LOCATION, LOCATION,
LOCATION:

ASSET LOCATION DATA SOURCES FOR NATURE-RELATED FINANCIAL RISK ANALYSIS

SPATIAL FINANCE INITIATIVE

CONTENTS

ACKNOWLEDGEMENTS

Cover image: Fires near Cape Town January 2019. Cape Town exemplifies a region with high economic value, driven by tourism, agriculture, and wine industries, while also being a biodiversity hotspot with unique ecosystems like the Cape Floristic Region. However, it faces significant nature risks, including frequent droughts and wildfires, which threaten both its natural habitats and economic assets. **Image:** ESA

INTRODUCTION

This report looks into the availability of asset location data, addressing an often-heard frustration within the finance community that there is a lack of location information to assess the nature-related financial risks of counterparties and portfolios. At the Oxford Sustainable Finance Group and the Spatial Finance Initiative we have done research with asset-level data for nearly 10 years. While we have found that asset (location) data is available for many sectors, it is not often easily accessible or available in a usable format for financial analysis. Despite, or because of, these technical challenges, we are increasingly seeing commercial and non-profit players develop asset location databases, both for internal purposes and external distribution. This is contributing to a growing number of solutions providing analysis at the physical asset level.

This report provides an overview of different sources of asset location data with examples across sectors and geographies. We assess data availability for sectors with material nature risks and dependencies, discuss overall limitations of the data sources and provide recommendations to address these in the short term. The report also comes with an inventory of asset location databases which we aim to update over time.

Our work builds and expands on the efforts from other leaders of asset-level financial risk analysis such as 2 Degrees Investing initiative's asset-level data and climate-related financial analysis market survey, WWF's biodiversity data puzzle report and more recently Resilient Planet Data Hub's Synthesis of Hazard, Vulnerability and Asset-Level Data Sources for Physical Climate Risk Assessment and Adaptation. Each has identified asset data sources for different purposes, from climate transition risk to physical climate risk to biodiversity risk applications. We believe any sustainability-related risk, impact or opportunity should be assessed at the asset level, in a bottom-up way. Robust asset data that connects asset location with ownership and operational information is the fundamental building block to do so.

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KEY TAKEAWAYS

1. Companies' dependencies and impacts on nature are inherently location and context specific. Location data of counterparties' operations is therefore critical for financial institutions to understand nature-related financial risks in a meaningful way.

2. Location data can be found in company disclosures and websites, public data registers or is available through commercial or non-profit data providers. But data availability and quality vary significantly between sectors and geographies.

3. We created an inventory of 145 asset databases and have found good data availability for sectors such as mining and power, with the most significant data gaps for agriculture, forestry and fishing sectors. Overall, data gaps are more problematic for nature dependency analyses than for nature impact analyses, as many industries with medium or high dependencies have poor location data coverage.

4. Many asset location datasets have not been created for financial risk applications. Limitations and challenges include accessibility of datasets, inconsistent formatting, poor ownership information and update frequency. Additionally, coverage of natural assets is very low.

5. Overall, location data is more widely available than perceived but there are limitations on the usability of existing datasets. These could be addressed in the short term by the finance sector advocating for a principle of asset-level disclosure, the public sector opening up data collected for (environmental) regulatory purposes and the research community developing efficient methodologies for cleaning and standardising existing data points.

145

WE CREATED
AN INVENTORY
OF 145 ASSET
DATABASES

SPATIAL DISTRIBUTION OF NATURE AND BIODIVERSITY

The availability and condition of nature, biodiversity, and ecosystem services are inherently linked to local contexts. For instance, a company operating in a water-scarce area may face elevated risks related to water availability and quality, which can directly affect operational costs and lead to potential conflicts with local communities. Similarly, the degradation of ecosystems can disrupt essential services businesses rely on, such as pollination, water purification, and climate regulation. Companies contributing to local environmental degradation may also face penalties, remediation expenses, or reduced market access due to heightened regulatory scrutiny or shifts in consumer preferences.

WHILE THE DRIVERS OF BIODIVERSITY LOSS AND ENVIRONMENTAL DEGRADATION CAN BE BOTH GLOBAL AND LOCAL, A COMPANY'S RELIANCE ON AND IMPACT ON NATURE ARE ALWAYS SPECIFIC TO THE LOCATION.
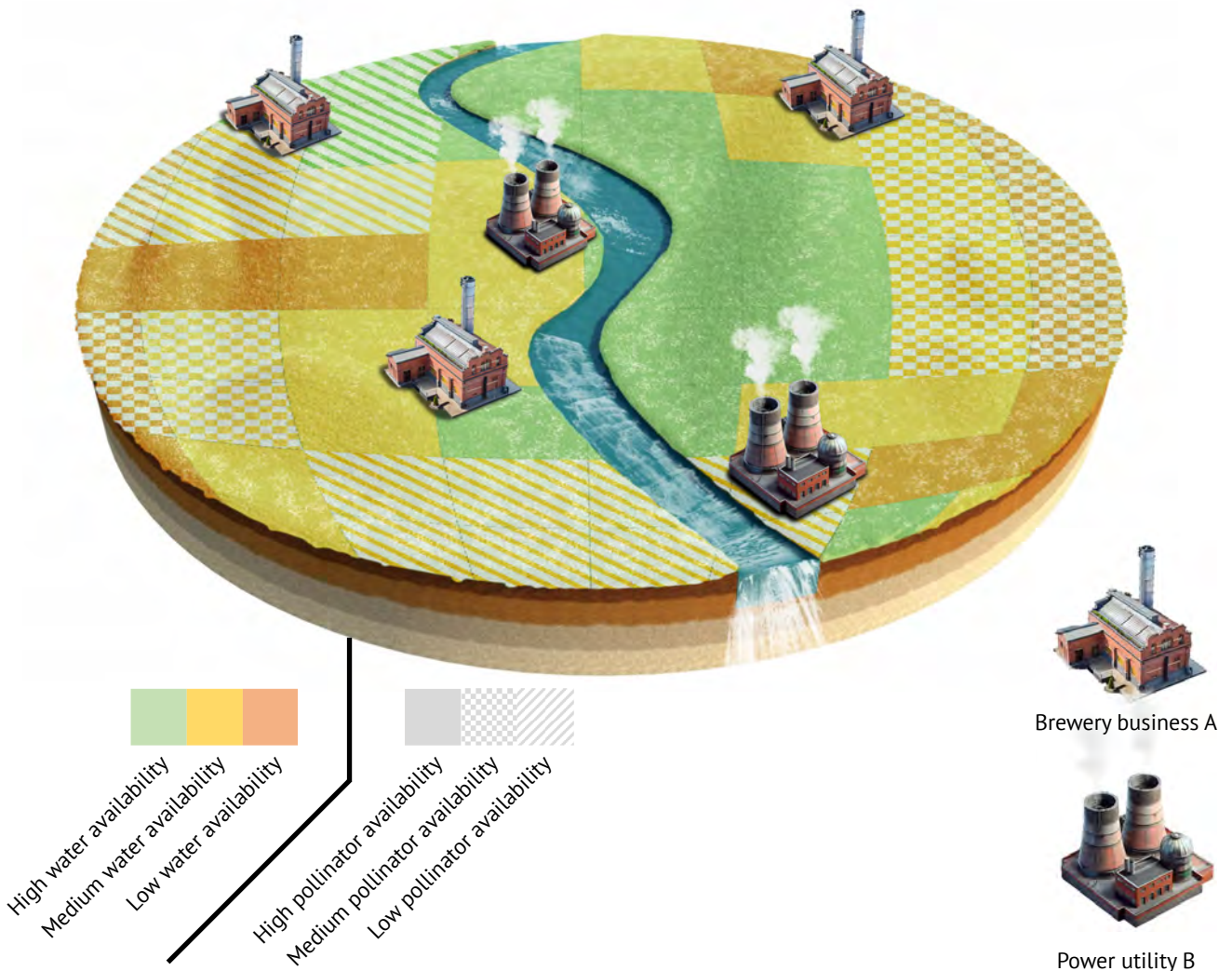
While the drivers of biodiversity loss and environmental degradation can be both global and local, a company's reliance on and impact on nature are always specific to the location. As organizations begin to assess, manage, and disclose nature-related financial risks, they must adopt a spatially explicit approach. This emphasis on location is increasingly reflected in guidance and tools for assessing and disclosing such risks. For example, the Taskforce on Nature-related Financial Disclosures (TNFD)'s LEAP framework encourages organizations to start by "locating their interface with nature." This involves identifying an organization's activities by sector and value chain, including direct operations, and determining how these intersect with specific ecosystems, biomes, and ecologically sensitive areas. Similarly, the Science Based Targets Network emphasizes the need to consider location-specific impacts and dependencies when setting nature-related targets.

