Biodiversity Risk in the Corporate Bond Market

Online Appendix

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This Online Appendix contains supplementary tables and materials referenced in the main text of the paper "Biodiversity Risk in the Corporate Bond Market." The sections are labeled Online Appendix A through Online Appendix R and are cited by these labels in the main manuscript.

Online Appendix A. Details of the Biodiversity Footprint Measure

Data descriptions and figures in this appendix are from the IDL's methodological guide for clients (February 2023 version) and other IDL data handouts available to us. Due to the technical nature of the methodologies, some parts of this appendix may include word-for-word expressions from the IDL documentations.

Methodology

IDL estimates the biodiversity footprint of a firm using a metric called Mean Species Abundance (MSA). This metric indicates the average relative abundance of native species in an ecosystem compared to their abundance in an ecosystem disturbed by human activities. An area with an MSA of 0% is interpreted as having completely lost its original biodiversity, whereas an MSA of 100% means that the level of biodiversity is equal to an original, undisturbed ecosystem.

To make this comparable and meaningful, biodiversity footprint translates this metric into km^2.MSA, a unit that combines how much land is affected and how much biodiversity is lost. For example, degrading 1 km² of land from 100% to 0% MSA results in –1 km².MSA; degrading 2 km² from 100% to 50% MSA also equals –1 km².

The computation of biodiversity footprint begins with the Wunderpus model, developed by IDL. This input-output model maps a company's activities (referred to as commodities) as well as its certifications and sustainability labels (referred to as attributes) and allocates product flows to economic sectors based on the NACE classification—the classification of economic activities in the European Union. It then assesses and quantifies the company's environmental pressures, including land use change, climate change driven by greenhouse gas emissions, air pollution from Nitrogen and Sulphur emissions, and water pollution.

Then, IDL translates these pressures through pressure-impact damage functions based on the GLOBIO model by PBL Netherlands Environmental Assessment Agency, into the same biodiversity impact unit, km2.MSA. The figure below summarizes IDL's biodiversity accounting methodology.

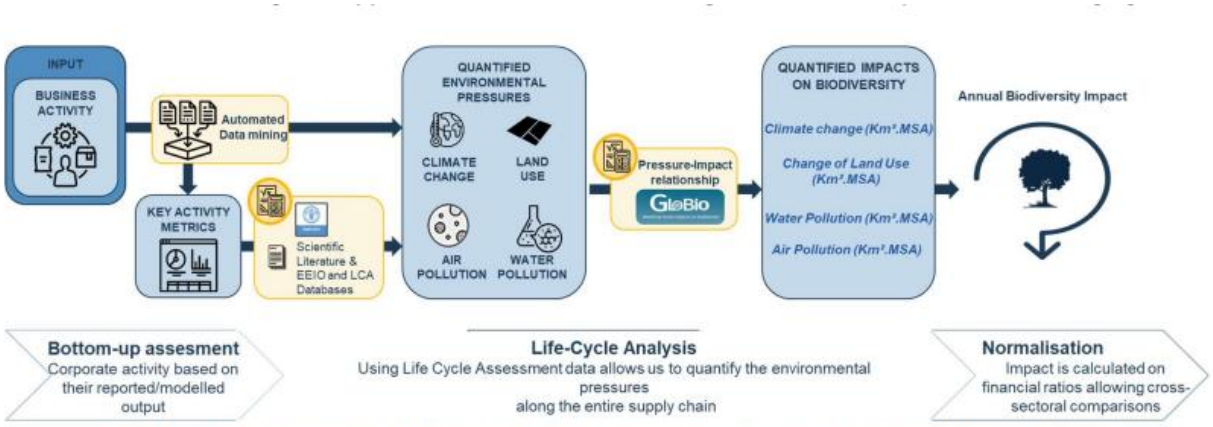


Figure 3: Illustration of the global approach and modelling process of IDL's biodiversity accounting methodology.

Source: the IDL's methodological guide for clients (February 2023 version)

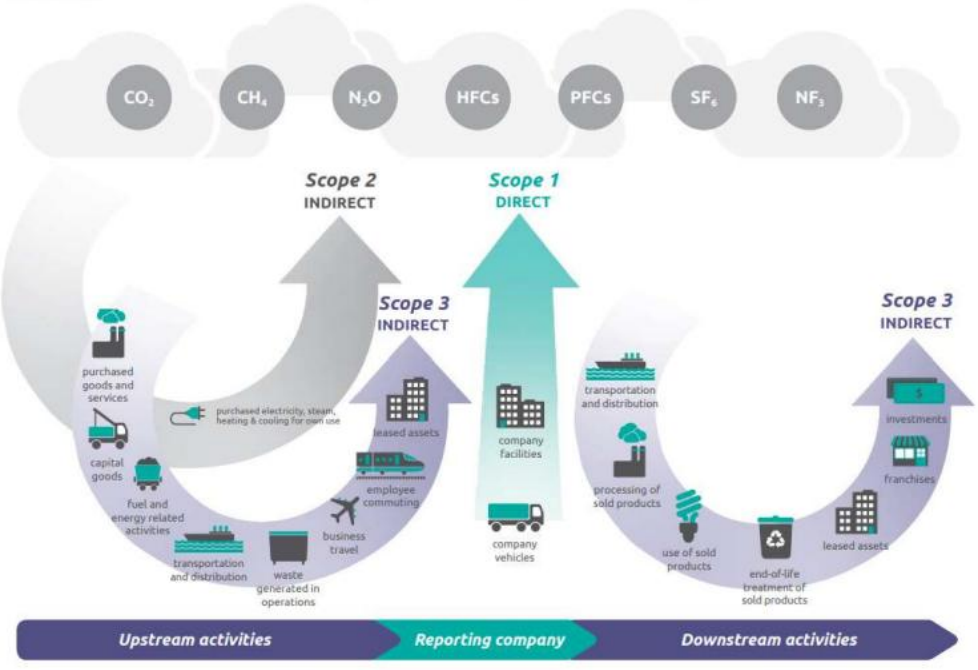
Scope 1, Scope 2, and Scope 3 Biodiversity Footprint

Biodiversity footprint has three components: Scope 1, Scope 2, and Scope 3. The table below provides their brief definitions.

