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ASSESSING THE IMPACTS AND DEPENDENCIES ON NATURE

A CASE STUDY USING A DIVERSIFIED UK ASSET OWNER PORTFOLIO

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ZSL Zoological Society of London

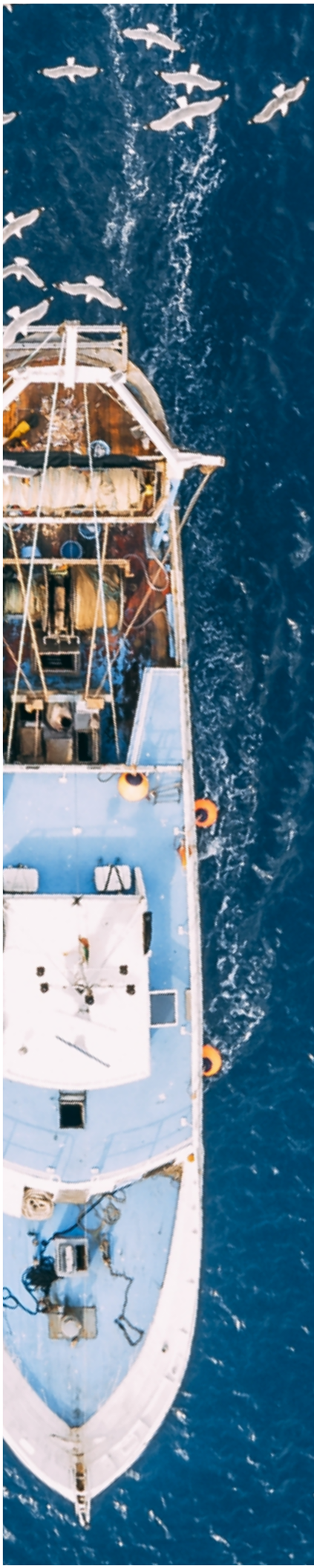
ABOUT ZSL
Founded in 1826, the Zoological Society of London (ZSL) is an international conservation charity, driven by science, working to restore wildlife in the UK and around the world; by protecting critical species, restoring ecosystems, helping people and wildlife live together and inspiring support for nature. Through our leading conservation zoos, London and Whipsnade, we bring people closer to nature and use our expertise to protect wildlife today, while inspiring a lifelong love of animals in the conservationists of tomorrow.

ZSL Sustainable Business & Finance

ZSL's Sustainable Business & Finance programme works with commercial organisations, communities, NGOs and governments to address major global challenges to forest and biodiversity loss. We work with all actors in commodity supply chains – from producers to buyers and investors – to achieve supply chain transparency and sustainability, supporting practices which protect & enhance biodiversity.

SCOTTISH WIDOWS

ABOUT SCOTTISH WIDOWS
Scottish Widows Group Limited (Scottish Widows) is a major insurance, pensions and investment provider, and part of Lloyds Banking Group. Our approach to responsible investment and stewardship is underpinned by our Group purpose of helping Britain prosper. For Scottish Widows, this means using our expertise to help customers plan and prepare for a more secure financial future.



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INTRODUCTION

Economic activity is driving degradation of nature and loss of biodiversity at an unprecedented rate. Most indicators of ecosystems and biodiversity – the bedrock of environmental assets and ecosystem services – show rapid decline (IPBES, 2019). In fact, ZSL's Living Planet Index (LPI) has revealed an average species population decline of 69% since 1970 (ZSL, WWF, 2022) and in the UK alone, 1 in 6 native species are currently at risk of extinction (State of Nature report, 2023). Over 50% of global GDP is moderately or highly dependent on the ecosystem services and environmental assets that nature and biodiversity provide (WEF, 2020), and a report recently published by the Green Finance Institute demonstrated material risks for the UK economy and financial sector from biodiversity loss and environmental degradation (GFI, 2024).

The situation has not gone unnoticed by global policymakers. The Kunming Montreal Global Biodiversity Framework, as established in 2022, set a common global goal for the protection and restoration of nature, and particularly, alignment of financial flows with these long-term outcomes.

And yet, there is a current financing gap upwards of $700bn per year (CBD, 2022). Pension funds, typically investing over a long-term horizon in a diverse portfolio of companies, are an important part of this funding equation. Notably, because of reliance on the global economy, which is reliant upon nature, a pension's investments are dependent upon nature in varying degrees. Additionally, today's impacts from these investments shape tomorrow's landscapes. It is therefore crucial that pension providers leverage their position as long-term investors and begin to use available data and tools to identify and manage the risks and opportunities arising from nature-related issues. This will in turn support portfolio resilience and alignment to global goals for nature and biodiversity.

In 2023, ZSL and financial services company CACEIS laid out their recommended steps for

Step	Action
1	Build knowledge on biodiversity
2	Develop a policy on biodiversity
3	Understand where your scheme's risks are
4	Engagement on risks and opportunities
5	Ongoing monitoring and reporting
6	Member updates
7	Monitor new regulation or frameworks

Table 1: Steps for Trustees to Address Biodiversity and Nature-Related Risks and Opportunities - 'Why Biodiversity Matters' (ZSL, CACEIS 2023)

