UNIVERSITY OF CAMBRIDGE
INSTITUTE FOR SUSTAINABILITY LEADERSHIP

Case Study

Nature-related financial risk: use case

Mapping exposure to nature-related risks across financial indices

NATURE POSITIVE

AON

The University of Cambridge Institute for Sustainability Leadership partners with business and governments to develop leadership and solutions for a sustainable economy. We aim to achieve net zero, protect and restore nature, and build inclusive and resilient societies. For over three decades we have built the leadership capacity and capabilities of individuals and organisations, and created industry-leading collaborations, to catalyse change and accelerate the path to a sustainable economy.

Aon shapes decisions for the better, to protect and enrich the lives of people around the world. Nature related risks and dependencies goes to the heart of this and we are proud to have contributed to this important work. The urgent need to address nature-related loss must be supported by a better understanding of the risks and dependencies. This publication raises awareness and gives investors the tools to act.

The Investment Leaders Group (ILG) is a global network of pension funds, insurers and asset managers, with over £14 trillion under management and advice. The ILG's vision is an investment chain in which economic, social and environmental sustainability are delivered as an outcome of the investment process as investors go about generating robust, long-term returns. It is convened by CISL

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Preface

Members of the Banking Environment Initiative and Investment Leaders Group are working with the University of Cambridge Institute for Sustainability Leadership (CISL) and academic partners to determine a common language and framework for financial institutions to identify and assess nature-related financial risks, so that these risks can be measured and managed.

Since forming in 2020, this collaboration has so far detailed the financial materiality of biodiversity loss and land degradation and published its cornerstone Handbook for Nature-related Financial Risks. The Handbook explains how specific sources and types of nature loss, and the response to that loss, result in financial risk, explaining key concepts and providing a method for risk identification and assessment. During the following phase of research, member financial institutions used this Handbook to develop use cases that demonstrate how nature-related risks manifest in their portfolios.

This paper is one of a series of use cases, each assessing a specific type of nature-related financial risk. Financial institutions led their internal risk assessment process and subsequent write-ups in close collaboration with the CISL team, who offered guidance, input and support.

The purpose of these use cases is to enable and galvanise further assessments of nature-related risk across the financial system. Detailing the risk assessment process aims to show ways in which the wider financial industry can make such assessments of its own. All financial firms are vulnerable to nature-related financial risks, and the financial materiality of nature loss evidenced constitutes an urgent call to action.

The more that assessments are undertaken and shared, the easier it will be for others to follow and understand the urgency of managing nature-related risks and taking action to mitigate nature loss. Through the creation of these use cases, financial institutions have started to generate internal engagement regarding nature loss, as well as catalysing new conversations with clients and investee companies. Through these conversations, collaborative strategies can emerge to mitigate nature loss and support a transition to a nature-positive economy.

Executive Summary

Why is this paper needed?

Nature loss presents a global systemic threat, comparable to global warming. The need to identify, measure and manage risks to a portfolio as a result of nature loss is pressing. Running a portfolio through the mapping exercise will help an analyst to:

- Scope nature-related risks
- Begin engaging at sector level to manage and mitigate the risk

The relevance of nature loss to financial institutions is becoming increasingly apparent as natural capital degrades, and economic activities stretch finite resources. If economies continue to undertake 'business as usual' activities, nature loss will continue, threatening the conditions needed for human wellbeing and survival; for example, how water insecurity can destabilise business operations in agriculture, food and beverage (ABF) sectors.

The degradation of the goods and services which nature provides poses financial risks. Nature-related risks manifest as these ecosystem services decline due to drivers such as overexploitation, pollution and climate change. Each industry sector is dependent on a variety of ecosystem services, and it is these dependencies that are mapped in this paper, indicating where nature-related financial risk likely sits in a way which can be interpreted by asset owners, investment managers and investment consultants.

This mapping exercise shows that material nature-related risks most likely exist within resource-intensive industries such as agriculture, beverages and utilities, energy and mining, with the most prominent risk factor currently being the dependence on water security.

Ecosystem Services

"Benefits that people obtain from natural capital, such as air and water purification services, crop pollination and the breaking down of waste. Biodiversity underpins the flow of benefits. Ecosystem services are also known as 'nature's contributions to people"

Source: CISL Handbook for Nature-related Financial Risks

The insights were made possible by utilising the definitions and guidance of CISL's Handbook for Nature-related Financial Risks, the industry dependencies on ecosystem services determined by ENCORE and the MSCI All World Index as a proxy for a portfolio.