Scope 1	All direct pressures and impacts generated in the area controlled by the entity and other impacts directly caused by the entity during the assessed period.
Scope 2	All pressures and impacts resulting from purchased non-fuel energy generation for site-level use.
Scope 3	All pressures induced by the activity of a company that are not directly owned or controlled by the company, such as those arising from its supply chain (e.g., purchased goods and services) or the downstream use of its products.

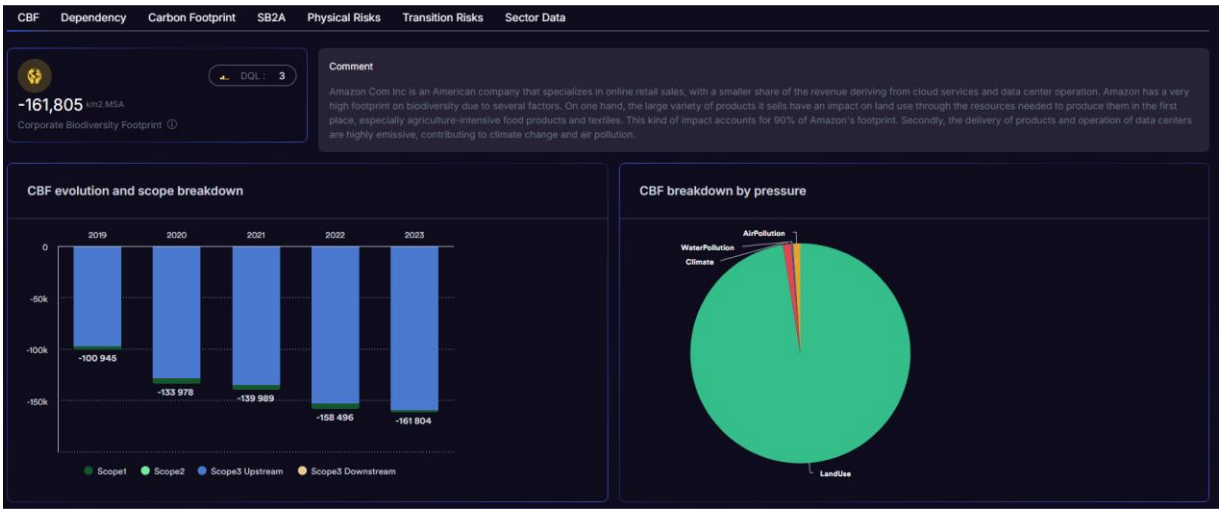
The following examples illustrate how companies may generate biodiversity footprints under each scope. For Scope 1, a company might directly use land for its manufacturing facilities or emit pollutants through on-site fuel combustion. Under Scope 2, it may contribute to emissions by purchasing electricity or heat generated off-site. Scope 3 includes all other indirect impacts on biodiversity and is divided into two categories. Scope 3 Upstream is primarily related to inputs the company purchases, including activities such as the transportation and distribution of goods, waste generated in operations, and employee commuting. Scope 3 Downstream refers to impacts associated with products sold by the company, such as their processing, use, and end-of-life treatment. The figure below provides an example of activities categorized under Scopes 1, 2, and 3 in the context of GHG emissions—one of the components of biodiversity footprint.

Figure [I] Overview of GHG Protocol scopes and emissions across the value chain



Source: the IDL's methodological guide for clients (February 2023 version)

A Case Study – Biodiversity Footprint of Amazon



In 2023, Amazon recorded a biodiversity footprint of –161,805 km².MSA. This figure represents the estimated biodiversity loss associated with its operations and value chain. The footprint has increased steadily since 2019, driven largely by Scope 3 upstream activities, which include the sourcing of agricultural, textile, and other land-intensive products. These activities account for the majority of the impact, with land use alone responsible for around 90% of the total footprint. Smaller contributions come from climate change and air pollution, both of which are linked to the emissions intensity of Amazon's logistics and infrastructure. Scope 1 and Scope 2 impacts—stemming from direct operations and purchased energy—contribute relatively little in comparison. Amazon's case illustrates how extensive supply chains, rather than on-site activities, can be the primary driver of biodiversity loss in large multinational firms.

Data Quality Level

The Data Quality Level (DQL) framework represents the quality and completeness of the dataset, with DQL 1 being the highest quality and DQL 5 the lowest (no data reported). Higher DQL levels reflect greater reliance on modeling and assumptions rather than firm-disclosed data. The table below provides detailed information on each level.

DQL	Description
1	Uses detailed reported data on revenue, commodity volumes, and environmental pressures. Modeling is limited to biodiversity impact.
2	Uses reported data on global and sectoral revenues and commodity volumes. Environmental pressures and biodiversity impacts are estimated using life cycle analysis and modeling.
3	Uses reported revenue by sector. The model estimates commodity flows, environmental pressures, and biodiversity impacts using sector averages.
4	Uses total global revenue only. Sector allocation, commodity flows, environmental pressures, and biodiversity impacts are all estimated from external classification data.
5	No company-specific data is available. All values—including revenue allocation, commodity flows, pressures, and impacts—are modeled using regional and sectoral benchmarks.

Discussions

Here we share our observations from working with the IDL dataset to inform future researchers.

