

Sustainability Industry Report

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Top Industries Affected by Biodiversity Loss



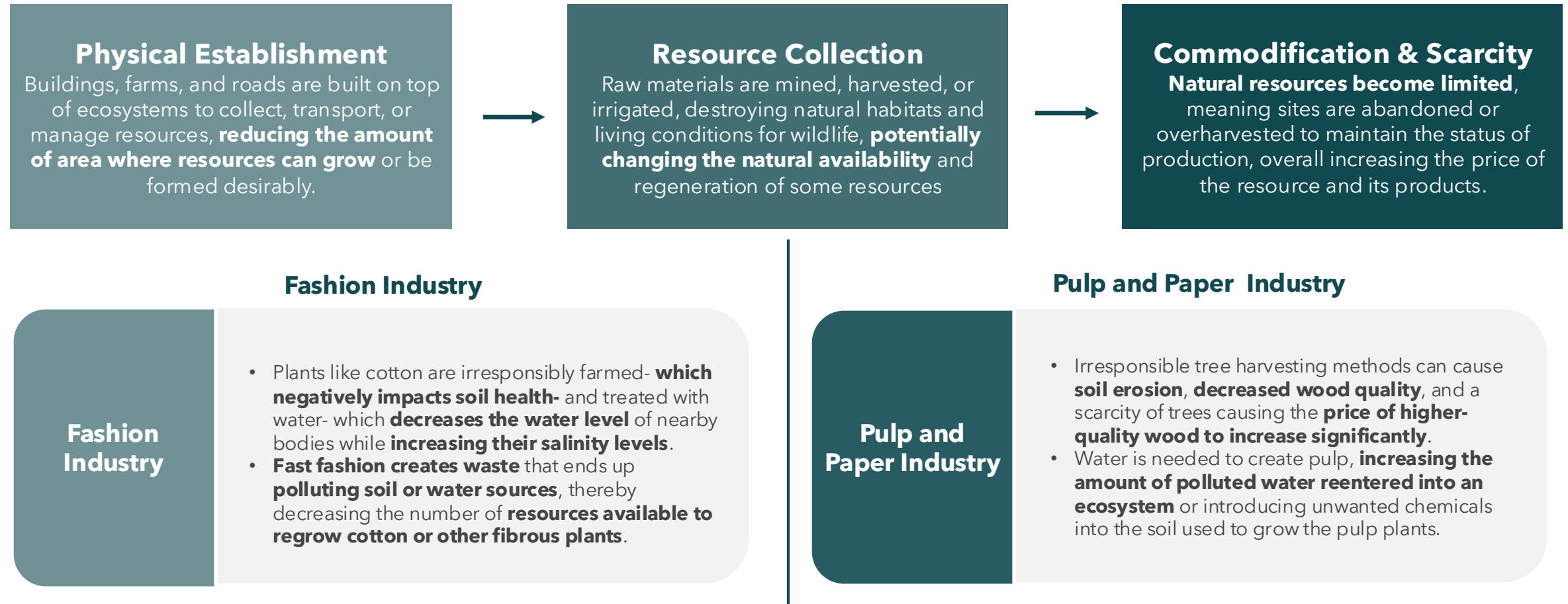
Ecosystems provide both the resources needed to sustain many industries and contain the balance necessary to maintain existing infrastructure and travelling desires that produce trillions of dollars in value annually.

Industry		Environmental Dependency
	Agriculture and Fisheries	- Nearly 40% of Earth's terrain is used for agricultural means, and the continued adaptation to diverse terrain can lead to new crop discovery, faster growth time, or optimized farming methods. - Fisheries in biodiverse areas benefit from the on-season, off-season catches, discouraging from overfishing one species and potentially providing farmers with multiple, high-paying species.
	Tourism	- An estimated 80% of global tourism being dependent on nature, driving up to 343 billion dollars (USD) in revenue annually, positively contributing to increased biodiversity in protected areas. - Tourism can positively or negatively impact other industries (like local economic growth or fisheries and tourist boating), often increasing its contribution to national GDPs- contributing 10% globally.
	Utilities	- While renewable energy can do harm to local biodiversity, sources like hydropower rely on healthy bodies of water to generate power and biofuel relies on healthy plant and animal development. - Residential and commercial water supplies rely on healthy water/water that can be sufficiently treated, and natural ecosystems can help mitigate potential flood risks or runoff contamination.
	Insurance	- Biodiversity loss may lead to an increase in food security, meaning more people are susceptible to illness, or a decrease in climate stability, meaning natural disasters are more frequent and impactful. Up to 125 trillion dollars (USD) in value are provided by nature globally, meaning insurance companies could be liable to cover biodiversity-related losses or damage in a variety of sectors.

Corporate Processes vs. Nature



Corporations rely on balanced ecosystems to maintain the ability to source materials, maintain the costs of non or slow-renewing resources, and to maintain their dependency on local ecosystems that fuel supply chains.