This approach is critical because actions beneficial in one area may not yield the same positive effects elsewhere due to varying ecological and social conditions.

To implement this, organizations need to know the locations of their operations and supply chains, as well as those of their counterparties or portfolio companies. While individual companies are likely aware of where their operations are based, they may not have detailed information about the sourcing locations of their direct or indirect suppliers. For many financial institutions looking to assess nature-related risks across their client or investment portfolios, gaining access to comprehensive location data remains a significant challenge. In this report, we present various sources of asset location data and provide a directory of open and commercial asset location databases.

High water availability
Medium water availability
Low water availability

High pollinator availability
Medium pollinator availability
Low pollinator availability

Brewery business A

Power utility B

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CASE STUDY:
WWF BIODIVERSITY & WATER RISK FILTER

The WWF Biodiversity Risk Filter and WWF Water Risk Filter are open online tools designed to help businesses, financial institutions, and policymakers assess and manage environmental risks related to biodiversity and water resources.

The Biodiversity Risk Filter allows users to understand and quantify how business operations and supply chains might impact or be impacted by biodiversity loss, considering factors such as habitat destruction, species loss, and ecosystem degradation.

Meanwhile, the Water Risk Filter focuses on evaluating risks associated with water scarcity, quality, and regulatory pressures, which can affect businesses' operational continuity and long-term sustainability.

These tools present environmental risks in a spatially explicit manner, requiring users to input precise location data for analysis. By integrating global datasets with localized information, they generate detailed risk maps that visually represent potential threats across different geographic areas. Enabling users to see how risks vary by location, highlighting hotspots where biodiversity or water risks are most pronounced.

THE BIODIVERSITY RISK FILTER ALLOWS USERS TO UNDERSTAND AND QUANTIFY HOW BUSINESS OPERATIONS AND SUPPLY CHAINS MIGHT IMPACT OR BE IMPACTED BY BIODIVERSITY LOSS, CONSIDERING FACTORS SUCH AS HABITAT DESTRUCTION, SPECIES LOSS, AND ECOSYSTEM DEGRADATION.

SOURCES OF ASSET LOCATION DATA

We can distinguish three types of sources for asset location data:

- **Information published by a company itself**
- **Information published by public bodies**
- **Information provided by 3rd party (data) providers**

Within this report we focus on 'built' assets rather than 'natural' assets such as agricultural fields, water bodies or forests. Built assets are more likely to be owned by and connected to individual entities which is critical for financial risk assessments. The location of built assets can also provide indications of likely sourcing regions and connections to 'natural' assets that the company or its supply chains rely on. Natural assets could be identified and characterised using remote sensing and mapping techniques, but connecting these with economic entities is notoriously difficult and is out of scope of this report.

COMPANY DISCLOSED/REPORTED DATA

A lot of companies disclose information about the location of their operational assets through their own websites or sustainability reporting. For example:

- Asia Pulp & Paper is a privately owned producer of paper and pulp products headquartered in Indonesia. They list their pulp and paper mills on their website with address, age information and product types.

- Cargill is a privately owned global agrifood business headquartered in the US. They disclose asset (location) information for a subset of their operations in their ESG report, as well as a list of locations for palm oil mills and plantations in their direct and indirect supply chains.

- Newcrest Mining is a publicly listed gold mining company, headquartered in Australia. They provide (coarse) location information of their producing assets, advanced projects and exploration projects

in their annual sustainability report. As well environmental, social and governance data at the asset-level in their ESG databook.

- Scala Data Centres is a private company that builds and operates data centres in Latin America, headquartered in Brazil. On their website they list data centres that are operational, under construction, under development or being planned, providing information on (coarse) location, size and IT capacity.

- Solvay is a publicly listed multinational chemical company headquartered in Belgium. They list the addresses of all their production sites, R&D centres, offices and (national) headquarters on their website.

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CASE STUDY:
LOCATION DISCLOSURE REQUIREMENTS

Both mandatory regulations and voluntary initiatives are increasingly pushing companies to disclose location-specific information, acknowledging that sustainability impacts and risks are tied to geographical context. However, these disclosures often cover only a subset of high-risk facilities or vary in the level of geographical detail provided.

In Europe, the **Corporate Sustainability Reporting Directive** mandates that sustainability reports include geographical or contextual information necessary to understand sustainability impacts and risks. Additionally, the European Sustainability Reporting Standards' Requirement E1-9 requires disclosure of the locations of significant assets at material physical risk.

In the United States, the **SEC's Climate-Related Disclosure Rules** 1502(a)(1)(i) require companies to disclose the geographic locations and characteristics of properties, processes, or operations subject to material physical climate risks, although the rules do not specify the required level of detail.

The **International Sustainability Standards Board's' IFRS S1** requires entities to disaggregate data by geographic location when it is material and relevant, particularly for scenario analysis and location-based Scope 2 emissions. **IFRS S2** focuses on anticipated climate impacts on value chains, including concentrated risks in specific geographic locations, though it does not mandate a specific level of detail.

The **Global Reporting Initiative's Environmental Standards** suggest disclosing energy use (GRI 302), water use and effluents (GRI 303), emissions (GRI 305), and waste (GRI 306) by location.

Finally, the **Taskforce on Nature-related Financial Disclosures** recommends disclosure of the locations of assets and/or activities in the organisation's direct operations and, where possible, upstream and downstream value chain(s) only for priority locations. These are locations where an organisation has a material nature-related dependency, impact or opportunity. Or sensitive locations of high environmental or cultural importance.

Collecting information directly from company websites and disclosures can be time consuming as the reporting is patchy, not standardised and the quality or completeness can vary, often requiring additional searches in mapping/search engines. Guidance or standards on disclosing asset location information could improve this, but is currently lacking in most mandatory and voluntary reporting standards and initiatives.

A number of companies also report location information through the Carbon Disclosure Project (CDP). In CDP's 2023 water questionnaire there is a section to disclose exact latitude and longitude coordinates for facilities with "inherent water-related risks with the potential to have a substantive financial or strategic impact" for all sectors. And a section for mining companies to disclose the location of tailings "classified as 'hazardous' or highly hazardous'". CDP's 2023 forests questionnaire includes sections to disclose the locations of "project(s) focused on ecosystem restoration and long-term protection" and "mining projects".