Our first observation is about the empirical methods that are suitable for using biodiversity footprint in research. We find in untabulated regressions that biodiversity footprint is largely constant within a firm during our analysis period. For instance, the lagged Log(*Biodiversity Footprint*) can explain over 90% of the variation in Log(*Biodiversity Footprint*). Similarly, firm fixed effects alone can explain more than 95% of the variation in Log(*Biodiversity Footprint*). This suggests that, for practical purposes, biodiversity footprint is largely a firm fixed effect. Therefore, a cross-sectional, rather than a within-firm, empirical design is more suitable when using biodiversity footprint as an independent variable of interest. Consistent with these observations, we find in untabulated results that the coefficient estimate on Log(*Biodiversity Footprint*) in our baseline specification (Column (6), Table 2) is positive but statistically insignificant when we control for firm fixed effects.

Our second observation is based on what we learned from our interactions with the IDL representatives. We discovered that the IDL improves its methodology for computing biodiversity footprint and updates historical estimates using the most recent approach. This means that the biodiversity footprint data used in previous papers may differ from what is currently available for the same period. We were told that the legacy dataset is unavailable, or at least not practical to share, because it would require the IDL to provide a snapshot of the biodiversity dataset at a specific time. Consequently, if researchers wanted to replicate our findings, they would ideally need the biodiversity dataset as of when we purchased the dataset, not when we publish this paper. We are unable to assess whether these methodology changes are material. However, this is a limitation for researchers aiming to replicate prior findings.

Online Appendix B. Variable Definitions

This appendix provides the definitions of variables reported in Table 1 along with their data sources. All continuous variables are winsorized at the 1st and 99th percentiles of their sample distributions in each year.

Variables	Definitions
Dependent Variable	
Yield Spread (%)	The difference between the yield-to-maturity of a corporate bond and the yield-to-maturity of its maturity-matched benchmark Treasury bond, computed as of the last trade date in a month. When a bond is traded multiple times on that day, yield-to-maturity is calculated using the weighted average price based on trade amounts. Source: Bond prices are from TRACE, bond characteristics are from FISD and Bloomberg, and Treasury yields are from the Treasury's website.
Bond Characteristics	
Log(Years to Maturity)	Natural logarithm of bond maturity in years, measured as of the trade date. Source: FISD, Bloomberg, TRACE.
Log(Number of Trades in a Month)	Natural logarithm of the number of trades in the trade month. Source: MSRB.
Senior, Secured, Callable, Puttable, and Sinkable Dummies	Dummy variables indicating whether a bond is senior, secured, callable, puttable, or has a sinking fund provision. Source: FISD, Bloomberg.
Investment Grade Dummy	Indicates whether a bond's median numerical credit rating from S&P, Fitch, and Moody's falls within the investment grade range (e.g., above BB+). Source: FISD, Bloomberg.
Firm Characteristics	
Log(Assets in Millions)	Natural logarithm of total assets from the latest annual report prior to the trade date. Source: COMPUSTAT.
Net Income/Assets (%)	Net income divided by total assets from the latest annual report prior to the trade date. Source: COMPUSTAT.
Cash/Assets (%)	Cash and equivalents divided by total assets from the latest annual report prior to the trade date. Source: COMPUSTAT.
Debt/Assets (%)	Sum of short- and long-term debt divided by total assets from the latest annual report prior to the trade date. Source: COMPUSTAT.
CAPX/Assets (%)	Capital expenditures (CAPX) divided by total assets from the latest annual report prior to the trade. If missing, CAPX is set to zero. Source: COMPUSTAT.
R&D/Assets (%)	Research and development expenditures (R&D) divided by total assets from the latest annual report prior to the trade. If missing, R&D is set to zero. Source: COMPUSTAT.
Ave. Monthly Stock Returns (%)	Average of monthly stock returns during the one-year period prior to the trade month. Source: CRSP.
Std. Monthly Stock Returns (%)	Standard deviation of monthly stock returns during the one-year period prior to the trade month. Source: CRSP.
Biodiversity Characteristics	
Log(Biodiversity Footprint)	Natural logarithm of the annual biodiversity footprint of a firm, lagged by a year. Source: IDL.
Log(Biodiversity Footprint – Scope 1)	Natural logarithm of the annual biodiversity footprint of a firm associated with its direct activities (e.g., land use), lagged by a year. Source: IDL.
Log(Biodiversity Footprint – Scope 2)	Natural logarithm of the annual biodiversity footprint of a firm associated with its indirect activities (e.g., electricity consumption), lagged by a year. Source: IDL.
Log(Biodiversity Footprint – Scope 3)	Natural logarithm of a firm's annual biodiversity footprint that occurs outside of its direct control (e.g., through the use of its products), lagged by a year. Source: IDL.

Online Appendix C. Determinants of Biodiversity Footprint

This table reports the determinants of biodiversity footprint between 2019 and 2023. The regression equation is the same as that in Table 2, except that the dependent variable is Log(*Biodiversity Footprint*) instead of *Yield Spread*. All continuous variables are winsorized at the 1st and 99th percentiles by year. The sample in Columns (1) and (2) includes bond-month level observations as in Table 2, whereas the sample in Columns (3) and (4) includes unique observations at the firm-year level. See Table 2 for the remaining details. The numbers in parentheses are the t-values computed using standard errors clustered at the firm-level.