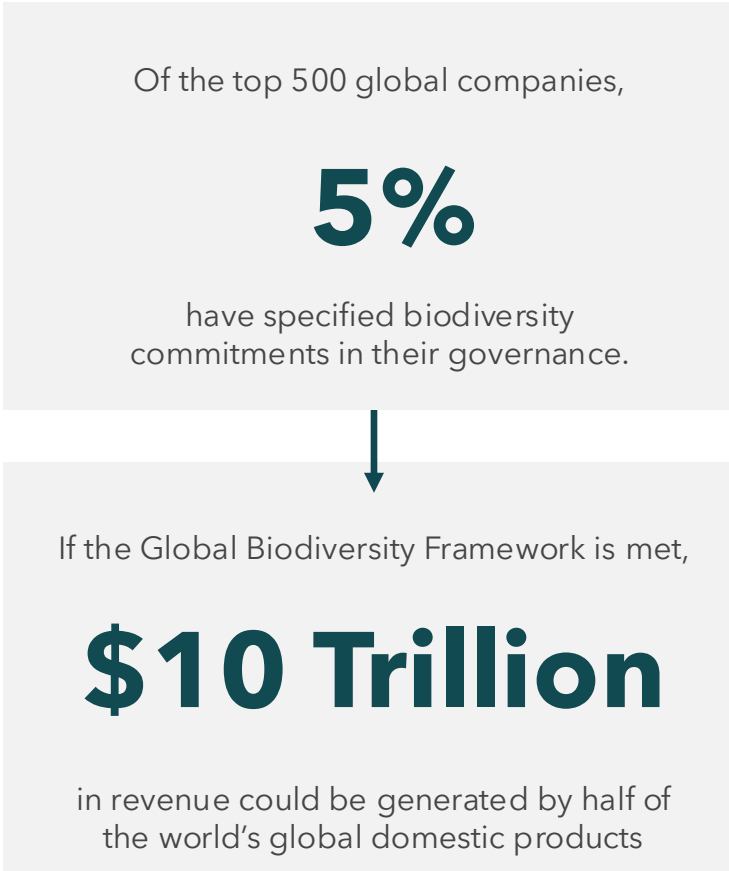


Examples of Existing Corporate Biodiversity Policy



Implementing specific policies to encourage healthy sourcing practices to mitigate environmental effects can be an effective way to meet emission requirements, establish long-term stability, and market to conscious consumers.

Agriculture	Retail	Utilities
Bayer Bayer has committed to the development of technology that makes fostering biodiversity easier, as well as partnering with local farmers to adapt tools to individual needs.	Patagonia With multiple environmental programs and a commitment to sourcing from Fair Trade factories, Patagonia has decreased in water and carbon footprint by up to 30% since 2022.	Eversource Eversource hires environmental specialists to minimize the damage done to ecosystems upon infrastructure implementation and works to conserve the land they own.
Syngenta Syngenta committed to enhancing over 7.4 million acres of land through last year, as well as supporting projects that introduce wildlife to pollinators outside of farmland.	IKEA Ikea has committed to source their materials from companies promoting healthy, local bio preservation methods and restricting the chemicals used to refine their products.	ENEL Partnering with local conservation organizations, ENEL has embarked on multiple, long-term wildlife restoration projects in areas around their existing facilities.
General Mills With the aim to practice restorative agriculture on over one million acres of farmland, General Mills is aiming to be carbon neutral by 2050.	Inditex In a 2024-approved policy, Inditex approved changes to their supply chain and has committed to source all their materials from responsible sources by 2030.	Long Road Energy Long Road has invested in conservatory land near previous installment projects to preserve migratory lands and areas with high biodiversity density levels.



Eversource, ENEL, General Mills, IKEA, Inditex, Long Road Energy, Patagonia, Syngenta, WBCSD, WEF (I), WEF (II)

Case Studies: Mitigating Commodity Problems



Cocoa production and palm oil sourcing are both huge contributors to deforestation, which is hard to assess due to supply chain complexity. Through different methods, deforestation and other issues can be pinpointed and mitigated.

Unilever - Palm Oil



Palm oil sourcing is a **huge driver of deforestation and loss of biodiversity**. This environmental risk creates **climate consequences as well as legal and supply chain risks**.

Addressing the Problem

Action

- Unilever has adopted a **No Deforestation, No Peat, No Exploitation (NDPE) policy** across suppliers.
- The policy is intended to build **high traceability** so that deforestation can be followed back to specific methods and products.
- **Satellite monitoring** is used and **non-compliant suppliers are suspended** at violation.

Impact

- **Traceability is critical** because with the complexity of current supply chains, it is **difficult to link products to deforestation and stop use**.
- Unilever is able to **map thousands of suppliers, and assess risk of deforestation** using geospatial data.
- Unilever supports **farmer training and agroforestry** to reduce loss of forests.

Mars - Sustainable Cocoa



Cocoa production is a **major driver of deforestation and loss of biodiversity**, while **farmer incomes** remain extremely low and **supply chain** is only minimally visible.

Addressing the Problem

Action

- Mars uses **satellite monitoring to detect and prevent** deforestation.
- **Farmer income programs are heavily prioritized**, and productivity support is invested in.
- **Agroforestry, the practice of growing cocoa with trees to restore ecosystems, is heavily promoted** and utilized by producers.

Impact

- Mars has **planted 1.8m+ trees and created large scale farmer training and income programs**.
- Mars has used satellite monitoring to assess hundreds of thousands of hectares for risk of deforestation.
- Industry initiatives enforce **commitment to deforestation-free cocoa**.

Opacity and Visibility Gaps in Supply Chains



Because products go through many tiers and hands during the production process, it is difficult to gain a clear picture of what factors pose a risk to biodiversity. This lack of visibility makes it difficult to assign accountability for sustainability.

Diluted Responsibility

No single actor has full oversight over the supply chain. Companies typically manage the first tier of suppliers, which **allows them to deflect any responsibility for biodiversity threats** that are deeper in the supply chain.

Disconnected Impacts

Loss of biodiversity occurs at the **raw material stage**, but products pass through many different points before they reach brands. This makes it **difficult to link any environmental damage** to specific companies.

Data Fragmentation

Environmental data is often **incomplete or inconsistent due to self-reportedness**. This increases the risk of greenwashing and makes it difficult to enforce accountability over environmental sustainability.

Limited Leverage

Firms have little control over suppliers that are not the first tier in the chain. Especially when sourcing through traders or cooperatives, **companies have a reduced ability to enforce sustainability standards**.

Visibility Gaps

- Most firms can trace back to Tier 1 of the supply chain, but **visibility of firms drops dramatically at Tier 2 and further**. Only a small minority of companies have full multi-tier visibility of their supply chain.
- The raw material extraction stage of production like farms and mines **has the highest risk to biodiversity but is the least visible part** of the supply chain.
- Informal producers **often don't have the digital systems or incentives to share data**, creating blind spots in the chain. Inconsistent formats and records lead to **missing or unreliable data**.

Key Takeaway

The supply chain contains many points where visibility is difficult, making it hard to assign responsibility for environmental impact and therefore difficult to fix the environmental damages occurring.

Initiatives Addressing Biodiversity Loss



Several kinds of organizations form with the goal of convening many different players in the supply chain. This enables shared accountability and communication as well as sharing resources and standardizing data and impact.

Commodity Roundtables

- Roundtables like the Roundtable on Sustainable Palm Oil bring **together producers, traders, brands, banks and NGOs** (non-governmental organizations).
- These organizations **set shared sustainability standards and certify commodities as a group** (for example, the Roundtable on Sustainable Palm Oil certifies palm oil.)
- Governance of roundtables gives **equal representation across stakeholder groups** and enables consensus-based decisions, allowing several different parts of the supply chain a voice.