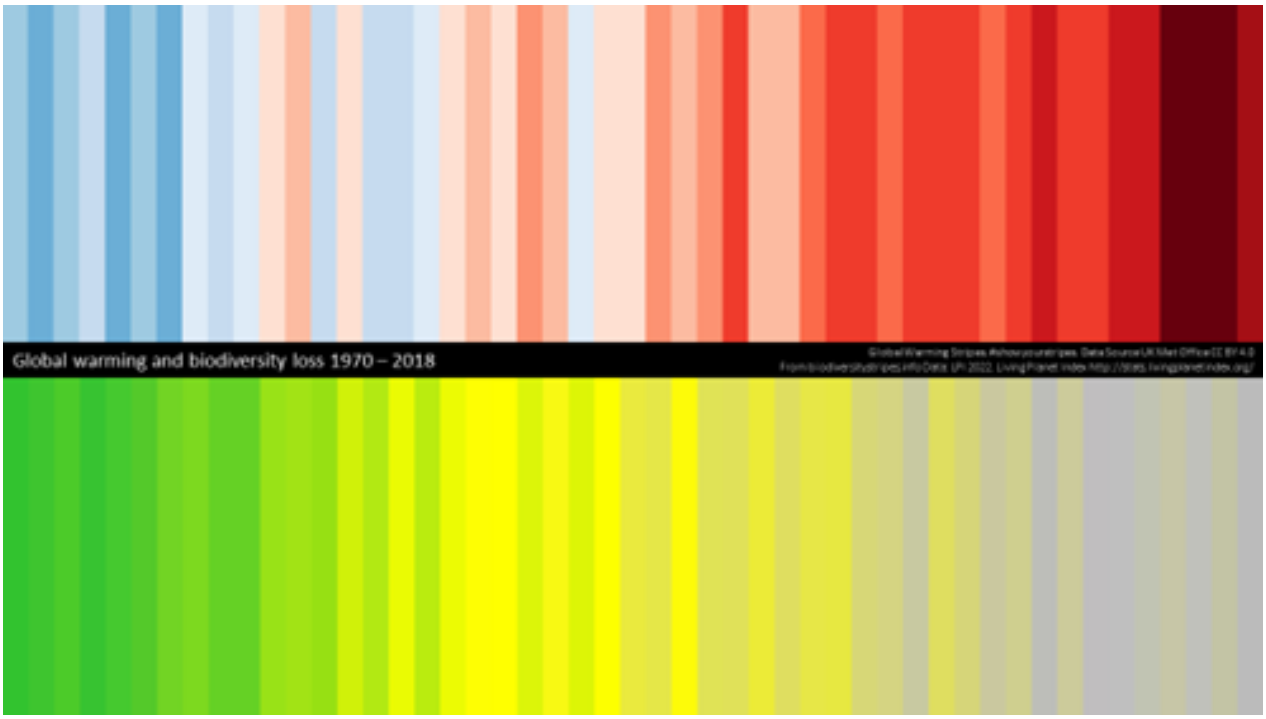


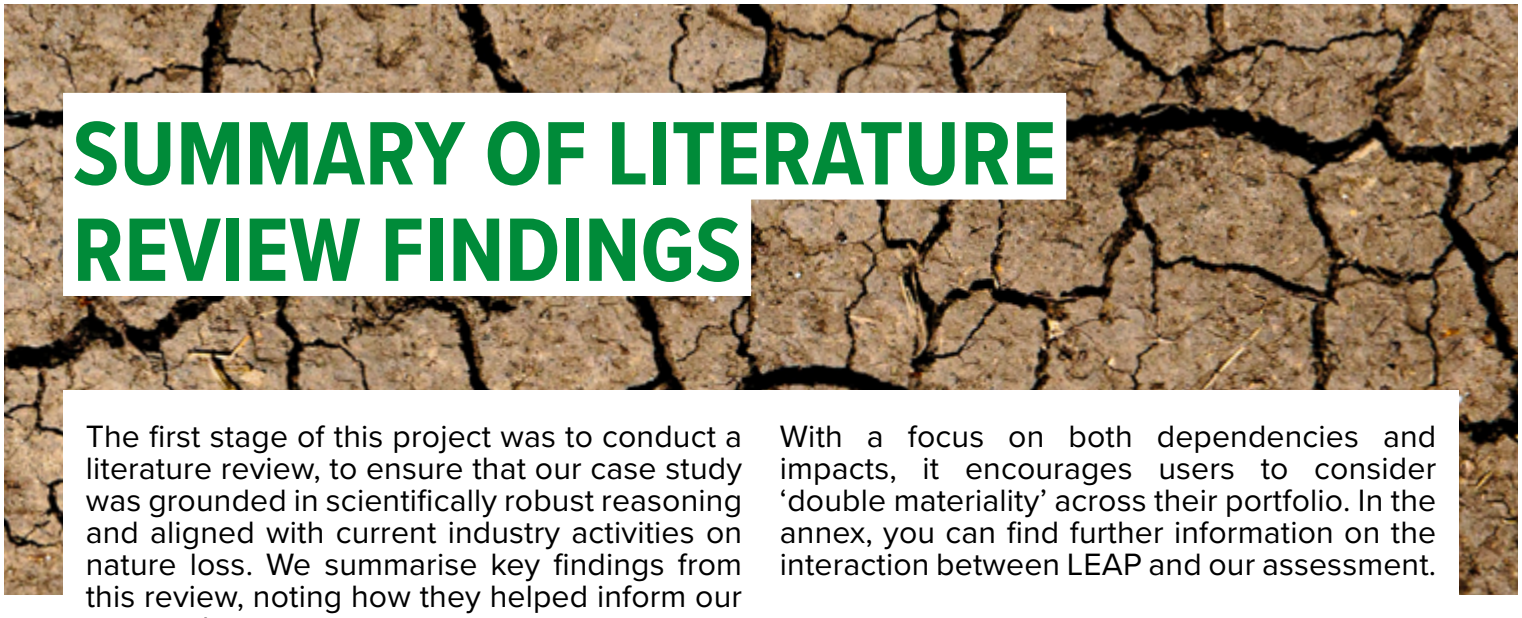
Figure 1: Biodiversity Stripes - University of Derby, Climate Stripes - University of Reading
This image demonstrates the linkage of the biodiversity crisis with the climate crisis, with rising temperatures coinciding with nature loss.

the pensions industry to take action on nature, in a paper called 'Why Biodiversity Matters?'. In this step-wise guide, which can be adapted to suit a range of financial institutions and their respective needs, it was highlighted that conducting a thorough assessment of a pension fund portfolio's impacts and dependencies on nature is an essential step for those looking to take action on biodiversity. However, for asset owners with a vast, diverse portfolio, this can be an intimidating task.

It was no different for Scottish Widows, when they started considering the topic of nature and its implications for their customer investment portfolios. The Sustainable Finance team here at ZSL provided Scottish Widows with specialist training on nature and biodiversity. After publishing their Nature and Biodiversity Report and deforestation position statement in 2023, Scottish Widows wanted to leverage ZSL's expertise to assess their investment portfolio exposure to nature related issues.

This paper provides an illustrative case study, presenting insights for an asset owner approach to assessing exposure to nature-related dependencies and impacts across their investment portfolio and the findings of the assessment carried out between both parties. It presents insights for asset owners who are looking to assess their exposure to nature-related risks and opportunities. It covers the challenges encountered, such as the absence of detailed company-specific and geographic data and suggests ways in which progress can still be made.

This project proved to be a useful capability building exercise for ZSL and Scottish Widows. It has delivered learnings that will help support deeper analysis to further understand the ways in which environmental issues may impact customer outcomes and the actions investors can take to address these.



SUMMARY OF LITERATURE REVIEW FINDINGS

The first stage of this project was to conduct a literature review, to ensure that our case study was grounded in scientifically robust reasoning and aligned with current industry activities on nature loss. We summarise key findings from this review, noting how they helped inform our approach.

TASKFORCE ON NATURE RELATED FINANCIAL DISCLOSURES (TNFD)

The TNFD has emerged following on from the success of the TCFD (Taskforce on Climate Related Financial Disclosures). It is one of the leading initiatives for encouraging corporates and the finance sector to integrate nature firmly into their decision making. At the core of integrating the TNFD risk management and disclosure framework is the LEAP approach. This is a piece of optional guidance which takes users through four key steps for integrating nature:

- **Locate** – identify the firm's interface with nature.
- **Evaluate** – consider nature dependencies and impacts.
- **Assess** – assess the material risks and opportunities.
- **Prepare** – take steps towards responding and reporting.