The exercise and its results are akin to a heatmap, which can be used to narrow the focus of further analysis and engagement by asset owners, investment managers and investment consultants. With the scope narrowed, engagement can begin by investigating whether investee companies, indicated as being most exposed, are taking action to mitigate the nature-related risks.

Introduction

The connection of nature loss to company operations may seem distant or abstract at first. Yet industrial production processes, such as the manufacture of clothing, depend on ecosystem services. Disruption or degradation of these services can result in a financial cost to companies. To join these dots, we must categorise the repercussions of nature loss on ecosystem services, on which company operations depend. These ecosystem services are rarely given the recognition they deserve. In their Handbook for Nature-related Financial Risk, CISL provides five simple ecosystem categories that financial institutions can use to identify their exposure to risks stemming from nature loss (see Table 1).

Mapping dependences on ecosystem services

Seeing nature dependencies through the lens of industry sectors is meaningful to an investment community that needs to map, manage and mitigate potential exposures to nature-related risks, to protect returns. ENCORE indicates how industrial sub-sectors depend on different ecosystem services. Using those indications enables the mapping of risk exposure stemming from nature loss at a sub-sector level, providing a helpful degree of granularity for financial decision makers. ENCORE also uses GICS ("Global Industrial Classification Standards") classifications, commonly used by investors in analysis and decision-making.

To simplify analysis of this exposure, the 21 ecosystem services detailed by ENCORE are consolidated into the five ecosystem services defined in CISL's taxonomy (see Appendix).

Table 1: Ecosystem Service Categories

Five categories of ecosystem services
1. Air quality and local climate *E.g. the regulation of temperature, humidity and pollutants*
2. Water security *E.g. the availability of freshwater*
3. Food and other goods provision *E.g. pollination enabling agricultural output*
4. Habitat intactness *E.g. intact habitats reduce risk of disease*
5. Hazard regulation *E.g. mangroves that protect coastlines*

How is ecosystem service dependence determined?

ENCORE identified 80 production processes which are employed by the GIC sub-sectors and estimated the dependence of these processes on ecosystem services. To determine how material the ecosystem service dependence of a sub-sector is, two main considerations were made:

1. How significant is the loss of functionality to the production process if the ecosystem service is disrupted?
2. How significant is the financial loss due to the loss of functionality in the production process?

Based on this assessment, ENCORE created a view of how materially dependent the production processes are on ecosystem services:

- **Very High materiality (VH):** the loss of functionality is severe, and the expected financial impact is severe.
- **High materiality (H):** the loss of functionality is severe and/or the financial impact is moderate, or vice-versa. Production is disrupted and/or financial loss is non-negligible.
- **Medium materiality (M):** the loss of functionality is moderate or the financial impact is moderate. Production is disrupted or financial loss is non-negligible.
- **Low materiality (L):** very small or limited loss of functionality and/or very small or limited financial loss. The production process can continue without changing and/or there is very limited or no financial loss.
- **Very Low materiality (VL):** very small or limited loss of functionality and very small or limited financial loss. The production process can continue without change and there is very limited or no financial loss.
- **Not applicable (NA):** the production process has no recorded dependence on ecosystem services underpinned by biodiversity.

Source: ENCORE

Several ecosystem services are deemed more important than others and therefore given a double weighting when materiality is assessed. These are the ecosystem services which offer direct physical input, namely animal-based energy, fibres and other materials, genetic materials, ground water and surface water.

Mapping nature-related risk exposures across a portfolio

Methodology

The materiality of ecosystem services to subsector production processes was connected with sector weights within the MSCI All World Index to provide an indication of nature-related dependencies across the Index.

More specifically, the market value weighting of each constituent in the Index was taken and multiplied by its materiality score across all relevant production processes and applicable ecosystem services.

These constituent materiality scores were then aggregated at the level of CISL's higher-level ecosystem service taxonomy and shown as an overall number, with a higher number representing higher nature-related risk.

While the exercise has been run on an equity index, it could be replicated with other securities using a security identifier. Fixed income corporate issues, for instance, can be mapped into its GIC sub-sector grouping, and the mapping done in the same way for equities.

Findings

The analysis was run for both the global equity index and an emerging markets index, and a broadly similar trend was found in both. Findings include:

- The MSCI All World Index, a proxy representation for the global economy, is most dependent on water security.

  Water security is an integral part to all or most aspects of the supply chain for companies across a range of sectors, therefore this finding was not surprising.

  Air quality and local climate, as well as hazard regulation, are two other ecosystem service categories on which the MSCI All World Index shows high dependency. These categories cover a broad range of ecosystem services, including disease control, which the COVID-19 pandemic has shown can be highly material for global markets.