Public-Private Partnerships

- Partnerships **uniting companies and governments** can work to tackle issues of environmental threats.
- **The Cocoa & Forests Initiative (CFI)** partners the national governments of Ghana and Cote d'Ivoire with leading cocoa/chocolate companies to **end deforestation and restore forests** previously affected by cocoa production.
- The EU's Sustainable Cocoa Initiative uses multi-stakeholder based dialogue like "Cocoa Talks" to **align goals for policy, industry and sustainability**.

Industry Platforms

- The World Cocoa Foundation **convenes companies, farmers, NGOs and federal governments in a forum** for the creation of solutions on traceability, farms' income and deforestation occurring as a result of cocoa production.
- Platforms like these enable **sharing of tools, setting universally applicable standards and aligning data across the sector** where production occurs

Benefits of Collective Approaches

- Problems are **systematically ingrained and occur across borders**. Deforestation is driven by demand globally and by local farming practices, so fixing this issue **requires coordinating many countries and actors**.
- No single actor controls the full supply chain—**national governments, companies and farmers all control different aspects** and responsibility for climate effect cannot be fully assigned to one. **No one facet can solve biodiversity loss alone**.
- **Scale and impact of initiatives require coordination**. Collective action and co-investment are necessary to be able to scale solutions across entire landscapes.

Sourcing from Biodiverse Regions



Global companies source commodities from ecosystems rich in biodiversity, and sourcing from these areas may create risks to biodiversity, climate sustainability, legal compliance status, and sourcing sustainability.



Deforestation & Biodiversity Loss

Agricultural commodities like soy, palm oil, and cocoa are the **dominant drivers of global forest loss**. These are the main resources being harvested from these regions.



Climate & Yield Sustainability

Deforestation causes **damage to ecosystems that are essential to climate regulation**. Causing soil degradation and water insecurities, this damage threatens crop yield as well.



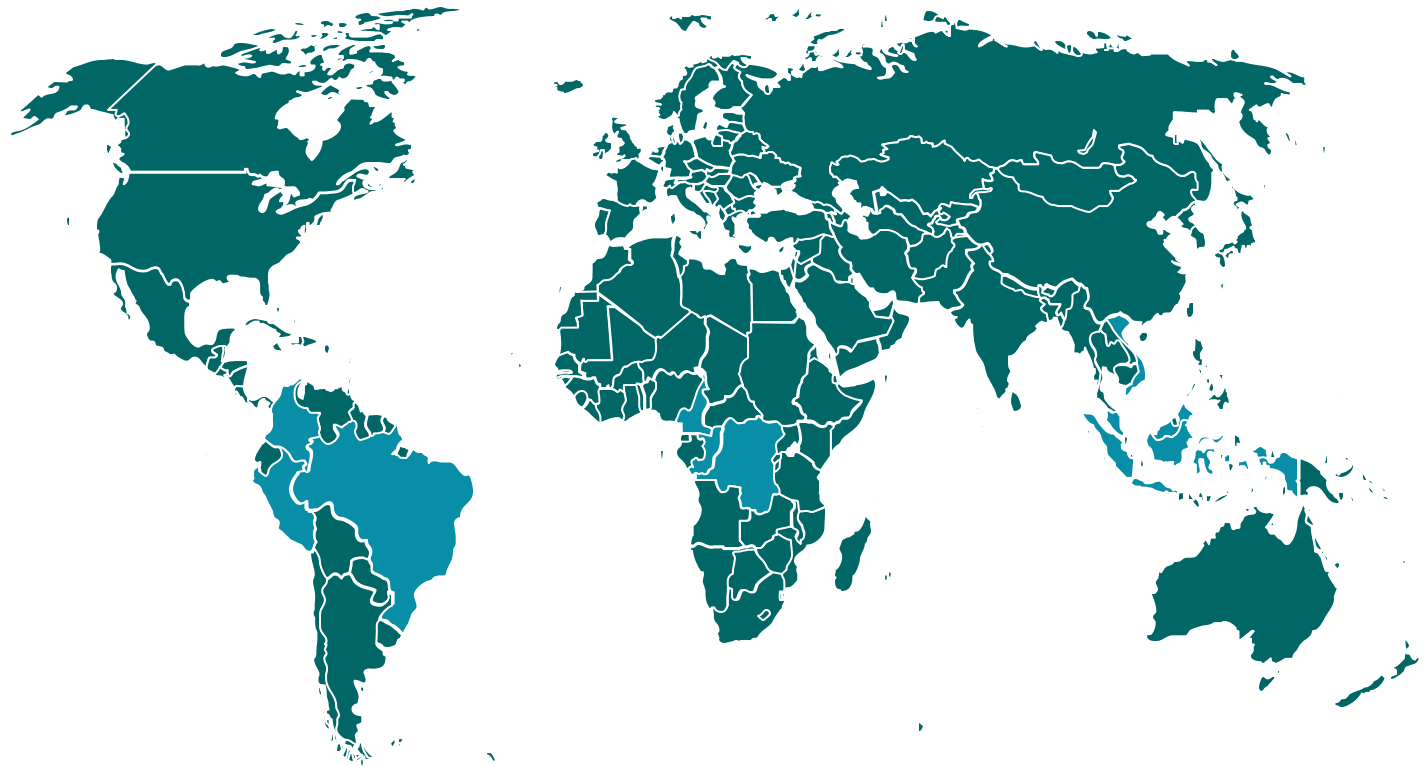
Regulatory & Compliance Pressure

Governments are beginning to introduce **supply chain laws** emphasizing a decrease of deforestation. This **increases compliance costs and legal risks** for companies.



Supply Chain Complexity

Supply chains for these commodities are extremely complicated and require difficulty with tracing. **Sourcing sustainability and risk are hard to assess**.



Major sourcing regions for agricultural commodities include the **Amazon, Southeast Asia, and the Congo Basin**. Significantly affected countries include Brazil, Peru, and Colombia in the Amazon; Indonesia, Malaysia, and Vietnam in Southeast Asia; and the Republic of the Congo, Democratic Republic of the Congo, and Cameroon in the Congo.