Over the course of this collaboration, we attempted to align with this guidance closely. With a focus on both dependencies and impacts, it encourages users to consider 'double materiality' across their portfolio. In the annex, you can find further information on the interaction between LEAP and our assessment.

DOUBLE MATERIALITY

Double materiality acknowledges both the risks to a portfolio arising from both dependencies and impacts on nature, and risks to nature arising from the same dependencies and impacts.

We adopted a double materiality approach for this assessment, as we view it as crucial for establishing an idea of the relationship between nature and our investment portfolio.

The literature review allowed us to understand the benefits and drawbacks of specific tools and methodologies and identify those which best suited a double materiality assessment involving broad, high-volume diversification across public markets. Having discounted tools such as biodiversity footprinting and off-the-shelf solutions due either to their complexity or suitability at this stage, we selected the UNEP-FI developed tool ENCORE. Alongside information on biodiversity impacts, the tool presents sector-by-sector information on ecosystem service dependencies and impacts, down to the production process level – a perfect match for an early-stage exposure assessment preceding deeper company level analysis required to support targeted engagement.

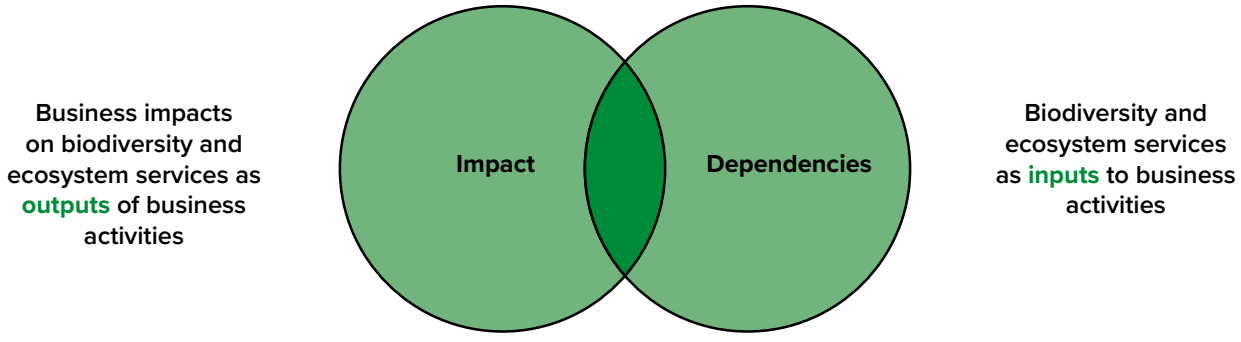


Figure 2: Business Impacts and Dependencies on Biodiversity and Ecosystem Services

SELECTING ENCORE

A publicly available database which offers insight into potential nature-related dependencies and impacts at the sector level. This offering makes it suited for assessments involving diversification across public markets and high volume of portfolio constituents. However, selection of the tool was also founded in deeper analysis. Leveraging guidance published by the EU Business and Biodiversity Platform – the Biodiversity Measurement Navigation Wheel – we considered several different criteria to support tool selection, including:

- **Business context**. This was our scope – the level we wanted to assess i.e. portfolio and sectors. Here we recognised the early stage we were at, considering what tools were best suited for generating initial insights on nature risks and dependencies.

- **Biodiversity pressures**. This, given our diversification across various sectors and production processes, was determined as the five key primary drivers of loss according to IPBES. Though carrying varied coverage of each impact driver, ENCORE is sufficiently stacked to build upon through additional research.

- **Biodiversity scope**. Linking to dependencies and impacts, this was consideration of how the tool could deliver insight for both dependencies and impacts for a broadly diversified portfolio. ENCORE covers these for 11 sectors, 138 subindustries and 86 different production processes. It assesses sub-industry dependence on 21 different ecosystem services, which were classified according to the Common International Classification of Ecosystem Services (CICES). These were more detailed than any other sub-sector level analysis that could be found on ecosystem service dependencies. For impacts, it rates sector and subindustry contribution to 11 different impact drivers, which can be mapped against the five according to IPBES.

- **Biodiversity metrics**. Here we considered what output was required, recognising core sector metrics in the TNFD framework. Being at an early stage, we wanted to focus on comparable, relatively easy to generate data.

- **Level of efforts**. As a nascent discipline for us, we were mindful of the expertise and operational functionality that is required by different tools. We consider early-stage exposure assessment through ENCORE as lower demand in this respect, relative to tools providing footprints. Though not perfectly aligned, economic sectors and subindustries were, at time of assessment, classified by ENCORE according to the Global Industry Classification Standard. This helped with mapping to the portfolio. Additionally, effort encompasses cost – ENCORE is an open-source database.

FOOTPRINTING TOOLS

These provide a helpful way to understand the impacts that corporates and financial institutions have on nature. They generally aim to combine the complex relationships between impact drivers and the state of nature into a single metric for a portfolio, in a time-efficient manner which can support target setting.

However, their use by the finance industry is still nascent – these tools are not typically used in early-stage assessments. Besides suitability for those at the start of their journey, the range of different approaches and methodologies available has presented selection challenges. There is no single tool or metric which can comprehensively provide all insight, such is the complexity of assessing nature. In fact, TNFD points to a need to use a dashboard of multiple indicators and metrics to best capture changes in the state of nature.

Another limitation is that at their core, footprinting tools focus primarily on the impacts of investments on nature rather than taking a double materiality approach, and thus they do not give a rounded view of total potential biodiversity impact. Finance for Biodiversity and TNFD also note that many of the footprinting approaches developed for the finance sector do not adequately address all the drivers of biodiversity loss. Impacts on marine ecosystems are often undervalued, and crucial drivers of biodiversity loss such as species overexploitation and invasive alien species frequently disregarded due to data shortages. A more detailed comparison of the existing footprinting tools is included in the Annex (Annex A).

For those considering footprinting, we note different categories of limitations which are helpful to consider, as follows:

- Capability of the tool
- Consensus regarding its use
- Consistency of inputs
- Capacity of the finance industry to use them appropriately
- Contextualisation of conclusions.

The TNFD provides useful insight on these areas

in their discussion paper on footprinting (TNFD, 2023).

Additionally, early guidance is available to help overcome the associated challenges such as how to combine multiple methods. A study by the Finance for Biodiversity Foundation demonstrated use of footprinting tools when assessing nature. However, it did still identify limitations to output when using a combination of four tools (BIA-GBS, CBF, BFFI and GID). We consider their study to be decision-useful insight (FFB, 2023). Where biodiversity footprinting is currently used, one of the most used metrics is MSA.km^2, which is the Mean Species Abundance per square kilometre, measuring the change in quality of an ecosystem compared to a natural reference state. Assessment using this metric allows one to focus on the compositional state of an ecosystem. Other tools use PDF.km^2 (Potentially Disappeared Fraction) which similarly looks at the condition of an ecosystem, but from the functional perspective. The question of which to use really comes down to conclusion derived from selection criteria. Fundamentally, reducing nature to a single metric would serve to undermine the complexity of nature and leave gaps in the analysis. These two metrics can be combined to generate the best possible insight.