Sample:	**Bond-Month Level**		**Firm-Year Level**	
Variables	**(1)**	**(2)**	**(3)**	**(4)**
Log(Assets)	0.74***	0.72***	0.92***	0.92***
	(8.17)	(7.68)	(10.40)	(9.98)
Net Income/Assets	0.01	0.02	0.03**	0.04**
	(1.01)	(1.33)	(2.58)	(2.38)
Cash/Assets	0.01	0.02	-0.01	-0.01
	(1.09)	(1.30)	(-0.69)	(-0.50)
Debt/Assets	-0.01	-0.01	0.00	0.00
	(-0.96)	(-0.89)	(0.28)	(0.27)
CAPX/Assets	-0.06	-0.08*	-0.04	-0.05
	(-1.42)	(-1.72)	(-0.94)	(-1.08)
R&D/Assets	0.02	0.02	-0.06	-0.07
	(0.67)	(0.46)	(-1.07)	(-1.14)
Ave. Monthly Stock Return	0.01	0.01	-0.01	0.01
	(0.84)	(0.30)	(-0.42)	(0.18)
Std. Monthly Stock Return	-0.00	-0.00	0.00	-0.00
	(-0.13)	(-0.21)	(0.02)	(-0.19)
Consumer Nondurables	1.93***	.	1.93***	.
	(4.64)	.	(4.51)	.
Consumer Durables	0.20	.	0.45	.
	(0.54)	.	(1.23)	.
Manufacturing	0.14	.	0.41	.
	(0.26)	.	(0.81)	.
Energy	0.94**	.	0.81	.
	(2.32)	.	(1.42)	.
Chemicals	0.95***	.	0.89**	.
	(3.20)	.	(2.35)	.
Business Equipment	-1.53***	.	-1.32**	.
	(-3.49)	.	(-2.43)	.
Telecommunications	-2.65***	.	-3.11***	.
	(-6.88)	.	(-5.61)	.
Utilities	0.18	.	-0.01	.
	(0.46)	.	(-0.03)	.
Shops	3.21***	.	2.80***	.
	(5.72)	.	(4.89)	.
Health	0.35	.	0.52	.
	(0.74)	.	(0.73)	.

Continued on the next page.

Online Appendix C continued.

Intercept	Yes	Yes	Yes	Yes
Bond Characteristics	Yes	Yes	No	No
Year-Month Fixed Effects	Yes	No	No	No
Industry × Year-Month Fixed Effects	No	Yes	No	No
Year Fixed Effects	No	No	Yes	Yes
Industry × Year Fixed Effects	No	No	No	Yes
Number of Observations	135,867	135,867	619	619
Adjusted R-squared (%)	54.29	55.72	46.32	44.33

*, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Online Appendix D. Coefficient Estimates on the Control Variables and Their Expected Signs

This table presents the coefficient estimates on the control variables from the regression of yield spreads in Column (1) of Table 2, along with their expected signs. All continuous variables are winsorized at the 1st and 99th percentiles by year. See Table 2 for further details. The numbers in parentheses are the t-values computed using standard errors clustered at the firm-level.

Variables	Expected Sign	Coefficient Estimates on Controls Column (1), Table 2
Log(Years to Maturity)	+	34.48***
		(16.92)
Log(Number of Trades in a Month)	−	-0.84
		(-0.67)
Senior Dummy	−	-27.01*
		(-1.73)
Secured Dummy	−	-42.21***
		(-2.70)
Callable Dummy	+	-17.32**
		(-2.54)
Puttable Dummy	−	15.94*
		(1.92)
Sinkable Dummy	−	17.36
		(0.43)
Investment Grade Dummy	−	-90.40***
		(-7.53)
Log(Assets)	−	-10.24***
		(-3.68)
Net Income/Assets	−	-1.90***
		(-5.05)
Cash/Assets	−	-0.10
		(-0.33)
Debt/Assets	+	0.65***
		(3.03)
CAPX/Assets	−	-0.47
		(-0.44)
R&D/Assets	−	-2.32***
		(-3.07)
Ave. Monthly Stock Return	−	-2.80***
		(-3.53)
Std. Monthly Stock Return	+	6.47***
		(9.32)

*, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Online Appendix E. The Relation Between Standardized Biodiversity Footprint and Yield Spreads

This table reports the estimates in Table 2 using control variables standardized to have a mean of zero and a standard deviation of one. All continuous variables are winsorized at the 1st and 99th percentiles by year. See Table 2 for further details. The numbers in parentheses are the t-values computed using standard errors clustered at the firm-level.

Sample:	**All**		**Pre-COP15**		**Post-COP15**	
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Log(Biodiversity Footprint)	6.86**	6.29**	3.59	1.85	7.76***	8.74***
	(2.55)	(2.53)	(1.07)	(0.58)	(2.92)	(3.33)
Wald Test			(3) vs. (5)		(4) vs. (6)	
Prob > Chi^2 (%)			23.85		4.77	
Intercept	Yes	Yes	Yes	Yes	Yes	Yes
Bond Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Firm Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	No	Yes	No	Yes	No
Year-Month Fixed Effects	Yes	No	Yes	No	Yes	No
Industry × Year-Month Fixed Effects	No	Yes	No	Yes	No	Yes
Number of Observations	135,867	135,867	47,774	47,774	88,093	88,093
Adjusted R-squared (%)	58.82	63.17	65.57	69.83	56.95	58.82

*, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Online Appendix F. Components of Scope 3 Biodiversity Footprint and Yield Spreads

This table reports the results of the baseline regression model (Column (6), Table 2) using the components of the Scope 3 Biodiversity Footprint as biodiversity measures. In Columns (1)−(6), these components of the Scope 3 measure are *Air Impact*, *Greenhouse Gas*, *Land*, *Water*, *Upstream*, and *Downstream*, respectively. All continuous variables are winsorized at the 1st and 99th percentiles by year. See Table 2 for further details. The numbers in parentheses are the t-values computed using standard errors clustered at the firm-level.