Biodiversity Loss from Key Commodities



While sourcing key resources from biodiversity hotspots drives habitat loss, climate change and other effects, these resources are important for production of goods and impact different industries and global companies significantly.

	Impact	Industries	Companies
Palm Oil	Palm oil is a dominant force of deforestation in Southeast Asia, especially Indonesia and Malaysia.	Palm oil is used in food, cosmetic products and household goods.	Unilever, Nestle, and Procter & Gamble rely on sourcing.
Soy	Soy production is a major driver of land conversion , causing vast areas to be cleared for agriculture.	Soy is used in meat and dairy production (animal feed).	Carill, Bunge, and ADM are dependent on soy production.
Beef	Beef production creates significant amounts of greenhouse gases, deforestation and pollution.	Food retail and leather for fashion and automobiles rely on cattle.	Companies using beef include Marfrig and JBS.
Cocoa	Cocoa is a significant cause of forest loss . It causes loss of valuable animal habitat and deforestation.	Cocoa is used mainly in retail of food and beverages.	Mars, Mondelez, and Barry Callebaut heavily use cocoa.
Timber	Logging and expansion of plantations causes loss of habitat and is unsustainable resource-wise.	Timber is important for construction, paper and packaging production.	Asia Pulp & Paper & IKEA depend on timber sourcing.
Minerals	Harvestation of minerals causes significant and intense pollution and habitat destruction.	Minerals are heavily utilized for electronics, batteries & vehicles.	Companies reliant on minerals include Tesla and Apple.

Production Effects of Ecosystem Degradation



The impacts caused by sourcing important commodities from biodiversity hotspots threaten production stability, rendering both the supply chain and costs volatile and creating reduced margins and environmental harms.

Production Stability Threats



- Degradation of soil **threatens fertility of soil and decreases yield of crops**. Output is lower and more volatile.
- Water stress **limits irrigation and generation of energy**, causing slowdowns in water-dependent sectors.
- **Habitat and biodiversity loss** significantly threaten ecosystem resources.

Supply Chain Volatility



- Environment **degradation increases the effect of physical disruptions** like droughts or floods, which hurts production.
- Resources become scarce, causing significant **supply shortages**. Prices become more volatile.
- Risks ripple through multi-tier supply chains, **amplifying effects**.

Cost Pressures



- The increase of resource scarcity **increases prices for raw materials and operations**.
- Disruptions such as environmental disasters or scarcities **will have greater effects**, rendering them more costly.
- **Commodities will be more volatile** due to supply and **margins will likely be reduced** by this volatility.

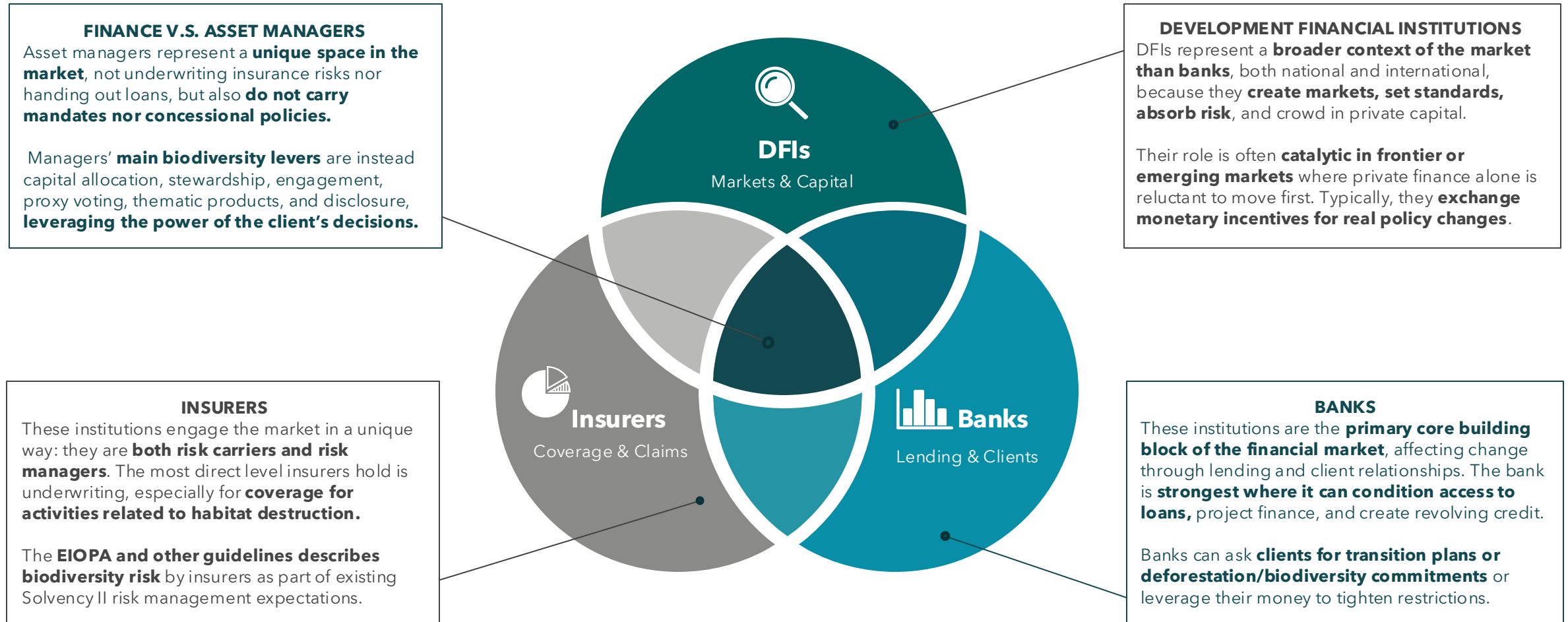
Key Takeaway

The risks and volatility caused by sourcing from biodiversity-rich areas are significant and have an amplified effect in multi-tier supply chains. Environmental harms and costly effects necessitate a change in sourcing strategy.

Financial Institutions and Biodiversity



Banks, insurers, and development finance institutions (DFIs) are engaging with biodiversity risks through lending, underwriting, and capital allocation for nature-positive projects while risk managers handle positive investments.