Noting these complexities, ZSL therefore encouraged Scottish Widows to take their first steps via a sector focused exposure assessment targeting potential impacts and dependencies on nature across their portfolio. Evidence-based insight would be taken from a combination of ZSL research, the ENCORE tool, and multiple company specific biodiversity metrics. A benefit of taking the first steps in-house rather than using footprinting tools, is that this approach supports the building of internal capacity on biodiversity. Applying learnings from the findings can help to identify and manage risk and conduct informed engagement with investee companies.

We note that as capability and understanding increases, and footprinting tools become established mechanisms, they could help to supplement internal work and provide a more complete assessment. Though not a suitable approach for our exposure assessment at this stage of our work, we welcome innovation in this space and remain excited about the potential in these tools.

IMPACTS: DRIVERS OF LOSS APPROACH

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) has identified the direct drivers of change in nature with the largest global impact as: (1) changes in land and sea use; (2) direct exploitation of organisms; (3) climate change; (4) pollution and (5) invasive alien species (IPBES, 2019). IPBES note that these drivers result from "an array of underlying causes – the indirect drivers of change – which are in turn underpinned by societal values and behaviours that include production and consumption patterns, human population dynamics and trends, trade, technological innovations and local through global governance" (IPBES, 2019). They also importantly highlight that the rate of change in these drivers differs among regions and countries. The five drivers of nature loss are:

1. **Changes in land and sea use** – Land use change has the largest relative impact on terrestrial and freshwater ecosystems, and the most prevalent cause of land use change is agricultural expansion, with one third of terrestrial land covered by crops or used for animal husbandry (IPBES, 2019). Primary natural forests, home to the highest rates of biodiversity, are the most at risk with 420 million ha of forests lost since 1990 (FAO, 2020). Sea use change is also mentioned as a key risk to biodiversity and is primarily caused by high impact industrial fishing techniques such as bottom trawling, deep sea mining and coastal infrastructure.

2. **Direct exploitation of organisms** – This driver relates to the unsustainable use of natural resources or the "overexploitation, of animals, plants and other organisms, mainly via harvesting, logging, hunting and fishing" (IPBES, 2019). Humans rely on around 50,000 different species for food, fuel, cosmetics, medicines, tourism and other purposes. A third of wild fish in the ocean are overfished, more than 10% of wild trees are threatened by unsustainable logging, and more than 1,300 mammals are being pushed to extinction by unsustainable hunting, with overexploitation driving the loss of keystone species in many ecosystems such as rhino, elephant, and tigers (IPBES, 2019).

3. **Climate change** – The frequency and intensity of extreme weather events, and the fires, floods and droughts that they can bring, have increased in the past 50 years, while the global average sea level has risen by between 21 and 24 cm since 1880, and at

a rate of more than 3 mm per year over the past two decades (Climate.gov, 2022). These changes have contributed to widespread impacts in many aspects of biodiversity, including species distribution, phenology, population dynamics, community structure and ecosystem function.

4. **Pollution** – Pollution from industry causes significant negative impacts to freshwater, marine and terrestrial ecosystems. Air, water or soil pollution can directly impact a species by making the surrounding environment unsuitable for survival (for example, in the case of an oil spill) or it can affect a species indirectly by impacting food availability or reproductive performance, thus reducing population size over time (ZSL, WWF 2020). Although global trends are mixed, all forms of pollution have continued to increase in some areas, while marine plastic pollution in particular has increased tenfold since 1980, affecting at least 267 species, including 86% of marine turtles, 44% of seabirds and 43% of marine mammals (IPBES, 2019).

5. **Invasive alien species** – Invasive alien species compete with native species for space, food and other resources. They can even turn out to be a predator for native species, or spread diseases that were not previously present in the environment (ZSL, WWF 2020). As a result they are a significant driver of biodiversity loss globally, and are reported to be the second most common threat associated with species that have gone completely extinct since 1500 (Bellard et al. 2016). Records of alien species have increased by 40% since 1980, associated with increased trade and human population dynamics and trends (IPBES, 2019), and this shows no signs of slowing, with Global Change Biology researchers predicting that the number of established alien species will increase by 36% between 2005 and 2050 (Global Change Biology, 2020).

ZSL and SW decided to adopt a drivers of loss approach, and framed the research to allow insights on how the portfolio is impacting key drivers. As Scottish Widows was already focusing on decarbonisation across their portfolio - and thus climate change as a driver of loss - it was decided that the project would not cover this driver of loss. Additionally, due to its status as a critical resource for the global economy and thematic priority for Scottish Widows, specific focus was placed on water use. Despite data being readily available on land use change, climate change and pollution, there was less information on the direct exploitation of organisms and invasive alien species. As a result, ZSL conducted a deeper dive into these two drivers and consulted with key NGOs, as well as experts from ZSL's scientific institute to build out a list of key contributing sectors which was then integrated into the analysis. This approach provided Scottish Widows with an indicative view of exposures to causes of biodiversity loss in their portfolio.

To align with Scottish Widows' internal priorities and support stewardship activities on water, the decision was made to isolate freshwater use as a distinct driver, which will be further explained in the approach section of this paper.

DEPENDENCIES: ECOSYSTEM SERVICES APPROACH

Ecosystem services, simply put, are the benefits to people from ecosystems. The term was popularised by the Millenium Ecosystem Assessment (MA), a major UN-sponsored effort to analyse the impact of human actions on ecosystems and human well-being. In this assessment, which finished in 2005, four different categories of ecosystem service were identified: provisioning services, regulating services, cultural services and supporting services.

- Provisioning services refer to the direct products that can be extracted from nature. Alongside food and water, other types of provisioning services include timber, wood fuel, natural gas, oils, and plants that provide fibres for clothing and textiles, as well as a range of medicinal benefits.

- Regulating services refer to the ecosystem processes that work together to keep life stable on earth. Regulating services include pollination, decomposition, water purification, erosion and flood control, as well as carbon storage and climate regulation.

- Cultural services are the non-material benefits that nature can have on mental wellbeing and social development. These include the roles ecosystems play in local, national and global cultures; the building of knowledge and the spreading of ideas; creativity born from interactions with nature (music, art, architecture); and the physical space for recreation.

- Supporting services are the fundamental, underlying natural processes that sustain ecosystems. These include the creation of soils, the water cycle, photosynthesis

and nutrient cycling. These processes allow the Earth to sustain basic life forms and underpin all other ecosystem service categories.