- The MSCI All World Index is least dependent on ecosystem services that underpin the provision of food and other goods.

  This is mostly due to structural reasons. Firstly, within the MSCI All World Index, companies, which are highly dependent on the ecosystem services that provide food, such as agriculture, have a very small share of the Index by weight. This is partly compensated for by analysing the agriculture, beverages and food sector separately. Secondly, this analysis only picks up direct dependencies, rather than the potential indirect impacts should the service decline. For example, if the food supply was restricted and the cost spike, then the indirect impacts on other sectors, such as consumer discretionary spending falls, could be material.

The graphs below show:

1. Nature-related dependencies of the global world equity index, MSCI All World Index
2. The specific dependencies of the agriculture, beverage and food sectors (ABF) and the utilities, energy and mining (UEM) sectors, on ecosystem services
3. Analysis of ABF and UEM dependence on water security
4. The dependence on ecosystem services across companies with different ESG ratings

Figure 1: Nature-related dependencies of the MSCI All World Index[i]

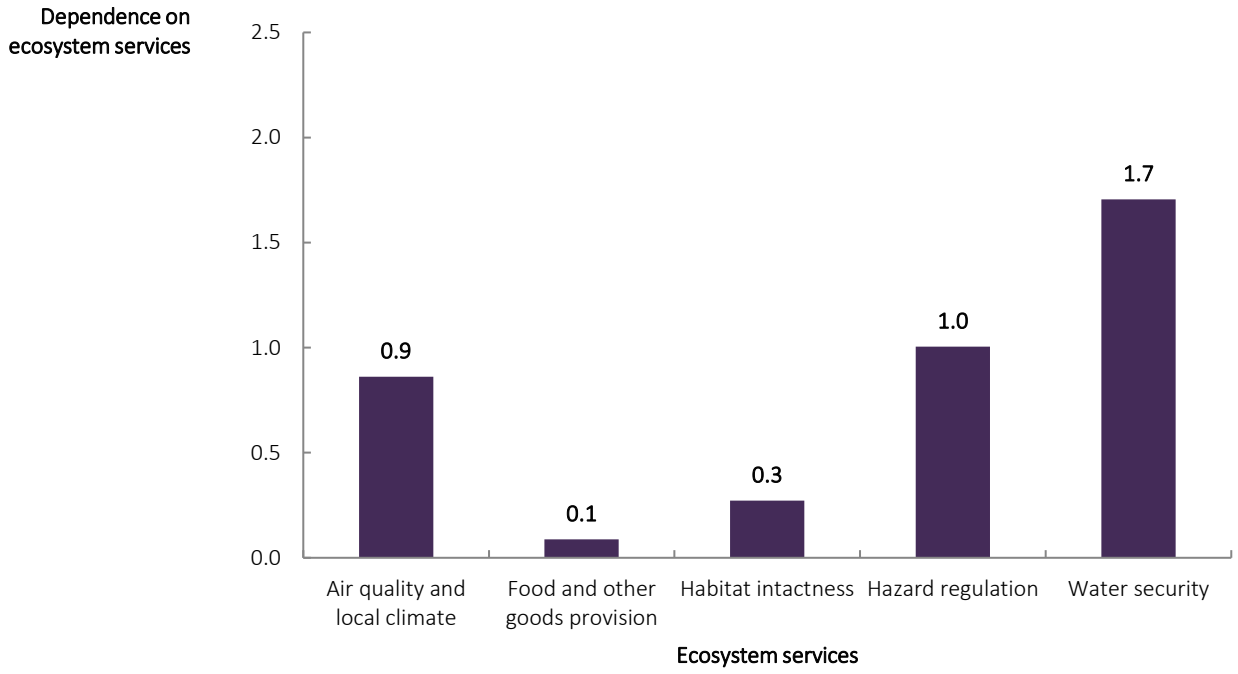


Figure 1 is a score out of 10. The low scores are an indication of how the majority of the index is made up of sub-sectors not highly or moderately directly dependent on ecosystem services. Indeed, in the MSCI All World Index, the largest GIC weights are IT (22.9 and 21.9 per cent respectively), Financials (13.2 and 19.2 per cent), and Communication Services (9.3 and 11.0 per cent). Although not included in the analysis here, this weighting trend is also true for the MSCI Emerging Markets Index. Yet the nature-related dependence scores mapped to these sectors are amongst the lowest. This is partly since the ENCORE dependence score does not capture the dependence on nature of companies in supply chains or other channels, where more material exposure may also exist. Using carbon emissions as an analogy, the ENCORE score is similar to measuring carbon emissions from a scope 1 perspective rather than a scope 1+2+3 perspective.