Chartered Banker, CPRAM, DNB, GABV, Impact Institute, TNFD, UNEPFI

Biodiversity Tied to Financial Instruments



The emergence of biodiversity-linked finance is represented by a stack in the market, with broad corporate financing on the top, followed by the application of biodiversity credits and habitat units, supported by blended finance options.

Financial Instruments

Biodiversity Loans/Lending

- The **broadest of the three categories**, sustainability-linked loans (SLLs) do not require proceeds to be spent on a specific green project, **fitting into general corporate financing** that occurs.
- For instance, E.SUN Bank's Taiwan transaction with Yulon Motor was a **\$1B NTD SLL that included biodiversity KPIs** tied to restoring Taiwan native tree species, alongside other climate KPIs.

Biodiversity Credits/Units

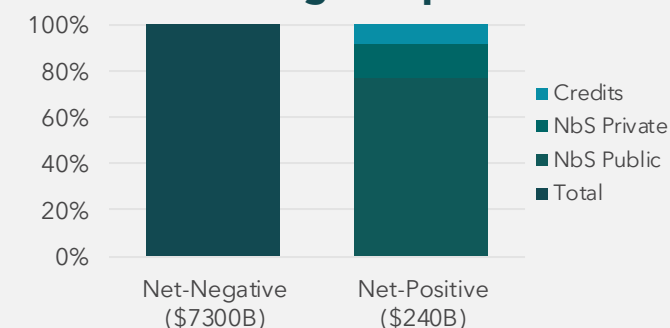
- A credit as a **tradable unit representing a positive biodiversity outcome** from a nature-based project, based on scientific metrics, and crucially **not used to offset an equivalent** negative biodiversity impact elsewhere.
- For example, **44% of respondents said their biodiversity credits were bundled** or stapled with carbon credits

Blended Finances

- This matters most when the **economics of biodiversity are real but not yet "bankable," combining three layers**: concessional capital/grants, technical assistance, and commercial capital.
- For instance, the Global Fund for Coral Reefs (GFCR) said it had **expanded from 12 to 19 coral nations and mobilized more than \$35 million** for conservation action.

Takeaways

Financing Comparisons



- Even within nature-positive finance, most capital is still public and traditional, while the “innovative biodiversity finance” mechanisms are barely visible in total capital terms.
- Against the total net-negative nature financing, positive financing makes up a significantly less amount than its counterpart.

Business Wire, CBD, GFCR (I), GLF, IFC, Pollination, TNFD, UNDP, UNEP, UNEPFI (I), UNEPFI (II), World Bank

Biodiversity Protection Incentives: FrieslandCampina Case



Financial markets are beginning to seriously incentivize biodiversity protections, but not at the rate to drive tangible ecological change at scale, with most instruments small, unevenly measured, and better at signaling strategic intent.

Royal FrieslandCampina N.V.

- The company is a multinational dairy cooperative which is **based in Amersfoort, Netherlands**.
- As one of the **world's largest dairy co-operatives** and one of the top 5 dairy companies in the world, FrieslandCampina has an **annual revenue of over €13B**.
- Their biodiversity performance is **tied to company payments, milk pricing, and bank lending** terms.

Key Takeaway

Financial markets are incentivizing biodiversity protection at the margin, but they are not yet doing so with enough scale, consistency, or ecological verification.

At the market level, the incentives are real but still weak relative to the size of nature-negative finance, and we are in transition from symbolic finance to conditional incentive finance.

BROADER FINANCIAL MARKETS

Financial markets are **starting to incentivize biodiversity** protection, but not yet strongly enough to say they are reliably driving real ecological change at scale. Finance directly **harmful to nature reached \$7.3T**, while investment in **nature-based solutions was only \$220B**, a gap of more than 30 to 1.

FRIESLANDCAMPINA

FrieslandCampina, Rabobank, and WWF Netherlands **helped develop the Biodiversity Monitor for Dairy Farming**, and the monitor was designed explicitly to create “new revenue models.” Farms that **perform better on biodiversity can get lower interest rates and more favorable commercial** terms.

BIODIVERSITY MONITOR

This is a **results-based methodology built around seven KPIs**, including permanent grassland, protein from own farm/region, soil nitrogen surplus, and more. **Rabobank pilots it through loan interest discounts**; and the monitor was designed so that multiple **stakeholders can “stack” rewards** on the same KPI set.

- The **largest biodiversity impacts** in the Dutch dairy system **came from imported feed**, and the authors warn that relying on a single composite biodiversity index can **create exclusionary focus and perverse outcomes**.
- If the sector met proposed safeguards, **biodiversity impacts could be cut by around 94%**, but doing so could also imply difficult trade-offs, including a **possible ~26% drop in dairy production** in one modeled pathway absent efficiency gains.

Environmental Damage as a Financial Risk



In an increasingly disaster-prone world due to the acceleration of climate change, investors are carefully evaluating these new biodiversity and pollution-related metrics to review investment decisions and the risk of corporate dependencies.

5-10%

A small number of companies have **implemented formal biodiversity strategies** or assessed their dependencies on resources.

23%

Less than a quarter of the world's largest companies have **disclosed their biodiversity-related risks**.

70%

A large sum of large corporations have **not fully assessed the impact of their supply chains on biodiversity** and the environment.

Specialized Frameworks

Specialized frameworks are used to **translate biodiversity loss into a financial risk** and to help investors rethink investment decisions. Organizations such as TNFD, the 2015 Financial Stability Board Initiative, and EU **encourage companies to report and act** on their nature-related **dependencies, impacts, risks, and opportunities**.

Risk Assessment Devices

Different tools are **used by investors to map the risk that different corporations pose on natural resources** impacted by climate change and how they themselves are affected. **Initiatives such as ENCORE, sponsored by the NCFA and the Corporate Biodiversity Footprint (CBF)** by the Iceberg Data Lab drive investor decisions.

Supply Chain Impact Analysis

This important method **analyzes the biodiversity dependence of corporations**, especially on ecosystem services, and **evaluating their risk of collapse**. For instance, **57% of the world's largest companies** that make up S&P Global 1200 have a **significant nature dependency risk** that can interrupt global business operations.

Other Evaluation Strategies

Considerations such as the **monitoring of litigations and regulations on environmental policy across the world** are important, as companies failing to adhere face fines and lawsuits. Risk also leads to **greater investor demand into premiums from firms with high biodiversity impacts** from industries prone to damage.