Most, if not all, business activities are dependent on one or more of these types of ecosystem services to some extent. Based on ENCORE's data, the three sectors globally with the strongest dependencies on nature are Agriculture, Aquaculture & Fisheries, and Forest Products. Utilities, Oil & Gas and Mining also have a high dependency on nature (Global Canopy, 2018; UNEP-WCMC, 2018). With biodiversity and therefore ecosystem services on the decline, these dependencies create material risks for sectors and the companies operating in them. This is because reliability of environmental assets and ecosystem services, and cost-effective access to them, are important factors for business operations and profitability. Consequently, financial institutions investing and providing financial services to highly dependent companies are exposed to these risks.

FROM IMPACTS & DEPENCENCIES TO FINANCIAL RISKS

The ways in which risks arising from nature dependency and negative impact translate into financial risk is demonstrated in Figure 3 in guidance from the Cambridge Institute for Sustainability Leadership.

The five main drivers of nature loss put ecosystem services at risks which reflects the 'physical risks' related to nature. In response to nature loss and the issues it causes, policy makers may introduce regulation and consumers may shift demand, for example to deforestation free products – resulting in transition risks and additional costs for

Figure 3: Framework for identifying nature-related financial risks (CISL, 2021)

SUMMARY OF APPROACH

The diagram below (Figure 4) outlines the steps taken by ZSL in collaboration with Scottish Widows to develop an understanding about the nature-related impacts and dependencies of their investment portfolio. The challenges that arose during each stage of the process will be highlighted in Annex C, some of which will be explored further in the 'Limitations' section of this paper.

To achieve actionable insight through this work, we leveraged research papers, methodologies and data available in the public domain, together with interviews with experts within ZSL and beyond. As many financial organisations that have conducted similar exercises can attest to, this was often an exercise in troubleshooting and filling data gaps. We hope that by describing our process, the decisions we made at different stages and the challenges we encountered, we can help other financial institutions learn from our experience and expand on this important work.

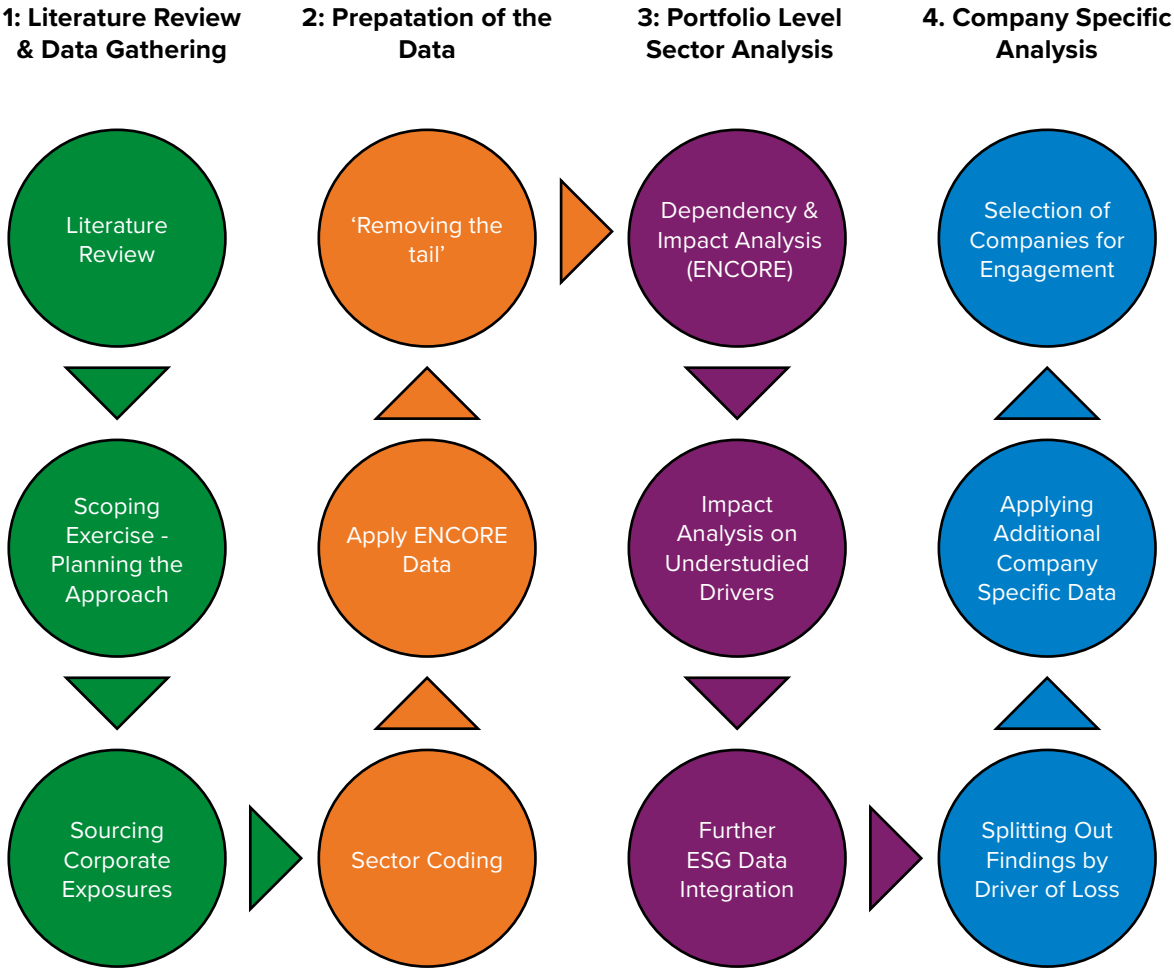


Figure 4: Steps to Understand Nature-Related Impacts and Dependencies in the Portfolio

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SUMMARY OF FINDINGS

The findings of this work were split into portfolio level and company level datas, allowing Scottish Widows to see overall impacts and dependencies by sector but also identify specific companies to engage with on key biodiversity topics. A summary of the key findings follows.

PORTFOLIO LEVEL IMPACTS

The portfolio assessment case study revealed that Scottish Widows has roughly 10% of total holdings assessed held in the top 20 most nature impacting sub-industries, according to ENCORE. This sits within a broader expectation by the TNFD that globally diversified portfolios (MSCI ACWI) can expect approximately 44% of exposure in holdings which have material nature-related dependencies and impacts.

Figure 5 lists the top 20 subindustries deemed to be most impactful on nature from ENCORE and ZSL. ENCORE rates subindustries on magnitude of business impact on 11 different 'impact drivers' including terrestrial, marine and freshwater ecosystem use, water use, several different forms of pollution, and GHG emissions. As explained earlier, ZSL bolstered this data with research on additional drivers including the direct exploitation of organisms and invasive alien species. In this case, impact drivers are weighted equally, so those coming out as highly impactful are likely to be contributing considerably to several different drivers rather than intensely contributing to a single driver.

