Nature

Sustainability's Next Frontier

Citi GPS: Global Perspectives & Solutions

November 2024

Ying Qin
Global Thematic Analyst
Citi Global Insights

ying.qin@citi.com

Devon Stone
Citi Global Data Insights

devon.stone@citi.com

Savina Chahal
Citi Business Advisory Services

savina.chahal@citi.com

Andrea Fleming
Citi Global Insights

andrea.fleming@citi.com

Andreas Theodoulou
Citi Global Data Insights

andreas.theodoulou@citi.com

Elizabeth Curmi
Head of Climate Finance & Energy Transition
Citi Global Insights

elizabeth.curmi@citi.com

Jason Channell
Head of Sustainable Finance
Citi Global Insights

jason.channell@citi.com

Contributors

Bridget Fawcett
Managing director and Head, Sustainability & Corporate Transitions
Citi Investment Banking

Dr Genevieve Patenaude
CEO
Earth Blox

Alex Logan
Co-Founder & CEO
Cecil Earth

NATURE

Sustainability's Next Frontier

We often talk about saving the planet, but the truth is that we must do these things to save ourselves" – Sir David Attenborough

Nature's health is in decline, leaving our planet facing a twin climate and nature crisis.

The contribution of business and finance to nature loss and their role in addressing it are increasingly coming into focus. These issues took center stage at the recent International Biodiversity Conference (COP16) in Cali, Colombia.

In 2021, we published a Citi GPS report on Biodiversity which made the case for why businesses and investors should care about biodiversity loss.

Since then, we've seen the development of a global ecosystem in support of a nature positive future from global policy frameworks and treaties such as the Global Biodiversity Framework, UN High Seas treaty to reporting and disclosure initiatives, and frameworks for target setting.

Investor pressure and initiatives are also growing, and last year the Network for Greening the Financial System (NGFS) launched a framework to help central banks and supervisors act on nature-related financial risks.

Over the past few years, corporate awareness of nature-related risks has grown, and companies are upskilling and starting to assess their impact and dependencies across a range of nature issues.

However, progress still trails that made on climate. According to a study by McKinsey only 25% of the Fortune Global 500 companies have freshwater consumption targets and just 5% have targets for biodiversity loss, compared to 83% that have climate targets.[1]

Nature loss is more complex than climate change. It is location-specific and there's no one common metric to measure progress such as CO2eq for climate. Businesses will be expected to move on several nature-related issues, including deforestation, freshwater use, pollution, ocean health decline and biodiversity loss. However, they are often considered and addressed in siloes, or consigned to the back burner as climate takes full focus.

Scientists have been telling us for years that nature loss and climate change are intrinsically interlinked, and neither can be successfully resolved in isolation. Nature is vital for climate mitigation and adaptation, and climate action is essential for addressing nature loss.

A focus on the energy transition will only solve part of the environmental challenge we face, effective transition to net zero requires a broadening of the focus beyond carbon to encompass and embrace nature.

[1] https://www.mckinsey.com/capabilities/sustainability/our-insights/where-the-worlds-largest-companies-stand-on-nature

The Taskforce on Nature-related Financial Disclosures (TNFD) stresses that both climate change and nature loss are strategic risk management issues, and an integrated approach is needed by business and finance. Opportunities exist for corporates to adopt a more holistic approach to managing nature and climate risks and opportunities.

We recognize this is no easy endeavor, and nature data poses a significant challenge for the business and finance community in terms of managing risks and reporting.

This is why the sustainable finance team in Citi Global Insights have partnered with Citi Global Data Insights on this report. We'll make the case for why businesses should consider a more holistic approach to managing nature and climate risks. And we'll demonstrate that data and resources, data partners and innovative technology exists for businesses to make meaningful progress in measuring their nature impacts and risks.

The report starts by a short introduction on the current state of nature health and why it matters for business, before diving into our main analysis which assesses:

1. how industries impact and depend on nature across all realms (land, freshwater, oceans, atmosphere) and their revenue exposure

2. potential hotspots of conflict between industrial activities and ecologically sensitive areas.

Chapter 2 examines the evolving landscapes of nature regulation and initiatives, nature data and finance solutions and includes expert voices from within and outside Citi. The report concludes with a chapter on the shifting landscape towards more integrated environmental management and best practice for corporates.

Our proprietary analyses found that –

- $15 trillion of business revenue (spanning 7 industries) has potentially high direct negative impacts across all nature realms – land, freshwater, oceans and atmosphere.

- High priority sectors identified by the TNFD have at least 15% of industrial facilities in areas with high/extremely high water stress, and at least 10% are in areas with or close to threatened species.

Our approach has its limitations, but a holistic analysis of nature impacts, dependencies and location assessment at the sector level allows us to demonstrate and provide insights into *why* corporates and investors should act and *how* they can start to assess nature impacts and dependencies.

We also demonstrate that nature-related risks and financial impacts are increasing for individual companies. And even though the current snapshot of corporate action pales in comparison to climate, we show that the direction of travel is encouraging.

Increasing number of companies are setting nature-related goals and targets across a variety of issues, and corporates are upskilling and employing more climate and biodiversity personnel.

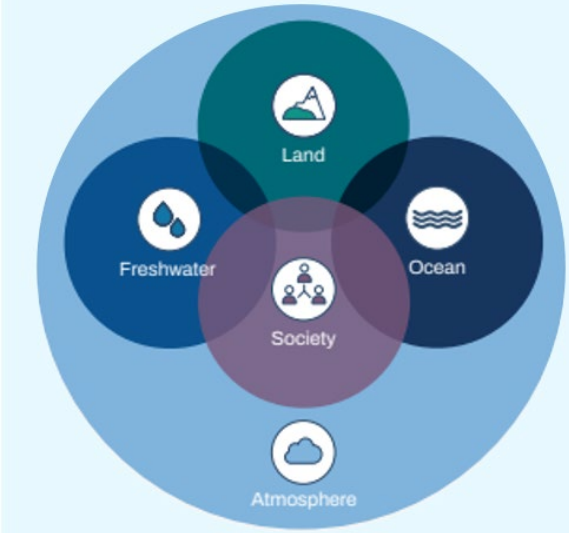
Nature is the next sustainability frontier for business and finance.

Nature and Biodiversity are often used interchangeably but they are not the same.

Nature is a broader term and considers "all non-human living entities and their interaction with other living or non-living physical entities and processes". Nature can be viewed through the concept of realms – land, freshwater, ocean and atmosphere.

The TNFD adopts the following framework which recognizes 1) the close relationship of climate and nature by the inclusion of atmosphere and 2) society (people, corporates, financial institutions) sits at the centre and interacts with and across all realms.

Figure 1. Four realms of Nature - Land, Freshwater, Ocean and Atmosphere



Source: TNFD

Biodiversity is the living component of Nature and refers to the diversity of life. The seminal Dasgupta Review on the Economics of Biodiversity equates biodiversity to a financial portfolio, and the economics of it to portfolio management – just as diversity within a portfolio of financial assets reduces risk and uncertainty, so does diversity within a portfolio of natural assets which enables nature to be productive and resilient. Biodiversity is an essential characteristic and often considered a vital indicator of nature health.

Natural capital is also a term that is often used and refers to the "The stock of renewable and non-renewable natural resources (e.g. plants, animals, air, water, soils, minerals) that combine to yield a flow of benefits to people"[2] These flows of benefits are called **ecosystem services**, and can be largely grouped into three categories:

- Regulating and maintenance services i.e. pollination and climate regulation.

- Provisioning services i.e. crops and water.

- Cultural services i.e. recreation and education. Studies have conservatively estimated the economic value of ecosystem services to be between $125 – 140 trillion per year.

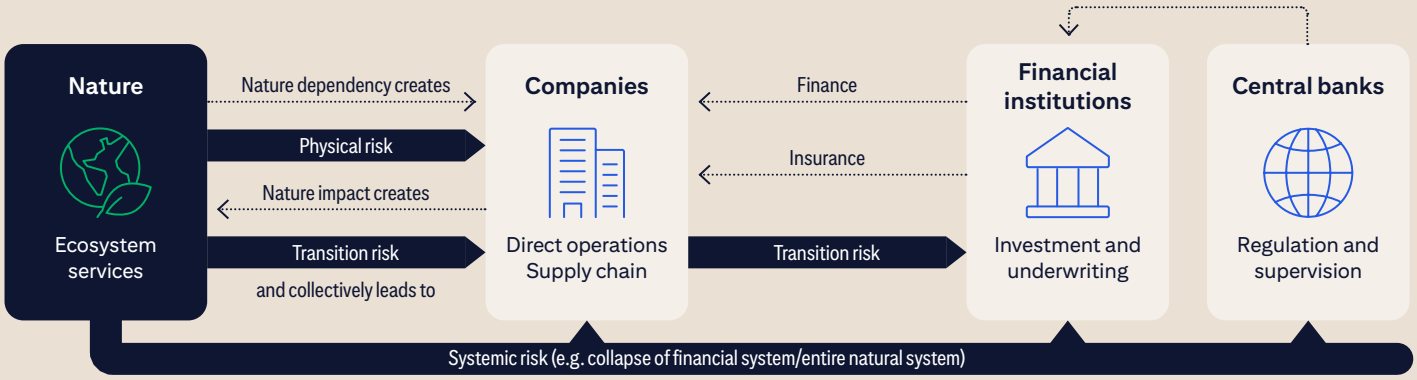
Nature positive is a global societal goal which can be defined as "Halt and reverse nature loss by 2030 on a 2020 baseline and achieve full recovery by 2050".[3]

[2] Capital Coalitions (2016) Natural Capital Protocol
[3] https://www.naturepositive.org/what-is-nature-positive/

Nature: Sustainability's Next Frontier

Nature in crisis – why does it matter for business?

Companies face growing pressure to comply with regulations and manage nature-related risks, but action still lags behind that for climate. All industries are exposed to nature risks in their direct operations or supply chains.



Examples of physical risks

- Short-term events e.g. wildfires, oil spills, drought
- Long-term incremental changes e.g. climate change, ocean acidification

Examples of transition risks

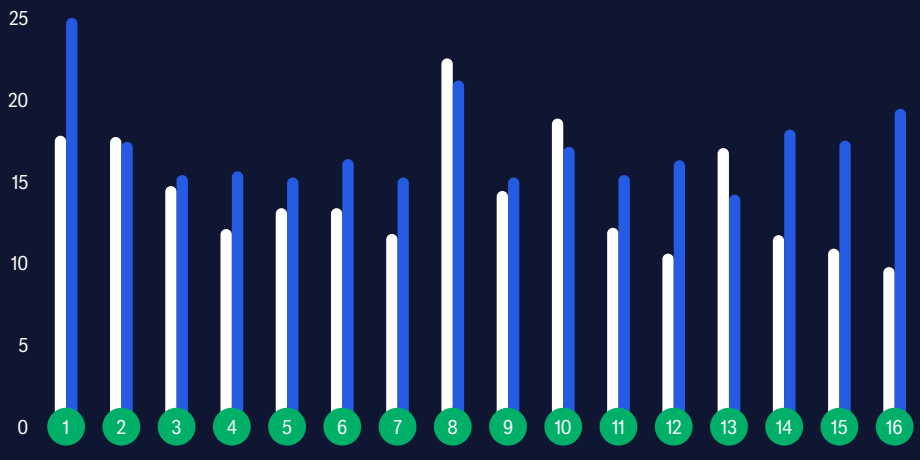
- Regulatory risks
- Liability risks
- Market risks
- Reputational risks
- Technology risks

Source: Citi Global Insights, BNEF

Location matters

We find that priority sectors identified by the TNFD have at least 15% of industrial facilities in areas with high/extremely high water stress, and at least 10% are in areas with or close to threatened species.

Percentage of high impact industrial facilities in nature sensitive areas



1. Coal Mining
2. Construction – General Contractors & Operative Builders
3. Electric, Gas and Sanitary Services
4. Fabricated Metal Products
5. Heamy Construction, Except Building Construction, Contractor
6. Industrial and Commercial Machinery and Computer Equipment
7. Lumber and Wood Products, Except Furniture
8. Metal Mining
9. Mining and Quarrying of Nonmetallic Minerals, Except Fuels
10. Oil and Gas Extraction
11. Paper and Allied Products
12. Petroleum Refining and Related Industries
13. Pipelines, Except Natural Gas
14. Primary Metal Industries
15. Rubber and Miscellaneous Plastic Products
16. Textile Mill Products

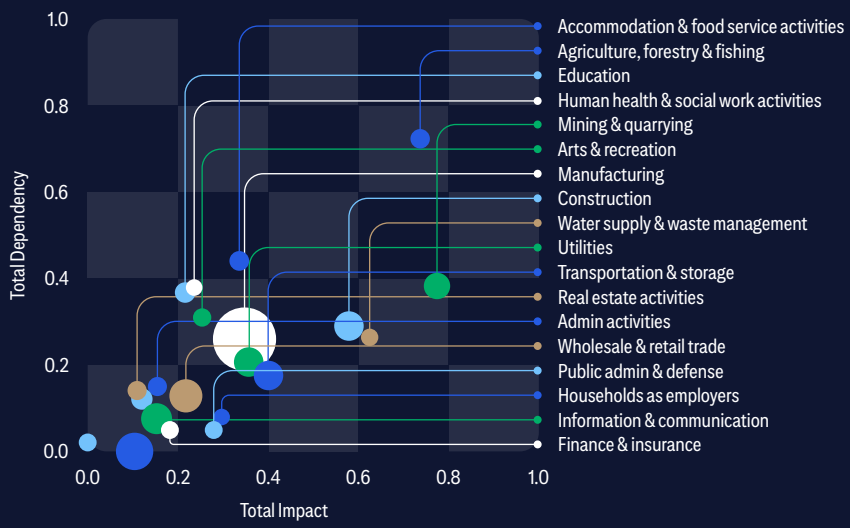
Source: Citi Global Insights, Dun & Bradsheet, WRI

A holistic view to nature impacts and dependencies

Taking a holistic approach rather than "stacking" climate and nature issues allows identification of synergies and trade-offs to managing environmental risks.

We find that $15 trillion of business revenue (spanning 7 industries) has potentially high direct impacts on nature across all realms - land, freshwater, oceans and atmosphere.

Dependency, impact and revenue by industry



Examples of nature dependencies

- Storm & flood mitigation
- Climate regulation
- Pollination
- Soil erosion control
- Water supply & quality
- Biomass provisioning
- Education, scientific & research services

Examples of nature impacts

- Resource extraction i.e. freshwater use, timber, wild-caught fish
- Ecosystem use i.e. agriculture, aquaculture mining, GHG emissions
- Pollution i.e. nutrient, toxic, solid waste and non-GHG pollutants
- Introduction of invasive alien species

Source: Citi Global Insights, ENCORE, FactSet, S&P (size of each sector's bubble represents its total revenue)

Move towards integrated climate and nature management

Navigating nature frameworks and standards can be a complex endeavour, but the data and resources exist for businesses to make meaningful progress on establishing a nature baseline and strategy. Leading companies are starting to take integrated action on climate and nature.

Key steps

Source: Citi Global Insights, WBCSD

1. **Develop a nature baseline**
   Use and engage in the evolving nature frameworks, initiatives and data ecosystems, and collaborate with the science/NGO community

2. **Consider an integrated climate and nature strategy**
   Action areas that can deliver co-benefits across nature and climate i.e. deforestation-free supply chains, water stewardship, circular economy solutions to address waste and pollution, nature-based solutions

3. **Leverage finance solutions to support sustainability goals**
   Consider sustainable finance solutions such as sustainable debt, sustainable supply chain finance, nature-based carbon credits, payment for ecosystem services

Profile of a leading company on nature

- A regenerative mindset and purpose
- Considers all material impacts and dependencies across all realms in direct operations and supply chains
- Has a fully integrated strategy and goals for nature, climate and equity

Contents

Chapter 1 – Why does nature matter for corporates?

What is the current state of nature?

"Our imprint is now truly global. Our impact is now truly profound. Our blind assault on the planet has finally come to alter the very fundamentals of the living world" -

These powerful words from Sir David Attenborough in the 2020 documentary A Life On Our Planet, starkly sums up the state of the world.

Human activities are driving the destruction, degradation and depletion of the natural world. The evidence is truly sobering.

Wildlife populations have seen an average 73% decline since 1970.[4] Over 50% of coral reefs have been lost since the 1950s.[5] Up to 40% of global land area is now classed as degraded.[6] And approximately 35% of global wetlands have been lost since 1970.[7]

A suite of metrics exists that can serve as helpful tools for understanding and tracking biodiversity changes. For example, the Natural History Museum's Biodiversity Intactness Index (BII), estimates how much of an area's natural biodiversity remains.