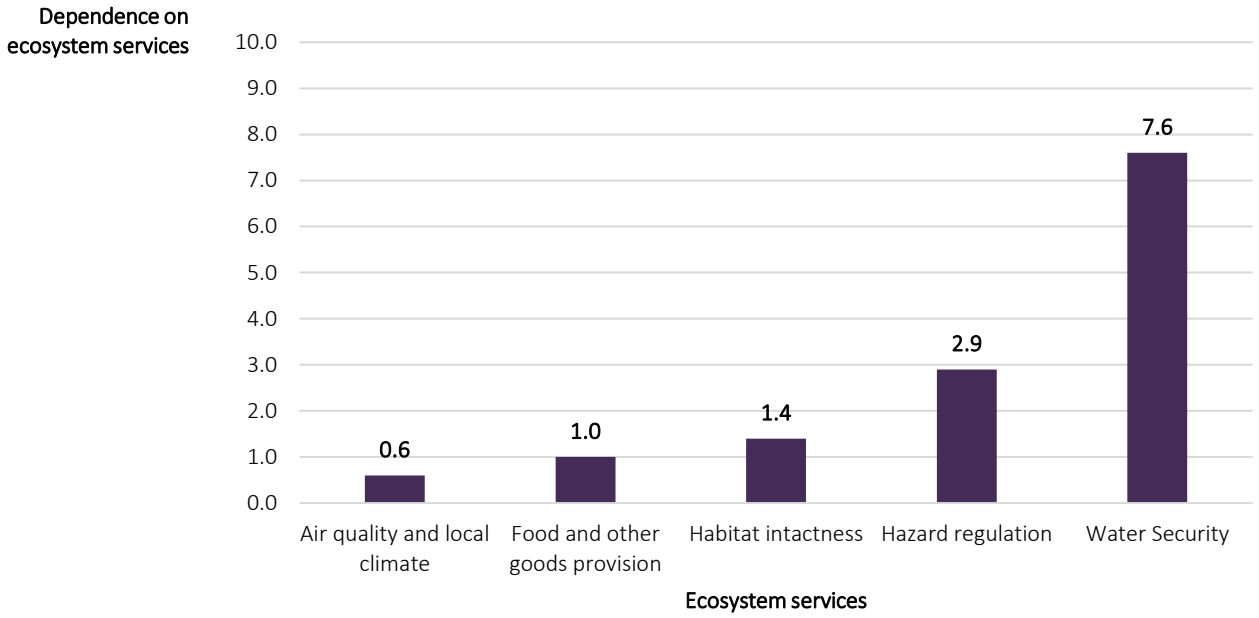
Exposures of Agriculture, Beverage and Food and Utilities, Energy and Mining segments

Due to their smaller representation in the Index, the ABF and UEM segments of the Index were analysed in isolation to see how this might change the nature-related risk exposures indicated. Both ABF and UEM were found to be more dependent on water security than the Index as a whole, with UEM showing a particularly high dependence on air quality and local climate, while the two sectors had a comparable dependence on the services that regulate hazards.

[i] This is a score out of 10. The y-axis is adjusted here to make the difference between the services clearer. To create this score out of 10 the following steps were taken:

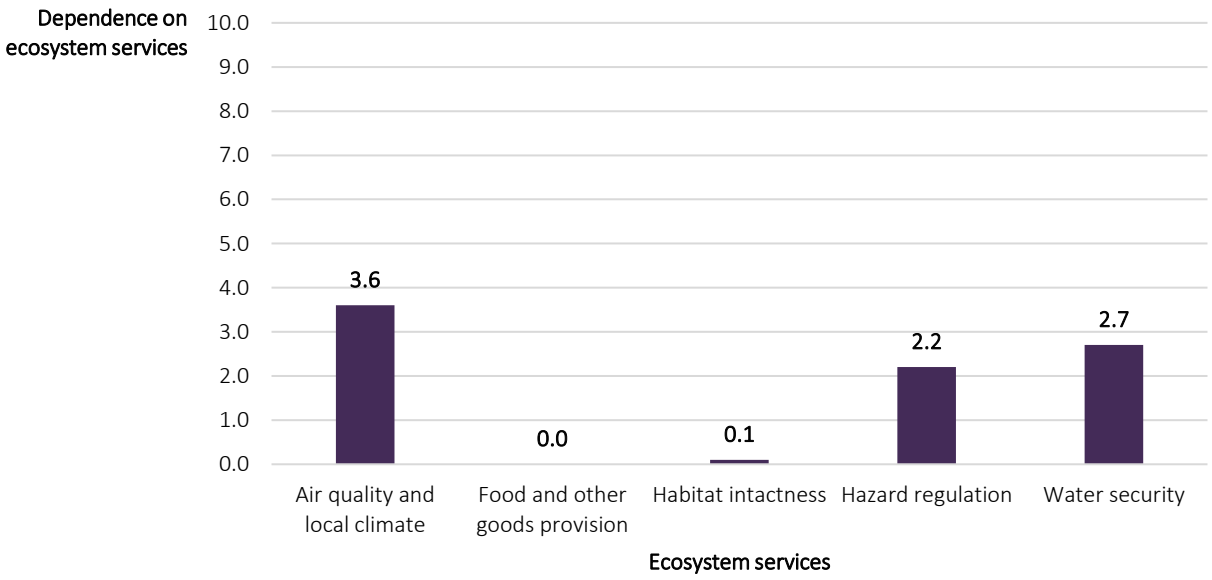
1. The qualitative materiality scores of ENCORE (VL to VH) were translated into a score out of 10 for each ecosystem service and for each subsector. Each subsector thus has a dependence score for each of the five ecosystem services out of 10
2. This dependence score can be assigned across the index depending on the market cap weight of the subsector in the index, thereby producing a market weighted dependence of the index as a whole on each ecosystem service.

Figure 2: Nature-related dependencies of the MSCI All World Agriculture, Beverage and Food sectors



Whilst the dependence on the services that provide food and other goods is low for ABF relative to the other ecosystem services, it is 10 times that of the MSCI All World. By focussing on the agriculture sector alone, the dependence jumps again, to over 38 times more than MSCI All World. This demonstrates that in the above Figure 2 the services that support the provision of food are being supressed in the scoring, relatively speaking, by the inclusion of the Beverage sector and industries like Food Processing in the weighting which have little direct dependence on the service and hence fall outside the scope of the ENCORE approach, despite having an obvious reliance on food production. This is again an indication of the importance of considering the risks of nature loss along value chains in a 1+2+3 scope sense, in addition to the scope 1 sense enabled by ENCORE and this methodology.

Figure 3: Nature-related dependencies of the MSCI All World Utilities, Energy and Mining sectors



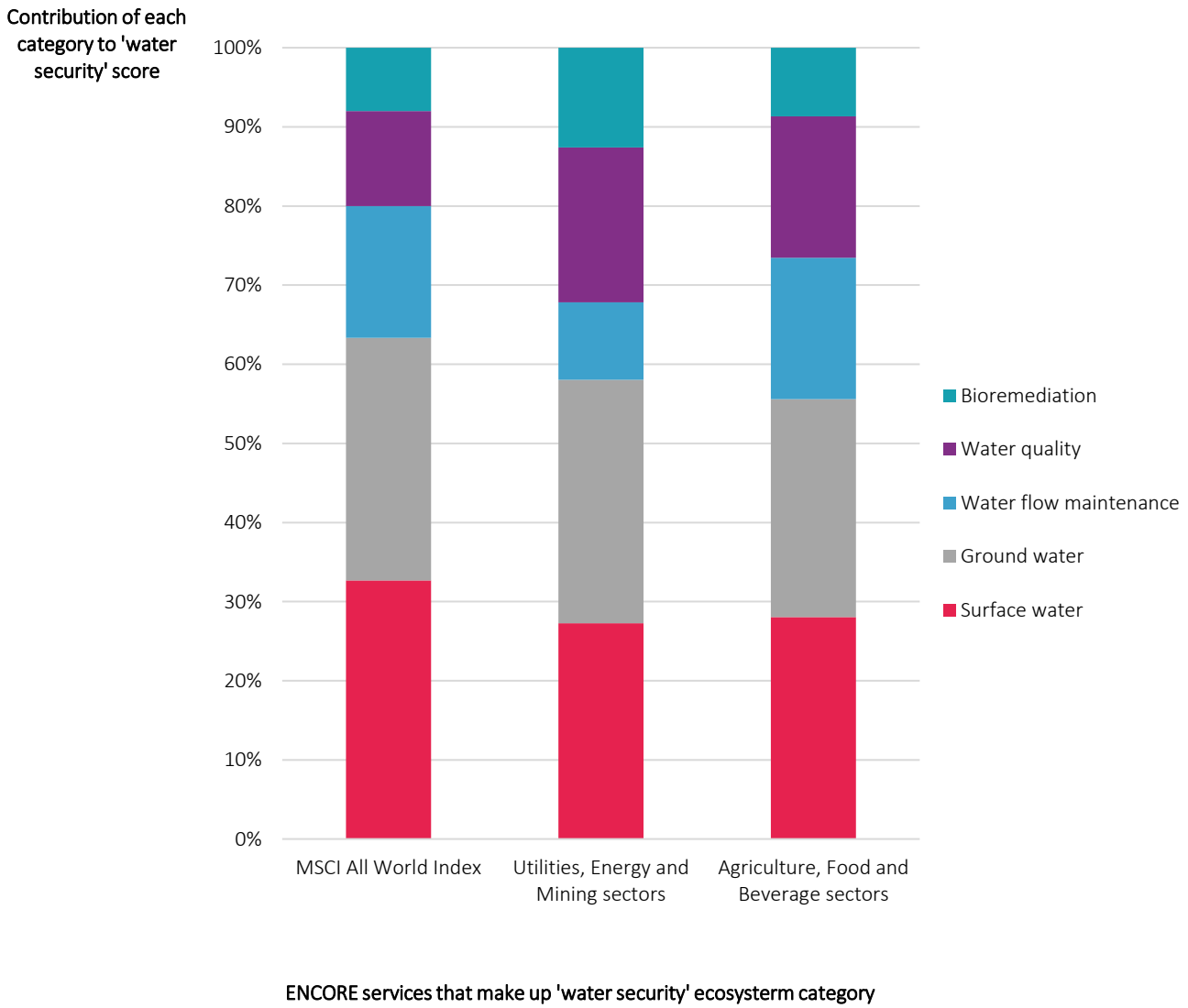
Mines are often located near communities or in areas with high levels of natural capital. Mining activities rely on protection from disruption, such as local climate regulation and the prevention of landslides, to provide a broadly consistent environment in which they can plan and conduct operations. They also have a high reliance on water. This is similar for energy and utility companies.