Despite covering two nature topics (water and forests) that are inherently location specific, the location disclosure sections do not cover all operations but merely a subset of some

facilities, projects or 'at risk' assets.

Overall we see that where reporting standards or frameworks recommend location disclosures, these are limited to facilities with the most material (financial) risks. How this materiality is determined and how many locations are disclosed is typically left to the discretion of the company. This leaves investors, regulators and other stakeholders with an incomplete picture of nature pressures and dependencies. Particularly in light of future changes in risk exposure, or cumulative dependencies and pressures from multiple organisations operating in the same geographical area.
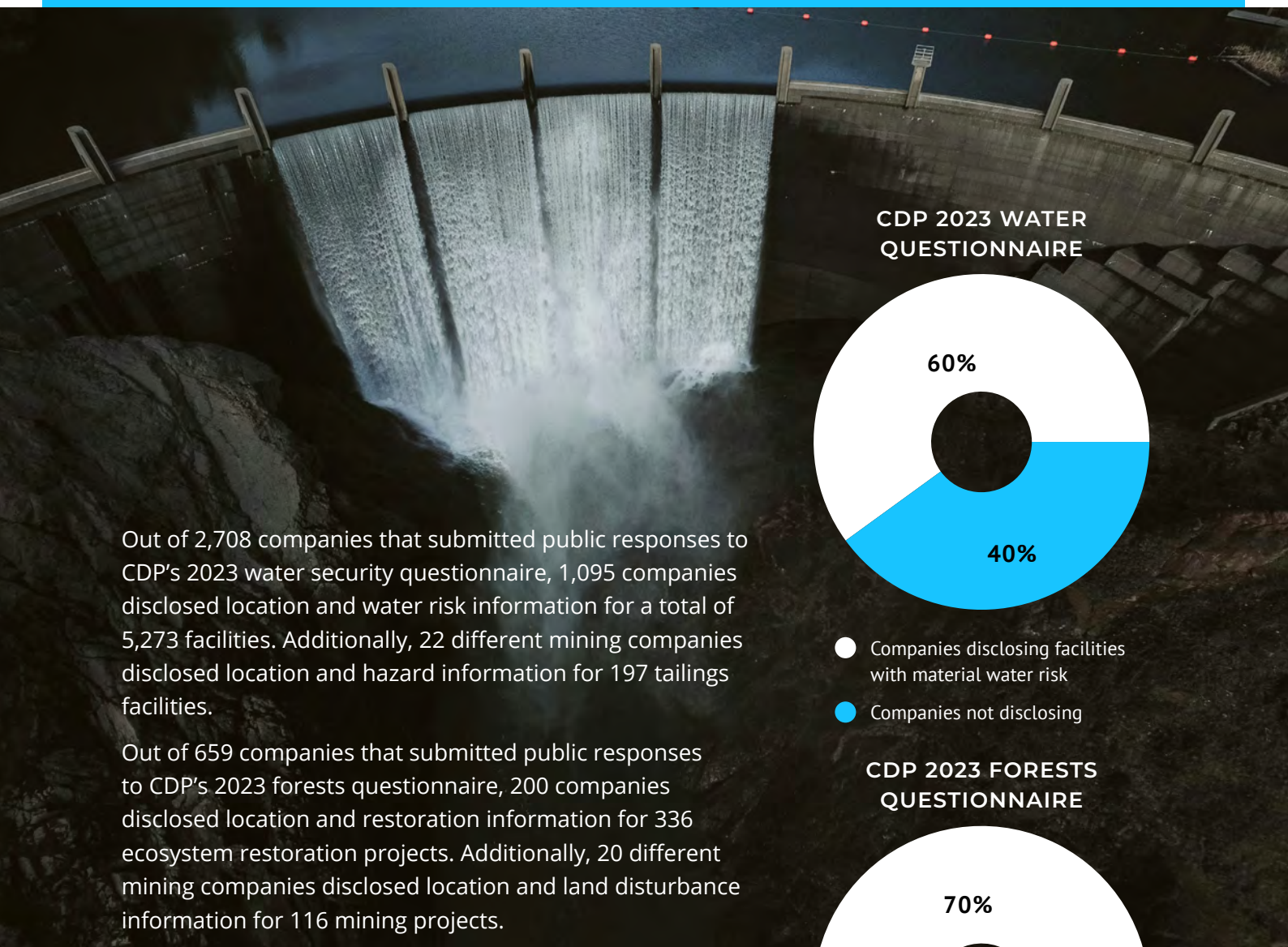
OVERALL WE SEE THAT WHERE REPORTING STANDARDS OR FRAMEWORKS RECOMMEND LOCATION DISCLOSURES, THESE ARE LIMITED TO FACILITIES WITH THE MOST MATERIAL (FINANCIAL) RISKS.

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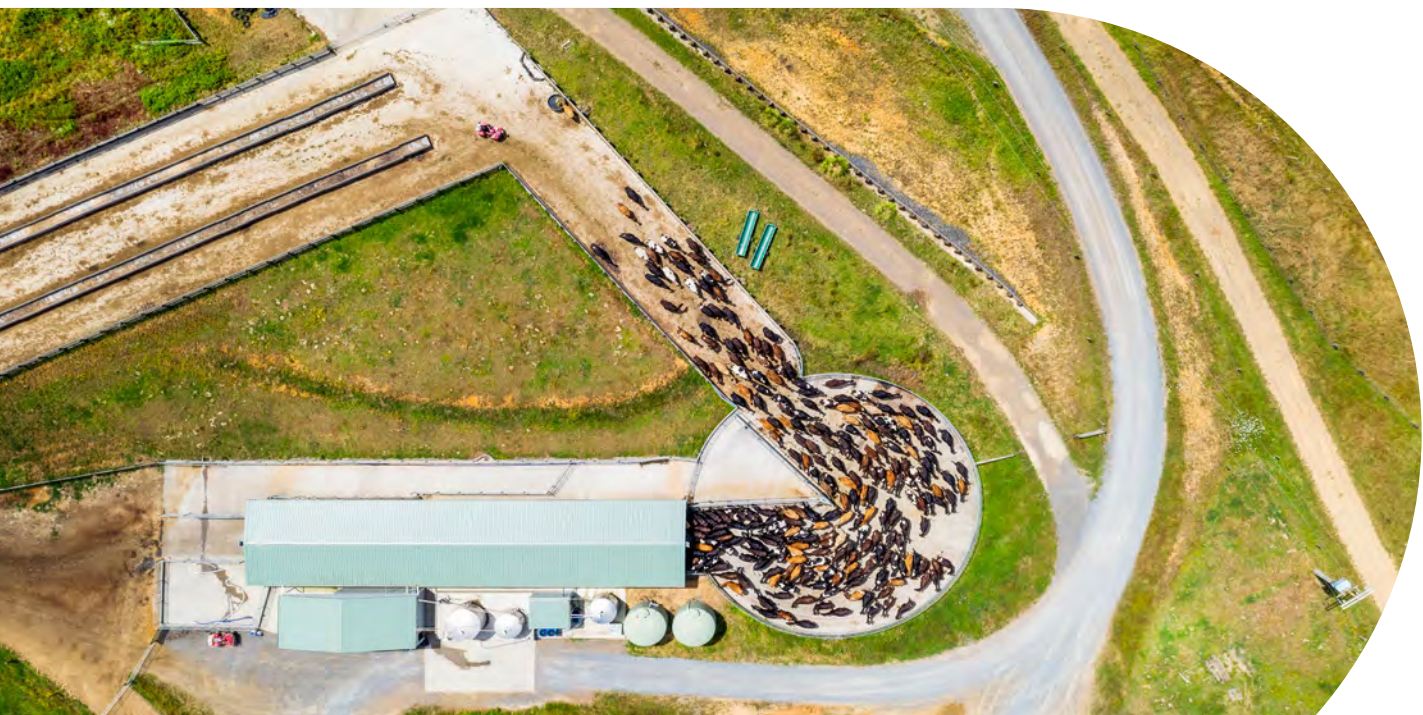
CASE STUDY:
LOCATION DISCLOSURE THROUGH CDP

Out of 2,708 companies that submitted public responses to CDP's 2023 water security questionnaire, 1,095 companies disclosed location and water risk information for a total of 5,273 facilities. Additionally, 22 different mining companies disclosed location and hazard information for 197 tailings facilities.