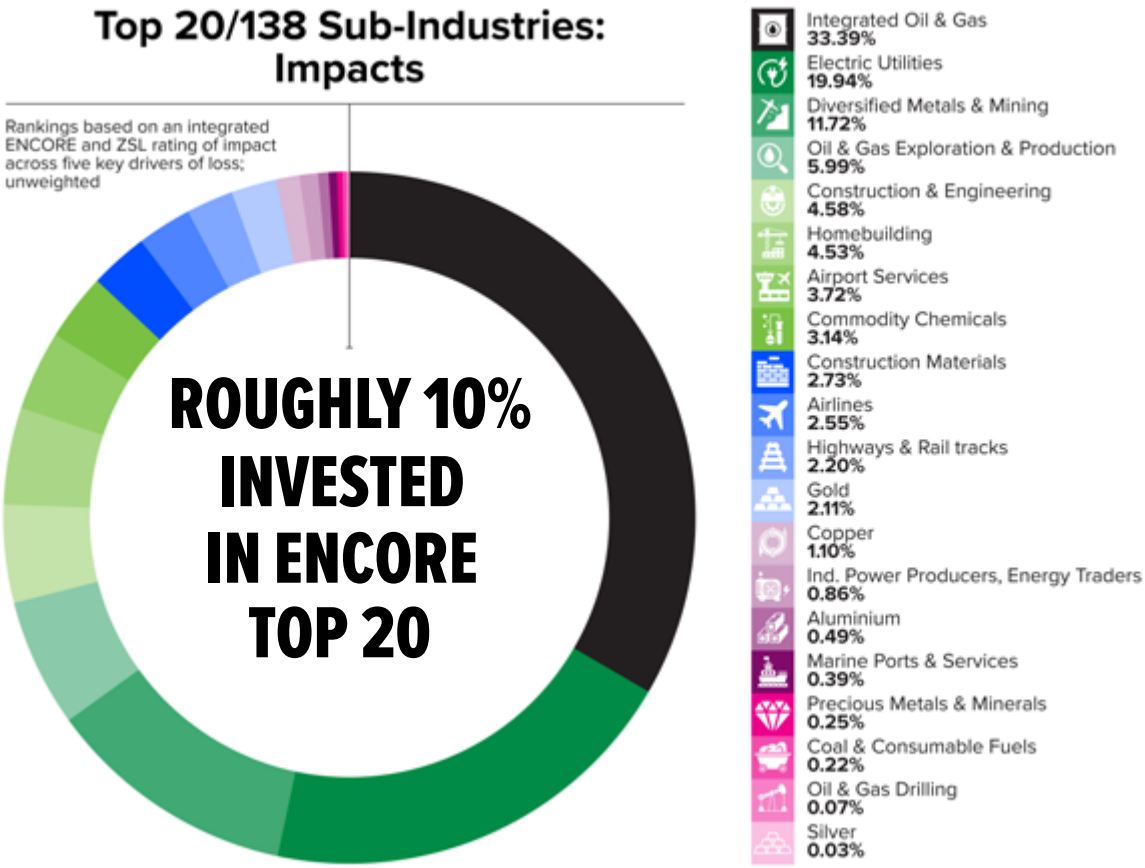

Figure 5: Top 20 Most Impactful Sub-industries on Nature: ENCORE and ZSL Assessment

To give a better understanding of key areas of concern, portfolio level impacts were split out into five key drivers of biodiversity loss, integrating impact scores from ZSL and ENCORE for subindustries before also weighting by their prevalence in the SW global portfolio – i.e. amount of exposure to the company. It is important to an asset owner to consider what matters most to investment portfolios and consider the level of impact and amount of investment, and how this translates into potential risk.

Below we show the top 10 subindustries by level of potential impact on each driver before and after this has been weighted by level of exposure.

Land and Sea Use Change

Integrated Oil and Gas was revealed to be the most impactful subindustry in the SW portfolio in terms of land and sea use, due to a high exposure and impact score (from ENCORE). Perhaps surprisingly, Agricultural Products did not factor in the weighted top 10 despite being the primary driver of land use change worldwide (Ritchie et al., 2021) and achieving an impact score of 8/12 on ENCORE. This is due to a relatively low investment exposure to the sector from Scottish Widows, as well as the equal weight given to land and sea use change in the scoring. For this reason industries that have both onshore and offshore impacts, such as oil and gas and construction, scored so highly. Industries such as Renewable Electricity and Electric Utilities also scored highly for this driver due to the marine and terrestrial habitat modification necessary for certain infrastructure such as offshore wind or solar farms. However, the severity of impacts of, say, a solar farm, depends on the biodiversity quality of land being converted.

Ranking	Subindustry	Land and sea use change impact score (/12)
1	Integrated Oil & Gas	12
2	Construction & Engineering	11
3	Marine Ports & Services	11
4	Construction Materials	10
5	Oil & Gas Drilling	10
6	Oil & Gas Storage & Transportation	9
7	Electric Utilities	8
8	Oil & Gas Exploration & Production	8
9	Renewable Electricity	8
10	Agricultural Products	8

Table 2: Top 10 Subindustries by Potential Impact on Land and Sea Use Change (Before Weighting by Exposure)

Weighted Ranking	Subindustry	Land and sea use change impact score (/12)
1	Integrated Oil & Gas	12
2	Electric Utilities	8
3	Diversified Metals & Mining	7
4	Construction & Engineering	11
5	Oil & Gas Exploration & Production	8
6	Integrated Telecommunication Services	3
7	Iron	4
8	Water Utilities	6
9	Oil & Gas Storage & Transportation	9
10	Homebuilding	7

Table 3: Top 10 Subindustries by Potential Impact on Land and Sea Use Change (After Weighting by Exposure)

Water Use

Agricultural Products, Apparel and several different metal extraction industries are given the highest impact rating (that is, worst for potential risks) from ENCORE on water use. Globally, irrigation for agriculture accounts for 72% of all freshwater withdrawals (FAO, 2021) and water intense crops such as cotton go some way to explaining the high impact of apparel on this driver of biodiversity loss. It's estimated that the fashion industry currently uses around 93 billion cubic metres of water per year, which is roughly four percent of all freshwater extraction globally, a figure that is set to double by 2030 on current trends (Ellen MacArthur Foundation, 2017).

Scottish Widows' investment in the pharmaceutical manufacturing sub-industry goes some way to explaining its prominence in the weighted impact rankings across all the remaining drivers of loss. The pharmaceutical industry does have particularly high levels of water use in manufacturing, reflecting both an impact and a dependency that could pose significant risks for companies in this industry (WWF, 2021).