Why is water security the most depended on ecosystem service?

The following graphs show why the MSCI All World Index is most dependent on water security. The 'water security' ecosystem service category encompassed five ENCORE services, shown by the blue columns in the below Figure 4. Of these five ENCORE services, it is the reliance on ground and surface water availability that drives the overall dependency score.

The degree of dependence on the five ENCORE services within water security also varies. For example, whilst the water security of UEM sector companies depends least on water flow maintenance, those in the ABF sector depend least on bioremediation.

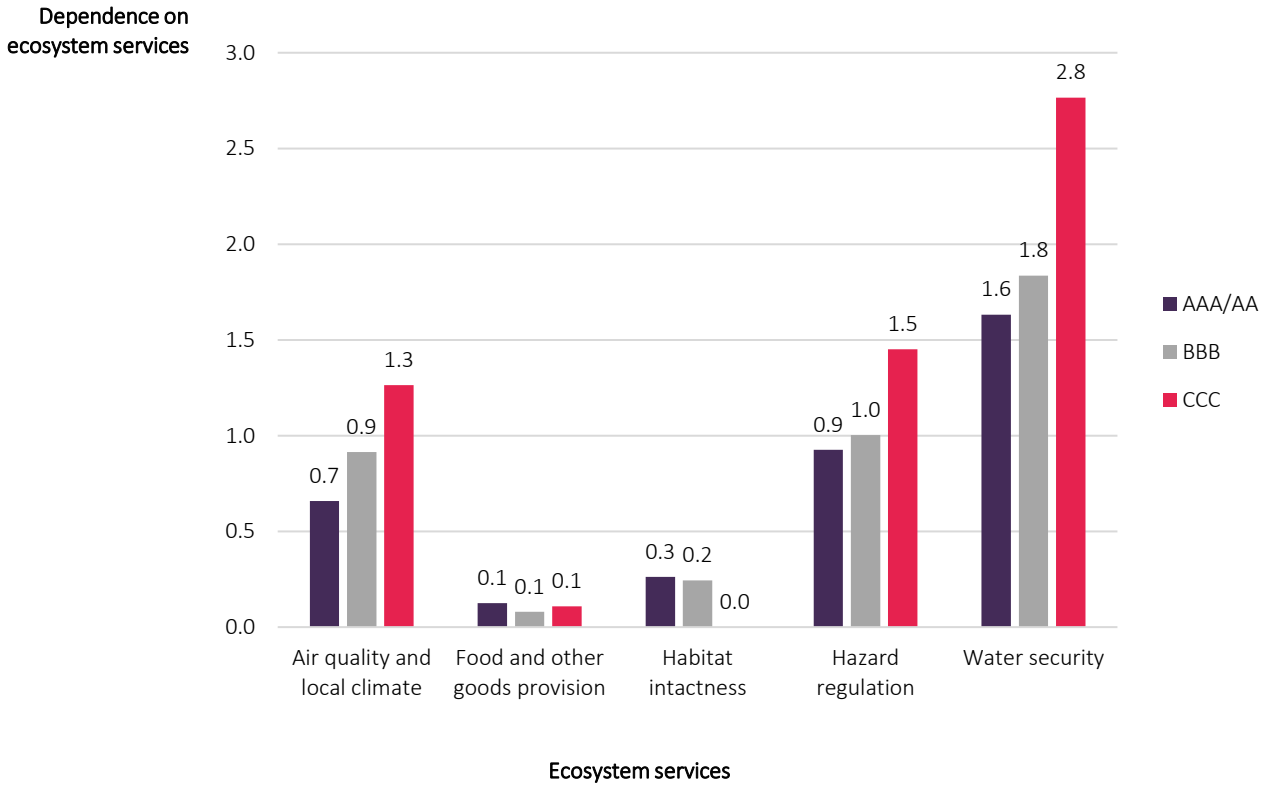
Figure 1: Water-related dependencies that compose the 'water security' score