Out of 659 companies that submitted public responses to CDP's 2023 forests questionnaire, 200 companies disclosed location and restoration information for 336 ecosystem restoration projects. Additionally, 20 different mining companies disclosed location and land disturbance information for 116 mining projects.

CDP 2023 WATER QUESTIONNAIRE

60%

40%
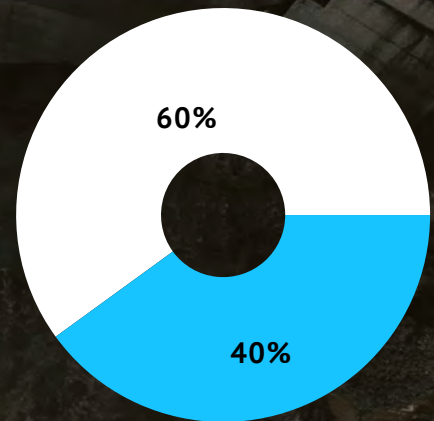
○ Companies disclosing facilities with material water risk

● Companies not disclosing

CDP 2023 FORESTS QUESTIONNAIRE

70%

30%
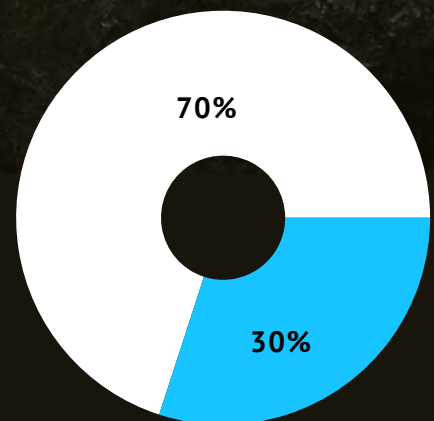
○ Companies disclosing restoration project information

● Companies not disclosing

5,273

1,095 COMPANIES DISCLOSED LOCATION AND WATER RISK INFORMATION FOR A TOTAL OF 5,273 FACILITIES

PUBLIC DATA REGISTERS

Public registers of (high impact) facilities and their reported environmental pollution offer a second source of asset location information. For instance, pollutant release and transfer registers (PRTR) catalogue releases and transfers of potentially harmful substances to the environment reported by companies in certain jurisdictions. The Organisation for Economic Co-operation and Development (OECD) has identified 44 national PRTRs around the world. Some of these have been aggregated in regional registries such as:

- The **European** PRTR, available through the European Industrial Emissions Portal, covers 96,824 industrial facilities across 73 economic activities within EU member states, Iceland, Liechtenstein, Norway, Switzerland, Serbia and the UK. It provides information on location, ownership, operational features and environmental pollutants and transfers.

- The Commission for Environmental Cooperation in **North America's** Taking Stock initiative combines PRTR data for Canada, Mexico and the United States, covering 47,633 facilities across 99 industries with information on their location, air, water and land discharges and waste transfers. Facility names are provided which often refer to their operating companies.

Other examples of public registers include:

- **Australia's** National Pollutant Inventory covers 7,942 industrial facilities across 180 sectors and provides information on their location, ownership, emissions and transfers.

- **Brazil's** Cadastro Técnico Federal de Atividades Potencialmente Poluidoras is a register for entities that undertake potentially environmentally damaging activities in Brazil. This includes location data from 421,597 Brazilian companies/facilities across 196 activity types.

- **Chile's** Registro de Emisiones y Transferencia de Contaminantes covers 4,344 industrial facilities across 19 industries and provides information on location, ownership and emissions.

- The Institute of Public and Environmental Affairs is a Chinese NGO that collates environmental pollution data disclosed by different governments across China, and by enterprises themselves. Their interactive Blue Map database provides environmental compliance data for more than 1.64 million factories in China including 72,000 "key monitoring" facilities.

- **India's** Central Pollution Control Board maintain an online continuous emission & effluent monitoring system that collects periodic emissions and effluents data from discharge points of industrial units. The system covers 5,356 industrial facilities across 17 'grossly polluting industries' and provides a facility's address, company ownership and activity type.

- The **UK's** Renewable Energy Planning Database tracks the progress of UK renewable electricity projects over 150kW through planning stages until operations. It is updated quarterly and provides location information for 16,190 projects alongside information on the operator, technology, capacity and development stages.

- Various **US** government departments provide facility specific information about suppliers that are registered or certified to sell their products in the US, for instance the Department of Agriculture's Organic Integrity Database with certified organic farms or businesses or the Food and Drug Administration's Drug Establishment Registration Database with establishments that manufacture, prepare, propagate, compound or process drugs that are distributed in the U.S.

A significant amount of asset (location) information is available within governments and public institutions worldwide. This data is often collected as part of national environmental reporting regulations or environmental licensing and permitting processes, but it is typically dispersed across different departments. In countries with Pollutant Release and Transfer Registers, accessing asset data should be easier, although the detail and quality of the data vary widely between registers.

While this data is generally not suitable for financial risk analysis due to inconsistent ownership information and formatting challenges, it can serve as a useful starting point. In many countries, it helps to map the spatial footprint of some of the most environmentally polluting facilities and industries. It can also assist financial institutions in identifying facilities in certain geographic areas that may be relevant to their portfolios.

3RD PARTY DATA PROVIDERS

Finally, asset location information is increasingly available through third party data providers, which can be either commercial entities or non-profit organisations and research projects.

COMMERCIAL DATA PROVIDERS

There are different types of for-profit asset data providers that offer either 'raw' data or derived asset-level data insights under different licensing models. Traditionally, sector specific asset databases were maintained and licensed for marketing and sales purposes within the industry. For example:

- Enverus provides oil & gas analytics at the oil well and rig level across multiple basins.

- The Glassglobal Plants database provides production information for glass producers worldwide at the furnace level.

- The Global Cement Directory provides a listing of all global cement plants including specific plant process information and contact information.