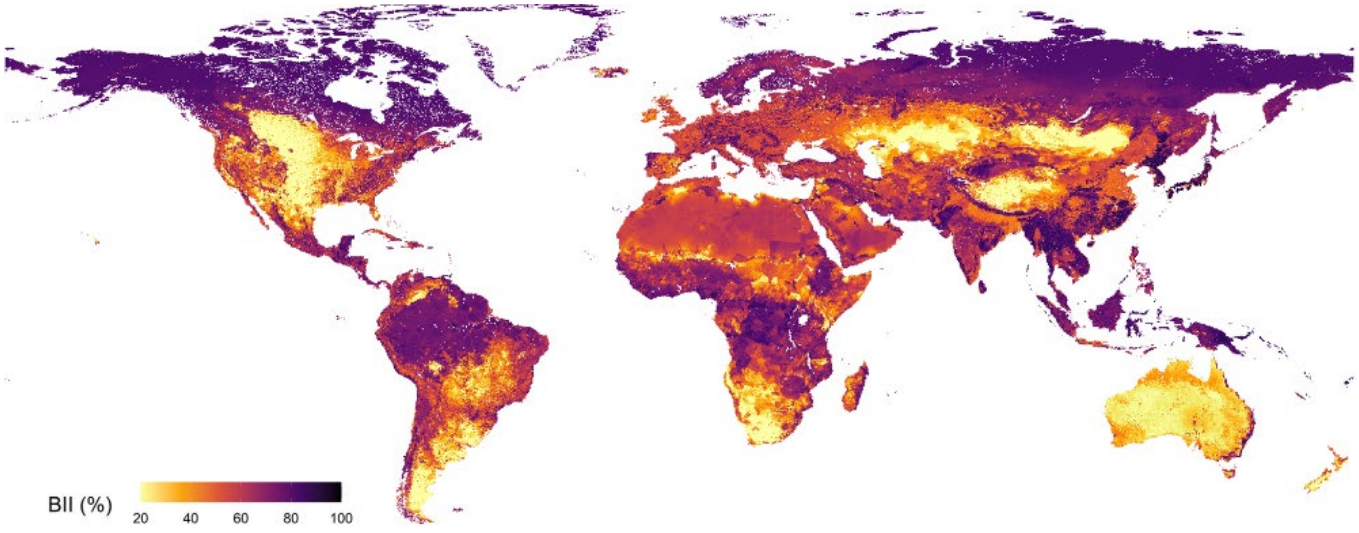
A BII of 90% or more indicates the area has sufficient biodiversity to be a resilient and functioning ecosystem, whereas less than 90% means ecosystems may function less reliably. A BII of 30% or less indicates these areas are at risk of ecosystem collapse.

According to researchers, globally biodiversity intactness is at 75% which is significantly below the 90% "safe limit".[8]

The map below helps to demonstrate the global scale of the challenge we face in tackling nature loss and the importance of local assessments.

[4] WWF (2024) Living Planet Report 2024
[5] Eddy, Tyler D., et al. "Global decline in capacity of coral reefs to provide ecosystem services." One Earth 4.9 (2021): 1278-1285.
[6] UNCCD (2022) Global Land Outlook 2nd Edition
[7] Ramsar Convention on Wetlands (2021) Global Wetland Outlook Special Edition
[8] https://www.nhm.ac.uk/discover/news/2021/october/analysis-warns-global-biodiversity-is-below-safe-limit.html

Figure 2. Biodiversity Intactness Index map



Source: Natural History Museum

In a landmark UN assessment in 2019, we were warned that nature's decline was "dangerous and unprecedented" and negative trends will continue to 2050 and beyond if we continue business-as-usual.

The seminal 2021 report The Economics of Biodiversity: The Dasgupta Review stressed that "our unsustainable engagement with Nature is endangering the prosperity of current and future generations."

Nature-related risks are climbing the ranks of global risks. In the latest Global Risks Perception Survey by the World Economic Forum, extreme weather events were identified as the 2nd highest global risk over the next 2 years.

Over the next 10 years, 4 out of the top 5 global risks are nature related.

In July 2024, the Network for Greening the Financial System (NGFS) published the final version of its conceptual framework for nature-related financial risks which aims to guide policies and action by central banks and financial supervisors, recognizing the importance of integrating nature-related risks into the financial system.

Figure 3. Global risks ranked by severity over the next 2 and 10 years

Source: WEF

Biodiversity loss and loss of ecosystem services could cost the global economy trillions of dollars and create long-term risks to society more broadly. For example, a 2021 World Bank report found that global GDP could fall by 2.3% (equivalent of $2.7 trillion) in 2030 under a partial ecosystem collapse scenario, compared to a baseline scenario of no ecosystem collapse.

The analysis considered the collapse of wild pollinators, marine fisheries and timber provision from tropical forests and found that low-income and lower-middle income countries would be hit the hardest.[9]

What does nature loss mean for business?

Our 2021 Citi GPS report on Biodiversity stressed that that most businesses have a two-way relationship with nature. On the one hand they depend on the goods and services that it provides, and on the other their operations and supply chains may have direct or indirect impacts on biodiversity and ecosystems.

An example that illustrates this well are fisheries which depend entirely on healthy fish stocks, but unsustainable and destructive practices can lead to over-exploitation, habitat loss and pollution, which in turn erode the very natural capital their profitability relies on.

A widely cited 2020 report by WEF and PwC estimated that $44 trillion of economic value generation is moderately or highly dependent on nature. The analysis has since been updated to $58 trillion (equivalent of 55% of global GDP).[10]

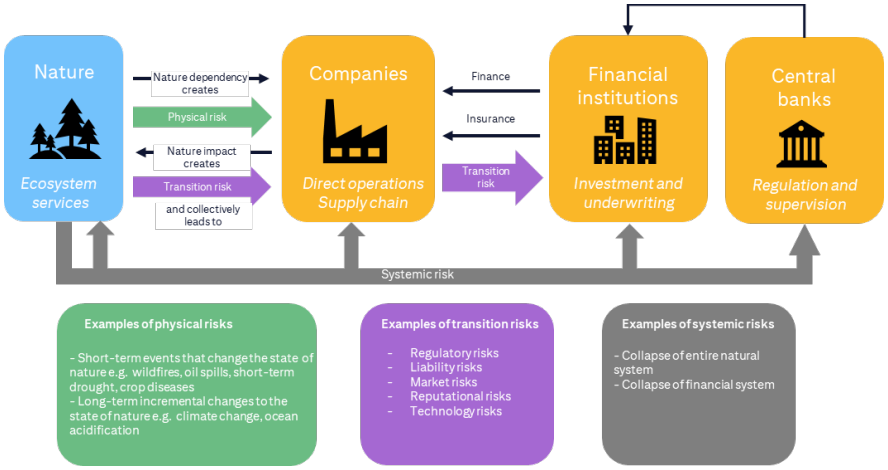
Nature loss poses a risk to businesses that depend on nature, as well as those that can be held responsible for the destruction or degradation of nature. Companies are increasingly expected to report on “double materiality” which broadens the concept of materiality from a sole focus on “outside-in” effects to include an “inside-out” view of how operations impact society and the environment.

Supply chains are exposed to changes in natural capital and ecosystem services creating physical risks, and those with high impacts on nature are increasingly exposed to transition risks which include regulatory risks, reputational risks and market risks.

The figure below illustrates how nature impacts and dependencies can create risks for businesses and financial institutions.

[9] Johnson, Justin Andrew, et al. The Economic Case for Nature: A global Earth-economy model to assess development policy pathways. World Bank, 2021.
[10] https://www.pwc.co.uk/issues/esg/now-for-nature.html

Figure 4. Nature-related impacts, dependencies and risks



Source: Citi GPS, adapted from BNEF (with permission)

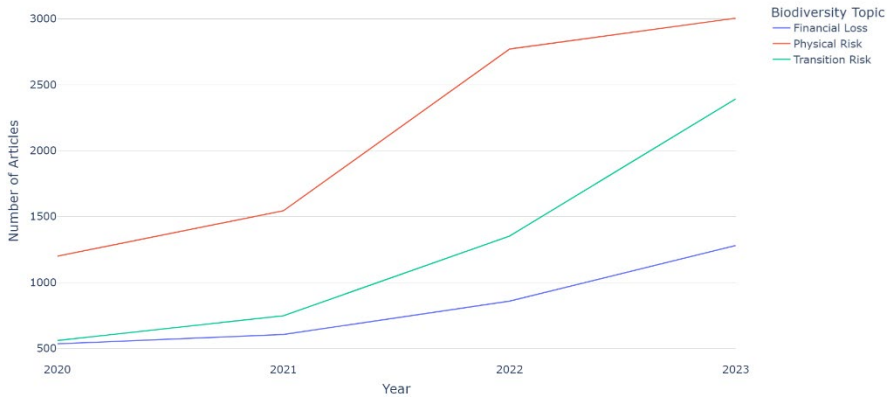
The mishandling of nature risks is starting to lead to financial losses for companies. For example, a BNEF study highlighted 10 company case studies spanning industries, geographies and company sizes, where mismanagement of nature risks (both physical and transition) led to financial impacts of at least $80 billion.[11] For example, one of the case studies was a utility company which was impacted by a combination of physical risk as well as legal and reputational risk when sparking transmission lines ignited untrimmed tree branches, resulting in a series of wildfires. This led to a material fall in share price as well as billions of dollars in settlements.

Key emerging trends in nature-related litigation against companies, financial institutions as well as states and public entities was explored in a 2024 report by NGFS which discussed a wide range of cases covering biodiversity loss, deforestation, ocean degradation, plastic pollution and carbon sinks.[12]

Our own analysis found that nature-related risks and financial losses incurred from individual companies are on the rise, further demonstrating the financial importance of a business in managing nature-related risks. For financial losses, we considered a variety of impacts including fines, penalties, settlements, legal liabilities, lost revenues, damage to assets and fall in share price.

[11] BNEF (2023) When the Bee Stings: Counting the Cost of Nature-related Risks
[12] NGFS (2024) Nature-related litigation: emerging trends and lessons learned from climate-related litigation

Figure 5. Media mentions of corporate nature-related risks and financial losses



Source: Citi Global Data Insights & Alphasense

How do businesses impact and depend on nature?

Economic activities are putting pressure on nature in five key ways:

1. Resource exploitation and use
2. Ecosystem use or change
3. Climate change
4. Pollution
5. Invasion of alien species.

A landmark study by IPBES found that these five drivers have caused more than 90% of nature loss in the past 50 years.[13]

Business and finance will be increasingly expected to address these impact pressures which span across all four realms – land, freshwater, ocean and atmosphere.

Pollution for example comes in many forms i.e. solid waste, nutrients, toxic chemicals, noise and light, and cuts across all realms. The figure below shows drivers of nature loss mapped across the realms with examples of impact metrics that corporates can consider.

We recognize that not all drivers will be material for all businesses, but we think this holistic view by driver and realm is a helpful way of framing and illustrating all the different ways business activities can impact nature and what indicators they can use to measure impact.

For businesses to identify exposure to nature risks and opportunities, understanding the drivers of nature loss is a good place to start.

[13] Díaz, S et al. (2019). IPBES global assessment: summary for policymakers. (IPBES stands for the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services)

Figure 6. Drivers of nature loss across the four realms

<table>
<tr><th></th><th>Terrestrial</th><th>Freshwater</th><th>Ocean</th><th>Atmosphere</th></tr>
<tr><td>Climate change</td><td></td><td></td><td></td><td>GHG emissions
(e.g. Volume of CO2, CH4, N2O, SF6, HFCs, PFCs)</td></tr>
<tr><td>Ecosystem use or change</td><td>Terrestrial ecosystem use
(e.g. area of agriculture by type, area of open cast mine by type, area of forest plantation by type)</td><td>Freshwater ecosystem use
(e.g. area of wetland, pond, lakes, streams, rivers or peatland used for ecosystem services or infrastructure)</td><td>Marine ecosystem use
(e.g. area of aquaculture by type, area of seabed mining by type)</td><td></td></tr>
<tr><td rowspan="3">Resource exploitation</td><td></td><td>Freshwater use
(e.g. Volume of groundwater consumed, volume of surface water consumed)</td><td></td><td></td></tr>
<tr><td colspan="3">Other abiotic resource extraction
(e.g. Volume of mineral extracted)</td><td></td></tr>
<tr><td>Other biotic resource extraction
(e.g. Number of wild-caught mammals by species, Volume of timber by species)</td><td>Other biotic resource extraction
(e.g. Volume of wild-caught fish by species)</td><td>Other biotic resource extraction
(e.g. Volume of wild-caught fish by species, volume of timber by species)</td><td></td></tr>
<tr><td rowspan="4">Pollution</td><td colspan="3">Nutrient pollutants
(e.g. Volume discharged to water and soil i.e. nitrates and phosphates)</td><td rowspan="4">Non-GHG air pollutants
(e.g. Volume of PM2.5, PM10, VOCs, NOx, SO2, CO)</td></tr>
<tr><td colspan="3">Toxic pollutants
(e.g. Volume discharged to water and soil i.e. heavy metals, chemicals)</td></tr>
<tr><td colspan="3">Solid waste pollutants
(e.g. Volume of waste by specific material constituents i.e. plastic, lead; by classification i.e. non-hazardous, hazardous, radioactive); or by disposal method i.e. landfill, incineration, recycling, specialist processing)</td></tr>
<tr><td colspan="3">Disturbance
(e.g. Decibels and duration of noise, lumens and duration of light)</td></tr>
<tr><td>Invasive species</td><td colspan="3">Introduction of invasive species
(e.g. Direct introduction of non-native invasive species into areas of operation)</td><td></td></tr>
</table>

Source: Citi GPS, IPBES, ENCORE

Scientists agree that nature loss is an equally urgent crisis as climate change. Neither will be successfully solved unless both are addressed with the same immediacy. Right now, we're driving a vicious cycle of harm across climate change and nature loss. Climate change is one of the main drivers of nature loss and is expected to worsen extreme weather events such as droughts, flooding, and heatwaves.

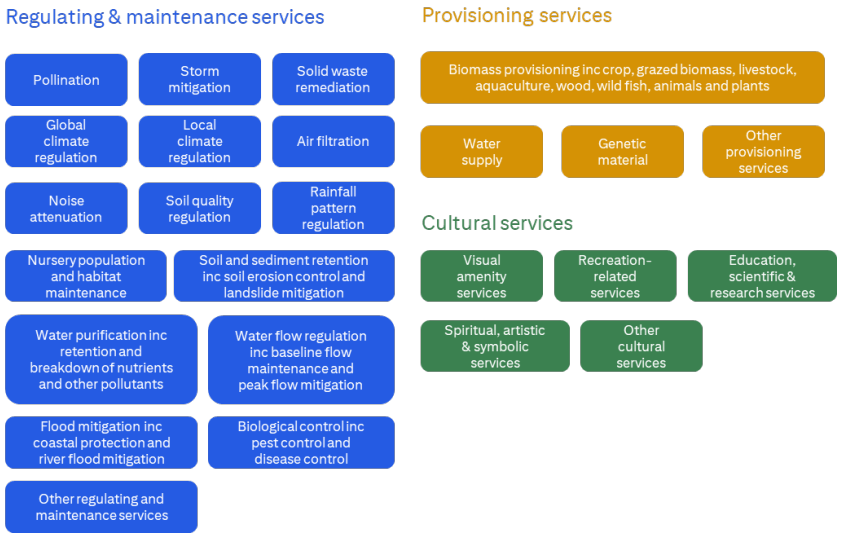
As climate change intensifies, so will its impact on nature across the realms which can lead to loss and degradation of biodiversity and ecosystem services including carbon sinks and in turn lead to the release of more GHG emissions into the atmosphere.

It is more challenging to map nature dependencies across realms as often ecosystems work together to provide the services and benefits which businesses depend on. For example, water flow regulation is provided by the hydrological cycle which enables the circulation of water through the planet's atmosphere, land, freshwater and oceans.

Climate regulation is another vital ecosystem service provided by nature, and benefits are delivered at various levels – global climate regulation is provided through the long-term storage of CO_2 in soils, vegetable biomass and the oceans.

At a regional level, climate is regulated by winds and ocean currents, and at local and micro-levels, vegetation can modify temperatures, humidity and wind speeds.[14] Figure 7 shows the variety of ecosystems services that business activities can depend on which can be grouped into regulating and maintenance services, provisioning services and cultural services.

Figure 7. Ecosystem services provided by nature



Source: Citi GPS, ENCORE

Corporates are increasingly recognizing the importance of addressing "scope 3" emissions in their supply chains. The same concept also applies to nature impacts and dependencies, which not only matter for direct business operations but also upstream and downstream.

According to research by PwC, all industries have material dependencies on their supply chains. This implies that a decline/loss of ecosystem services could have significant knock-on effects across industries and supply chains. Larger corporates from a variety of sectors such as fashion & retail, paper & packaging, construction are increasingly demanding their suppliers present evidence of the chain-of-custody certification by the Forest Stewardship Council (FSC) to demonstrate effort on minimizing biodiversity and nature impacts.

[14] https://encorenature.org/en/data-and-methodology/services

We have talked much about businesses depending and impacting nature, but fundamentally it is us as people who rely on nature for our basic needs like clean air, food, freshwater and raw materials that sustain our daily lives.

Many experts have commented on how humanity is out of harmony with nature. People and Nature are deeply intertwined, a connection that is exemplified by Indigenous Peoples. For generations, they have lived in a close relationship with the natural environment, cultivating a profound understanding of the land, water and biodiversity that sustains them.

Indigenous Peoples represent 6.2% of the global population but manage or have tenure rights over at least 25% of the world's land surface.[15] Indigenous Peoples hold a wealth of knowledge about local ecosystems, sustainable resource management and environmental stewardship which can contribute significantly to global conservation efforts.

However, it is also this symbiotic relationship that is threatening Indigenous Peoples as natural ecosystems continue to be destroyed to make way for industrial activities.

One example is deforestation which has and continues to impact Indigenous Peoples by disrupting their ancestral lands and traditional way of life, and threatening their livelihoods which are closely tied to the health of the forests.

Beyond direct impacts, deforestation can also lead to negative health impacts for Indigenous Peoples due to pollution, disruption of microclimates, introduction of disease and loss of access to traditional medicines. Studies have also found that deforestation and lost access to traditional lands leads Indigenous Peoples to have to seek alternative employment, including in the informal economy where they are likely to encounter exploitation.[16]

Forest500 stresses that too many companies and financial institutions are ignoring the crucial link between deforestation and human rights, with issues including failure to secure the Free Prior and Informed Consent [FPIC][17] of Indigenous Peoples and local communities, land use conflict as well as labour rights abuses. Their latest human rights briefing found that a third of the companies they assessed did not have a single publicly available human rights policy for any of the commodities they were assessed for, which included palm oil, soy, timber and beef.[18]

A foundational step for every business on their nature journey is developing a nature baseline which is often not an easy task. Nature is complex and multi-faceted. It varies greatly from location to location and there is no one-size fits all dataset or metric that businesses can lean on to understand or quantify nature impacts and dependencies.