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Log(Scope 3 − Air Impact)	3.80**	.	.	.	.	.
	(2.51)	.	.	.	.	.
Log(Scope 3 − Greenhouse Gas)	.	4.34***	.	.	.	.
	.	(2.99)	.	.	.	.
Log(Scope 3 − Land)	.	.	3.10***	.	.	.
	.	.	(2.61)	.	.	.
Log(Scope 3 − Water)	.	.	.	1.39	.	.
	.	.	.	(1.12)	.	.
Log(Scope 3 − Upstream)	.	.	.	.	2.92**	.
	.	.	.	.	(2.27)	.
Log(Scope 3 − Downstream)	.	.	.	.	.	3.52***
	.	.	.	.	.	(3.59)
Intercept	Yes	Yes	Yes	Yes	Yes	Yes
Bond Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Firm Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Industry × Year-Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	88,093	88,093	88,093	88,093	87,933	74,002
Adjusted R-squared (%)	58.74	58.73	58.46	58.13	58.44	60.73

*, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Online Appendix G. The Subsample Tests for the Scope 1 and 2 Effects

This table reports the results of the regression in Columns (1) and (2) of Table 4 for alternative subsamples. The samples in Column (1) of Panels A and B include observations with above median Scope 1 and Scope 2 values, respectively. The samples in the remaining columns include industries with highest Scope 1 levels in Panel A and Scope 2 levels in Panel B. All continuous variables are winsorized at the 1st and 99th percentiles by year. See Table 2 for further details. The numbers in parentheses are the t-values computed using standard errors clustered at the firm-level.

Panel A: Scope 1 Subsample Tests

Sample:	**High Scope 1**	**Energy Industry**	**Utilities Industry**	**Shops Industry**
Variables	**(1)**	**(2)**	**(3)**	**(4)**
Log(Biodiversity Footprint – Scope 1)	6.76**	30.27***	0.13	4.67**
	(2.25)	(3.14)	(0.06)	(2.51)
Intercept	Yes	Yes	Yes	Yes
Bond Characteristics	Yes	Yes	Yes	Yes
Firm Characteristics	Yes	Yes	Yes	Yes
Industry × Year-Month Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	41,788	4,454	31,445	2,563
Adjusted R-squared (%)	56.99	72.00	54.51	86.29

Panel B: Scope 2 Subsample Tests

Sample:	**High Scope 2**	**Chemicals Industry**	**Telecom Industry**	**Durables Industry**
Variables	**(1)**	**(2)**	**(3)**	**(4)**
Log(Biodiversity Footprint – Scope 2)	-1.15	14.41**	76.31	-41.42
	(-0.24)	(3.10)	(0.26)	(-1.10)
Intercept	Yes	Yes	Yes	Yes
Bond Characteristics	Yes	Yes	Yes	Yes
Firm Characteristics	Yes	Yes	Yes	Yes
Industry × Year-Month Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	47,856	3,507	6,695	5,203
Adjusted R-squared (%)	64.03	54.19	58.37	70.98

*, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Online Appendix H. A Daily Event Study of Yield Spreads around the TNFD [−5, +5]

This table reports the results of Table 6—a daily event study around the TNFD—during five trading days before and after the TNFD (June 4, 2021), excluding the event day. All continuous variables are winsorized at the 1st and 99th percentiles by year. See Table 6 for further details. The numbers in parentheses are the t-values computed using standard errors clustered at the firm-level.

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
Log(Biodiversity Footprint) × Post-TNFD	0.24	0.17	0.04	0.05	.	.	.	.	.	.	.	.
	(1.42)	(0.88)	(0.34)	(0.40)	.	.	.	.	.	.	.	.
Log(Biodiversity Footprint − Scope 3) × Post-TNFD	.	.	.	.	0.31**	0.35**	0.03	0.10	.	.	.	.
	.	.	.	.	(2.48)	(2.46)	(0.29)	(1.00)	.	.	.	.
High Biodiversity Footprint Dummy × Post-TNFD	.	.	.	.	.	.	.	.	0.46	0.18	0.13	0.05
	.	.	.	.	.	.	.	.	(0.78)	(0.32)	(0.33)	(0.13)
Intercept	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	No	No
Bond Fixed Effects	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Bond Characteristics	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	No	No
Calendar Day Fixed Effects	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Industry × Calendar Day Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Number of Observations	15,619	15,619	15,619	15,619	15,619	15,619	15,619	15,619	15,619	15,619	15,619	15,619
Adjusted R-squared (%)	52.65	52.53	2.10	2.94	52.66	52.54	2.09	2.97	52.65	52.53	2.10	2.94

*, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Online Appendix I. A Daily Event Study of Yield Spreads around the COP15 [−3, +3]

This table reports the results of a daily event study around the COP15. As in the TNFD event study, the sample includes the three-trading-day window surrounding COP15, excluding the conference days. Accordingly, the sample includes the three trading days before the beginning of COP15 on October 11, 2021, and the three trading days after it ended on October 15, 2021. The regression equation is the same as that in Table 6, except that *Post-COP15* dummy variable replaces *Post-TNFD* dummy variable. All continuous variables are winsorized at the 1st and 99th percentiles by year. See Table 6 for details. The biodiversity measure is biodiversity footprint in Columns (1)−(4), the Scope 3 biodiversity footprint in Columns (5)−(8), and a dummy variable indicating whether an observation's biodiversity footprint is above the 50th percentile of the sample in Columns (9)−(12). The numbers in parentheses are the t-values computed using standard errors clustered at the firm-level.