Key Takeaway

Biodiversity and the chances of supply chain disruptions across the world are quickly becoming an important factor to investors. Corporations should focus on transparency and comprehensive reports on their impacts.

[European Commission](#), [Iceberg Data Lab](#), [S&P Global](#), [TCFD](#), [TNFD Global](#), [UNEP](#), [WRI](#)

Frameworks for Biodiversity-Related Risks



Several emerging or existing frameworks act as global guardrails meant to steer corporations towards disclosing/acting upon biodiversity-related risks, including helping shape corporate sustainability reporting on dependencies and risks.

TCFD Framework

- The Task Force on Climate-related Financial Disclosures (TCFD) uses a **voluntary, science-based, and scenario-driven framework**.
- **Various UN branches** such as the UNDP, UNEP FI, WWF, and Global Canopy are the **founding sponsors of the project**.
- TCFD uses the **LEAP Approach (locate, evaluate, assess, and prepare)** to guide organizations.
- Their disclosure recommendations encourage businesses to report and act on their **nature-related dependencies, impacts, risks and opportunities**.
- The task force helped investor decisions but **disbanded in 2023 after integrating into the IFRS Sustainability Standards**.

SBTN Framework

- The Science-Based Targets Network (SBTN) provide a **credible and prescriptive approach**.
- Their methods are **grounded in the best available science** to support human needs and stay within Earth's limits.
- The SBTN Framework sets up a **5-step approach to guide companies** and cities to form a **net-zero, nature-positive future**.
- Their steps include (1) assessing pressures, (2) prioritizing components, (3) measuring and setting targets, (4) acting, and (5) reporting progress.
- They also encourage the setting of specific targets to **address natural pressure points** using the **Mitigation Hierarchy (avoid, reduce, regenerate, and restore)**.

CDP Framework

- The Carbon Disclosure Project (CDP) is a **global environmental reporting system used by over 23,000 companies, cities, and regions**.
- Scores organizations from **A to F** to **monitor their progress**, benchmark against their peers, and **drive investor decisions**.
- CDP has **integrated climate, water, and forest questionnaires** focusing on transparency and accountability.
- Their guidelines focuses on nature-related **dependencies, impacts, risks, and opportunities (DIROs)**.
- From 2025, **nature-related questions become mandatory**, especially for high-impact sectors like food or chemicals.

[CDP \(I\)](#), [CDP \(II\)](#), [CDP \(III\)](#), [SBTN \(I\)](#), [SBTN \(II\)](#), [UNDP](#)

Corporate Environmental Regulations



With the urgency of the climate change question increasing year over year, governments on both the global and regional/national scale have put into place new frameworks, policies, and legal requirements for corporations.

Two-Level Policy Action

Global

- Global environmental **laws and agencies have increased 38x**, with **1100+ multilateral environmental agreements (MEAs)**.
- Several **multi-party state agreements** such as the **Paris Climate Accords, Montreal and Kyoto Protocols, etc.** have been created to address the issue of **climate change and biodiversity loss**.

Regional and State

- The United States and European Union **lead in terms of the scale of environmental regulations** in their regions/states.
- Actions such as the **U.S. Clean Air Act have saved over 17M lost workdays** for consumers, businesses, and the government.
- The EU Green Rules **cost businesses roughly €1B** annually.

Environmental Governance Policies

Kunming-Montreal Global Biodiversity Framework (GBF)

- The organization's new **"Target 15" goal encourages legal or policy actions** to force corporations to **disclose environmental risks**.
- Guidelines are meant to produce means for **sustainable consumer consumption patterns** and **reducing supply chain impacts**.

COP29 Finance Goal

- At the latest UN Climate Change Conference in 2024, governments agreed to a **new financial target of \$300B annually for climate efforts**.
- These new funds are meant to have **developed countries contribute more significantly** to developing countries for **green development**.

EU Nature Restoration Law

- The law **mandates legally binding targets** to restore 20% of EU land and sea areas by 2030 and **all degraded ecosystems by 2050**.
- **Due diligence statements are required** by deforestation regulations in the EU (EUDR) for **products such as coffee, cocoa, timber, fruits, etc.**

U.S. Endangered Species Act (ESA)

- The U.S. Department of the Interior **proposed new negative changes to the ESA that alters the "blanket rule"** for threatened species.
- Critics argue that the orders **weaken species protections** and biodiversity, but the process is said to **strengthen economic impacts**.

Quantifying Corporate Biodiversity Risks

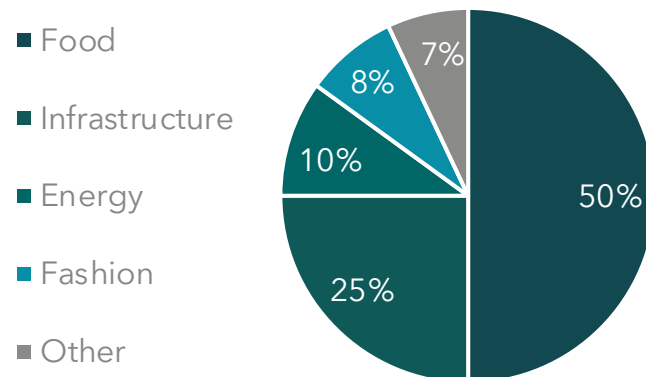


Biodiversity measurement is transitioning from fragmented, piecemeal ESG disclosure to a standardized, data-driven risk quantification powered by large-scale measurements, but still lacks full supply chain coverage and financial integration.