The TNFD advises corporates and financial institutions to locate where their or their portfolio's facilities interface with nature as an initial step in assessing their nature impacts and dependencies.

This requires businesses and financial institutions to not only have data on their or their portfolio's facilities but also have locationally specific nature data at a granular enough resolution to assess those facilities accurately. Ascertaining, processing, and interpreting such nature data remain some of the major challenges currently facing corporates and financial institutions in the space.

[15] Fa et al. (2020) Importance of Indigenous Peoples' lands for conservation of Intact Forest Landscapes

[16] ILO (2020) Implementing the ILO Indigenous and Tribal Peoples Convention No.169: Towards an inclusive, sustainable and just future

[17] The World Bank Environmental and Social Framework defines consent as the collective support of affected Indigenous Peoples communities for the project activities that affect them, reached through a culturally appropriate process.

[18] Forest500 (2024) Deforestation and human rights: too many companies and financial institutions ignoring the critical link

A helpful place to start may be at the sector level to identify the potentially material interfaces with nature. In the section below, we step through our main analysis.

Which industries have the biggest impacts and dependencies on nature?

We carried out 2 sets of analyses to demonstrate the breadth of nature issues businesses will be increasingly expected to address and provide insights into how they can get started in assessing their nature impacts and dependencies.

1. The first part identifies the industries which have the most material impacts and dependencies on nature across the realms – land, freshwater, oceans and atmosphere, alongside their potential revenue exposure.

2. The second part is a geospatial analysis, where we overlayed data layers for industrial facilities, biodiversity as well areas of water stress to identify potential hotpots of conflict between natural capital and economic activities.

The key datasets that we used can be found in the figure below.

Figure 8. Key data sources used in the analysis

Dataset	Source	Notes
Impact and dependency materiality ratings	ENCORE (Exploring Natural Capital Opportunities, Risks and Exposure) developed by the Natural Capital Finance Alliance and UN Environment Program World Conservation Monitoring Centre (UNEP-WCMC)	Provides impact and dependency materiality ratings for 271 economic activities based on the International Standard Industrial Classification (ISIC) groups and classes. The ratings indicate materiality of dependencies and pressures at the global level, and draw on quantitative environmental data where possible
Company revenue information	FactSet's Revenue Business Industry Classification System (RBICS) and S&P Capital IQ Financials datasets.	The RBICS dataset provides annual revenue percentage breakdown of over 48,000 public companies across 1,900+ business segments
Industrial facilities data	Dun & Bradstreet	The dataset includes the facility locations (over 3.8 million facilities) of 38K public companies, we consider only the facilities that have been identified by the TNFD as "priority sectors" which filtered down to 336K facilities. We do not consider private companies.
Key Biodiversity Areas / World Protected Areas	Integrated Biodiversity Assessment Tool (IBAT)	An overlap with an industrial facility is defined as being directly in or within 1km of a KBA or WPA
IUCN Red list of threatened species	IUCN	An overlap with an industrial facility is defined as being directly in or within 1km of an area with a threatened species
Water stress	Aquaduct Water Risk Atlas by WRI	The dataset assesses water stress from Low to Extremely high, we consider only areas with High to Extremely High water stress

Source: Citi Global Data Insights

The ENCORE tool provides insight into the potential materiality of the natural capital impacts and dependencies on ecosystem services of 271 economic activities based on the UN's ISIC industry classification.

In June 2024, the knowledge base went through a major update drawing on the latest scientific research and now includes not only direct potential dependencies and impacts, but also downstream and upstream value chain links. It is worth noting materiality ratings in the ENCORE database are potential measures, and not observed values and they are generic global assessments and not location specific.

Materiality insights by realm

Starting with a comprehensive overview of nature impacts, dependencies and risks, we show potential nature dependency and impact for 21 high level ISIC "Sections", with the bubble size of each section representing its total revenue. From the figure below, we can see that Agriculture, forestry and fishing stands out as having high impact and dependencies on nature, while Mining and quarrying has potentially the highest nature impacts.

The figure also shows that almost all industry groups have some level of direct dependencies and impacts on nature. Many industries are putting pressure on nature across several impact pathways which span multiple realms. **We estimate**

that $15 trillion of business revenue (across 7 industries) has potentially direct negative impacts across all nature realms – land, freshwater, oceans and atmosphere.[19]

These seven industries are – Agriculture, forestry and fishing, Construction, Utilities, Manufacturing, Mining and Quarrying, Transportation, and Water supply and waste management.

Figure 9. Dependency, impact and revenue by industry

Source: Citi Global Data Insights, ENCORE, FactSet, S&P

Financial and insurance activities show low *direct* impact and dependencies, but it is important to remember that this does not consider financed emissions and nature impacts.

Financial institutions play an important role in their lending, underwriting and investment activities of all other industries. For example, the latest data from Forest500 report that in 2022 a total of $6.1 trillion was invested into the 350 companies most at risk of driving deforestation.[20]

There is also a growing body of studies that have tried to estimate the dependencies of financial institutions on ecosystem services, for example 52% of UK GDP and 72% of the stock of UK lending have dependencies on ecosystem services.[21]

[19] We considered economic activities that have ENCORE materiality ratings of High or Very High across the impact drivers

[20] https://forest500.org/sites/default/files/forest_500-2023_annual_report.pdf

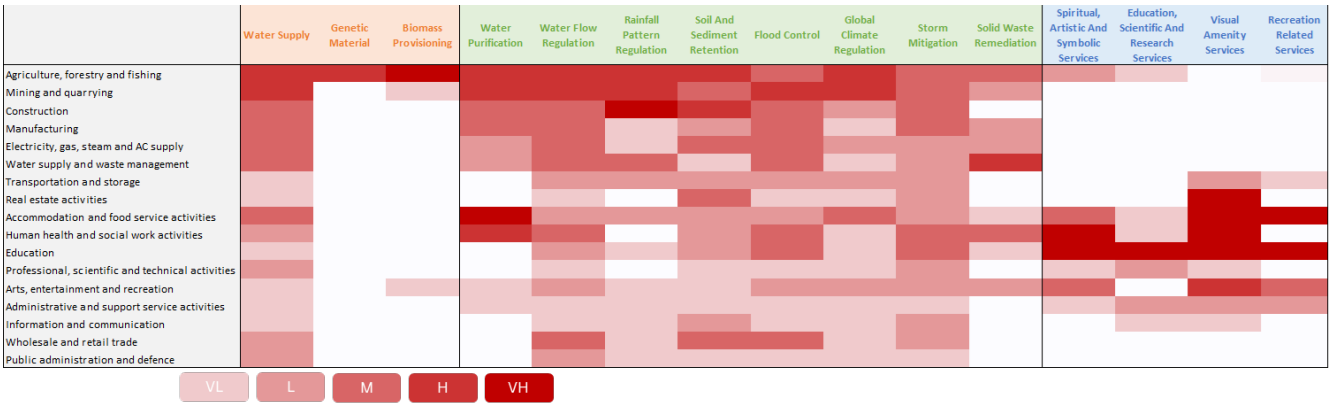
[21] The nature of risk – speech by Sarah Breeden | Bank of England

Let's take a closer look at nature dependencies and the ecosystem services that businesses depend on which are often more difficult to connect with business activities than impact drivers.

Most industries depend on some form of water-related ecosystem services which include water supply, water purification and water flow regulation. Flood and storm control and mitigation are also material ecosystem services across many industries such as mining and quarrying, construction, transportation as well as human health and social activities.

The provisioning of genetic material and biomass may only be highly material for Agriculture, forestry, and fishing but many industries are reliant on these ecosystem services through their supply chains.

Figure 10. A sample of industries and their nature-related dependencies



Note: We took the average dependency rating of the economic activities within each industry
VL= Very Low, L=Low, M=Medium, H=High, VH=Very High (Dependency materiality rating)
Source: Citi GPS, ENCORE

Global climate regulation and local climate regulation are also important ecosystem services for many industries which demonstrates the intrinsic relationship between climate and nature.

Agriculture, forestry and fishing, Mining and quarrying, Construction, Transportation, Utilities, Arts, entertainment and recreation and Accommodation and food services all have high dependencies on global climate regulation.

Education is very highly dependent on all cultural services, and Human health and social work activities depend highly on Visual amenity services and Spiritual, artistic and symbolic services.

When nature health is in decline, the provision of these critical ecosystem services is impacted. which can translate into business and finance risks.

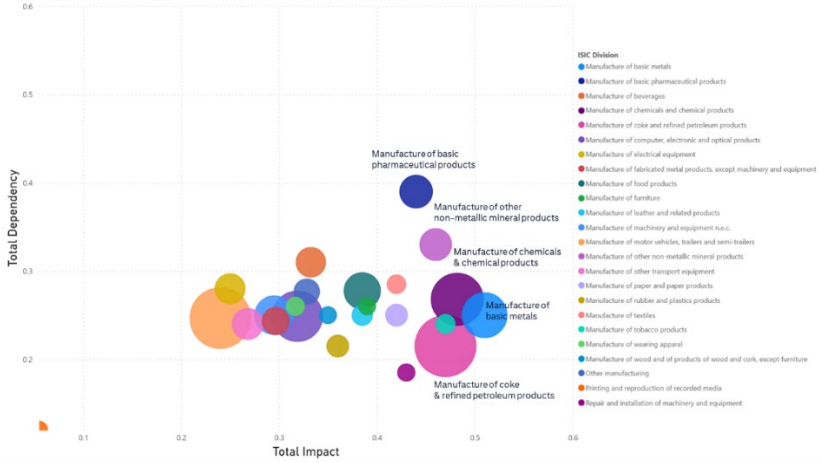
For example, water related risks such as drought, flooding, water scarcity, poor water quality as well as severe weather events can disrupt operations, damage assets, increase cost of utilities and have ripple effects across supply chains. CDP estimated the cost of water-related risks to business could total $594 billion, compared to a $152 billion cost of response.[22]

Whilst this high-level mapping helps to identify key sectors, there is a need to go more granular to unpack these broad industries to their constituent subindustries to

[22] https://www.cdp.net/en/companies/cdp-2023-disclosure-data-factsheet

understand their specific nature-related impacts and dependencies. For example, the figure below shows the break out of ISIC divisions “Agriculture, forestry and fishing” and “Manufacturing” which demonstrate the variability of dependencies and impacts within high level industry groups.

Figure 11. Dependency, Impact and Revenue of Manufacturing sub-industries

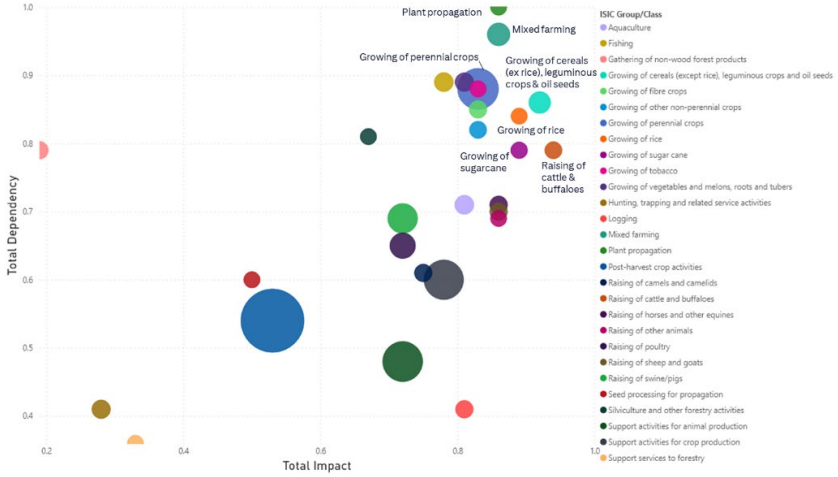


Source: Citi Global Data Insights, ENCORE, Factset, S&P

From the breakout of Manufacturing, we can see that the manufacture of food products, chemicals and chemical products, and coke and refined petroleum products appear to have the highest impacts on nature.

The manufacture of pharmaceuticals stands out as having high impact and high dependency, the latter referencing the industry’s strong dependence on freshwater and nature-derived materials.

Figure 12. Dependency, Impact and Revenue of Agriculture, forestry and fishing sub-industries



Source: Citi Global Data Insights, ENCORE, Factset, S&P

The breakout of Agriculture, forestry and fishing show a range of impacts and dependencies with raising of cattle and buffalo and growing of cereals having the highest impact. But most agriculture and livestock activity show high level of dependency and impact on nature.

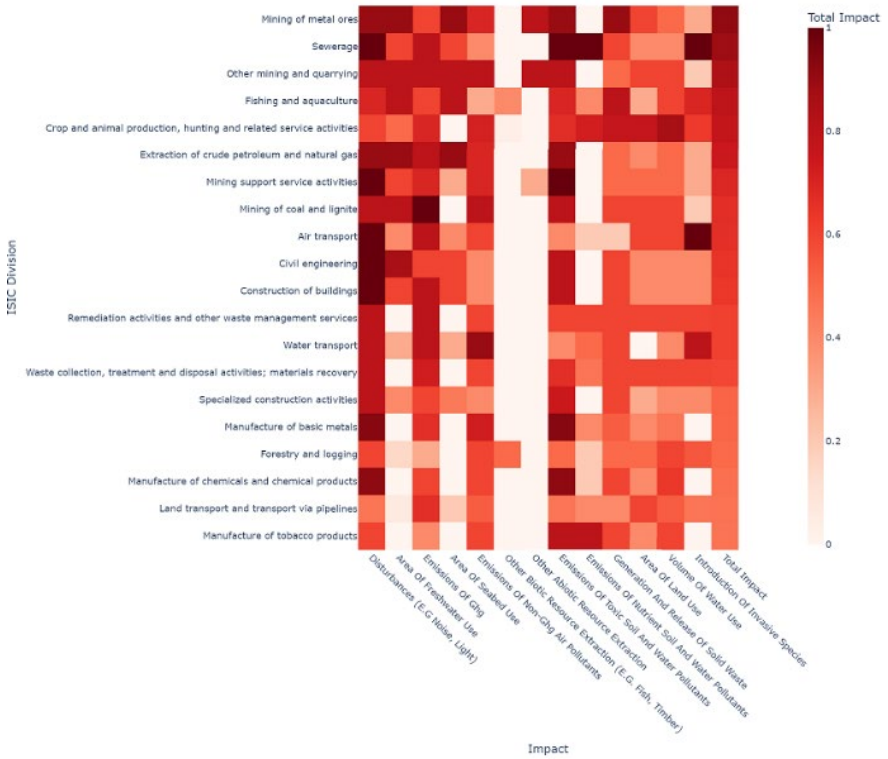
Back in 2018, in our first Citi GPS report on Food, we stressed that the global food system is not fit for purpose and is plagued by issues of sustainability, waste, and nutrition. Agriculture has altered the planet more than any other human activity accounting for 50% of habitable land, 70% of freshwater withdrawals, 80% of deforestation and 1/3 of human made GHG emissions.

Ensuring food security for a growing population while minimizing its environmental impact is a key challenge facing our global food system. We explored the critical Food, water, and climate change nexus in detail in a 2023 Citi GPS report where we highlighted the impact climate change would have on water resources and hence food production and global food security.[23]

Another lens to view the analysis is to consider which subindustries have the greatest impact and dependency on nature. An example of this is demonstrated in the figure below which shows a heatmap of the top 20 subindustries ranked by their total impact score and the breakdown of impact drivers.

We can see that 1) there are a variety of industrial activities that have high impacts on nature e.g. across agriculture, mining, manufacturing, transport, and waste management, and 2) industrial activities can have a range of impacts on nature across all the realms, most activities included in the list score highly for GHG emissions as well as a variety of impact pressure across other realms.

Figure 13. Potential sub-industries with the highest impact on nature



Source: Citi Global Data Insights, ENCORE

While these industry level insights may be a helpful guide and starting point, a complete and accurate view of nature impacts and risks is not possible without location-specific assessments.

[23] https://www.citigroup.com/global/insights/citigps/food-water-and-climate-change

As we demonstrated earlier with the map of Biodiversity Intactness Index, nature loss is local and the materiality of nature impacts and dependencies that business activities have will vary from location to location.

For example, in the TNFD's assessment guidance which follows the LEAP approach – the first step is Locate your interface with Nature which includes identifying **where** direct operations and value chains are located, which ecosystems they interact with and if they are ecologically sensitive locations.

Geospatial analysis

The second part of our analysis helps to demonstrate the importance of location specific assessments by identifying potential areas of conflict between industrial facilities and nature sensitive hotspots.

For the latter three indicators were used – 1) Key biodiversity Areas and World Protected Areas, 2) IUCN Red list of threatened species, 3) Water stress.

A conservative approach was taken by considering only the locations of industrial facilities that the TNFD have identified as "priority sectors"[24], if they are directly in or within 1km of a biodiversity sensitive area, and for water stress, we only include areas that are in High or Extremely High water-stress.

Using an overlay analysis, we were able to assess the intersections of our chosen group of industrial facilities with nature sensitive areas, and we found that:

- 8% (around 26000) of the industrial facilities are directly in or within 1km of a KBA or WPA
- 14% (around 48000) of the facilities are directly in or within 1km of an area with a red list threatened species
- 17% (around 55000) of the facilities are in areas of high or extremely high water-stress

These may not seem like concerning percentage points. but they are tens of thousands of potentially high impact industrial facilities that are operating in/near nature sensitive areas.