Industries such as Integrated Oil & Gas and mining appear again amongst the weighted list for impacts on water use, whilst consumer goods subindustries such as Personal Products and Packaged Foods & Meats also scored highly due to the large quantities of water use in manufacturing. Alongside attempting to reduce water use in manufacturing plants, companies in these subindustries should bear responsibility for the often large quantities of water required by consumers to use of their products, an industry example being 96% of Procter & Gamble (P&G)'s water withdrawals throughout its value chain occurring downstream (WRI, 2023).

Ranking	Subindustry	Water use impact score (/4)
1	Agricultural Products	4
2	Aluminium	4
3	Apparel, Accessories & Luxury Goods	4
4	Building Products	4
5	Coal & Consumable Fuels	4
6	Copper	4
7	Diversified Chemi-cals	4
8	Diversified Metals & Mining	4
9	Electric Utilities	4
10	Gold	4

Table 4: Top 10 Subindustries by Potential Impact on Water Use (Before Weighting by Exposure)

Weighted Ranking	Subindustry	Water use impact score (/4)
1	Pharmaceuticals Manufacturing	3
2	Integrated Oil & Gas	4
3	Electric Utilities	4
4	General Merchandise Stores	3
5	Iron	4
6	Diversified Metals & Mining	4
7	Automobile Manufacturers	3
8	Personal Products	3
9	Packaged Foods & Meats	3
10	Biotechnology Manufacturint	3

Table 5: Top 10 Subindustries by Potential Impact on Water Use (After Weighting by Exposure)

Note: 24 subindustries received the highest impact rating of 4 (Very high materiality) for water use. They could not all be listed here, so a snapshot of 10 is given on the left. To view the remaining 14, please visit the ENCORE website (www.encorenature.org).

Pollution

Pharmaceuticals Manufacturing scored highly for their weighted impacts across a range of pollution types. Information from ENCORE tells us that chemicals used in pharmaceutical production can contribute to soil and water pollution if not handled safely. Specifically, wastes and wastewater from production may contain eutrophicating substances, heavy metals, or active pharmaceutical ingredients, which can lead to pollution of irrigated soils, river sediments, surface, ground and drinking water, and has been linked in some cases to changes in animal physiology.

The inclusion of Diversified Banks in the weighted rankings represents an anomaly, having a comparatively low impact rating on pollution the data has been skewed by significant exposure to the subindustry. Rather than remove the sub-industry, we chose to remain transparent that a simple weighting methodology can create anomalies. It can be argued that the Financial Services sector be excluded from this type of analysis and, with respect to nature-related issues, be assessed from a different perspective altogether, namely financing activities. Those that scored higher on their impacts on pollution include: Electric Utilities, with power stations creating potentially hazardous waste that impacts air, soil and water quality; Automobile Manufacturers, due to the use of toxic and persistent materials in plants; and Diversified Metals and Mining, which has particularly destructive and far-reaching impacts on water and soil health. Mining's impacts on river health is particularly pernicious, with at least 23 million people around the world live on flood-plains contaminated by potentially harmful concentrations of toxic waste from metal-mining activity (Macklin et al., 2023).

General Merchandise Stores and Personal Products round out the weighted list, both contributing to the single-use plastic and microplastic pollution which is now one of the leading causes of marine biodiversity decline (WWF, 2022).

Ranking	Subindustry	Pollution impact score (/24)
1	Airlines	18
2	Precious Metals & Minerals	17
3	Commodity Chemicals	16
4	Construction & Engineering	16
5	Airport Services	15
6	Aluminium	15
7	Auto Parts & Equipment	15
8	Automobile Manufacturers	15
9	Coal & Consumable Fuels	15
10	Copper	15

Table 6: Top 10 Subindustries by Potential Impact on Pollution (Before Weighting by Exposure)

Weighted Ranking	Subindustry	Pollution impact score (/24)
1	Pharmaceuticals Manufacturing	14
2	Integrated Oil & Gas	13
3	Diversified Banks	2
4	Electric Utilities	15
5	Technology Hardware, Storage & Peripherals	10
6	Pharmaceuticals Services	5
7	Automobile Manufacturers	15
8	Diversified Metals & Mining	15
9	General Merchandise Stores	10
10	Personal Products	13

Table 7: Top 10 Subindustries by Potential Impact on Pollution (After Weighting by Exposure)

Direct Exploitation of Organisms

Traditional medicines as well as Western pharmaceuticals rely heavily on wild and often threatened species of plants. There are over 1,300 medicinal plants used in Europe, of which 90% are harvested from wild resources, and in the United States, about 118 of the top 150 prescription drugs are based on natural sources (Balunas & Kinghorn, 2005). Wild plant ingredients are also found in a variety of common household products, including food and beverages, beauty and cosmetic items, explaining the appearance of Packaged Foods & Meats and Personal Products subindustries in the weighted list.

Similarly to the land use change driver, the most significant contributor to direct exploitation, Agricultural Products (with an impact score of 7), does not feature on the weighted list due to low portfolio exposure. It is important to note that this does not suggest that efforts shouldn't be taken with companies in that sector. Scottish Widows can use company specific findings to identify engagement priorities, such as those in industries typically associated with exploitative practices such as fishing or the timber trade.

Ranking	Subindustry	Direct Exploitation Impact Score (/8)
1	Agricultural Products	7
2	Forest Products	4
3	Packaged Foods & Meats	4
4	Paper Products	4
5	Specialty Stores	4
6	Apparel Retail	3
7	Apparel, Accessories & Luxury Goods	3
8	Home Furnishings	3
9	Home Improvement Retail	3

Table 8: Top 10 Subindustries by Potential Impact on Direct Exploitation of Organisms (Before Weighting by Exposure)

Weighted Ranking	Subindustry	Direct Exploitation Impact Score (/8)
1	Pharmaceuticals Manufacturing	3
2	Pharmaceuticals Services	3
3	Packaged Foods & Meats	4
4	Electric Utilities	2
5	Personal Products	2
6	Apparel, Accessories & Luxury Goods	3
7	Restaurants	2
8	Food Retail	2
9	Hotels, Resorts & Cruise Lines	2

Table 9: Top 10 Subindustries by Potential Impact on Direct Exploitation of Organisms (After Weighting by Exposure)

Invasive Alien Species

As there was no ENCORE impact data relating to invasive species, the findings here were reliant on ZSL's own research. There is still a significant data gap on this topic, and work to be done to uncover the key drivers. However, there are strong links between the volume of commodity imports and the number of invasive alien species in a region, and patterns in the global spread of species often mirror shipping and air traffic networks. As a result, transport and trading companies such as those in the Air, Rail and Shipping industries are commonly believed to be the primary driver of the spread of invasive species (IPBES, 2023). There are concerns that biosecurity measures at international borders have not kept pace with the growing volume and diversity of not only global trade (including e-trade), but also of travel (for tourism). They are all reflected in the weighted top 10 list for impacts on this driver.