Nature-related risk exposure by ESG ratings

When the nature-related dependencies are compared amongst companies with different ESG ratings, companies with better ESG ratings were found to be less exposed (see Figure 5). Whether this can be attributed to better management of environmental risks or is a result of other factors requires further investigation.

Figure 5: Relative nature-related dependencies of the MSCI All World by ESG Ratings



Next steps

This mapping exercise represents a first step in identifying material exposures to the risks stemming from nature loss across sectors. Where exposures are highest, further analysis can be carried out, and engagement with either asset managers or portfolio companies about the potential extent of the risk can commence. Indeed, the Science-based Targets Network presents a 5-step process for setting targets for nature in which identifying materiality at sector level is part of the very first step, "assess".

By working to identify sector materiality for nature-related dependencies, the user can also begin to engage with the recently launched beta framework of the Taskforce for Nature-Related Disclosures (TNFD).[ii]

[ii] The G20 Sustainable Finance Roadmap and Central Bank Governors recognised TNFD as a leader in advancing nature-related measurement and reporting in October 2021. See: https://tnfd.global/news/g20-sustainable-finance-roadmap/

Conclusions

Companies across all sectors are dependent on the ecosystem services that nature provides. The decline of nature from pollution, climate change and overexploitation has repercussions on these services, upon which companies depend. This creates a knock-on effect for investors financing these companies, producing risk factors in portfolios due to nature loss. This mapping exercise has highlighted that the most prominent risk factor across a portfolio appears to be the dependence of assets on water security, with companies in resource intensive industries such as agriculture, beverages, utilities, energy and mining experiencing risk exposure many times greater than the MSCI All World Index.

This work is one way in which the relationship between nature and portfolios can become more transparent, contributing to wider momentum amongst the investor community to positively align with the Sustainable Development Goals (SDGs). Furthermore, as the method builds on ENCORE, the score is similar to measuring carbon emissions from a scope 1 perspective rather than a scope 1+2+3 perspective and so will be the tip of the iceberg in terms of exposure.

The exercise and its results are akin to a materiality assessment, which can be used to narrow the focus of further analysis and engagement by investment managers. With the scope narrowed, engagement can begin by investigating the extent to which their investments are exposed to nature loss and whether those investments are taking action to mitigate the risks. This materiality assessment and engagement are the much needed first steps toward measuring and managing nature-related financial risks, enabling the financial system to recognise the value of reversing nature loss.