Within the financial sector, asset data providers have traditionally offered products for globally traded commodities. However, recently more asset datasets are being
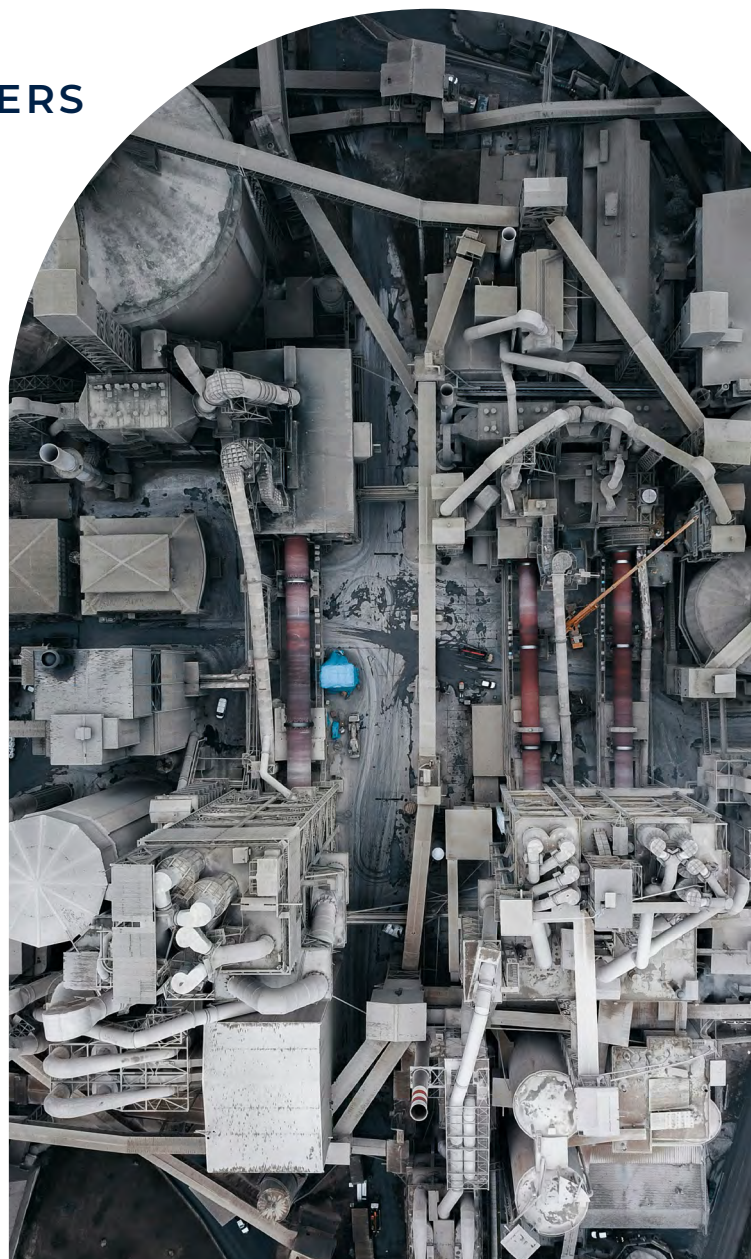
offered for climate, environmental and sustainability related financial applications. For instance:

- Asset Impact curates and licenses asset datasets for 11 climate critical industries, linking physical assets in the real economy and their activities to companies and securities.

- GlobalData provides asset datasets as part of their industry specific intelligence offerings covering vehicle production, healthcare and oil & gas fields and more.

- S&P Global licenses various sector specific asset databases for mining, oil refineries, power generation, ports and more.

Additionally, we are seeing generalist business data vendors such as Dun & Bradstreet partner with specialist analytics providers such as Climate Engine to explore environmental financial risk applications for their database of 200 million active business locations. Or risk data vendors such as Maplecroft that have created an internal database of 4 million+ corporate asset locations which they combine with their existing industry risk insights and environmental datasets to build a spatially explicit picture of companies' sustainability risks. Finally, there is huge untapped potential for the large tech companies such as Google, Microsoft or Baidu to exploit their asset location data for nature-related risk analyses.

NON-PROFIT ORGANISATIONS

Various non-profit organisations, projects or certification bodies curate or publish asset location databases for different industries. For instance:

- Our own GeoAsset project creates open asset databases for high impact industries linking asset location to ownership information and other operational features. Covering cement, steel, petrochemicals, pulp & paper and waste management facilities.

- Global Energy Monitor develops and analyzes data on energy infrastructure, resources, and uses. They provide open access to various asset databases with location, ownership and production information for energy (intensive) industries.

- The Marine Stewardship Council's supplier directory provides information on >20,000 certified business and facilities across the fisheries supply chain.

- Open Supply Hub offers an open data platform for supply chain for retailers and supply chain actors to upload production facility information for 9 sectors and currently lists >351,000 facilities across 174 countries.

- The Roundtable on Sustainable Palm Oil's GeoRSPO platform provides oil palm concession and mill data on location, ownership and certification status for all certified members.

As these databases have not necessarily been created with financial analysis in mind, their format may not be directly usable. Nonetheless they can provide useful location data for specific industries in an aggregated way. Due to the non-profit nature of these initiatives, the underlying business/funding models will determine whether they update their databases frequently, ad hoc or not at all.

CASE STUDY:

GLOBAL ENERGY MONITOR

Global Energy Monitor (GEM) is a non-profit research organization that tracks and reports on individual global energy projects, with the aim of enhancing transparency and accountability in energy and energy intensive sectors. Founded in 2007, GEM started with mapping individual coal-fired power plants but has since expanded its scope to include other critical energy infrastructure like oil and gas pipelines, steel plants, and renewable energy projects. Their open databases contain location, ownership and other operational characteristics for individual assets. They are typically updated every 6-12 months.

By creating comprehensive, publicly accessible databases and maps, GEM provides detailed insights into the development, financing, and environmental impact of energy infrastructure around the world. Their work is essential in highlighting the trends in energy production and consumption, especially concerning the transition from fossil fuels to renewable energy sources. GEM's research is used by a wide range of stakeholders, including policymakers, researchers, NGOs, activists as well as financial news and data providers.

ACADEMIA

Asset location databases are also created by researchers in academia. These databases will typically be based on novel data collection or database creation methodologies and published in academic journals. For instance:

- An asset-level dataset of high emitting facilities, published alongside Hamieh et al.' quantification and analysis of CO2 footprint from industrial facilities in Saudi Arabia, contains location, emissions and production information for 187 electricity, desalination, petrochemicals, refinery, cement, iron and steel facilities in Saudi Arabia[1].

- The global inventory of photovoltaic solar energy generating units by Kruitwagen et al. contains location, capacity estimate and age data for 68,661 commercial-, industrial- and utility-scale solar power installations[2].

- The HydroWASTE database by Macedo et al. contains 58,502 wastewater treatment plants and their characteristics from around the world[3].

- The global-scale data set of mining areas by Maus et al. contains >21,000 polygons of activities related to mining, mainly of coal and metal ore[4].

- The renewable power plant database for Africa by Peters et al. contains location, construction status, and capacity information for 1,074 hydro-, 1,128 solar, and 276 wind power plants across Africa[5].

- The global offshore wind turbine dataset by Zhang et al. contains location and age information for 6,924 offshore wind turbines across 14 countries[6].

These databases will typically not have been created with financial analysis in mind, and don't often include ownership information. Another constraint of academic databases is that they are typically not updated as individual researchers or research groups are not set up or incentivised to do so. However, these sources can still provide valuable location information of certain industries in certain geographies. And as the database creation methodologies are typically published openly, others are able to replicate and update the datasets.

Image: ESA/NASA–T. Pesquet

INVENTORY OF LOCATION DATABASES

Despite asset location data being available from a range of sources, data availability varies significantly between sectors. To understand the availability of asset location data across sectors we have compiled an inventory of asset databases which as a minimum contain asset location information. We have focused on identifying data sources for constructed assets (infrastructure, factories, etc.) rather than natural assets (farmland, forestry concessions, water bodies, etc). Our inventory is publicly available and includes:

• 114 sector specific databases from commercial, public and non-profit sources for fixed assets

• 11 sector specific databases from commercial, public and non-profit sources for mobile assets

• 20 Public databases covering multiple sectors

We hope to keep this directory up to date and encourage others to contribute location data sources.