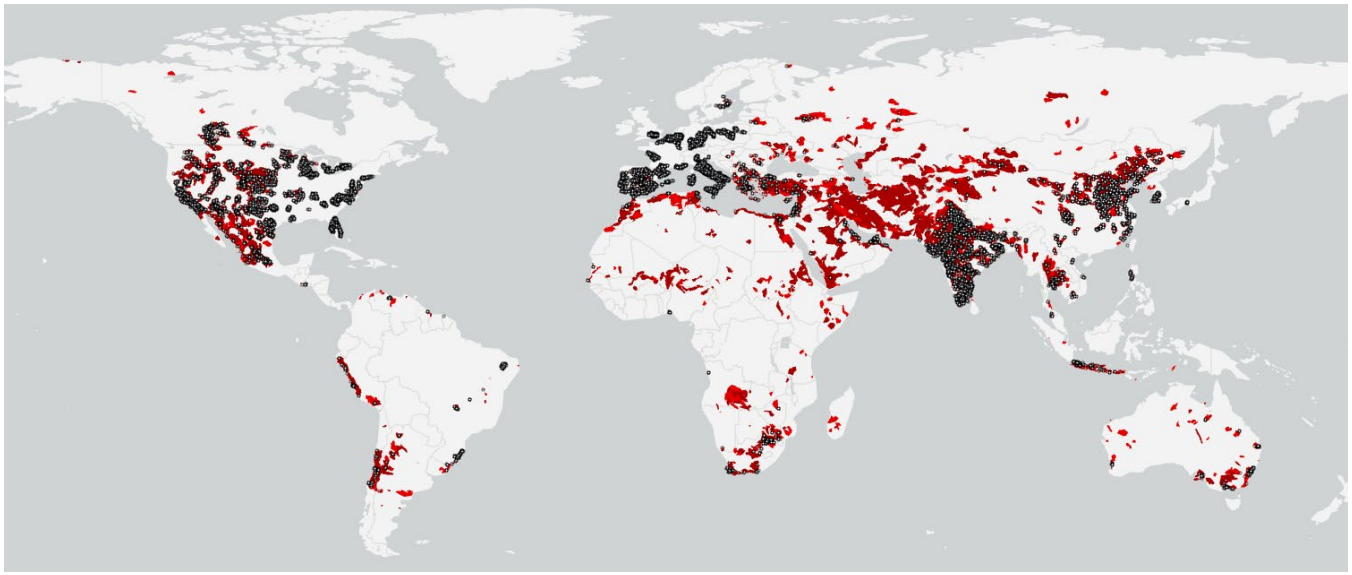
Regulatory and investor pressures are also increasing, for example, the EU Sustainable Finance Disclosure Regulation (SFDR) requires financial market participants to disclose on Principal Adverse Impacts (PAIs) of their portfolios.

One of the PAIs requires companies disclose activities that negatively affect biodiversity sensitive areas. It is not only vital for companies to know where their assets are but also the environment within which they operate.

The figure below maps the location of industrial facilities that are in areas of high or extremely high water-stress, which shows clusters of facilities across Europe, India, the United States and North China. The map presents a global view, but the dataset does allow us to zoom in for more local assessments.

[24] https://tnfd.global/wp-content/uploads/2023/08/Guidance_for_Financial_Institutions_v1.pdf

Figure 14. Map showing industrial facilities located in areas of high/extremely high water-stress



Source: Citi Global Data Insights, Dun & Bradstreet, WRI

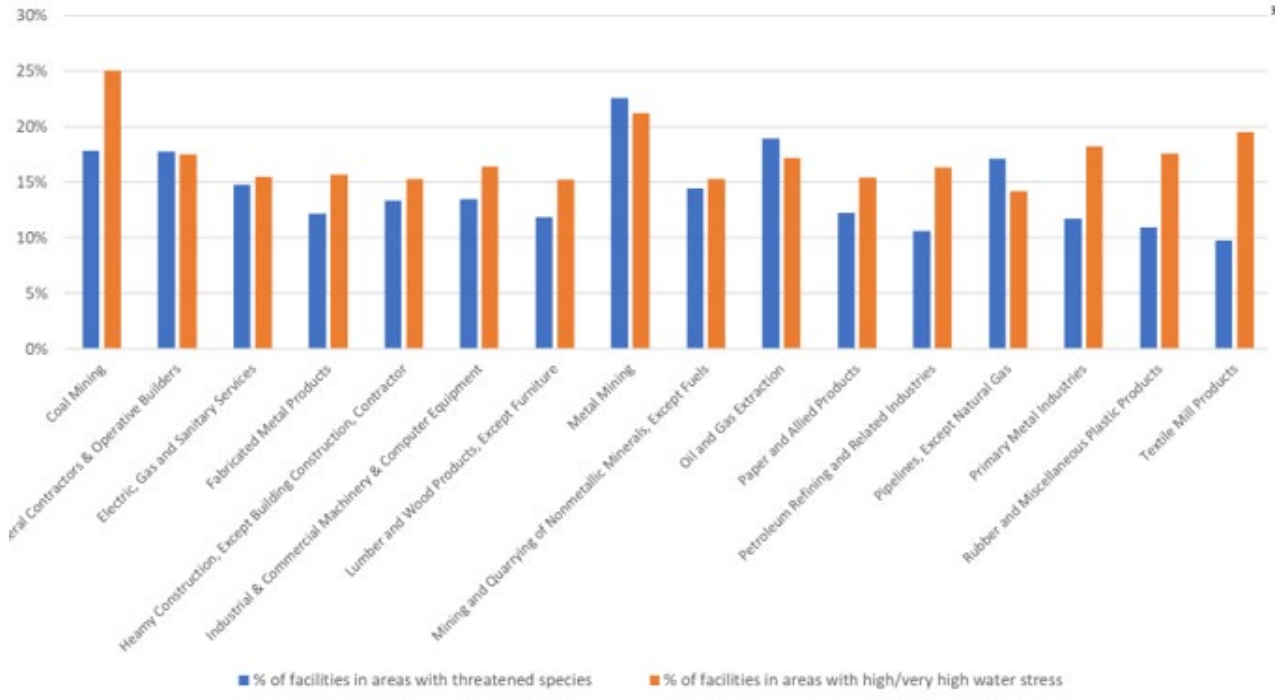
We can also consider the facilities exposure through a sector lens. We found that **TNFD priority sectors have at least 15% of industrial facilities in areas with high or extremely high water-stress, and at least 10% are located directly in or near an area with a red list threatened species.**

Coal mining for example uses water for extraction and washing and our analysis finds that 25% of facilities are in areas of high/extremely high water-stress. Metal mining has high impacts on nature including freshwater use and pollution and had the highest nature impact score from our analysis above.

We find that 23% and 21% of its operations are in areas with red list threatened species and high/extremely high water-stress respectively. Some of these facilities might also have touch points with several nature issues.

For example, we also found that 9% of coal mining and 10% of metal mining operations are in areas with threatened species **and** high/extremely high water-stress. This analysis demonstrates the importance of local assessments, and how publicly available data can be used to examine nature risks at the facilities level.

Figure 15. Percentage of TNFD priority sectors facilities in nature sensitive areas



Source: Citi Global Data Insights, Dun & Bradstreet, WRI

Conclusions

A holistic analysis of nature impacts, dependencies and location assessment at the sector level allows us to demonstrate and provide insights into *why* corporates and investors should act and *how* they can start to develop their nature baseline.

We think it also helps to support the case for a more holistic approach to managing climate and nature risks. Instead of "stacking" climate and nature issues, a holistic materiality assessment in our view can allow for more complementary and effective action at various levels -

- At an industry level, it can facilitate a more comprehensive assessment of who is best placed to tackle which nature issues as well as which nature issues require more attention by which industries. It can also help the identification of potential areas to deploy win-win solutions for climate and nature.

- At a company level, it can support the integrated risk management of climate change and nature loss, as well as help identify opportunities to leverage the climate-nature nexus in delivering goals on both fronts. A stacking approach may lead to material nature issues being left behind which can translate into business risks.

The findings we have presented above showcase some of the high-level insights that we have produced from our proprietary dataset which also lends itself to more granular assessments of nature impacts, dependencies, revenue exposure and facilities risk.

We aim to refine and improve the approach and data sources over time and explore sector specific impacts and dependencies in more detail.

Chapter 2 - How to navigate the current nature landscape?

Despite growing awareness of nature risks across business, the community faces significant challenges in tackling nature issues. These include lack of standardization and metrics, data gaps and transparency, lack of expertise and capacity, regulatory and policy uncertainties, perceived financial risks of novel and untested nature-based solutions, focus on short-term financial performance, limited nature-positive finance products and solutions.

We've broadly grouped the barriers into 1) lack of coherent nature governance and frameworks, 2) lack of fit-for-purpose nature data and intelligence, 3) lack of committed nature finance.

These barriers are not disparate and positive action across each area can help drive an acceleration towards collective corporate action towards a nature-positive future.

The good news is that progress is being made across all three dimensions and evolving quickly. Progress around nature regulation and frameworks is picking up speed, helping to shape the evolving nature data landscape and start to shift capital and investments towards more nature-positive outcomes.

In this section, we examine these three related ecosystems that businesses should tap into to guide and support their nature journey.

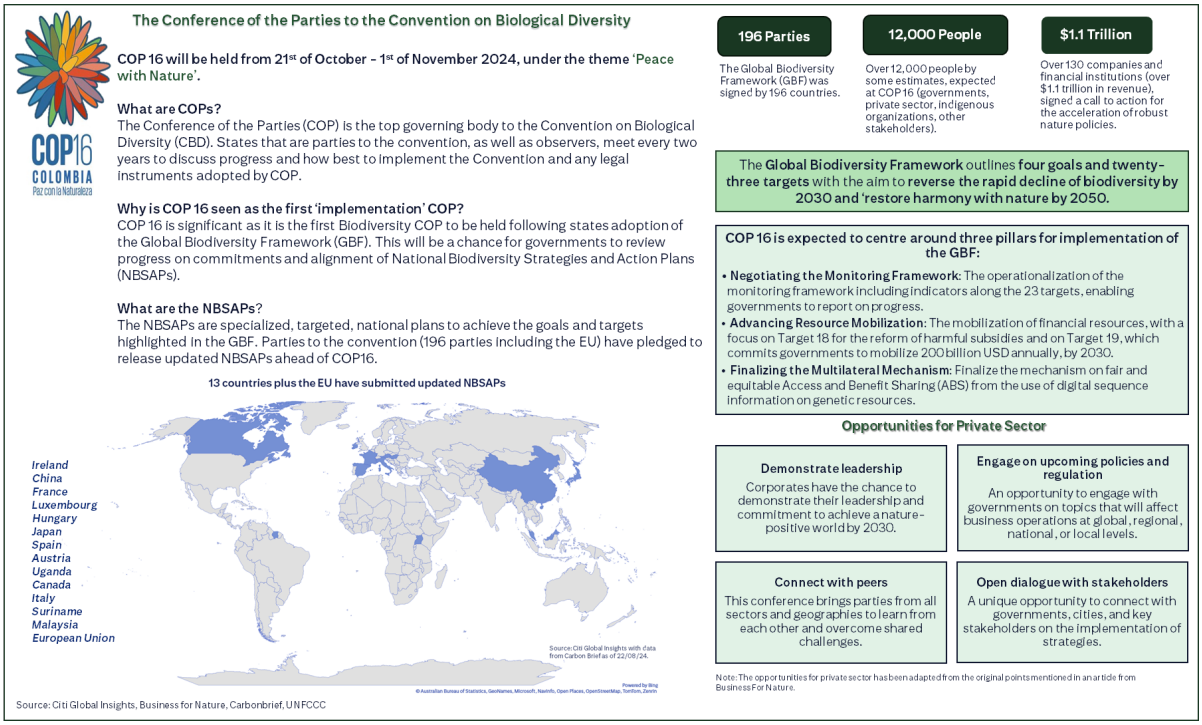
Nature governance, frameworks and initiatives

Nature issues have risen up the global agenda in recent years with increased targeted action by governments across many areas. Several landmark agreements were reached in the past few years -

- At the COP15 Biodiversity Summit in 2022, the Kunming-Montreal Global Biodiversity Framework (GBF) considered the "Paris Agreement" moment for nature was agreed. The framework contains 4 global goals and 23 targets which collectively aim to reverse the decline of biodiversity by 2030 and "restore harmony with nature" by 2050.
- The UN agreement on Biodiversity Beyond National Jurisdiction (also known as the High Seas Treaty) was agreed in 2023 after decades of negotiations and is the first ever treaty to protect the world's high seas.
- A UN treaty to end plastic pollution is under development by 2024.

The next international biodiversity summit will be held in Colombia in October where governments and non-state actors will gather to review the implementation and progress of the Global Biodiversity Framework. Countries are expected to submit National Biodiversity Strategies and Action Plans (NBSAPs) similar to NDCs for climate ahead of the conference.

Figure 16. International Biodiversity Conference (COP16) taking place in Colombia, October 2024



Source: Citi GPS

Several different nature-related laws, policies, frameworks and standards feed into how corporates may report on and manage their nature footprint. These have typically lagged comparable climate laws and standards, but they are developing more quickly in recent years.

This is particularly so since the adoption of the GBF which includes a target (target 15) which calls for businesses to "assess, disclose, and reduce" biodiversity-related risks and negative impacts by 2030. This for many represents a clear message that corporate action will be mandated, and focus trained on the need for clear guidelines for nature-related disclosures.

The EU also appears to be leading with regards to mandatory disclosures, for example with the adoption of the Corporate Sustainability Reporting Directive (CSRD) and Corporate Sustainability Due Diligence Directive (CSDDD).

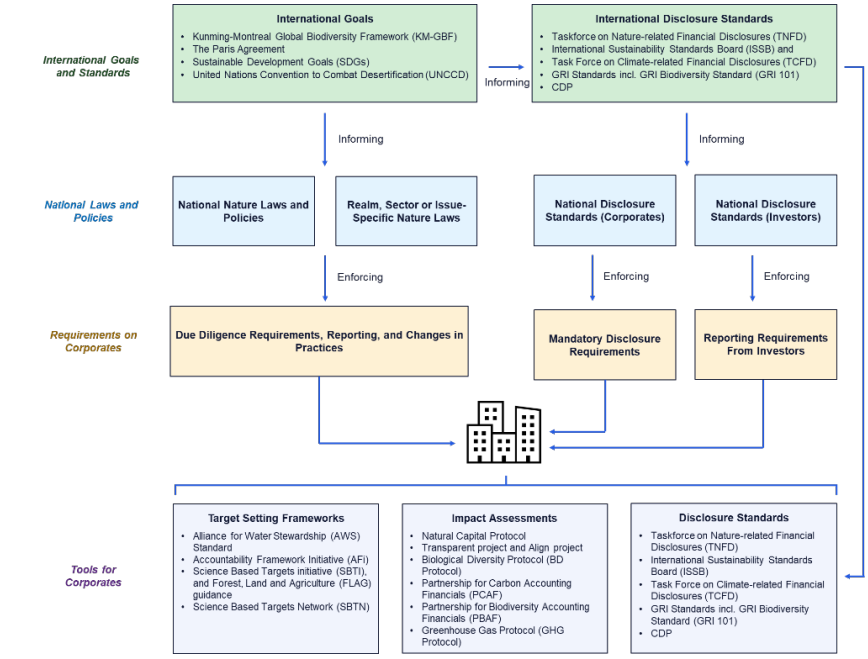
The CSRD came into effect 1 January 2024 and incorporates the concept of "double materiality" and requires companies to report on how sustainability issues might create financial risks as well as the company's own impacts on society and the environment. This directive will impact more companies than any other sustainability regulation to date with approximately 50,000 companies worldwide within scope.

The CSDDD aims to harmonize the requirements for companies to assess and mitigate environmental and social risks of their operations and supply chains. The EU Deforestation Regulation (EUDR) came into force in June 2023 and will start to apply in December 2024 requires any companies that place or export forest-risk commodities in or from the EU market to collect information, mitigate and assess risks and report on their due diligence and compliance. The commodities that are currently in scope are – palm oil, cattle, soy, coffee, cocoa, timber and rubber as well as derived products i.e. beef, chocolate.

In May 2024, China's sustainability reporting guidelines for companies listed on its three largest stock exchanges came into effort. The guidelines require companies to begin mandatory disclosure on a broad range of sustainability topics including biodiversity from 2026.

The figure provides a summary of how the nature regulations, policies and frameworks landscape is evolving.

Figure 17. Nature policies and framework landscape



Source: Citi GPS

In recent years, we have seen the mirroring of successful climate initiatives for nature, as well as development of a few key nature initiatives. We highlight a few examples below grouped by 1) disclosure standards, 2) target setting frameworks and 3) impact assessments.

Disclosure standards

The Taskforce on Nature-related Financial Disclosures (TNFD) recommendations were released in 2023 which follows the footsteps and complements the TCFD which has now been incorporated into the ISSB's first set of global standards released in June 2023, comprising of IFRS S1 (sustainability) and IFRS S2 (climate).[25]

Countries are yet to incorporate nature into their disclosure requirements, apart from the EU which has already incorporated nature into the CSRD. However, the ISSB have announced that they would be researching nature disclosures which will include reviewing the TNFD.[26]

[25] https://www.ifrs.org/news-and-events/news/2023/06/issb-issues-ifrs-s1-ifrs-s2/

[26] https://www.ifrs.org/news-and-events/news/2024/04/issb-commence-research-projects-risks-opportunities-nature-human-capital/

Given countries have announced their intention to leverage ISSB for their own disclosure rules, the potential future incorporation of nature into ISSB may be the catalyst for the inclusion of nature in future mandatory disclosure requirements.

In the meantime, corporates can leverage existing global frameworks to guide and provide the basis for their reporting. This includes the TNFD but also other global frameworks that complement it such as the Global Reporting Initiatives (GRI) standards as well through CDP, both of which have announced alignment and partnerships with the TNFD.

Target Setting Frameworks

Frameworks have also emerged to guide corporates on establishing nature-related goals and targets. These frameworks complement the disclosure standards cited above and form another set of tools and knowledge base that corporates can leverage.

In the past, key guidance on target setting has evolved from more realm or industry-specific needs, for example The Alliance for Water Stewardship's AWS Standard, and the Accountability Framework initiative (AFi) for the agricultural and forestry sectors.

The most recent development in international target setting standards is the Science Based Targets Network (SBTN) in 2023, which builds on SBTi and AFi to provide guidance specifically for nature.