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
Log(Biodiversity Footprint) × Post-COP15	0.33	0.21	0.23*	0.22	.	.	.	.	.	.	.	.
	(1.65)	(0.88)	(1.82)	(1.55)	.	.	.	.	.	.	.	.
Log(Biodiversity Footprint - Scope 3) × Post-COP15	.	.	.	.	0.24	0.09	0.23**	0.15	.	.	.	.
	.	.	.	.	(1.51)	(0.45)	(2.35)	(1.09)	.	.	.	.
High Biodiversity Footprint Dummy × Post-COP15	.	.	.	.	.	.	.	.	0.93	0.46	0.77**	0.55
	.	.	.	.	.	.	.	.	(1.43)	(0.64)	(2.24)	(1.42)
Intercept	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	No	No
Bond Fixed Effects	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Bond Characteristics	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	No	No
Calendar Day Fixed Effects	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Industry × Calendar Day Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	9,264	9,264	9,264	9,264	9,264	9,264	9,264	9,264	9,264	9,264	9,264	9,264
Adjusted R-squared (%)	55.36	55.2	7.11	8.35	55.36	55.2	7.21	8.32	55.36	55.2	7.13	8.32

*, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Online Appendix J. A Daily Event Study of Yield Spreads around the TNFD and COP15 Events for High Footprint Cases [−3, +3]

This table reports the results of a daily event study around the TNFD and COP15 events using observations with high biodiversity footprints as the treatment group. The sample includes the three trading days before and after the corresponding events. See Table 6 and Online Appendix I for the event windows of TNFD and COP15 studies, respectively. The regression equation is the same as that in Table 6, except that *Post-COP15* dummy variable replaces *Post-TNFD* dummy variable in Columns (1) through (4). *High Biodiversity Footprint Dummy* is a dummy variable indicating whether an observation's biodiversity footprint is above the 75th percentile of the sample. The numbers in parentheses are the t-values computed using standard errors clustered at the firm-level.

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
High Biodiversity Footprint Dummy (75th Percentile) × Post-COP15	1.98***	1.93**	0.88***	1.41**	.	.	.	.
	(3.32)	(2.14)	(2.72)	(2.60)	.	.	.	.
High Biodiversity Footprint Dummy (75th Percentile) × Post-TNFD	.	.	.	.	0.52	0.27	0.47	0.47
	.	.	.	.	(0.54)	(0.27)	(0.97)	(0.96)
Intercept	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	No	No	Yes	Yes	No	No
Bond Fixed Effects	No	No	Yes	Yes	No	No	Yes	Yes
Bond Characteristics	Yes	Yes	No	No	Yes	Yes	No	No
Calendar Day Fixed Effects	Yes	No	Yes	No	Yes	No	Yes	No
Industry × Calendar Day Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes
Observations	9,264	9,264	9,264	9,264	9,452	9,452	9,452	9,452
Adjusted R-squared (%)	55.37	55.21	7.13	8.53	53.02	52.93	0.61	1.22

Online Appendix K. Biodiversity News Sensitivity (6-Factor Model) and Yield Spread

This table replicates Table 9 using a biodiversity news sensitivity estimated from a 6-factor model. *Biodiversity News Sensitivity* is the sensitivity of excess bond returns to innovations in the NYT Biodiversity News Index of Giglio et al. (2026) lagged by a month. We estimate this sensitivity using the past 5 years of monthly excess bond returns controlling for innovations in climate news index, excess bond market returns, term spread, credit spread, excess stock market returns, and size and value factors. We reverse the coefficient estimate on the biodiversity news index so that a higher *Biodiversity News Sensitivity* is associated with a greater exposure to biodiversity-related risks. All continuous variables are winsorized at the 1st and 99th percentiles by year. See Table 9 for further details. The numbers in parentheses are the t-values computed using standard errors clustered at the firm-level.

Sample:	**All**	**Pre-COP15**	**Post-COP15**
Variables	**(1)**	**(2)**	**(3)**
Biodiversity News Sensitivity	3.09**	2.90	3.91***
	(2.53)	(1.34)	(5.47)
Wald Test		(2) vs. (3)	
Prob > Chi^2 (%)		64.78	
Intercept	Yes	Yes	Yes
Bond Characteristics	Yes	Yes	Yes
Firm Characteristics	Yes	Yes	Yes
Industry × Year-Month Fixed Effects	Yes	Yes	Yes
Number of Observations	188,461	100,631	87,830
Adjusted R-squared (%)	63.56	64.20	68.51

*, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Online Appendix L. Addressing the EIV Bias in the Biodiversity News Sensitivity Estimates

This table investigates whether the relationship between *Biodiversity News Sensitivity* and *Yield Spread* reported in Column (3) of Table 9 is robust to addressing the EIV bias using the instrumental variable approach of Jegadeesh et al. (2019). In Columns (1)−(2), *Biodiversity News Sensitivity* is estimated from a 3-factor model as in Table 9, and in Columns (3)−(4), it is estimated from a 6-factor model as in Online Appendix K. The sample period includes observations from the post-COP15 (on or after October 11, 2021) periods. All continuous variables are winsorized at the 1st and 99th percentiles by year. See Table 9 and Online Appendix K for further details. The numbers in parentheses are the t-values computed using standard errors clustered at the firm-level.

Biodiversity News Sensitivity:	**3-Factor Model**		**6-Factor Model**	
Regression:	**First Stage**	**Second Stage**	**First Stage**	**Second Stage**
Variables	**(1)**	**(2)**	**(3)**	**(4)**
Instrument for Biodiversity News Sensitivity	0.19***	.	0.24***	.
	(8.28)	.	(12.86)	.
Instrumented Biodiversity News Sensitivity	.	9.19***	.	4.65***
	.	(4.21)	.	(2.91)
F-Statistic for Weak Instrument	68.58		165.33	
Intercept	Yes	Yes	Yes	Yes
Bond Characteristics	Yes	Yes	Yes	Yes
Firm Characteristics	Yes	Yes	Yes	Yes
Industry × Year-Month Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	87,652	87,652	87,652	87,652
Adjusted R-squared (%)	22.33	63.99	20.26	67.07

*, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Online Appendix M. The Interaction between Biodiversity Footprint and Dependency

Column (1) of this table reports the regression in Column (3) of Table 10 by including the interaction of Log(*Biodiversity Footprint*) and *Biodiversity Dependency* as an additional control. Columns (2) through (5) of this table includes dummy variables that identify subsamples of high vs. low values of biodiversity footprint and dependency based on sample medians. See Table 10 for details. The numbers in parentheses are the t-values computed using standard errors clustered at the firm-level.