Inventory breakdown by data source

Commercial ● Non-profit/Academia ● Public ●

40%
41%
19%
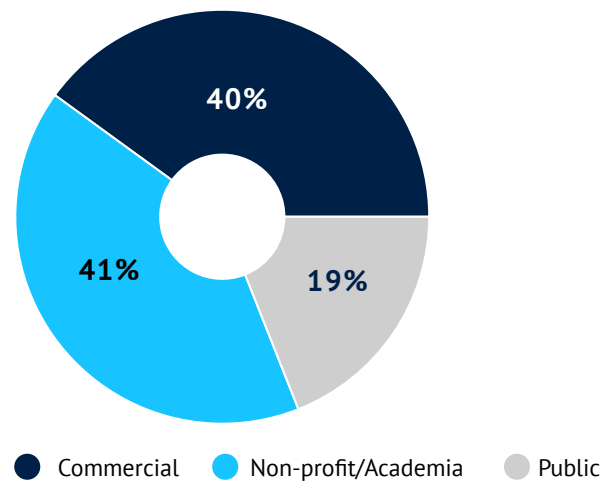
Inventory coverage for sectoral databases with fixed assets

● Commercial   ● Non-profit/Academia   ● Public
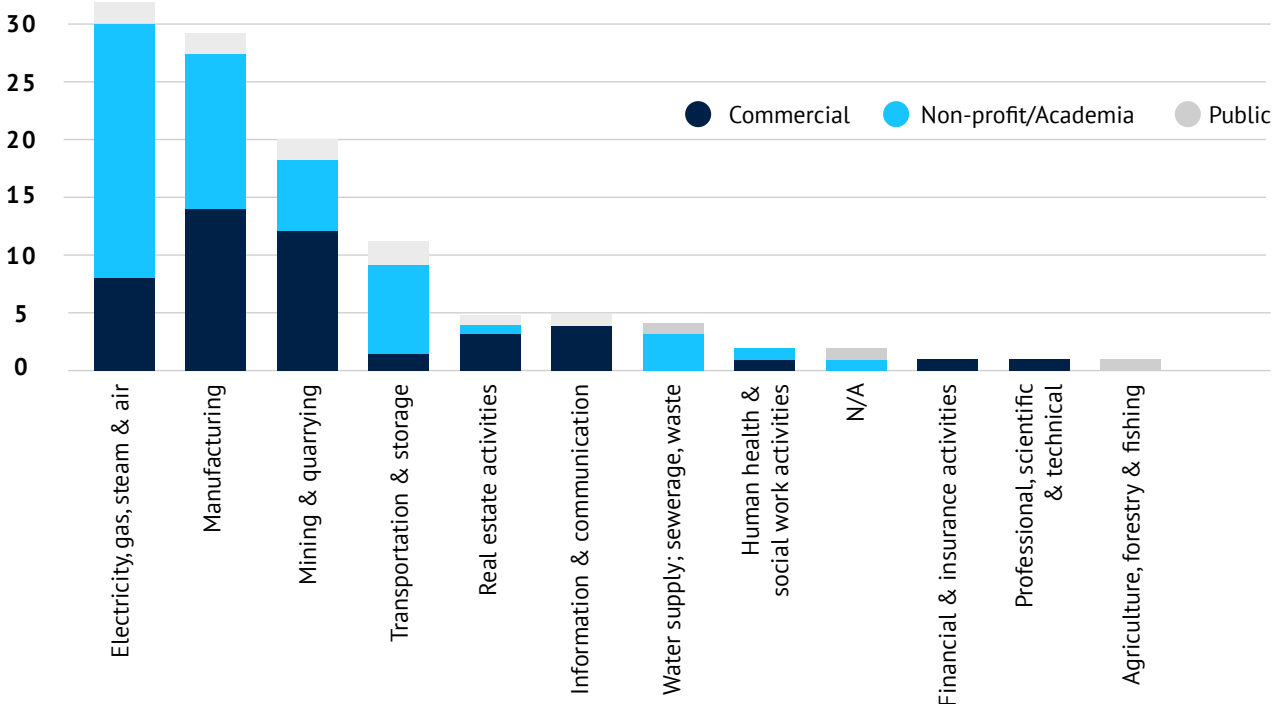
AVAILABILITY OF ASSET LOCATION DATA PER SECTOR

To date we have identified 114 sectoral databases from public, non-profit and private data providers and captured information about industry covered, asset type, geographic coverage, number of assets, asset features available, license type and most recent update year. We assessed data availability based on the number of databases available for each sector and their geographical scope:

DATA AVAILABILITY	NUMBER OF DATABASES	GEOGRAPHICAL COVERAGE
LOW	1-2	Global or non-global
MEDIUM	3-5	Global
HIGH	>5	Global

We then used the databases from the Exploring Natural Capital Opportunities, Risks and Exposure (ENCORE) tool to categorise the nature dependency and impact materiality for each sector. The tool is widely used by financial institutions to screen for potential nature-related financial risks in portfolios. We assigned low, medium and high materiality labels to sectors based on the number of 'high' or 'very high' ecosystem service dependencies or pressures that were associated with each sector:

DEPENDENCY/IMPACT MATERIALITY	NUMBER OF 'HIGH' OR 'VERY HIGH' DEPENDENCIES/PRESSURES
LOW	0
MEDIUM	1-2
HIGH	>2

The figures below plot data availability against nature dependency and impact materiality for 21 industries (classified as 'sections' under ISIC Rev.4). For the purpose of this report we have only assessed data availability and have not considered data suitability for nature-related risk assessments, which will inevitably be lower.

We find relatively good location data availability for sectors such as mining and power or subsectors of manufacturing, transport or real estate. However, location data for most other sectors is limited or non-existent. This is more problematic for nature dependency analyses than for nature impact analyses, as many industries with medium or high dependencies have poor location data coverage.

The most significant and important location data gap is for primary economic activities in agriculture, forestry and fishing. These will constitute the supply chains of many large, international companies that financial institutions have the highest exposure to. Given the high dependencies and impacts on nature of these industries, this is where a lot of nature-related financial risks for secondary and tertiary industries is expected to originate from.

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Asset location data availability vs nature dependency materiality per sector

DATA AVAILABILITY

HIGH
Electricity, gas, steam and air conditioning supply

Mining and quarrying

MEDIUM
Manufacturing

Transportation and storage

Real estate activities

LOW
Information and communication

Financial and insurance activities

Water supply; sewerage, waste management and remediation activities

Human health and social work activities

Professional, scientific and technical activities

NONE
Other

Wholesale and retail trade; repair of motor vehicles and motorcycles

Administrative and support service activities

Arts, entertainment and recreation

Construction

Accommodation and food service activities

Agriculture, forestry and fishing

Education

DEPENDENCY MATERIALITY

LOW   **MEDIUM**   **HIGH**

Asset location data availability vs nature impact materiality per sector

DATA AVAILABILITY

HIGH
Electricity, gas, steam and air conditioning supply

Mining and quarrying

MEDIUM
Manufacturing

Transportation and storage

Real estate activities

LOW
Information and communication

Human health and social work activities

Financial and insurance activities

Professional, scientific and technical activities

Water supply; sewerage, waste management and remediation activities

NONE
Other

Construction

Agriculture, forestry and fishing

**DEPENDENCY MATERIALITY**

LOW   **MEDIUM**   **HIGH**

DATA CHALLENGES AND LIMITATIONS

While we identified various types of data sources and numerous databases, many of these will not be readily usable for nature-related financial risk applications. Key challenges and limitations include:

1. **Accessibility:** Data from public sources is not always made available to the public, despite the relevance of the environmental pollution reported to the public at large. Additionally, when public data does get published, it is not always made available at the granularity at which it has been originally collected.