The first stage of SBTN guidance incorporates freshwater and land (with climate covered by SBTi). This framework remains a work in progress, with guidance across all realms, stages and types of business to be developed over the coming years as it aims to align with societal goals including the GBF and Paris Agreement.[27]

Impact assessments

The other key piece of standards development in nature that can be leveraged by corporates is measurement and accounting. Standards relating to nature are being developed to guide corporates in a similar way to that of the GHG protocol for emissions. Like target setting and disclosure standards, there are also a number of separate yet similar impact assessments which can be confusing to navigate.

The Natural Capital Protocol was developed under the Capitals Coalition to provide a framework and toolkit for measuring nature impacts and dependencies.[28] There are also some sector-specific and biodiversity-specific guides such as the Transparent and Align projects and The Biodiversity Protocol.

Another tool that can be leveraged by business and finance is the ENCORE knowledge base which we used for our analysis. The web-based tool allows a screening of potentially significant impacts and dependencies at the sector level. The SBTN have also developed a materiality screening tool which builds on ENCORE data.

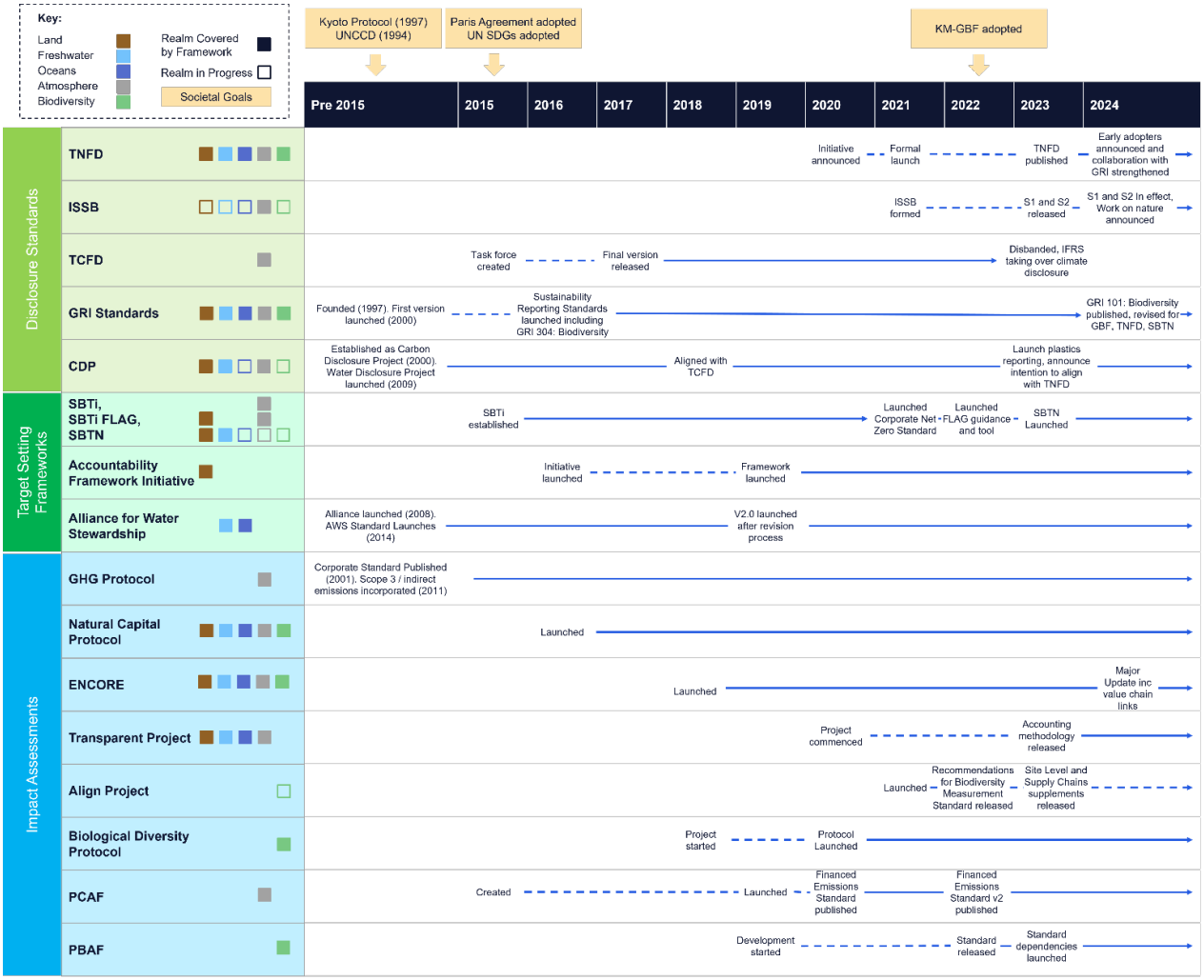
[27] https://sciencebasedtargetsnetwork.org/how-it-works/the-first-science-based-targets-for-nature/

[28] https://capitalscoalition.org/capitals-approach/natural-capital-protocol/

Overall, this is still some way to go in having a harmonized and unified set of nature accounting principles and the landscape remains complicated. We recognize that for corporates, navigating the different frameworks and standards for disclosure, target setting, and measurement can be a complex endeavor, particularly as many relate and link to each other despite remaining separate initiatives.

The landscape is evolving quickly but we have tried to map out the timeline of initiatives and realm coverage in the following diagram.

Figure 18. Timeline and realm coverage of nature-related initiatives



Source: Citi GPS

As corporates face increasing pressure to comply with regulations and manage nature-related risks, the need for fit for purpose nature data is going to grow. Regulation is already having an impact on the nature data ecosystem which we examine next.

Nature data ecosystem

For the past two and a half years, Citi Global Data Insights have been developing a nature and biodiversity framework that allows for the systematic measurement of nature impacts and dependencies.

Early on in our nature journey, we were invited to be part of the TNFD's data catalyst program which allowed us to engage with a wide host of nature data providers and have seen first-hand how the space has evolved.

One of our main learnings over the years is the belief that there is a shortage of nature data is not true. There is a wide array of nature data providers, ranging from open-source providers through to earth observation specialists. However, we have seen a lack of breadth in the nature data space.

Nature datasets are often limited in terms of data coverage (this includes availability across realms), lack of historical data, and lack of data in remote locations where business operations could be present. These data gaps have given rise to the adoption of earth observation and satellite data, and geospatial analytical tools in the nature data ecosystem.

Ecosystem Growth

When we first started to develop our nature framework, the nature data ecosystem largely comprised of non-governmental organizations, academic institutions, and start-ups. At the time, most providers supplied raw biodiversity data that was realm or ecosystem specific. Producing asset level insights required applying a bottom-up methodology to combine, analyze, and interpret these data.

As a precursor to facility level assessments, a common starting point for capturing nature-related risks and impacts across the financial services industry was, and still is, to use subindustry-level datasets such as the Global Canopy, UNEP FI and UNEP-WCMC's ENCORE tool[29] or UNEP FI's portfolio impact analysis tool[30] as a mechanism for identifying the potentially material impactful and at-risk industries in their portfolios.

This top-down approach is a useful steering mechanism, but due to the complexities of nature deeper facility level assessments are needed to paint a clearer picture of nature impacts and risks.

The need for nature data was accelerated by growing regulatory requirements, such as the EU's CSRD, as well as the release of cross-sector and sector-specific reporting metrics in frameworks such as the TNFD. This accelerated need for data led to rapid maturation and growth of the nature data space.

In 2023, larger ESG data providers started to enter the nature data ecosystem by combining bottom-up and top-down datasets and approaches.

For example, Bloomberg announced a biodiversity beta program, in which it combines its own revenue data with biodiversity data such as the Natural History Museum's Biodiversity Intactness Index[31]. Standard and Poor's released its nature risk suite, which consists of its ecosystem footprint (impact focused), ecosystem signification (impact focused), dependency composite score (risk focused) tools[32].

[29] ENCORE (encorenature.org)
[30] Investment Portfolio Impact Analysis Tool – United Nations Environment – Finance Initiative (unepfi.org)
[31] The Natural History Museum and Bloomberg Team Up to Make the Museum's Biodiversity Intactness Index Available to Financial Markets for the First Time | Press | Bloomberg LP
[32] Nature Positive | S&P Global (spglobal.com)

More recently, we have seen further development in the nature data space through index providers partnering with nature data platforms. One such example would be MSCI's partnership with nature focused startup NatureAlpha[33].

The advancement in the nature space, as reflected in the fact that the TNFD's data catalogue now boasts over 190 nature data solutions[34], has meant that corporates and financial institutions have more avenues for accessing nature data and they can now access data through a more ingestible medium.

Start-ups, NGOs, and larger data providers are now providing pre-processed and company specific nature metrics that are aligned to the TNFD. The underlying methodologies of these nature solutions vary.

Understanding the Ecosystem

Engaging with and assessing nature data vendors is a continuous aspect of the development of our nature related framework. We have assessed over 75 vendors to date. To make our assessment of the nature data ecosystem more digestible, we categorized the types of nature data providers that are involved in the space -

- Financial Market Translator: data providers that link, or could be used to link, corporations to nature-related impacts and risks.
- Biodiversity Data Provider: raw or processed nature-related data providers.
- Satellite Imagery and Geo-Spatial Analytics Provider: vendors that provide raw or processed satellite imagery, and/or geographical information systems that could be used to perform the geospatial analytics required to measure nature related risks, impacts, and opportunities.

Once we categorize a vendor, we assess the vendor across the following four lenses:

1. Global Coverage: how global their data coverage is?
2. Corporate Linkage: how feasible is it to tie their data to corporates?
3. Open Source: is the data and its underlying methodology publicly available?
4. Realm Coverage: how many of nature's realms does their data cover?

The table below details is a subset of our vendor assessments[35]. Please note our assessments are qualitative and based on publicly available information.

[33] NatureAlpha announces collaboration with MSCI
[34] Tools Catalogue – TNFD
[35] CGDI's full nature vendor list can be provided on request.

Figure 19. A sample of nature data providers and their coverage

Vendor	Vendor Type	Global Coverage	Corporate Linkage	Open Source	Atmosphere	Fresh Water	Oceans	Terrestrial
Biodiversity Intactness Index	Biodiversity Data Provider	Yes	No	Yes	No	No	No	Yes
EarthBlox	Satellite Imagery and Geo-Spatial Analytics Provider	Yes	No	No	Partial	No	Partial	Yes
ENCORE	Financial Market Translator	Yes	Partial	Yes	Yes	Yes	Yes	Yes
Hub Ocean	Biodiversity Data Provider	No	Yes	No	Partial	No	Yes	No
IBAT	Biodiversity Data Provider	Yes	No	No	No	Yes	Yes	Yes
WWF Biodiversity Risk Filter Tool	Biodiversity Data Provider	Yes	No	Yes	No	Yes	No	Yes

Source: Citi GPS, Citi Global Data Insights (CGDI's full nature vendor list can be provided on request)

Innovation within the Ecosystem

The two main tracks of innovation that we have seen in the nature data space over the last two-and-a-half years involve improving in-situ observations and using artificial intelligence (AI) to enhance how satellite imagery can be used to track nature impacts and risks.

When it comes to enhancing in-situ measures, we have seen firms such as NatureMetrics[36] look to democratise and scale biodiversity project monitoring measures through the use eDNA.

We have also seen growth in Ecoacoustics biodiversity monitoring. Ecoacoustics is the "interdisciplinary science that investigates natural and anthropogenic sounds and their relationships with the environment"[37]. This emerging technology allows users to measure and analyze the movement and health of species such as bats, birds, and amphibians at scale.

It can also be used to monitor freshwater species and Baker Consultants are currently researching if the technology can be used to accurately measure soil health[38]. Ecoacoustics technology ensures that users can broaden the scale of their in-situ observations, reduce the number of their infield man hours, and generate a historical set of observations.

The other area of innovation that we have observed is the combining of AI and satellite imagery to extract and predict nature impact and risk. The use of satellite imagery for monitoring environmental impact and risk is a well-established discipline.

The technology allows end users to scale and improve the timeliness of their analytics. Combining the power of satellite imagery and AI allows end users to move from prescriptive analytics to predictive analytics. Meta and World Resources Institute have launched a global map of tree canopy height at a 1-meter resolution, allowing the detection of single trees.

[36] eDNA & Biodiversity Monitoring Solutions by NatureMetrics
[37] https://doi.org/10.1002/9781119230724.ch1
[38] Ecoacoustics | Baker Consultants

This is to promote forest monitoring and reduce deforestation. The map, and its underlying model developed using AI, are publicly available. Meta is set to use their model as a part of their efforts to achieve net zero emissions across its value chain by 2030[39].

In 2023, we collaborated with Earth Blox, an earth observation and geospatial analytics firm, to produce our own proof-of-concept analysis centred around spatially overlaying and combining a series of satellite imagery derived data layers to measure current and historic nature impact at the facility level. The datasets, derived metrics, and geospatial techniques used in our analysis are detailed in our 2023 nature report[40].

Tips for Navigating the Ecosystem

Finding a starting point for evaluating nature impacts and risks can be overwhelming. However, as we have demonstrated the data, data partners, and innovative technology exist for corporates and investors to make progress in measuring their nature impacts and risks. Our top tips for corporates and investors when starting their nature journey are:

1. A good starting point is to identify your facilities that are most likely to have material nature impact or nature risk. As an investor, a good starting point for analyzing your portfolio is to begin your analysis at a sector, industry, or sub-industry level. This exercise will not produce an in-depth assessment of your nature exposures or impacts, but it will act as a steering mechanism for the industries on which you should focus your deeper and more manually intensive efforts. This type of analysis can be achieved using publicly available data.

2. When in doubt, engage with the nature community. We have found that NGOs and academic institutions are more than willing to give financial institutions and corporates much needed advice when it comes to identifying and working with nature data.

3. Adopt satellite imagery and geospatial analytics. As mentioned in this section, accurately measuring nature impacts and risks must be done at the facility level. To achieve this, leveraging satellite imagery and geospatial data techniques is necessary.

Thoughts from within the Ecosystem

Dr. Genevieve Patenaude, CEO Earth Blox

1) How can satellite imagery analytics support businesses in their sustainability transition and what is it not suitable for?

The key advantage that satellite imagery plays in this landscape is providing both situational awareness and trend mapping. We now have access to satellite image datasets that go back 20 years with consistent and global data, and the rapid rise in commercial satellite companies can now provide daily repeat coverage over any land surface on the planet.

This is why we developed Earth Blox – to make it as easy as possible to access the data and extract useful information on status or trends. It can provide current and

[39] Using Artificial Intelligence to Map the Earth's Forests - Meta Sustainability
[40] https://www.citivelocity.com/t/eppublic/31mGn

historical insights on deforestation and habitat loss, pollution monitoring, water resource management, crop monitoring, oil spill detection, and wildfire tracking.

Businesses now need satellite imagery to provide the information required to report on EUDR, TNFD, CSRD, and other standards or regulatory frameworks.

But we also see businesses using satellite imagery to evaluate potential nature-based risks to their assets or supplier assets, anywhere in the world. Knowing their vulnerabilities to climate change and other nature-related hazards allows more effective risk management and mitigation.

It is always important to know the limits of satellite imagery, however. The biggest impact is cloud cover, nighttime, and winter darkness. All images based on camera-like sensors can't see through clouds and need sunlight to illuminate the area of interest, so there may be a delay in getting the information you need.

The increase of radar satellites has helped fill these gaps, as they can see in the dark and see through clouds.

2) Tell us how satellite imagery analytics can be used to support nature reporting?

By way of example, Stage 3 of the LEAP process for TNFD asks you to measure the scale and scope of your dependencies on nature, taking into consideration the structure, composition, and function of an ecosystem. Satellite imagery can be used to derive metrics such as ecosystem primary productivity, land cover dynamics, or surface topography and slope.

These metrics can be combined with other derived datasets (such as the Biodiversity Intactness and Ecosystem Intactness) to score a company's asset based on ecosystem "reliance" and "resilience" scores. These scores then indicate how dependent that asset is to the surrounding ecosystem services.

A key point to remember here is that these calculations need to be carried out across large asset footprints and potentially for thousands, or even millions, of company assets. (Here, an "asset" refers to tangible infrastructure such as factories, mines, farms, mills, etc).

Collecting such data on the ground, or even by drone, would neither be cost-effective nor practical. To process such data on a desktop requires sourcing the data, downloading it, then merging it together to determine the metrics. With cloud computing now ubiquitous, tools like Earth Blox can do these calculations at scale and in a fraction of the time.

3) How do you see the wider nature data space evolving over the next 2-5 years?

We are entering an era of data proliferation. Nature data will see a notable increase in data frequency and improvements in quality. These measurements will come from improved ground-based tools (such as unpiloted aerial vehicles (UAVs)), as well as aircraft and satellites. Generative Artificial Intelligence (GenAI) will also make an impact, but perhaps not in the ways we expect.

We are seeing the growth in Earth Observation (EO) satellite constellations for measuring nature continue to grow rapidly. This is particularly the case in the commercial sector, so while we can expect improved coverage and faster data acquisition, we will start to see increasing costs of raw data impact on the value

chain – value for money will then drive many of the data-based decisions in a way that hasn't always been the case to date.

While commercial satellites for mapping the environment will likely move towards larger constellations of smaller satellites (to ensure good global coverage) there are also two new space agency missions – BIOMASS (from ESA) and NISAR (from NASA and the Indian Space Agency) – that could disrupt the forest-data markets.

These missions will provide new snapshots of the world's forests that, much like GEDI has done before them, will spur a rapid increase in the quality of global map products of forest canopy height, biomass (carbon), and structure, across all the suppliers.

Finally, advancements in large EO models (similar to large language models) will facilitate easier navigation through extensive datasets. While these technologies might not drastically enhance the data accuracy per se, they will significantly improve the accessibility and usability of data, empowering researchers to better leverage the vast amounts of collected data – that is, more emphasis on "sense-making", rather than just "sensing".