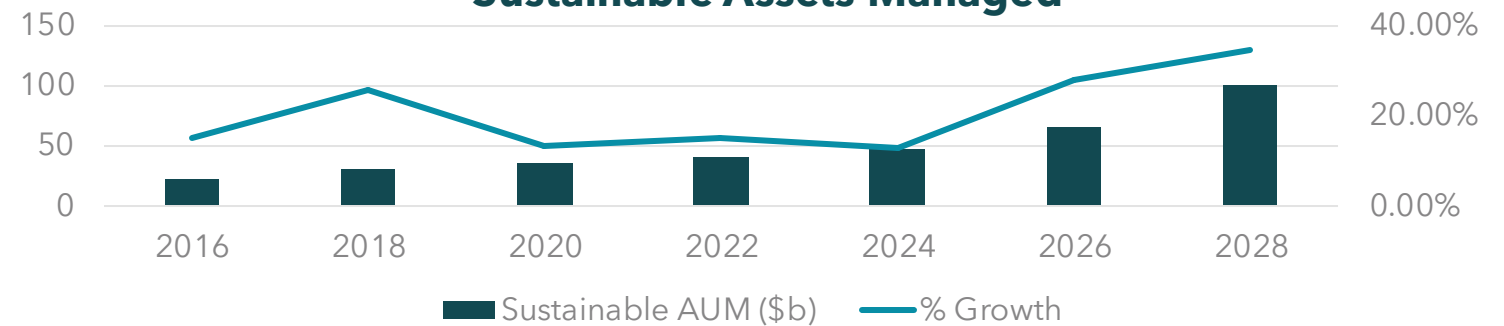
Biodiversity Measurement

- Companies have increasingly come under biodiversity scrutiny, with over **21k analyzed in 2025**, comprising around **2.8m mapped physical assets** across academic datasets.
- Over **235 metrics** track corporate biodiversity risk, reflecting **rapid standardization and uptake**.
- Green-economy initiatives have **projected value of >10.3T by 2050**, driven by shifting consumer demand, regulatory pressure, and innovation.

Corporate Biodiversity Risk



Sustainable Assets Managed



Late 1980s

Now

Metric Development

- "Biodiversity" as a term** was developed, with **no consensus definition in business**.
- Harms are ill-defined**, ill-regulated, and pollution runs rampant.

- Over **235 metrics** track every aspect of business-related biodiversity risk.
- LPI measures **state-caused biodiversity risk** across multiple domains and trade inputs.

Data Collection

- Ad-hoc, localized surveys** form the backbone of biodiversity knowledge.
- Data is **siloes across proprietary or private records**, preventing sector analysis.

- Data-collection advances** like satellite imaging augment around **36% of datasets**.
- 86% of companies disclose ESG data**, facilitating industry-specific meta-analyses.

Consumer Base

- Environmental awareness limited to over **10% of consumers globally**.
- "Sustainability branding" as a concept emerges** from environmental movements.

- 78% of consumers** rank sustainability as a top product priority, despite higher costs.
- "Sustainable" products **grew at about 8% faster rates** than non-sustainable ones.

Corporate Biodiversity Risk Tracking



Biodiversity risk tracking is a rapidly emerging, supply-chain-wide strategy for corporate risk management; though large strides have been made in transparency and data quality, industry-wide gaps in adoption remain.

Overview

Corporate biodiversity tracking spans **all aspects of the supply chain**, from supplier contract to product delivery. Third-party pressure has **induced over 99% of companies to release ESG reporting standards**.

Satellite Monitoring

Satellites enable real-time tracking by companies and non-profits at less than **20-meter resolution globally**, enabling **open-source transparency** over biodiversity risks.

Integrated Risk Platforms

Combining **broad satellite data** and **supplier-specific audits**, platforms screen over **\$22t of assets over 730 companies** for integrated biodiversity risk calculation.

Barriers to Implementation

Corporate biodiversity risk transparency has **immense upfront costs**, with over **36% of companies** lacking biodiversity risk tracking at operational scale, leaving a **critical gap in sustainability initiatives** and biodiversity tracking.



Architectural Traceability

Traceability is considered when creating the supply chain, with **60% of companies integrating digital traceability** during supplier contracting. These tools now track over **10,000 suppliers across 5 tiers globally**.



Supplier Audits

Supplier audits increase purchase transparency, empirically **improving risk detection by over 50%**. However, around **75% of companies** are ill-equipped to do so.



Actionable Outcomes

Companies **divest from harmful suppliers** in high-impact industries, like palm oil, which comprises **60% of tropical deforestation**. Traceability throughout the supply chain **decreases company liability**.

Operationalizing Biodiversity Conservation



Biodiversity conservation can be integrated into company operations at three levels of complexity: upstream, in supplier sourcing and investment; directly, in company-specific operations; and strategically, in companies' future orientation.

Upstream Integration

Sustainable sourcing, supplier traceability audits

- Companies **control supplier-network impacts in heavy-impact industries** like agriculture, forestry, or fisheries.
- **>57.5% of companies** have a **100% deforestation-free supply chain**, after divesting from high-impact forestry.
 - **>33% of market capitalization discloses** company information regarding impacts on nature.
 - Key industry players:
 - Nestlé, after public pressure, sources **~50% of its resources** sustainably, **up from 22% in 2022**, representing **87% of the market for these resources**, like eggs and cacao.
 - Ikea has committed **>100b EUR into carbon capture and reforestation** efforts.

Direct Integration

Land-use analysis, operational footprint management

- Companies directly reduce biodiversity impact by **changing how they themselves use land and resources**.
- Corporate land-use contributes to **>10% of global emissions annually**.
 - Commodity supply-chains' **land usage practices** have historically contributed to **>33% of global biodiversity loss**.
 - Key industry players:
 - Danone cut direct emissions from company-owned structures and vehicles by **~95% under their Re-Fuel program**, on track for **100% by 2030**.
 - Nike **diverts 100% of its waste from landfills** with robust recycling programs, preventing biodiversity pollution.

Strategic Integration

ESG architectures, risk-disclosure frameworks

- Companies **integrate sustainability into their strategic operations** through reporting frameworks, like the GRI or SASB.
- Frameworks **recommend sustainability-aligned market movements**, like **M&A with sustainable startup ventures**.
 - **Over 500 companies** have explicitly signed onto **TNFD-aligned biodiversity reporting frameworks**.
 - Key industry players:
 - Microsoft has committed to **carbon-negativity, water-positivity, and zero-waste by 2030**, under their **\$1b Climate Mitigation Fund**, with sustainability reports increasing reporting transparency.

Biodiversity Transparency Models



Transparency models for tracking corporate biodiversity risk range across legacy supply-chain-wide audits to using distributed-ledger blockchain technology to make all business transactions and contract acquisitions immutable.