2. **Data formats:** Asset location data is often, but not always, presented in spreadsheet formats. Other formats include PDFs, web pages, power BI tools or other which are harder to process. Additionally, the formatting of the same type of data, such as address or coordinates, can differ between databases. Overall, there is no standardisation of asset (location) information due to the lack or harmonisation of location or environmental disclosure requirements.

3. **Ownership information:** Information on the owners or the operators of specific assets is essential for financial risk analysis, in order to attribute nature dependencies or impacts to the right organisation. However, in some location databases, particularly from academic sources, this information is lacking. And where commercial, public or non-profit sources do provide this information, it is not standardised, not cleaned or quality controlled, or comes with different types of identifiers, if any.

4. **Update frequency:** Different data providers update databases at different frequencies. Commercial or non-profit providers may update their databases quarterly to annually. Certification bodies may even update their databases on a daily or weekly basis. But public registers which rely on company or country reported inputs, may not publish data until months or years after a reporting cycle. And many academic databases, once created, will not be updated at all.
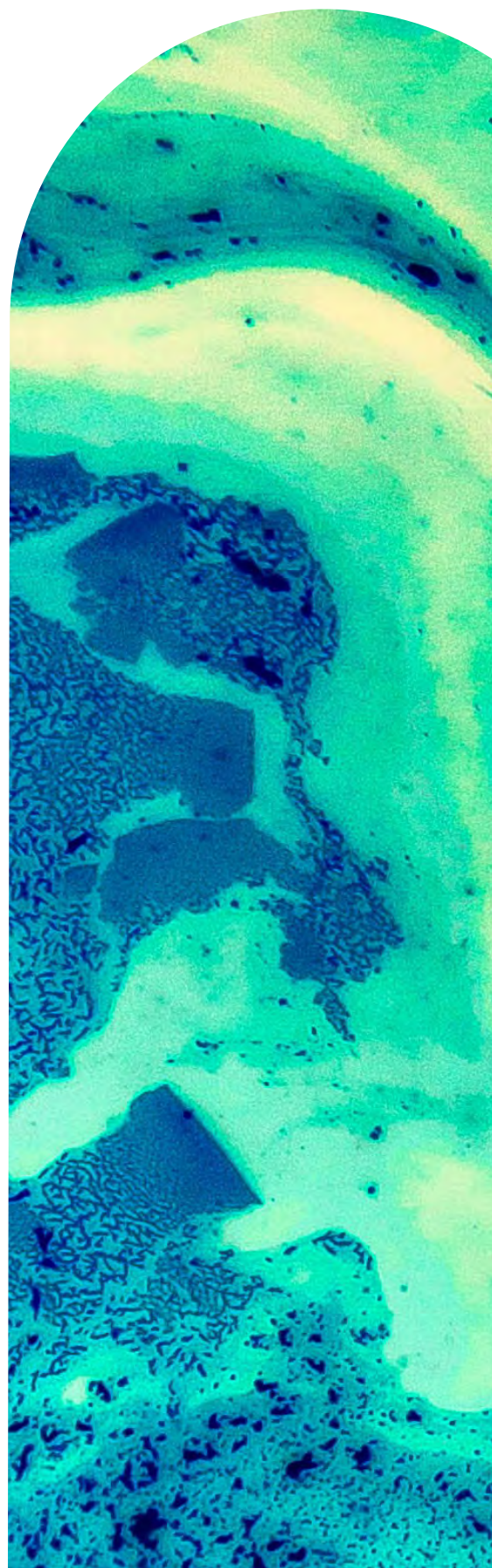
5. **Coverage:** The coverage of geography, asset types, and features varies for each dataset depending on the provider and the primary purpose of the database. While this is understandable, it can hinder analysis, especially when data that is or could be collected is not made publicly available. For example, public registers often require reporting only for certain sectors, and within those, only for facilities that exceed specific pollution thresholds, with data often limited to pollution figures. Additional details, such as production levels, workforce size, and risk or impact mitigation measures, would be valuable but are typically not collected or reported.

6. **Emerging markets data gaps**: On average, environmental regulation, data collection and reporting are less available in emerging markets. This means that public data is not/less accessible and/or less reliable compared to registers in developed markets. Combined with a discrepancy in nature and biodiversity research and data availability in emerging markets, this may ultimately hinder investment in countries that need it most.

7. **Natural asset data gaps:** Many global and local (geospatial) datasets exist that show the extent or quality of land based assets. But information about economically operated natural assets (within their spatial boundaries linked to operators or owners) is hard to find. This data is notoriously difficult to collect as it encompasses billions of 'assets' from fields to forests to water bodies. Certification schemes in a few sectors publish location information (partially) for farmland or plantations under said certain certification scheme, but this represents only a fraction of those sectors.

WHILE WE IDENTIFIED VARIOUS TYPES OF DATA SOURCES AND NUMEROUS DATABASES, MANY OF THESE WILL NOT BE READILY USABLE FOR NATURE-RELATED FINANCIAL RISK APPLICATIONS
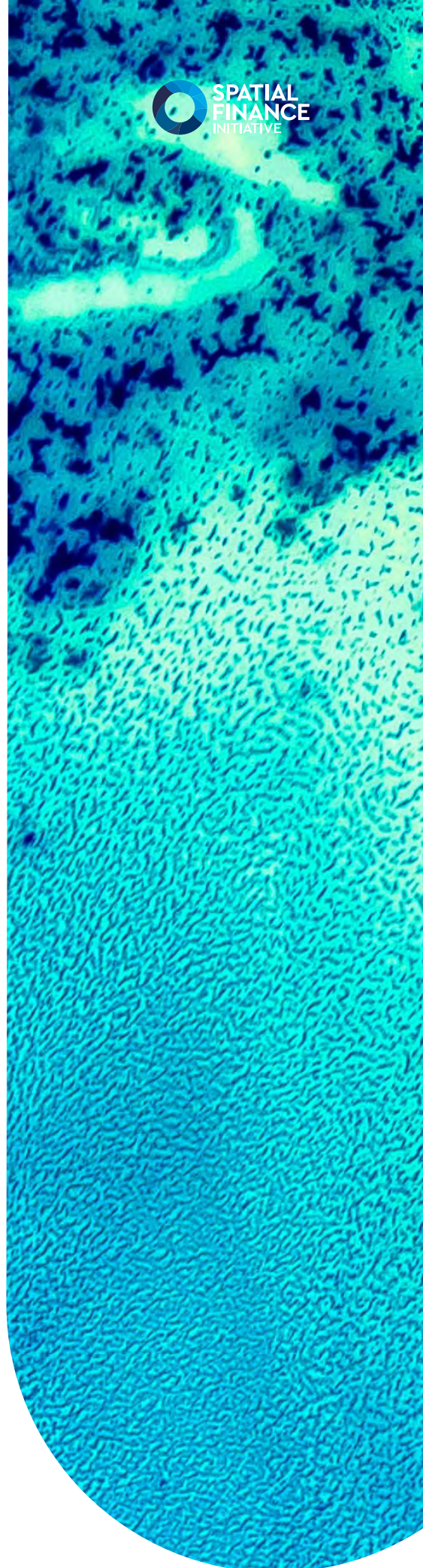
WAY FORWARD

Asset location information is more widely available than often perceived. The challenge lies less in the lack of data but more in the accessibility and usability of this information. However, with the growing awareness of nature-related financial risks, the wide range of asset location data sources available, and advancements in data collection and processing technologies, these barriers can be addressed within a relatively short timeframe.