Alex Logan, Co-Founder & CEO Cecil Earth

1) What are the fundamental challenges with nature data Cecil is working to address?

Selecting datasets

With thousands of nature datasets available, it is difficult to choose one that meets the right criteria to support an analysis workflow. A lack of transparent dataset documentation leaves teams unable to evaluate trade-offs between nature datasets, resulting in teams spending weeks trawling through websites and documents or engaging with providers before they can even start.

Integrating and preparing datasets

Building integrations with one nature dataset is expensive and time-consuming – that cost grows with each additional dataset. Each integration requires managing hundreds of files, processing the data, and incorporating outputs into internal data infrastructure.

The lack of standardisation across datasets, such as in measurement units, spatial resolution, or CRS, makes it challenging to work with multiple data providers. Time is wasted cleaning and preprocessing data before analysis.

Navigating commercial agreements and usage rights

Data providers employ a variety of business models and apply their own usage rights to data, making it difficult to understand each dataset's usage limitations and costs.

Commercial data providers can also have minimum spend requirements, becoming prohibitively expensive for teams seeking smaller amounts of data (e.g. less than 100,000 ha).

These three barriers collectively hinder teams looking to use nature data. As a result, vast segments of the market are unable to comply with upcoming nature regulations or properly evaluate their risks and opportunities.

2) Who are your end users and how do you see them and use cases evolve over time?

Cecil supports data scientists, data analysts, and science teams who wish to use accurate site-level nature data in analysis workflows. These users come from various sectors, including nature tech startups, real asset managers, project developers of nature-based solutions, corporates, consultants, and financial institutions.

As the corporate and finance sectors face increasing pressure to manage nature-related risks, meet sustainability goals, and comply with stringent regulations, their need for reliable nature data will drive the growing demand for nature data.

Companies are beginning to recognize that integrating accurate, actionable nature data into their decision-making and supply chain management is essential for maintaining competitiveness, ensuring transparency, and achieving long-term business resilience.

We see three types of companies leading this evolution. The first are new technology tools, methodologies, and applications needing site-specific nature data to power their solutions – ranging from new financial instruments to advanced digital MRV.

Second, corporations with significant exposure to natural assets, like forestry, materials, and food, ag, and beverage companies, are finding their yield fluctuating and supply chains disrupted and are seeking ways to get ahead of these challenges.

Finally, the financial institutions that invest in and ensure these corporations and assets, as well as those building nature positive portfolios, are clamoring for better data to inform their diligence and risk analysis.

3) How do you see the wider nature data space evolving over the next 2-5 years

The environmental science and technology domains have gone into overdrive to respond to increasing demand for nature data. This is yielding data products with greater coverage, resolution, and accuracy – as well as new sensors that capture unmapped dimensions of nature.

Remote sensing is leading the charge, with many providers preparing sub-ten metre nature products and a new generation of hyperspectral satellites being deployed as we speak. We expect this, plus a push to leverage smartphone and IoT technologies to measure aspects of nature not visible from space (e.g. animal diversity, soil carbon), to unlock near real time tracking of nature and yield huge volumes of data for data teams.

Whether as a carrot or stick, regulation is going to significantly impact the nature data space. EUDR and CSRD are two of many regulations and voluntary reporting frameworks already forcing organizations to confront significant nature data gaps and measurement challenges.

While there will be pushback, delays, and false starts, this attention on measurement and reporting across many variables will force the entire ecosystem

to level-up their capabilities, resulting in new datasets, technologies, and ultimately more sophisticated management practices and regulation as the data improves.

Nature markets are relatively nascent and are currently dominated by top-down regulation plus a few early movers delivering end-to-end tech/data solutions. Even now, academic research is attempting to shift the market towards a more science-led approach, with initiatives like GEO BON creating frameworks to translate scientific outputs into sets of operational metrics.

We see this science-led approach becoming increasingly influential as the market matures to serve a greater diversity and sophistication of use cases around nature. We also expect the nature tech space to move away from a small number of end-to-end solutions and towards a network of entities specialized on one component of the system, such as data provision, data infrastructure, data analysis, or reporting.

As the accessibility of spatial data improves, particularly through SQL and API-enabled platforms, a broader range of users will be able to interact with and utilise this data.

This evolution will democratize the use of nature data, extending its reach beyond traditional data scientists and environmental researchers. Corporate sustainability teams, among others, will increasingly be able to analyze spatial data, empowering them to make data-driven decisions in support of sustainability goals.

Sustainable finance solutions

In this section, we start with a broad discussion on the current landscape of nature finance before diving into finance solutions for corporates.

Current state of nature finance

Estimates vary on how much currently goes towards nature-positive outcomes and how much is needed. Part of the challenge is that there is currently no universal definition or taxonomy of what nature finance is.

However, one thing is clear – there is a significant financing gap to protect and restore nature. More finance needs to be mobilized for nature, especially private capital.

Broadly action is needed on three fronts: 1) Financing the protection and restoration of natural ecosystems, 2) Supporting companies in their sustainability transition, 3) Financing nature disruptors and enablers.

A 2021 analysis by The Nature Conservancy identified an annual financing gap of $598-824 billion, with current spend (as of 2019) on nature-positive outcomes adding up to only $124–143 billion per year.[41] The majority of funding for nature currently comes from public sources, private finance remains limited but needs to be mobilized.

The Nature Conservancy also notes that much of the financing that is needed can be unlocked by redirecting existing spending flows to economic activities that are actively harming nature. The latest State of Finance for Nature update by UNEP estimated that almost $7 trillion per year of public and private finance flows have

[41] Deutz, Andrew, et al. "Financing Nature: Closing the global biodiversity financing gap." The Paulson Institute, The Nature Conservancy, and the Cornell Atkinson Center for Sustainability (2020): 256.

direct negatives on nature.[42] The $5 trillion of private finance flows that have a direct impact on nature is 140x larger than the private finance flow to nature-based solutions ($35 billion).

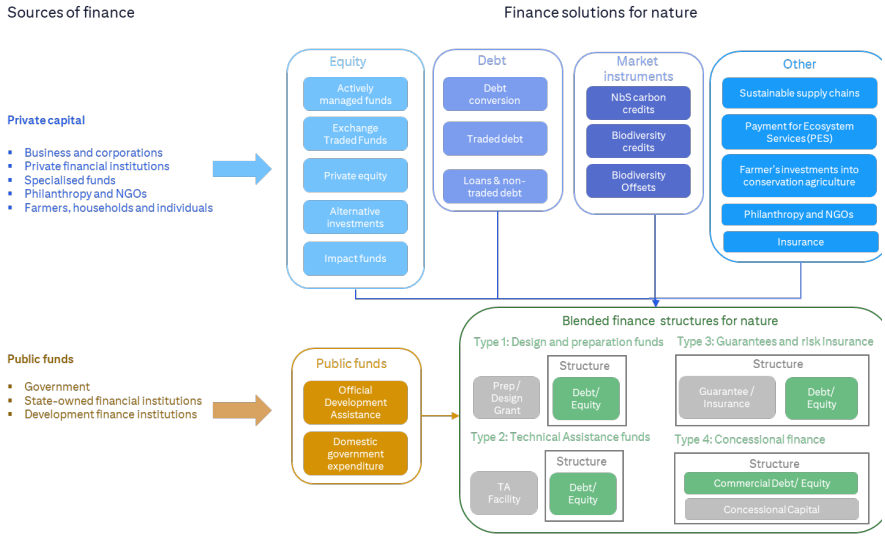
The current snapshot may seem rather bleak, but awareness of nature risks is growing amongst the finance community, driven by regulation and reporting requirements, expanding market demand, development of standards and frameworks and market opportunities.

The TNFD for example have released sector specific guidance for financial institutions to support the integration of nature into financial decision-making. UNEP FI and the Finance for Biodiversity Foundation have just published a Finance for Nature Positive discussion paper which proposes a Finance for Nature Positive working model with definitions and practical strategies. The two organizations aim to work towards a common understanding of how private finance can meaningfully contribute to the Nature Positive Goal.[43]

Ecosystem growth and innovation

Finance for nature may still be small but it is growing and evolving quickly. Even though guidance on nature finance is still being developed, there are already a host of finance solutions that can be used and or being used to support nature-positive outcomes. The figure below summarizes the finance solutions highlighted in the latest UNEP State of Finance for Nature report.

Figure 20. Finance for nature landscape



Source: Citi GPS, adapted from UNEP

Existing solutions already encompass a range of financial instruments, strategies and structures, that support a variety of nature-positive outcomes. We're seeing sustainable finance products and solutions that have been used to finance the energy transition also being adapted to nature issues, as well as innovations in nature-specific finance solutions.

[42] UNEP (2023) State of Finance for Nature 2023
[43] https://www.unepfi.org/publications/finance-for-nature-positive-discussion-paper/

A 2024 mid-year update from UNEP on the state of finance for nature reported a "surge" of private finance in the past 4 years from $9.4 billion to over $102 billion.[44] Asset classes that have contributed to the growth include alternative investments, traded debt, private equity as well as an increase in innovative financial instruments i.e. biodiversity credits, private venture capital for biodiversity, debt-for-nature swaps, nature-supportive ETFs.

Investors can engage in a variety of finance solutions such as impact investing, private equity and venture capital and channel capital into companies and start-ups that are nature-forward such as those involved in ecosystem restoration or regenerative agriculture. Public and private actors can utilize blended finance mechanisms such as public-private-partnerships and blended bonds to support large-scale conservation efforts. For example, debt-for-nature and climate swaps have been hitting headlines in recent years which restructures a country's debt in exchange for commitments to fund environmental projects. According to Convergence, the global network for blended finance, emerging trends suggest blended finance is key to creating a pathway to "investability" for nature-based solutions business models.[45]

Citi has now managed 4 World Bank outcome bonds, 2 of which are nature related. A wildlife conservation bond dubbed the "rhino" bond sought to protect black rhino populations, and the most recent one priced in January 2024, was a $100 million 7-year plastic waste reduction-linked bond. The innovative use of plastic credits in this transaction introduces a new way of financing plastic collection and recycling operations, and the projects supported in Ghana and Indonesia not only help to reduce plastic waste but also improvements in local pollution and air quality, human well-being and health as well as job creation.

Financing solutions for corporates

In our report Sustainable Transitions published earlier this year in collaboration with Citi Services, we emphasized that sustainable finance is a vehicle, not a destination and can be used for mitigating risks, building long-term resiliency, improving sustainable performance, and capturing growth opportunities.

We also made the case for greater treasury engagement and alignment earlier on in the sustainability journey of a company. Treasury can offer unique insights into business ecosystem risk and connect a company's sustainability objectives to sustainable finance.

Alignment of sustainability objectives to financing may have a positive impact on the cost of capital and improve access to new pools of capital, often via the use of innovative sustainable finance products or structures. It may also facilitate better engagement with stakeholders such as impact investors who have sustainability objectives at the core of their investment strategy.

Corporates can leverage **sustainable debt** markets to finance growth and transition, via Use of Proceeds instruments or general corporate purpose instruments such as KPI-linked bonds.

They can also use **trade and working capital solutions** such as sustainable supply chain finance or trade loans to incentivize sustainable practices across their supply chains. **Payment infrastructure** are needed to support new business opportunities, new revenue streams and new geographic footprint. **Market-based**

[44] https://www.unepfi.org/wordpress/wp-content/uploads/2024/06/Press-release-New-Green-Shoots-research-Clean-10062024-updated-2.pdf
[45] Convergence (2024) State of Blended Finance

mechanisms in support of nature are evolving quickly such as carbon and biodiversity credits. Other finance solutions for nature can include **payment for ecosystem services** as well as **insurance and risk mitigation instruments**. Corporates can also consider directing their corporate philanthropy towards conservation efforts though grants.[46] We discuss some of the finance solutions in more detail below.

Debt instruments

Over the past few years, sustainable debt instruments have grown in popularity. Use of proceeds and KPI-linked bonds and loans are being increasingly used to finance corporate transition. Green bonds make up the majority of issuance from corporates.

Green, blue or sustainability bonds can be used to finance or re-finance new or existing nature-related projects which could include sustainable agriculture, reforestation, green infrastructure, water conservation or biodiversity conservation.

Sustainability-linked bonds or loans can provide finance for corporate general purposes linked to nature-related targets. They can offer more flexibility in the Use of Proceeds than green, social and sustainability labelled bonds, and are gaining traction amongst corporates in financing climate transition efforts.

According to S&P, corporates dominate the sustainability-linked portion of the sustainable debt market, issuing 83% of all sustainability-linked bonds in 2023.[47] The term “nature bonds” are being increasingly used but there is currently no standard definition or criteria, which has led to calls for more guidance similar to the blue bonds guidance released last year to cover more ecosystems.[48]

Market-based mechanisms

In July 2023, we produced a primer on the voluntary carbon market which included recommendations for navigating the market. Discussions included the use of nature-based carbon credits which can be used for both categories of carbon credits – emission reduction and avoidance and carbon removal.

Examples of nature-based emission reduction credits include REDD+, changes to agricultural practices that retain already stored carbon. Nature-based carbon removal credits could include afforestation & reforestation, soil carbon enhancement and ecosystem restoration. The latter applies across land, freshwater and oceans and blue carbon credits that refer to carbon captured by ocean and coastal ecosystems are growing in demand.

Nature-based carbon credits have the potential to deliver co-benefits across climate and nature and communities. However, for now biodiversity benefits remain unquantified even though they are often considered premium carbon credits and typically sold at a higher price.[49] Large corporations e.g. technology companies are now buying nature-based carbon credits directly from carbon removal companies.

[46] See our Citi GPS report on Philanthropy and the Global Economy for more discussion on corporate giving

[47] https://www.spglobal.com/_assets/documents/ratings/research/101593071.pdf

[48] https://investesg.eu/2024/01/23/new-green-shoots-6-trending-products-for-nature-finance-and-5-nature-investing-themes-to-watch-in-2024/

[49] Compensate Foundation (2023) From Carbon to Nature

Interest in biodiversity offsets and credits is also growing and was mentioned in the GBF as examples of innovative financing schemes that countries should leverage to mobilize additional capital towards biodiversity conservation and restoration.

The voluntary biodiversity credits market is still in its very early stages of development and currently estimated at around $8 million. According to the WEF, global demand for voluntary biodiversity credits could reach $2 billion in 2030 and $69 billion in 2050.[50] Standards and principles are still very much evolving with various organizations putting out guidance. The Biodiversity Credit Alliance was launched at COP15 to bring clarity and provide guidance for the development of a credible and scalable market.[51]

There is also an ongoing debate on terminology and the difference between biodiversity credits and offsets which are sometimes used interchangeably across compliance and voluntary markets. Biodiversity offsets have traditionally been used to meet regulatory requirements and used to address negative impacts of specific development projects.

For example, the UK's Biodiversity Net Gain (BNG) legislation requires developers to deliver a BNG of 10% as measured by a statutory biodiversity metric. According to Carbonbrief, at least 56 countries have laws and policies that specifically require biodiversity offsets or some method of compensatory conservation.[52]

The BCA currently considers biodiversity credits to be instruments that can potentially be used in a variety of ways but recognize there are many experts who suggest they should not be used to compensate "direct like for like" negative impacts in biodiversity such as the traditional offsets.[53]

Sustainable trade and working capital solutions

Trade and working capital loans can be used to improve performance against nature-related criteria which can be use of proceeds or KPI-linked. Export credit backed financing is another solution that can be leveraged to support the nature transition in partnership with export credit agencies, development finance institutions and multi-lateral organizations, especially in developing markets.

Sustainable Supply Chain Finance is another finance tool that can be used to support nature-positive outcomes. Supplier sustainability metrics are integrated into supply chain finance programs, providing incentives to suppliers by improving working capital in reward for improved sustainability disclosure and/or performance.

Sustainability metrics currently largely focus on scope 3 emissions which is a key objective for many buyers in their engagement with their suppliers in reaching scope 3 net zero targets. However, other environmental and social factors can also be integrated from overall ESG credentials to nature-related factors like deforestation, water usage and pollution and biodiversity, as well as social factors such as supplier diversity and human rights. According to UNEP's 2023 State of Finance for Nature, sustainable supply chains was the second largest channel of private finance flows into Nature-based solutions ($8.6 billion).

---

[50] https://www.weforum.org/publications/biodiversity-credits-demand-drivers-and-guidance-on-early-use/

[51] https://www.biodiversitycreditalliance.org/

[52] https://interactive.carbonbrief.org/carbon-offsets-2023/biodiversity.html

Payment for Ecosystem Services (PES)

Payment for Ecosystem Services is a financial mechanism where beneficiaries of ecosystem services such as water supply and quality, biodiversity conservation or carbon sequestration, compensate those who manage or preserve these ecosystems.

The concept of PES is not new and gained traction with environmental economists in the 1990s. They are not widely used by corporates but there are a growing number of examples, especially from consumer staples companies that are using PES programs to protect and secure water resources, protect soil health, incentivize sustainable agriculture practices, and support company net zero targets.

Insurance and risk mitigation instruments

Insurance and risk mitigation instruments for nature can help protect businesses from environmental risks such as natural disasters, climate change and biodiversity loss. These instruments could include catastrophe bonds, weather derivatives and parametric insurance which provide payouts based on predefined environmental triggers like droughts or hurricanes. Corporates could utilize these products to not only mitigate financial risks but also incentivize more sustainable practices and build environmental resilience.

Interview with Bridget Fawcett, Managing Director and Head, Sustainability & Corporate Transitions, Investment Banking Citi

What are the main challenges you're hearing from corporate clients about managing nature risks and opportunities?

While businesses are increasingly aware of their co-dependencies on nature to deliver their products and services, many aspects of nature are not valued in our traditional financial frameworks. Corporates are grappling with how to incorporate nature risks while institutionalizing work to address climate, however the data, metrics and reporting frameworks for nature are far more complicated. Nature is broad-based, incorporating land, oceans, fresh water, and atmosphere. There is no single metric that addresses those risks, and the risks vary by industry type, geography, footprint.