Model	Mechanism	Impact	Scalability	Financial Cost	Key Limitations
Predictive Modelling	AI prediction algorithms extrapolate biodiversity risks from GPS/company data .	High Predictive algorithms have over 90% accuracy in ecosystem degradation detection with public data.	High Models retain extrapolative accuracy even with sparse datasets, with 100% GPS coverage.	Low GPS/company data is collected now, with AI training being a one-time investment.	AI is inherently extrapolative , with significant risk of overfitting or potential false positives .
Multi-Tier Mapping	Companies track Tier 2 and 3+ suppliers , tracing pollution across indirect suppliers .	High Scope 3 emissions account for about 90% of a corporation's emissions; mapping tracks these.	Medium Only 16% of organizations track beyond Tier 1, with exponential supplier count beyond Tier 1.	Medium Implementation costs around \$500k for supply-chain wide tracking, often with sprawling contracts.	Data collection is often semi-manual , with supplier data gaps or double-counting in over 60% of datasets .
Digital Accounting	Using widely used reporting software like Plana or Watershed to account emissions.	Medium Software is specialized toward specific metrics, often at the expense of less visible benchmarks.	High Once these accounting tools have been established, they export with few modifications.	Low Software exists already at the industry-level, with low barriers to integration once acquired.	Tracking software may inflate or double-count data , leading to inconsistent or misleading results .
Blockchain	Corporate transactions are recorded transparently on an immutable ledger .	Medium Though commodities are made hyper-traceable, non-traded commodities (land-use) are invisible.	Low Requires enterprise-level reorientation and large-scale data requirements for effective tracking.	High Implementation may cost over \$5M from the ground up, with high energy requirements.	Blockchains store all previous transactions , requiring enormous data-storage requirements .

Key Takeaway

Among approaches to increase corporate transparency regarding biodiversity impacts, bureaucratic hurdles of info-gathering remain the largest barrier to adoption and scale. Predictive approaches and digital accounting, using pre-defined information, remain the most robust at scale.

[Afflink](#), [aRxiv](#), [BCG](#), [BerkeleyHaas](#), [CapGemini](#), [CDP](#), [Deloitte](#), [Infor](#), [IntegrityNext](#), [Journal of Cloud Computing](#), [MIT](#), [Nature](#), [Normative](#), [NTC](#), [Plana](#), [ScienceDirect](#), [Watershed](#)

Scales of Corporate Biodiversity Cooperation



Corporate biodiversity cooperation augments the business's tolerance for biodiversity risk by mitigating environmental harms at various levels of granularity; as initiatives become more local, impact increases while feasibility decreases.

Biodiversity Cooperation

- Biodiversity-oriented corporate cooperation typically spans **a decade of transformation**, with **pilot projects, supply-chain tests, and operational scaling** fundamentally transforming the value chain.
- Cooperation is increasingly standardized, with **over 78% of Fortune 500 companies** having set an emissions standard with standards organizations.
- Governments across the world have taken the lead, **incentivizing business action through initiatives** like the EU's CSRD or CSDDD*.

*CSRD: Corporate Sustainability Reporting Directive; CSDDD: Corporate Sustainability Due Diligence Directive

Key Takeaway

Corporate biodiversity cooperation operates along four scales of operation, with impact inversely related to feasibility as initiatives become more localized.

Case Study: Unilever

- The palm oil industry is notoriously dirty, alone accounting for **5% of global deforestation**.
- In 2016, Unilever began supporting and organizing **government-backed initiatives in Malaysia and Indonesia** against dirty palm oil.
- These were supported by **NGOs like Conservation International**, small-scale **community share-holders**, and **GPS/AI monitoring**.
- The initiative has achieved a **97.5% deforestation-free** supply chain **over 400+ brands** and **20M hectares**.

1. Local Community Integration

Companies partner with **local communities and primary land managers**, training and subsidizing smallholders to implement **more sustainable practices** like regenerative agriculture, reaping **30% yield increases**.

Case studies: Palm oil, rainforest reforestation

2. Public-Private Governance

Through **quasi-regulatory agreements or explicit partnerships**, companies integrate sustainability directly into policy, **negotiating sector-wide, rather than commodity-wide** best practices.

Case studies: Multi-commodity rules (soy, cocoa, beef), deforestation

3. Shared Data/Monitoring

By partnering with **monitoring organizations like the IUCN**, companies decrease information asymmetries using **GPS to gather data** and AI to parse land-use changes, which represent **over 50% of Scope 3 emissions**.

Case studies: Clean energy, Peruvian forest governance

4. Financial/Policy Alignment

Companies **divest their portfolio from high-pollution industries** and suppliers, focusing policy towards **concrete, actionable sustainability goals**, with **\$429B in credit** allocated for reforestation.

Case studies: Carbon markets, biodiversity risk portfolios

Limits to Corporate Biodiversity Coordination



Although existing corporate efforts to protect biodiversity have been measurably successful, future efforts at the scale necessary for global transformation remain hindered by failures of coordination, enforcement, and incentives.

Biodiversity Efforts

- Overall effectiveness of corporate biodiversity efforts are **measurable but limited**.
- Efforts like the EUDR alone **reduce global emissions by around 0.19%**.
- However, **only around 7% of companies** have even 1 deforestation-free supply chain, with **about 33% having no commitments towards biodiversity** at all.

Coordination Failure

- Representing a **tragedy of common-sense morality, even one defection** from corporate biodiversity efforts causes **initiative-wide pull-out** due to lack of trust.
- **Leakage effects and offshoring** complicate tracking and **decrease public faith** in company commitments.
- Solution: Strictly enforced **jurisdictional guidelines** and **industry-level internal standards** over biodiversity.

Enforcement Failure

- Biodiversity laws often have **soft accountability mechanisms** that often cannot resist company short-termism.
- **Over 63% of companies** have weak pledges, with **stretching loopholes in conduct**.
- **Standards vary widely** across reporting mechanisms, with **inconsistent data formats**.
- Solution: **Mandatory disclosure frameworks** akin to CSDDD, with **independent monitoring and verification**.

Incentives Failure

- Economic systems **reward exploiting the environment**, with regulation **lagging behind the profit motive**.
- Though biodiversity offsets cover **150,000 square kilometers** globally, **most projects are fragmented (<1 km²)** due to **lack of consistent profitability**.
- Solution: **Redirect capital flows** through biodiversity markets to **subsidize environmental protection**.

Key Takeaway

Though efforts like the EUDR have been quantifiably successful, failures in coordination, enforcement, and incentives have limited effective response.