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Log(Biodiversity Footprint) × Biodiversity Dependency	-0.06	.	.	.	.
	(-0.37)	.	.	.	.
High Footprint & High Dependency	.	18.55***	.	.	.
	.	(2.71)	.	.	.
High Footprint & Low Dependency	.	.	13.82**	.	.
	.	.	(2.35)	.	.
Low Footprint & High Dependency	.	.	.	-17.80***	.
	.	.	.	(-3.19)	.
Low Footprint & Low Dependency	.	.	.	.	-5.55
	.	.	.	.	(-0.99)
Intercept	Yes	Yes	Yes	Yes	Yes
Bond Characteristics	Yes	Yes	Yes	Yes	Yes
Firm Characteristics	Yes	Yes	Yes	Yes	Yes
Industry × Year-Month Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of Observations	88,093	88,093	88,093	88,093	88,093
Adjusted R-squared (%)	59.06	58.57	58.45	58.82	58.11

*, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Online Appendix N. The Influence of Biodiversity Footprint on Coupon Rates

This table reports the results of regressions that study the influence of Log(*Biodiversity Footprint*) on coupon rates of new bonds issued by our sample firms. The dependent variable is the coupon rate (in bps). As in the baseline regressions, these regressions control for industry (based on Fama-French 12 industry classifications) by year-month fixed effects, bond-level variables (Log(*Years to Maturity*), *Senior Dummy*, *Secured Dummy*, *Callable Dummy*, *Puttable Dummy*, *Sinkable Dummy*, and *Investment Grade Dummy*), and firm-level variables (Log(*Assets in Millions*), *Net Income/Assets*, *Cash/Assets*, *Debt/Assets*, *CAPX/Assets*, *R&D/Assets*, *Ave. Monthly Stock Returns*, and *Std. Monthly Stock Returns*). Financial characteristics are from the latest annual report prior to the offering date. All continuous variables are winsorized at the 1st and 99th percentiles by year. See Online Appendix B for detailed variable definitions. The sample in Column (1) includes all observations between 2019 and 2023. Columns (2) and (3) report the same regression results during the pre-COP15 (before October 11, 2021) and post-COP15 (on or after October 11, 2021) periods, respectively. This table also reports the Wald test results for the null hypothesis that the difference between the coefficient estimates on Log(*Biodiversity Footprint*) in the given columns is zero. The numbers in parentheses are the t-values computed using standard errors clustered at the firm-level.

Sample:	**All**	**Pre-COP15**	**Post-COP15**
Variables	**(1)**	**(2)**	**(3)**
Log(Biodiversity Footprint)	-1.09	-3.25	9.99**
	(-0.26)	(-0.75)	(2.49)
Wald Test		(2) vs. (3)	
Prob > Chi2 (%)		0.58	
Intercept	Yes	Yes	Yes
Bond Characteristics	Yes	Yes	Yes
Firm Characteristics	Yes	Yes	Yes
Industry × Year-Month Fixed Effects	Yes	Yes	Yes
Number of Observations	1,063	475	588
Adjusted R-squared (%)	93.19	83.69	93.27

*, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Online Appendix O. Biodiversity Footprint and the Maturity Choice

This table reports the estimates from probit regressions in Panel A and their average marginal effects in Panel B. The dependent variable is *Medium-Term Dummy* that identifies bonds maturing between 5 and 10 years. The sample includes new corporate bonds issued by the firms in the main sample (see Table 1 for details). As in the baseline regressions, the probit regression incudes industry (based on Fama-French 12 industry classifications) by year-month fixed effects, bond-level controls (*Senior Dummy*, *Secured Dummy*, *Callable Dummy*, *Puttable Dummy*, *Sinkable Dummy*, and *Investment Grade Dummy*), and firm-level controls (Log(*Assets in Millions*), *Net Income/Assets*, *Cash/Assets*, *Debt/Assets*, *CAPX/Assets*, *R&D/Assets*, *Ave. Monthly Stock Returns*, and *Std. Monthly Stock Returns*). Financial characteristics are from the latest annual report prior to the offering date. All continuous variables are winsorized at the 1st and 99th percentiles by year. See Online Appendix B for detailed variable definitions. The sample in Columns (1) and (4) includes all observations between 2019 and 2023. Columns (2)−(5) and (3)−(6) report the same regression results during the pre-COP15 (before October 11, 2021) and post-COP15 (on or after October 11, 2021) periods, respectively. This table also reports the Wald test results for the null hypothesis that the difference between the coefficient estimates on biodiversity measures in the given columns is zero. The biodiversity measure in Columns (1) through (3) is Log(*Biodiversity Footprint*) and that in Columns (4) through (6) is a dummy variable indicating whether an observation's biodiversity footprint is above the 50th percentile of the sample distribution. Standard errors are clustered at the firm-level.