Despite this, corporates have increased their commitments to nature across various dimensions beyond carbon and water, to include forests, biodiversity, and nutrients. According to McKinsey, about one in five Global Fortune 500 companies now report on more than three nature metrics, while four in five have set carbon reduction targets.

In general, the topic of nature impact and risk exposure is vast and largely unaddressed – we need more agreement on taxonomy, and this work is being augmented by reporting requirements such as the EU CSRD and TNFD to standardize the way corporates are reporting on nature.

What are some innovative solutions you're seeing from corporates to address nature loss?

There is innovation happening where the economics of nature are being realized. New technologies are addressing food systems, nature-based carbon removals, nature reporting, water conservation and earth observation tools.

Given food systems account for roughly one third of global emissions, research is being done on how to incentivize farmers to adopt regenerative practices and creative solutions in food sectors, such as new marketplaces and indoor farming. Full Harvest is one marketplace connecting farmers with buyers of surplus and undesirable produce to minimize food waste.

The accelerated growth of nature-based carbon removal markets is another avenue where corporates purchase nature-based carbon credits directly from removal companies, such as Aurora Sustainable Lands, and NBS credits can be of high quality and cheaper than many other engineered solutions.

The Frontier Climate Coalition and Symbiosis Coalition is also funding early-stage nature-based removal companies, identifying the long-term winners and encouraging companies to be off-takers. On a corporate level, Walmart is a championing conservation via the Acres for America program and working to conserve 2mm acres of wildlife habitat in partnership with the public sector in the US.

How is finance evolving to support corporate transition on nature issues?

Sustainable financing has evolved significantly and now represents 12% of debt capital markets. We have seen $100bn+ raised by new private equity funds, with innovation in debt markets, such as SLBs and impact bonds, still in early stages. Regional banks and specialty finance programs are driving innovation at the local level, yet experience challenges with scaling.

The nature-based carbon removal market has also scaled rapidly, fueled by forward purchase agreements and various technology companies purchasing credits. While biodiversity credits have also been explored, additionality by the projects remains a core issue. Over time, we are likely to see innovative financing including biodiversity credits led by the World Bank and the World Wildlife Fund.

As we continue to build out our own physical risk models through geospatial data, we will have greater insight into where projects will maximize impact on nature. For example, Citi structured the World Bank's 7-year $100mn Plastic Waste Reduction-Linked Bond to fund projects in Ghana and Indonesia, addressing the 70mm tons of plastic that leaks into the environment, annually. The projects will further reduce local pollution, improve air quality and generate jobs in marginalized communities, with Citi as the offtaker of VCUs.

What do you think are the key enablers that can help accelerate corporate action on nature?

Firstly, corporates must have an integrated approach to climate and nature. Secondly, there should be a reporting prioritization for the locations that matter to both everyone and to specific industries and companies. The TNFD and CSRD reporting structures provide comprehensive frameworks with consistency, tracking pollution, water & marine resources, biodiversity, and ecosystems, with nature concepts incorporated in four out of five environmental reporting categories. Ratings firms like MSCI also evaluate nature risk for all companies using standardized metrics, but future direction should be more holistic and centralized.

Another key enabler is the advancement of nature data collection and analysis. There are 150+ companies developing earth observation and geospatial data tools. These are especially prevalent for addressing freshwater shortage through measuring corporate impact and dependency on biodiversity and water resources, a topic that will impact corporations across the globe.

Governance structures that incorporate nature risk in decision making will further advance these issues on corporate agendas. Once nature is considered a ‘top of the house’ priority, implementing approaches can be completed on a sector-specific and location-specific basis, but it starts with compiling relevant data and aligning the organization in a top-down approach to make nature management the focus.

Chapter 3 – What does good look like for corporates?

"Making peace with Nature is the defining task of the 21st century. It must be the top, top priority for everyone, everywhere". - UN Secretary-General António Guterres

Nature health is in decline around the world. The science is clear, and there is now a growing body of evidence on **why** the business community should care. Progress is also being made on **how** business can take action. In this chapter, we explore the direction of travel for business and sustainability, and what "good" looks like going forwards.

First, we consider the current state of corporate action, and then examine the broader landscape shift towards more integrated environmental management and disclosure, and best practice for corporates.

Current landscape in corporate action

Corporate awareness of nature-related risks has accelerated over the past few years, and companies are starting to assess their impact and dependencies across a range of nature issues including deforestation, freshwater use, pollution, ocean impact, biodiversity loss.

However, progress is still lagging that of climate and awareness and action varies across the realms. According to a study by McKinsey only 25% of the Fortune Global 500 companies have freshwater consumption targets, 9% have Forest targets and just 5% have targets for biodiversity loss, compared to 83% that have climate targets.[54]

The Nature Benchmark by the World Benchmarking Alliance tracks and measures how companies are reducing their negative impacts on nature, and their 2024 update found that most companies do not yet really understand how they affect and rely on nature – only 5% of companies assess their impact, less than 1% understand their dependencies and zero companies holistically assess and disclose their dependencies on nature. In terms of realms, the assessment found that most companies tend to focus on land or freshwater and neglect the oceans but even the focus on freshwater is missing a critical piece which is water quality and pollution.[55]

It is clear from the current snapshot that we still have a long way to go in reaching collective corporate action on nature, and whilst there are leading companies in the space, most are still early on their nature journey.

However, we are seeing progress and momentum. In June 2024, the TNFD announced that more than 400 organizations are now aligned with the framework and committed to disclose their nature-related issues based on its recommendations, a 30% increase since January this year. TNFD adopters now cover over 50 jurisdictions, 62 of 77 SICS sectors and the publicly listed companies represent over $6 trillion in market capitalization.[56]

[54] https://www.mckinsey.com/capabilities/sustainability/our-insights/where-the-worlds-largest-companies-stand-on-nature
[55] https://www.worldbenchmarkingalliance.org/publication/nature/
[56] https://tnfd.global/tnfd-adoption-now-over-400-organisations-and-new-sector-guidance-released/

Investor action and pressure on nature is also increasing. More investors are considering biodiversity and nature in their investment process and we're also seeing a growth in nature-related funds. Investor initiatives have also emerged such as Nature Action 100 which mirrors Climate Action 100.

The UNPRI have also launched Spring – an investor stewardship initiative on nature with the support of a group of over 200 investors managing $15 trillion. There are also a growing number of industry specific or issue specific initiatives such as FAIRR's Seafood Traceability Engagement and the Investor Policy Dialogue on Deforestation (IPDD).

One of the main findings from the 3rd sustainable investor sentiment survey carried out by our Citi Research colleagues between January-March 2024, was that Biodiversity loss is the 3rd leading sustainable investment theme after climate change and energy transition.

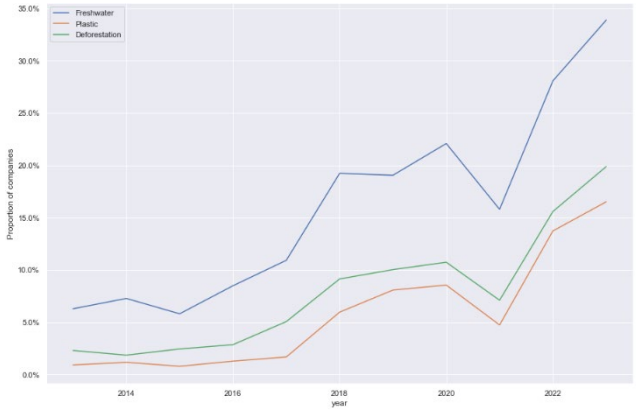
If we consider all nature-related themes - biodiversity loss, blue economy and water security, and deforestation, it would be the top priority theme for investors. The survey also found that 48% of participants are making strong or partial progress in integrating biodiversity loss into their investment progress.[57]

To further analyze the progress being made in nature action across business and finance, we assessed time trends in the corporate reporting of nature-related issues as well as the hiring of climate and nature experts by corporates and financial institutions.

Our analysis finds that the percentage of companies discussing nature-related goals or targets have increased substantially over the past few years, and there has been a growth in nature experts across business and finance.

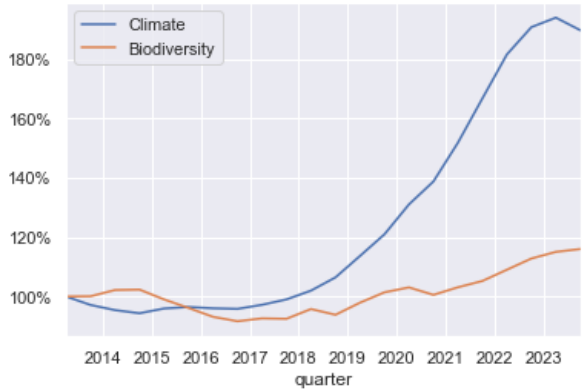
Within the universe of companies assessed[58], we found that a higher proportion of companies are discussing water-related goals compared to plastic and deforestation and the proportion of companies discussing water goal/targets increased from 6% to almost 35% in 2023.

Figure 21. Proportion of companies discussing nature-related goals and targets



Source: Citi Global Data Insights, CDP

Figure 22. Increase in Climate and Biodiversity related jobs in business and finance



Source: Citi Global Data Insights, Revelio Labs

[57] 175 institutional investors completed the survey across 22 countries. More information can be found here on Citi velocity

[58] MSCI AC World (around 3000 companies in developed and emerging markets)

An exploration of climate and biodiversity workforce allowed us to identify an almost 1.2x increase in the workforce since 2013 that are biodiversity-related. However, this increase does pale in comparison to climate personnel which has seen an almost 2x increase in the workforce over the past decade.

Further assessment by sector revealed most biodiversity personnel work in industrial services whereas climate-related personnel are more spread out across industries but largely in Utilities, Industrial services, and Energy minerals.

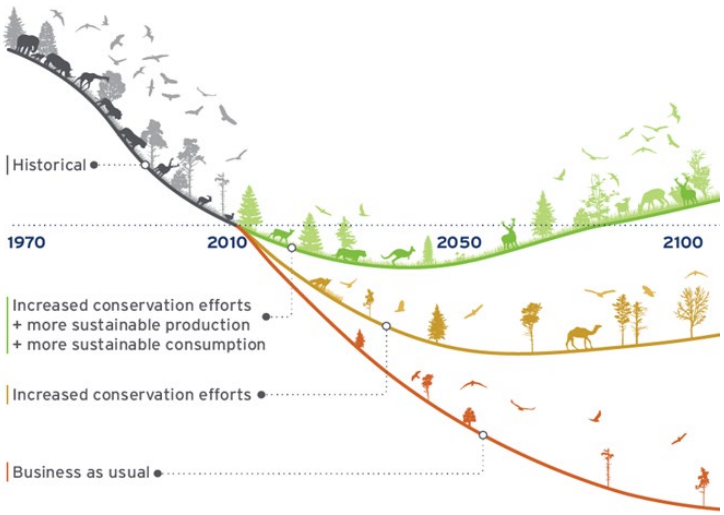
However, it is also worth noting that biodiversity experts still account for a very small number of roles in the business and finance workforce. Our latest data for Q3-2023 found on average 1 employee related to biodiversity for every 20,000 employees.

Shift towards integrated environmental management and disclosure

Nature-positive is a global societal goal which aims to "Halt and reverse nature loss by 2030 on a 2020 baseline and achieve full recovery by 2050".[59] Some experts call it the need to bend the curve on nature loss.

At the high level, we know what actions are needed – increased conservation efforts are critical but will not be enough. They need to go together with sustainable production and consumption measures to reduce negative impacts on nature. These actions are not separate from those needed to tackle climate change, and most nature-positive solutions also have positive climate impacts.

Figure 23. Bending the curve on biodiversity loss



Source: Citi GPS, Leclere et al. (2020), IIASA

To effectively tackle the interconnected planetary crises we currently face, more holistic approaches to environmental management are needed that embrace the climate-nature nexus from global frameworks and government policies to corporate and investment strategies.

The direction of travel does appear to be headed towards integration e.g. the TNFD is adopting a holistic approach to nature issues, SBTN is aiming towards integrated SBTs for all aspects of nature, regulations such as the EU's CSRD adopts a holistic

[59] https://www.naturepositive.org/what-is-nature-positive/

approach to sustainability reporting, CDP have adopted an integrated corporate questionnaire on climate change, forests, and water to encourage more holistic and balanced reporting. We are also starting to see demonstrations of integrated TCFD-TNFD disclosure reporting.[60]

UNEP FI's TNFD pilots are also looking at synergies across the frameworks and assessing an integrated climate-nature approach to sustainability reporting.

Climate remains the key area of focus across the wider sustainability reporting landscape, but nature is quickly gaining attention and focus and we expect greater integration of the nature realms and biodiversity as broader sustainability regulations, policies and frameworks develop and mature.

In terms of integrated solutions, IPBES and IPCC have identified key climate measures that are harmful for nature and biodiversity as well as measures that can make positive contributions for both climate and nature.[61] For example, replacing native vegetation with monoculture trees for carbon sequestration could lead to biodiversity and ecosystem services loss, pollution, and soil erosion.

Figure 24. Synergies and trade-offs of climate and nature measures

Climate measures harmful to nature and biodiversity	Key solutions for addressing climate change and nature loss
• Planting bioenergy crops in monocultures over large land areas	• Stopping the loss and degradation of carbon and species rich ecosystems on land and in the ocean
• Reforestation with monocultures	• Restoring carbon and species rich ecosystems
• Planting trees in ecosystems that have not historically been forests	• Increasing sustainable agricultural and forestry practices
• Increasing irrigation capacity (response to adapt agricultural systems to drought)	• Enhancing and better targeting conservation actions, coordinated with and supported by strong climate adaptation and innovation
• Any measures that focus too narrowly on climate change mitigation and adaptation should be evaluated in terms of their overall risks and benefits i.e. impacts of renewable energies on land/sea use change and pollution	• Eliminating subsidies that support local and national activities harmful to biodiversity i.e. deforestation, over-fertilisation, and over-fishing

Source: Citi GPS, IPBES/IPCC

Several studies have estimated the climate mitigation potential of nature-based solutions. A widely cited figure comes from a foundational analysis by Griscom et al. (2017) which estimated that nature-based solutions could contribute 37% of GHG emission reductions needed by 2030 to meet the Paris Agreement goals.

A more recent assessment by UNEP and IUCN found that nature-based solutions can deliver emission reductions and removals of at least 5 gigatons of CO2/year by 2030 and at least 10 gigatons by 2050 on a conservative basis.

The report also emphasized that nature-based solutions offer multiple co-benefits from biodiversity conservation and ecosystem services (i.e. soil health and water quality) to climate mitigation, adaptation, and resilience, as well as sustainable livelihoods and food, water, and energy provisions/security.[62]

[60] https://tnfd.global/knowledge-bank/an-illustrative-example-of-integrated-tcfd-tnfd-disclosures-for-the-tasmanian-forest-trust/

[61] https://www.ipbes.net/events/ipbes-ipcc-co-sponsored-workshop-biodiversity-and-climate-change

[62] UNEP/IUCN (2021) Nature-based solutions for climate change mitigation

In our minds, this makes a strong case for broadening the transition lens which currently focuses on energy and climate, to encompass nature and biodiversity. A more holistic approach to transition planning can allow the identification of synergies and trade-offs across climate and nature enabling more effective action on both fronts.

Best practices for corporates

So, what does this mean for business? Every corporate is on a different journey, but most are still at early stages of understanding and managing nature risks, and we recognize that nature-related regulations and frameworks are still in their infancy, and it is a challenging landscape to navigate.

Mandatory disclosure requirements such as the CSRD has now brought nature reporting into sharp focus for many businesses. However, there is already a whole host of resources and guidance available to corporates to help them on their nature journey.

We mapped out current nature-related regulations, policies and initiatives in Chapter 2 which hopefully provides a helpful overview of the current landscape. Grouping the initiatives and guidance into the three buckets of disclosure, impact assessment and target setting, and understanding which realms and needs each initiative covers can help organizations distil what to focus on. The frameworks can be used as a starting point and basis for nature practices and reporting rather than a prescriptive measure. After taking inspiration and guidance from the various frameworks, organizations can build and tailor their practices based on their business and sector knowledge.

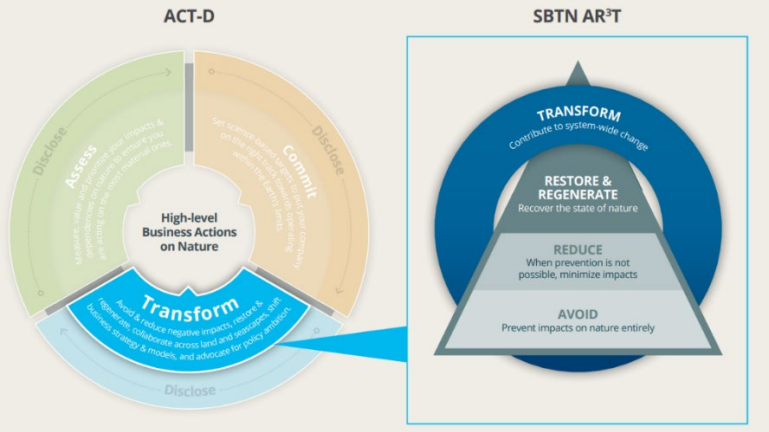
Businesses should consider their current and future nature impacts and dependencies in relation to the evolving legal and regulatory environment, which could present both risks and opportunities for business models and practices.

Even though there appears to be many different nature-related initiatives, there are efforts from leading organizations to align around a consistent approach to guide business action on nature.

We think a good place to start in developing a corporate nature strategy is Business for Nature, and along with WBCSD, SBTN, TNFD, WEF and Capitals Coalition have come up with the ACT-D (Assess, Commit, Transform, Disclose) framework to guide high level business action, and the SBTN AR3T (Avoid, Reduce, Restore & Regenerate, Transform) framework to guide the “Transform” stage of ACT-D.