Appendix

CISL and ENCORE Ecosystem Classification

CISL	ENCORE	ENCORE Definition
Air quality and local climate	Ventilation	Ventilation provided by natural or planted vegetation is vital for good indoor air quality. Without it, there are long-term health implications for building occupants due to the build-up of volatile organic compounds (VOCs), airborne bacteria and moulds.
	Climate regulation	Global climate regulation is provided by nature through the long-term storage of carbon dioxide in soils, vegetable biomass and the oceans. At a regional level, the climate is regulated by ocean currents and winds while, at local and micro levels, vegetation can modify temperatures, humidity and wind speeds.
Food and other goods provision	Fibres & other materials	Fibres and other materials from plants, algae and animals are directly used or processed for a variety of purposes. This includes wood, timber and fibres which are not further processed, as well as material for production, such as cellulose, cotton and dyes, and plant, animal and algal material for fodder and fertiliser use.
	Soil quality	Soil quality is provided through weathering processes, which maintain bio-geochemical conditions of soils including fertility and soil structure, and decomposition and fixing processes, which enables nitrogen fixing, nitrification and mineralisation of dead organic material.
	Animal-based energy	Physical labour is provided by domesticated or commercial species, including oxen, horses, donkeys, goats and elephants. These can be grouped as draught animals, pack animals and mounts.
	Pollination	Pollination services are provided by three main mechanisms: animals, water and wind. The majority of plants depend to some extent on animals that act as vectors, or pollinators, to perform the transfer of pollen.
Habitat intactness	Maintain nursery habits	Nurseries are habitats that make a significantly high contribution to the reproduction of individuals from a particular species, where juveniles occur at higher densities, avoid predation more successfully or grow faster than in other habitats.
	Genetic materials	Genetic material is understood to be deoxyribonucleic acid (DNA) and all biota, including plants, animals and algae.

Hazard regulation	Buffering & attenuation of mass flows	Buffering and attenuation of mass flows allow the transport and storage of sediment by rivers, lakes and seas.
	Mass stabilisation and erosion control	Mass stabilisation and erosion control is delivered through protecting vegetation cover and stabilising terrestrial, coastal and marine ecosystems, coastal wetlands and dunes. Vegetation on slopes also prevents avalanches and landslides, and mangroves, sea grass and macroalgae provide erosion protection of coasts and sediments.
	Flood and storm protection	Flood and storm protection is provided by the sheltering, buffering and attenuating effects of natural and planted vegetation.
	Disease control	Ecosystems play important roles in the regulation of diseases for human populations as well as for wild and domesticated flora and fauna.
	Dilution by atmosphere and ecosystems	Water, both fresh and saline, and the atmosphere can dilute the gases, fluids and solid waste produced by human activity.
	Pest control	Pest control and invasive alien species management is provided through the direct introduction and maintenance of populations of the predators of the pest or the invasive species, landscaping areas to encourage habitats for pest reduction and the manufacture of a family of natural biocides based on natural toxins to pests.
	Mediation of sensory impact	Vegetation is the main (natural) barrier used to reduce noise and light pollution, limiting the impact it can have on human health and the environment.
Water Security	Ground water	Groundwater is water stored underground in aquifers made of permeable rocks, soil and sand. The water that contributes to groundwater sources originates from rainfall, snow melts and water flow from natural freshwater resources.
	Surface water	Surface water is provided through freshwater resources from collected precipitation and water flow from natural sources.
	Water quality	Water quality is provided by maintaining the chemical condition of freshwaters, including rivers, streams, lakes and ground water sources, and salt waters to ensure favourable living conditions for biota.
	Filtration	Water, both fresh and saline, and the atmosphere can dilute the gases, fluids and solid waste produced by human activity.
	Water flow maintenance	The hydrological cycle, also called water cycle or hydrologic cycle, is the system that enables circulation of water through the Earth's atmosphere, land and oceans. The hydrological cycle is responsible for recharge of groundwater sources (i.e. aquifers) and maintenance of surface water flows.
	Bio-remediation	Bio-remediation is a natural process whereby living organisms such as micro-organisms, plants, algae and some animals degrade, reduce and/or detoxify contaminants.

Source: ENCORE, CISL

Glossary of terms

Exploring Natural Capital Opportunities, Risks and Exposure (ENCORE): ENCORE was developed by the Natural Capital Finance Alliance in collaboration with UNEP-WCMC and offers an online tool to highlight the materiality of ecosystem services at sector level, using the Global Industrial Classification Standards (GICS).

Taskforce on Nature-related Financial Disclosures (TNFD): a framework for organisations to report and act on evolving nature-related risks.

Science-Based Targets of Nature (SBTN): Science-Based Targets of Nature are measurable, actionable and time-bound objectives based on the best science which companies can set to give them a defining role in restoring nature.

Global Industry Classification Standards (GICS): a widely used method to assign companies to a specific economic sector or industry group. The GICS structure consists of 11 sectors, 24 industry groups, 69 industries and 158 sub-industries into which all major public companies are categorised.

United Nations Sustainable Development Goals (SDGs): The SDGs are a set of goals addressing global sustainability challenges such as poverty, inequality, climate change, degradation, peace and justice.

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