Panel A: Probit Estimates						
Sample:	**All**	**Pre-COP15**	**Post-COP15**	**All**	**Pre-COP15**	**Post-COP15**
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Log(Biodiversity Footprint)	-0.04	0.15*	-0.26**	.	.	.
	(-0.64)	(1.82)	(-2.44)	.	.	.
High Biodiversity Footprint	.	.	.	-0.45**	0.29	-0.61**
	.	.	.	(-2.36)	(0.56)	(-2.30)
Wald Test		(2) vs. (3)			(5) vs. (6)	
Prob > Chi2 (%)		0.06			14.57	
Intercept	Yes	Yes	Yes	Yes	Yes	Yes
Bond Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Firm Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Industry × Year-Month F. E.	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	907	400	507	907	400	507
Pseudo R-squared (%)	7.00	8.10	8.87	7.32	7.87	8.96
Panel B: Average Marginal Effects						
Sample:	**All**	**Pre-COP15**	**Post-COP15**	**All**	**Pre-COP15**	**Post-COP15**
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Log(Biodiversity Footprint)	-0.01	0.05*	-0.09**	.	.	.
	(-0.64)	(1.84)	(-2.46)	.	.	.
High Biodiversity Footprint	.	.	.	-0.16**	0.10	-0.21**
	.	.	.	(-2.38)	(0.57)	(-2.33)

*, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Online Appendix P. The Biodiversity Effect Controlling for Contemporaneous Stock Returns

This table reports the results of monthly yield spread and excess bond return regressions reported in Tables 2 and 7, respectively, while including the contemporaneous monthly stock returns as an additional control. The sample in all columns includes observations in the post-COP15 period. See Tables 2 and 7, respectively, for details of the yield spread (Column (1)) and excess bond return (Columns (2), (3), and (4)) regressions. The numbers in parentheses are the t-values computed using standard errors clustered at the firm-level.

Dependent Variable:	**Yield Spread**	**Excess Bond Return**		
Variables	**(1)**	**(2)**	**(3)**	**(4)**
Log(Biodiversity Footprint)	5.62***	0.92	.	.
	(3.34)	(1.31)	.	.
Log(Biodiversity Footprint – Scope 3)	.	.	0.81	.
	.	.	(1.49)	.
High Biodiversity Footprint Dummy	.	.	.	5.27**
	.	.	.	(2.23)
Intercept	Yes	Yes	Yes	Yes
Bond Characteristics	Yes	Yes	Yes	Yes
Firm Characteristics	Yes	Yes	Yes	Yes
Industry × Year-Month Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	88,093	84,099	84,099	84,099
Adjusted R-squared (%)	58.84	62.45	62.45	62.45

*, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Online Appendix Q. First Stage Probit Results from the Heckman Selection Model

This table reports the first-stage probit regression results for the Heckman selection model, reported as robustness test 16 in Table 13. The dependent variable is a dummy variable that equals one if a given observation has high-quality biodiversity footprint data (with a quality level better than 3) from IDL, and zero otherwise. Column (1) reports the coefficient estimates and Column (2) reports their marginal effects at the mean. All continuous variables are winsorized at the 1st and 99th percentiles by year. The numbers in parentheses are the z-values computed using standard errors clustered at the firm-level.

Model:	**Probit**	**dy/dx**
Variables	**(1)**	**(2)**
Log(Assets in Millions)	0.54***	0.18***
	(6.66)	(7.04)
Cash/Assets	0.00	0.00
	(0.25)	(0.25)
Debt/Assets	0.02***	0.01**
	(2.60)	(2.57)
Net Income/Assets	-0.00	-0.00
	(-0.13)	(-0.13)
CAPX/Assets	0.01	0.00
	(0.20)	(0.20)
R&D/Assets	-0.02	-0.01
	(-0.39)	(-0.39)
Ave. Monthly Stock Return	0.07**	0.02**
	(2.56)	(2.53)
Std. Monthly Stock Return	-0.01	-0.00
	(-0.34)	(-0.34)
Consumer Nondurables	0.94***	0.31***
	(2.88)	(2.83)
Consumer Durables	0.24	0.08
	(0.73)	(0.72)
Manufacturing	-0.57	-0.19
	(-1.56)	(-1.55)
Energy	0.28	0.09
	(0.81)	(0.80)
Chemicals	0.01	0.00
	(0.03)	(0.03)
Business Equipment	-0.16	-0.05
	(-0.48)	(-0.48)
Telecommunications	-0.90*	-0.29*
	(-1.72)	(-1.72)
Utilities	0.97***	0.32***
	(3.19)	(3.16)
Shops (Wholesale, Retail, and Some Services)	-1.37***	-0.45***
	(-3.55)	(-3.43)
Health	-1.17***	-0.38**
	(-2.60)	(-2.56)
Intercept	Yes	
Bond Characteristics	Yes	
Year × Month Fixed Effects	Yes	
Number of Observations	134,668	
Pseudo R-squared (%)	37.64	

*, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Online Appendix R. The Biodiversity Effect Using Low-Quality Biodiversity Footprint Measures

This table reports the baseline regression results (Column (6), Table 2) using a low-quality biodiversity footprint measure (IDL data quality level 3 or higher) in Column (1) and a biodiversity footprint measure estimated without quality restrictions in Column (2). All continuous variables are winsorized at the 1st and 99th percentiles by year. See Table 2 for further details. The numbers in parentheses are the z-values computed using standard errors clustered at the firm-level.

Sample:	**Biodiversity Footprint Quality >= 3**	**Biodiversity Footprint All Quality Levels**
Variables	**(1)**	**(2)**
Log(Biodiversity Footprint)	0.36	1.46
	(0.25)	(1.11)
Intercept	Yes	Yes
Bond Characteristics	Yes	Yes
Firm Characteristics	Yes	Yes
Industry × Year-Month Fixed Effects	Yes	Yes
Number of Observations	37,675	125,768
Adjusted R-squared (%)	72.32	62.23

*, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.