RECOMMENDATIONS FOR THE FINANCE SECTOR

- Financial institutions, regulators, and standard setters should advocate for a minimum level of asset (location) information disclosure by corporations, covering all operational assets. A "principle of asset-level disclosure" could be integrated into existing reporting standards to provide guidance on disclosing key location-specific asset characteristics, such as exact location, production details, and inputs, in a standardized format.

- While waiting for comprehensive disclosure across industries and jurisdictions, institutions can request location data bilaterally (e.g. through engagement), extract location data from internal client records (e.g. linked to collateral) or start experimenting with alternative data from public or non-profit sources.

RECOMMENDATIONS FOR THE PUBLIC SECTOR

- Environmental and industry regulators should make more of the location-specific information they collect from companies publicly accessible. This should extend beyond industries and companies covered under Pollutant Release and Transfer Registers and should be provided in standardized formats. The data should be published at the same level of granularity as it is collected (i.e., asset level, where available) rather than in aggregated forms at the company or regional level.

- Support should be provided to countries in emerging markets to help them develop and implement environmental regulations and open databases. This can be achieved through funding, capacity building, and technology transfer from developed markets. Enhanced data and transparency will not only improve environmental compliance but could also attract investment in nature-friendly business practices.

RECOMMENDATIONS FOR THE RESEARCH COMMUNITY

- Researchers should develop new methodologies for rapidly compiling asset location information. These could incorporate alternative data sources such as crowd-sourced data (e.g., OpenStreetMap), news articles, and satellite imagery, utilizing advances in artificial intelligence to process this information at scale and speed.

- Public bodies and research institutions should work to standardize how ownership information is displayed in these datasets, aligning it with formats used in corporate and financial analysis, such as Legal Entity Identifiers (LEI), International Securities Identification Numbers (ISIN), and national company registration numbers.
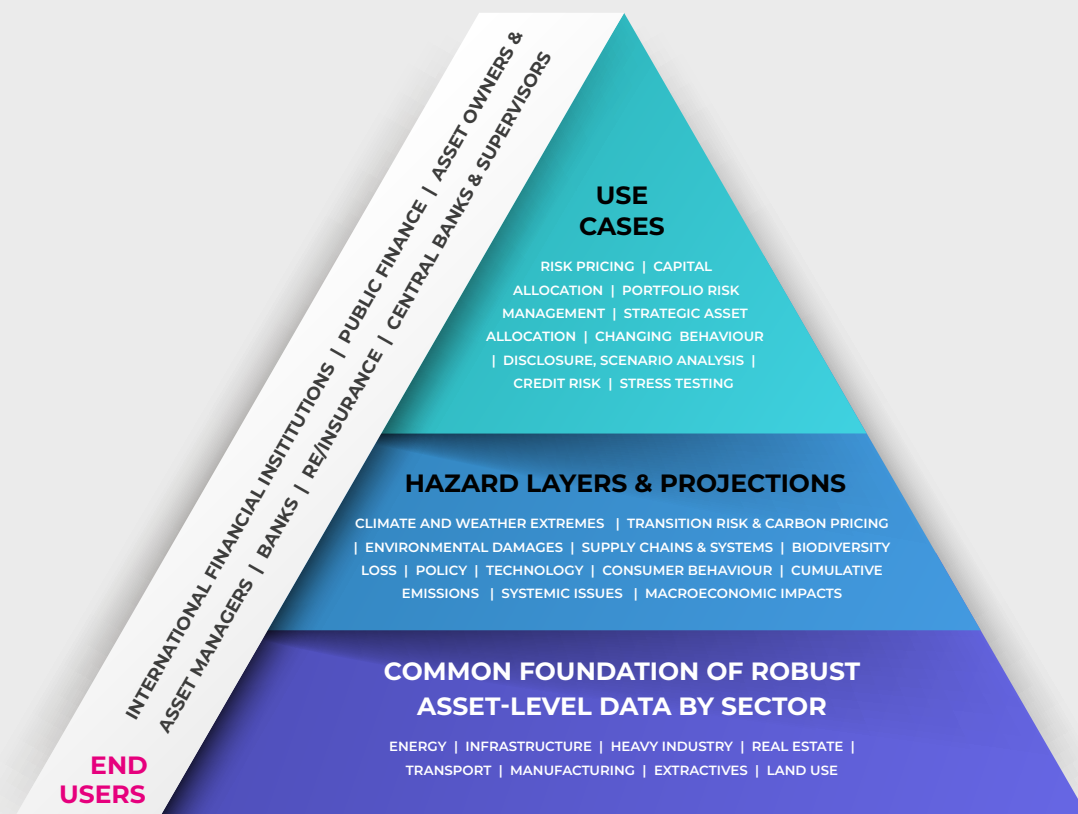
SPATIAL FINANCE INITIATIVE

ABOUT THE SPATIAL FINANCE INITIATIVE

The Spatial Finance Initiative was established by the Oxford Sustainable Finance Group at the University of Oxford, the Satellite Applications Catapult and the Alan Turing Institute to connect research capabilities in space, data science and financial services and make them greater than the sum of their parts. The initiative was set up to mainstream geospatial capabilities into financial decision-making globally and is committed to promote bottom-up sustainable finance applications by:

• Creating open, global asset databases for high impact industries through our GeoAsset project

• Promoting applied multi-disciplinary collaboration and research

• Upskilling and capacity building

The Spatial Finance Initiative is part of the UK Centre for Greening Finance and Investment, a national centre established to accelerate the adoption and use of climate and environmental data and analytics by financial institutions internationally. The centre acts as a platform to connect environmental science and innovation with financial institutions, providing a route by which needs are understood and the latest climate and environmental science is translated for financial decision-making.

INTERNATIONAL FINANCIAL INSTITUTIONS | PUBLIC FINANCE | ASSET OWNERS & ASSET MANAGERS | BANKS | RE/INSURANCE | CENTRAL BANKS & SUPERVISORS

END USERS

USE CASES

RISK PRICING | CAPITAL ALLOCATION | PORTFOLIO RISK MANAGEMENT | STRATEGIC ASSET ALLOCATION | CHANGING BEHAVIOUR | DISCLOSURE, SCENARIO ANALYSIS | CREDIT RISK | STRESS TESTING

HAZARD LAYERS & PROJECTIONS

CLIMATE AND WEATHER EXTREMES | TRANSITION RISK & CARBON PRICING | ENVIRONMENTAL DAMAGES | SUPPLY CHAINS & SYSTEMS | BIODIVERSITY LOSS | POLICY | TECHNOLOGY | CONSUMER BEHAVIOUR | CUMULATIVE EMISSIONS | SYSTEMIC ISSUES | MACROECONOMIC IMPACTS

COMMON FOUNDATION OF ROBUST ASSET-LEVEL DATA BY SECTOR

ENERGY | INFRASTRUCTURE | HEAVY INDUSTRY | REAL ESTATE | TRANSPORT | MANUFACTURING | EXTRACTIVES | LAND USE

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