	0.306
Korea	-0.012	1,930	0.337
Sweden	-0.365	1,336	0.315
Switzerland	0.03	1,212	0.388
Taiwan	-0.014	1,125	0.308
United Kingdom	-0.085	2,403	0.312
United States	0.02	13,749	0.288
Panel B: World Regions			
Europe	-0.015	11,930	0.325
Asia	-0.05	22,873	0.153
North America	0.01	15,680	0.285
South America	-0.146	1,644	0.325
Oceania	0.109	1,812	0.333
Panel C: Industries (if #Obs. >1,000)			
Asset Management	-0.247	1,266	0.451
Automotive & Logistics	-0.091	1,455	0.278
Beverages	0.029	1,288	0.305
Chemicals	-0.135	4,274	0.213
Construction & Real Estate	0.121	3,289	0.277
Electronics	-0.031	3,313	0.218
Financial Services	-0.024	7,700	0.313
Food	-0.215	3,614	0.121
Healthcare	0.043	2,481	0.186
Industrial Equipment	-0.141	2,373	0.348
Insurance	0.064	2,556	0.359
Internet & Data	0.567	1,460	0.209
Metals & Mining	-0.369*	3,452	0.260
Oil & Gas	-0.208	3,096	0.435
Pharmaceutical	0.037	2,582	0.126
Power	-0.214	2,808	0.207
Software	0.062	2,179	0.255
Telecommunications	-0.406	1,455	0.251
Transportation	-0.118	3,065	0.290

I.A. Table 7. Market Reaction to COP15 - Kunming: Additional Results

This table presents additional analyses, building on the specification in Column 1 of Table 6, to report on the market reaction to the first part of the COP15 (Kunming). We report results for firms with large versus small CBFs. The event window consists of the [-3,2]-day window around the focal date of October 13, 2021. The market reaction is computed as the within-firm difference in daily returns between the three trading days before versus after the event. We only report estimates on the main coefficient of interest (LARGE CBF × POST). LARGE CBF equals one for firms with a CBF value that is higher than the median value (as of the beginning of the year). Abnormal returns are returns in excess of their domestic stock market index returns (using MSCI indices). POST equals one in the three days after the event (days t= 0 to t = 2), with day t = 0 being the event date. Standard errors are clustered at the country level. Intercepts are not reported. *, **, and *** represent significance levels of 0.10, 0.05, and 0.01, respectively. The Data Appendix provides variable definitions.

	LARGE CBF × POST	#Obs.	R-squared	Fixed Effects
LARGE CBF AIR POLLUTION	-0.341***	10,765	0.22	Firm, Day
LARGE CBF LAND USE	-0.521***	10,765	0.224	Firm, Day
LARGE CBF GHG	-0.347***	10,765	0.221	Firm, Day
LARGE CBF WATER POLLUTION	-0.233	10,765	0.219	Firm, Day
CBF VALUE/TOTAL ASSETS	0.053	10,765	0.218	Firm, Day
CBF VALUE/SALES	-0.097	10,747	0.218	Firm, Day
CBF VALUE/PPE	-0.058	10,765	0.218	Firm, Day
Europe	-0.284**	2,242	0.195	Firm, Day
European Union	-0.276**	2,134	0.200	Firm, Day
Asia	-0.485***	3,792	0.267	Firm, Day
North America	-0.541**	2,855	0.314	Firm, Day
South America	0.125	254	0.380	Firm, Day
Oceania	-0.822	348	0.254	Firm, Day
Dropping absolute returns >5%	-0.403***	10,489	0.225	Firm, Day
Top Quartile CBF Value	-0.104***	10,765	0.224	Firm, Day
Continuous CBF Value	-0.493***	10,765	0.222	Firm, Day
Event window [-5,4]	-0.264***	19,728	0.140	Firm, Day

I.A. Table 8. Biodiversity Protection Proxies by Country

This table reports each country's Biodiversity and Habitat Score, its terrestrial protected areas (in %), and its marine protected areas (in %). The Data Appendix provides variable definitions. Values are reported as of 2020.

	BIODIVERSITY & HABITAT SCORE	% MARINE PROTECTED AREAS	% TERRESTRIAL PROTECTED AREAS
Australia	82.10	40.97	19.38
Belgium	82.40	36.27	15.56
Brazil	78.20	26.65	30.73
Canada	62.90	8.80	11.58
Chile	61.30	40.70	20.89
China	9.40	0.48	1.70
Denmark	76.90	18.24	16.33
Finland	71.10	12.09	13.25
France	86.50	45.57	27.25
Germany	88.50	45.35	37.78
Hong Kong	9.40	0.48	1.70
India	5.80	0.06	0.93
Indonesia	51.20	2.98	12.52
Ireland	59.60	2.37	14.22
Israel	39.70	0.07	23.93
Italy	76.50	5.87	21.49
Japan	80.80	8.99	21.37
Korea	61.00	1.77	16.61
Malaysia	51.90	.	.
Mexico	69.80	22.19	14.29
Netherlands	80.10	26.93	22.51
Norway	71.20	0.89	17.57
Poland	87.30	24.30	39.57
Saudi Arabia	29.30	2.61	4.76
Singapore	25.30	.	.
South Africa	91.00	14.66	8.49
Spain	85.80	13.05	28.13
Sweden	68.80	15.69	14.36
Switzerland	62.50	.	12.23
Taiwan	58.00	0.48	1.70
Thailand	51.40	.	.
Turkey	7.50	.	.
United Kingdom	81.50	41.37	28.61
United States	60.60	19.11	11.75