The AR3T framework adopts the better known “Mitigation hierarchy” approach which is a widely used set of guidelines for reducing negative impacts on biodiversity. **Businesses are advised to first avoid and reduce pressures on nature, then restore and regenerate the state of nature, and finally to transform systems to contribute to system-wide positive change.**

Figure 25. Business action on nature frameworks



Source: Citi GPS, Business for Nature

What does action look like for businesses? The SBTN provides examples of measures that help to illustrate the AR3T framework in practice which we have grouped by realms below.

Figure 26. Examples of action across AR3T framework

Mitigation hierarchy (AR3T)	Land	Freshwater	Ocean	Atmosphere
1) Avoid	- Avoid zero conversion of natural lands in direct operations and supply chains - Avoid persistent organic pollutants and chemicals with demonstrated negative impacts on biodiversity	- Avoid water withdrawals from sensitive ecosystems and limited resources - Avoid water pollution, effluents and runoffs	Avoid unsustainably or illegally harvested seafood and other marine resources from supply chains	
2) Reduce	- Reduce nutrient runoff by promoting/ adopting agricultural best management practices - Reduce agricultural land footprint in direct operations and supply chains - Reduce impact through conservation-agriculture practices i.e. inter cropping, cover crops, crop mosaics	- Reduce water use through behavioural and technology changes i.e. no-till farming, upgraded irrigation system, crop shifting, rainwater harvesting		Reduce GHG emissions (i.e. CO2, methane)
3) Restore & regenerate	- Improve ecological productivity in working lands in line with landscape scale objectives and stakeholder needs i.e. ecological agriculture, silvopasture, agroforestry, border plantings, ecological corridors - Support the ecological restoration of deforested and degraded land - Support forest landscape restoration i.e. reforestation, afforestation, rehabilitation, remediation of past conversion - Restore the landscape with native vegetation or pollinator habitat	- Increase soil's ability to retain water and sequester carbon through regenerative farming practices i.e. fertility management, mulching - Restore native vegetation to improve water quality and quantity in watersheds or along riparian/wetland buffers - Restore freshwater systems via: restoring environmental flows, reconnecting habitats including rivers, physical habitat restoration	- Support regenerative ocean farming	
4) Transform	- Leverage supply chains to transform productive systems in line with science-based targets for nature e.g. ensure suppliers provide deforestation and conversion-free products - Support local community rights and social safeguards - Increase supply chain transparency - Champion nature positive policies			

Source: Citi GPS, SBTN

Leading companies in the nature space are already putting these frameworks into action and helping to inform and improve guidance. They are also developing and announcing integrated climate and nature strategies and goals and adopting more holistic approaches to managing nature and climate risks and opportunities rather than "stacking up" environmental issues and tackling them individually.

The journey to a leading company on nature will likely take a few stages - the WBCSD's roadmaps to nature positive provides a helpful framing of the corporate nature journey and the attributes of a "leading" company across key dimensions.

Figure 27. Stages of maturity for strategy and actions on nature

	Starting	Developing	Advancing	Leading
Scope	Site(s) and product(s) considered	Direct operations considered	Partial upstream and downstream considered	**Both upstream and downstream considered**
Range of nature issues addressed	One impact across one realm considered (land, freshwater, coastal, oceans)	Several impacts across one realm considered	Several impacts and dependencies across several realms considered	**All material impacts and dependencies across all realms considered**
Integration of nature, climate and equity agendas	Nature actions considered separately from climate and equity actions	Equity and climate considerations in some ad hoc nature actions	Partial integration of nature, climate and equity in relevant corporate strategies and action plans	**Fully integrated strategy with demonstrated outcomes for nature, climate and equity**
Mindset and purpose	Overall aim is pursing efficiency gains to do less harm and achieve better value returns (**risk mitigation**)	Overall aim is sustaining the current status quo by doing no harm (**net zero**)	Overall aim is pursuing an ideal that heals past harm (**restorative**)	**Overall aim is building capacity for self-sustaining abundance of life (regenerative)**

Source: Citi GPS, WBCSD (note

A leading company on nature can be profiled as *having a regenerative mindset and purpose that considers all material impacts and dependencies across all realms in direct operations and supply chains (upstream and downstream) and has a fully integrated strategy and goals for nature, climate and equity*.

Integrated approaches to climate and nature are still very much in its infancy in transition plans, but leading organisations working on transition planning on climate are now also turning their attention to nature such as the Transition Plan Taskforce (TPT).

In a recent advisory paper, the taskforce proposes a shift from TPT's existing integration of nature which captures how climate goals integrate with nature but doesn't cover nature, to a holistic climate and nature transition plan that addresses both climate and nature goals and manages synergies and trade-offs. A holistic, strategic and rounded approach should consider[63] –

1. Responding to the entity's climate and nature related risks and opportunities
2. Decarbonizing the entity, eliminating negative impacts on nature and sustainably managing dependencies
3. Contributing to an economy-wide transition and restoration of nature

Clear sector specific transition pathways are also important to mobilize business action on nature, especially in the context of supporting the implementation of the Global Biodiversity Framework. Business for Nature, the WEF and the WBCSD have now developed guidance for 12 key sectors which complements the SBTN and TNFD and contributes to the targets of the GBF.[64]

The TNFD has also put out sector guidance which includes recommended sector-specific metrics for disclosure.

[63] TPT Nature Working Group (2024) The Future for Nature in Transition Planning
[64] https://www.businessfornature.org/sector-actions

There are also a growing number of industry-specific initiatives and commitments around nature, for example the International Council on Mining and Metals (ICMM) has committed to take urgent action to support a nature positive future by 2030 and is partnering with the TNFD on producing sector guidance for the mining and metals sector. There are also realm specific initiatives such as the UN Global Compact's CEO Water Mandate and Ocean Stewardship Coalition.

Figure 28. Examples of nature-related industry initiatives

Industry	Initiative	Description
Agriculture and Food	The Sustainable Agriculture Initiative (SAI) Platform	An agri-food value chain initiative with over 180 members working to advance sustainable agricultural practices through pre-competitive collaboration
	One Planet Business for Biodiversity (OP2B)	A business coalition focused on scaling nature-positive solutions in agriculture and food production
Forestry	The Tropical Forest Alliance	A public-private partnership platform that aims to reduce deforestation associated with commodity supply chains
	Forest Stewardship Council (FSC)	A global certification system ensuring responsible forest management
Textiles & Fashion	The Fashion Pact	A CEO-led initiative for sustainability in the fashion industry
	Sustainable Apparel Coalition (SAC)	Apparel, footwear and textile industry alliance for sustainable production
Mining & extractives	International Council on Mining and Metals (ICMM)	A CEO-led organisation aimed at improving sustainable development in the mining and metals industry
Fisheries	The Seafood Business for Ocean Stewardship (SeaBOS)	A science-industry initiative for seafood companies to address ocean sustainability challenges
	Marine Stewardship Council (MSC)	A certification programme promoting sustainable fishing practices
Energy	Proteus Partnership	A science-industry partnership aimed at supporting private sector decision making towards nature-positive outcomes
Consumer goods	Consumer Goods Forum (CGF) Forest Positive Coalition	A CGF initiative that brings together consumer goods retailers and manufactures committed to removing deforestation from supply chains
Finance	Finance for Biodiversity Foundation	An alliance of financial institutions that commit to protecting and restoring biodiversity through their finance activities and investments

Source: Citi GPS, Initiative websites

Priority action areas for integrated climate and nature action

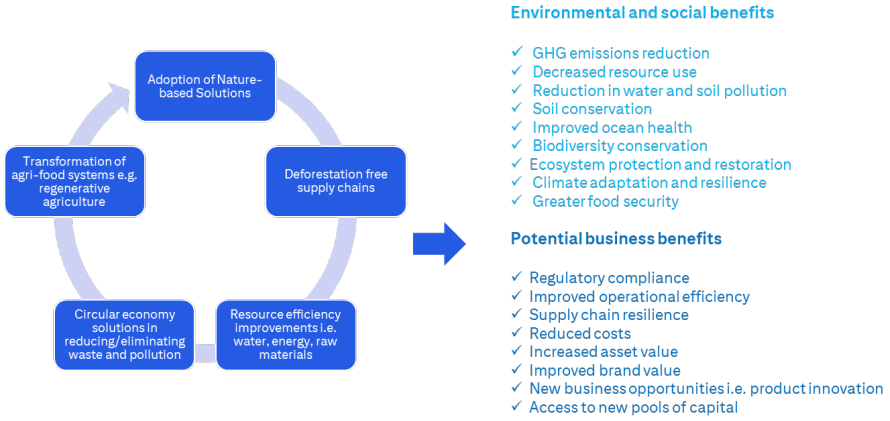
If businesses feel overwhelmed by the complexities of nature, we think deforestation is a good place to step on and make a start on addressing nature loss and support climate goals.

The use of forest-risk commodities is widespread across industries. Companies across all sectors should consider their exposure to forest risk commodities in their direct operations and supply chains.

Water use and pollution is another nature issue that businesses can focus their attention on. Investor action on water risks is growing, and according to CDP, investor demand for data on corporate water risks more than doubled in a year.[65]

We have identified five key areas of action for businesses to consider that can help to address both climate change and nature loss simultaneously, as well as potentially improve business performance which could include improved operational efficiency, new commercial opportunities, access to capital markets and reduced reputational risks.

Figure 29. Key action areas that can deliver co-benefits across climate and nature



Source: Citi GPS

These key action areas apply to all sectors in either or both their direct operations or supply chains. Transformation of agri-food systems isn't just relevant for the food industry but is part of the supply chain of most industries from consumer discretionary (including apparel and automobiles) and household and personal products to healthcare, industrials and energy sector.

One solution the agri-food industry is banking on is regenerative agriculture. There are many definitions and descriptions of regenerative agriculture, but according to Regeneration International, the key to regenerative agriculture is that *'it does no harm to the land but actually improves it, using technologies that regenerate and revitalize the soil and the environment'*.

Improving resource efficiency can not only help businesses manage nature and climate-related risks but also drive cost-savings. Water stewardship is rising up the corporate agenda and as we have demonstrated above, water-related risks may impact a whole host of industries.

The concept of the circular economy is gaining traction amongst the private sector, which lends itself to innovation and creativity in rethinking products, services and business models that keep materials in use for as long as possible and reduces waste to a minimum.

[65] https://www.cdp.net/en/articles/media/a-turning-tide-investor-demand-for-data-on-corporate-water-risks-more-than-doubles-in-a-year

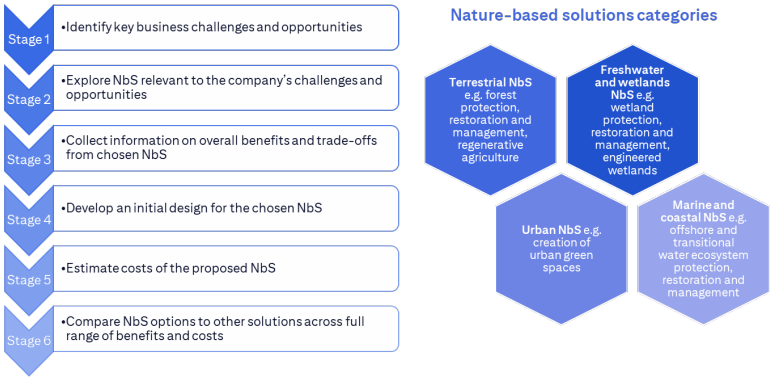
Businesses can explore circular solutions that can deliver environmental and economic benefits. According to the WEF, transition to a circular economy could generate $4.5 trillion in additional economic output by 2030.[66]

Businesses can support nature conservation and restoration through the adoption and investment into nature-based solutions which can also support climate goals.

The UN defines nature-based solutions as "actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits".

There is no unified and widely used taxonomy for nature-based solutions and businesses may be struggling to know where to start. Leading organizations are developing resources to help guide companies in the space, for example the WBCSD have developed a NbS blueprint to help companies which include a toolkit that provides examples of NbS, which business challenges and opportunities they can help to address and which biomes they can be applied.

Figure 30. Building the business case for Nature based Solutions



Source: Citi GPS, WBCSD

Many businesses may start their nature journey with a sole focus on regulatory compliance and risk management, but the potential commercial opportunities should not be underestimated or overlooked. A widely-cited analysis by the WEF found that nature-positive solutions could create annual business opportunities of $10 trillion, and 395 million jobs by 2030.[67]

The solutions are wide ranging across food, land and ocean use, to infrastructure and the build environment, and energy and extractives. We are also seeing an emergence of new companies in the natural capital space which are creating or supporting the delivery of products and services that protect, manage or restore nature.

We discussed the nature data ecosystem and vendors in the chapter above, which can be considered as part of a broader group of nature disruptors and enablers many of whom are utilizing emerging technologies such as satellite monitoring,

66

67 WEF and AlphaBeta (2020) The Future of Nature and Business

eDNA, and AI. Some are calling the space “nature tech” which is currently estimated at $2 billion but expected to triple by 2030.[68]

It is defined by Nature4Climate to encompass any technology that can be applied to enable, accelerate and scale up Nature-based Solutions and is different from Climate tech and Agtech in that its primary focus is on impacts on the natural world.[69]

However, there is overlap across the three markets e.g. nature tech considers interventions that help farmers boost crop yield livestock productivity while minimizing the environmental impact of agriculture.

Nature4Climate consider Nature tech in four broad categories –

1. Deployment – designed to alleviate the challenges faced by practitioners such as producers, foresters, ecosystem providers. E.g. tools to facilitate the sustainable utilization, restoration and implementation of natural capital.

2. Measurement, Reporting and Verification (MRV) – the multi-step process to measure environmental and social benefits from an activity and reporting the findings to third part verification.

3. Transparency – makes visible the ownership and transactions of nature assets e.g. tech enabled supply chain traceability.

4. Connection – used to connect at scale individuals, communities and organisations to marketplaces, technical assistance, communities.

[68] https://www.pwc.com/gx/en/services/sustainability/publications/surge-in-nature-tech-investing.html
[69] Nature4Climate and Capital for Climate (2022) The Nature Tech Market

Conclusions

Economic activities are driving unprecedented loss of biodiversity and natural capital and undermining the natural world's productivity and resilience which our economies and societies depend on.

Nature risks are rising for businesses and starting to lead to material financial losses. Stakeholder pressures from regulators, investors, clients and customers, and employees are also growing.

Businesses have a critical role to play in "bending the curve" on nature loss and will be increasingly coming under the spotlight on how they are impacting nature and how they are contributing to a nature-positive future. While progress is being made across business and finance, there is still a need for acceleration towards a collective embrace of nature positive and net zero transformation.

Figure 31. Key steps for corporates

Source: Citi Global Insights, WBCSD

We recognize that for most corporates, integrating nature into business decision making is not an easy task and requires fit-for-purpose nature data, intelligence and expertise, which have traditionally not been used widely by the business community. Nature-related regulations, frameworks and standards are also evolving and a step behind climate which can be challenging to navigate and adopt an integrated approach.

However, as we have demonstrated, data and resources exist for corporates to make meaningful progress on establishing a nature baseline and strategy. As our Head of Sustainability and Corporate Transitions, Investment Banking Bridget Fawcett said –

"Once nature is considered a 'top of the house' priority, implementing approaches can be completed on a sector-specific and location-specific basis, but it starts with compiling relevant data and aligning the organization in a top-down approach to make nature management the focus."

Don't wait for the perfect methodology because it doesn't exist. Gain support from leadership. Consider aligning climate and nature strategies and adopting a realms approach to environmental management and use finance solutions to support climate and nature goals.

As our premier thought leadership product, **Citi Global Perspectives & Solutions (Citi GPS)** is designed to help readers navigate the most demanding challenges and greatest opportunities of the 21st century. We access the best elements of our global conversation with senior Citi professionals, academics, and corporate leaders to anticipate themes and trends in today's fast-changing and interconnected world.

All Citi GPS reports are available on our website www.citigroup.com/global/insights/citigps

[Obesity and Beyond](#)
The surprising reach of GLP-1s
October 2024

[Cross Border Payments 24x7](#)
Faster, Simpler, Smarter
October 2024

[Global Giving](#)
Generosity and the Economics of Philanthropy
October 2024

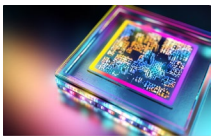
[Sustainable Transitions: Unleashing the Power of Treasury](#)
Unleashing the Power of Treasury
August 2024

[Hard to Abate Sectors and Emissions II](#)
The Road to Decarbonization
July 2024

[Embracing Demographic Transition](#)
Health and Wealth in an Aging World
July 2024

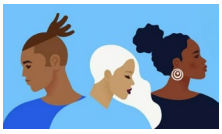
[AI in Finance](#)
Bot, Bank & Beyond
June 2024

[What Machines Can't Master](#)
Human Skills to Thrive in the Age of AI
May 2024

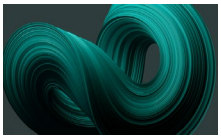


[Disruptive Innovations X](#)
Ten More Things to Stop and Think About
May 2024

[Future of Healthcare](#)
The Oxford Prescription
May 2024



[Closing the Racial Wealth Gap](#)
Restating the Economic Case
April 2024

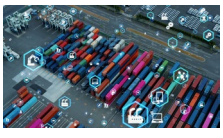


[Supply Chain Financing](#)
Building Resilience
January 2024

[Unlocking Climate and Development Finance](#)
Creating Bankable Projects
December 2023

[Food, Water, and Climate Change](#)
Solutions for Tackling this Critical Nexus
November 2023

[APEC Economic Outlook](#)
Navigating Shifting Dynamics
November 2023



[Supply Chains](#)
Lessons Learned Helped by New Technology
November 2023

If you are visually impaired and would like to speak to a Citi representative regarding the details of the graphics in this document, please call USA 1-888-800-5008 (TTY: 711), from outside the US +1-210-677-3788

IMPORTANT DISCLOSURES