Pharmaceuticals again come out as highest on the weighted list, as invasive plant species are frequently transported for the production of pharmaceutical and cosmetic compounds, as mentioned under direct exploitation above. Invasive alien species are also often used in forestry, agriculture, horticulture, aquaculture and in the pet trade, however Scottish Widows do not have significant exposure to these industries.

Ranking	Subindustry	Invasive Alien Species Impact Score (/4)
1	Air Freight & Logistics	4
2	Airlines	4
3	Airport Services	4
4	Marine	4
5	Marine Ports & Services	4
6	Forest Products	3
7	Highways & Rail Tracks	3
8	Home Improvement Retail	3
9	Hotels, Resorts & Cruise Lines	3
10	Oil & Gas Storage & Transportation	3

Table 10: Top 10 Subindustries by Potential Impact on Invasive Alien Species (Before Weighting by Exposure)

Weighted Ranking	Subindustry	Invasive Alien Species Impact Score (/4)
1	Pharmaceuticals Manufacturing	2
2	Pharmaceuticals Services	2
3	Electric Utilities	2
4	Packaged Foods & Meats	3
5	Hotels, Resorts & Cruise Lines	3
6	Trading Companies & Distributors	2
7	Air Freight & Logistics	4
8	Airport Services	4
9	Apparel, Accessories & Luxury Goods	2
10	Railroads	3

Table 11: Top 10 Subindustries by Potential Impact on Invasive Alien Species (After Weighting by Exposure)

PORTFOLIO LEVEL DEPENDENCIES

The portfolio assessment case study revealed that Scottish Widows has roughly 12% of total holdings assessed held in the top 20 most nature dependent sub-industries, according to ENCORE. Again, this sits within a broader expectation by the TNFD that globally diversified portfolios (MSCI ACWI) can expect approximately 44% of exposure in holdings which have material nature-related dependencies and impacts.

Figure 6 lists the top 20 subindustries deemed most dependent on nature by ENCORE, which rates subindustries on magnitude of business dependency across 21 different ecosystem services including ground water, climate regulation, soil quality, water quality and pollination. A high level of dependency on such services will pose a business risk, as many of such inputs are being depleted due to human impacts. Unsurprisingly, the subindustry 'Agricultural Products' is ranked highest for dependency, whilst industries from across the energy, consumer goods and chemicals sectors make up the remainder of the top 20.

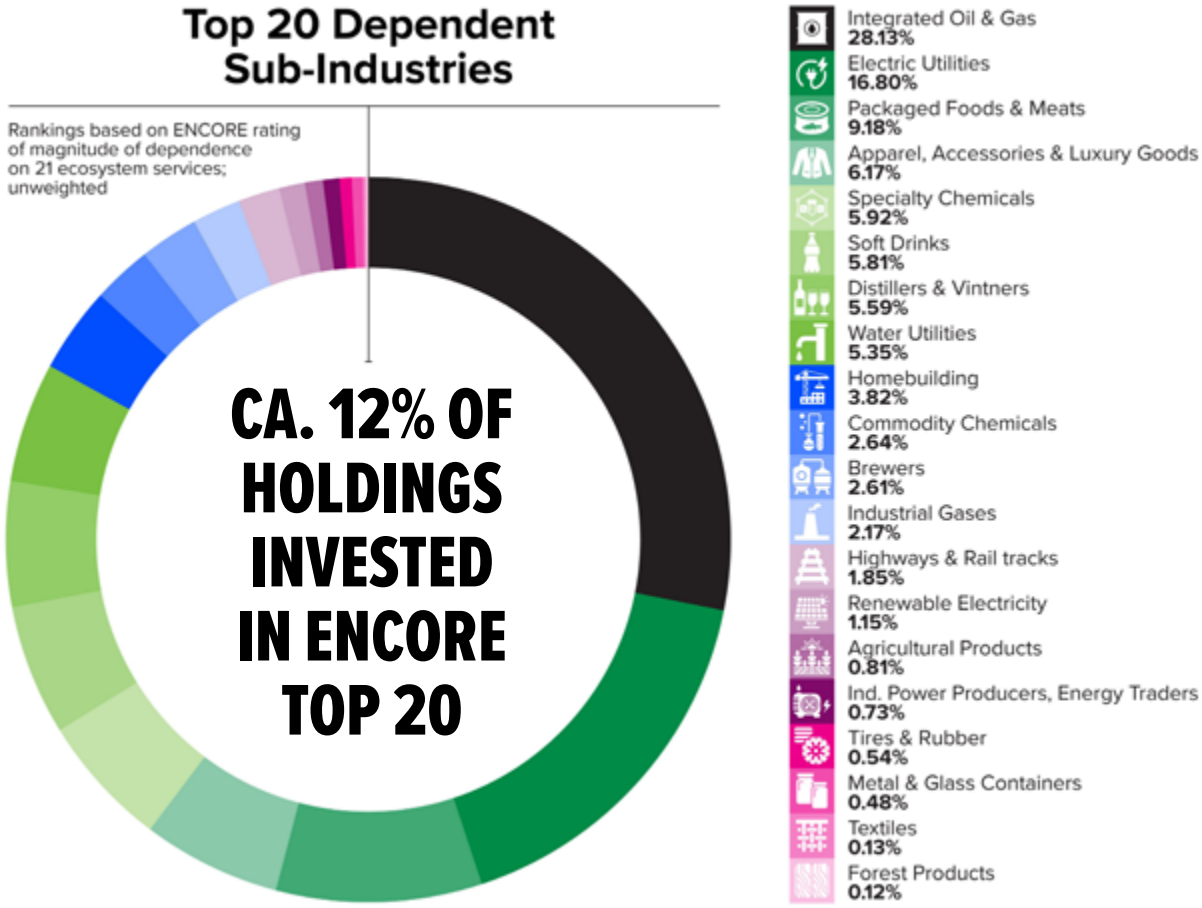

Figure 6: Top 20 Most Dependent Sub-industries on Nature: ENCORE and ZSL Assessment

Weighted by Exposure

Below is the ranking of subindustries by ENCORE dependency score but weighted by Scottish Widows' exposure to each industry across their portfolio. This gives a clearer picture of which subindustries may present possible risk to Scottish Widows in particular, due to their reliance on depleting ecosystem services and their prevalence in the portfolio.

Agricultural and Forest Products do not make the top 20 due to low exposure, whereas Water Utilities, Electric Utilities, Oil & Gas and Packaged Foods & Meats remain in the top 20 amongst others. Pharmaceuticals Manufacturing is being ranked highest due to level of exposure from Scottish Widows.

Figure 7 ranks 20 sub-industries by dependency score weighted by exposure within the Scottish Widows portfolio. A sub-industry can be considered a greater potential risk due to the extent of its dependency on depleting ecosystem services in addition to significance of exposure.

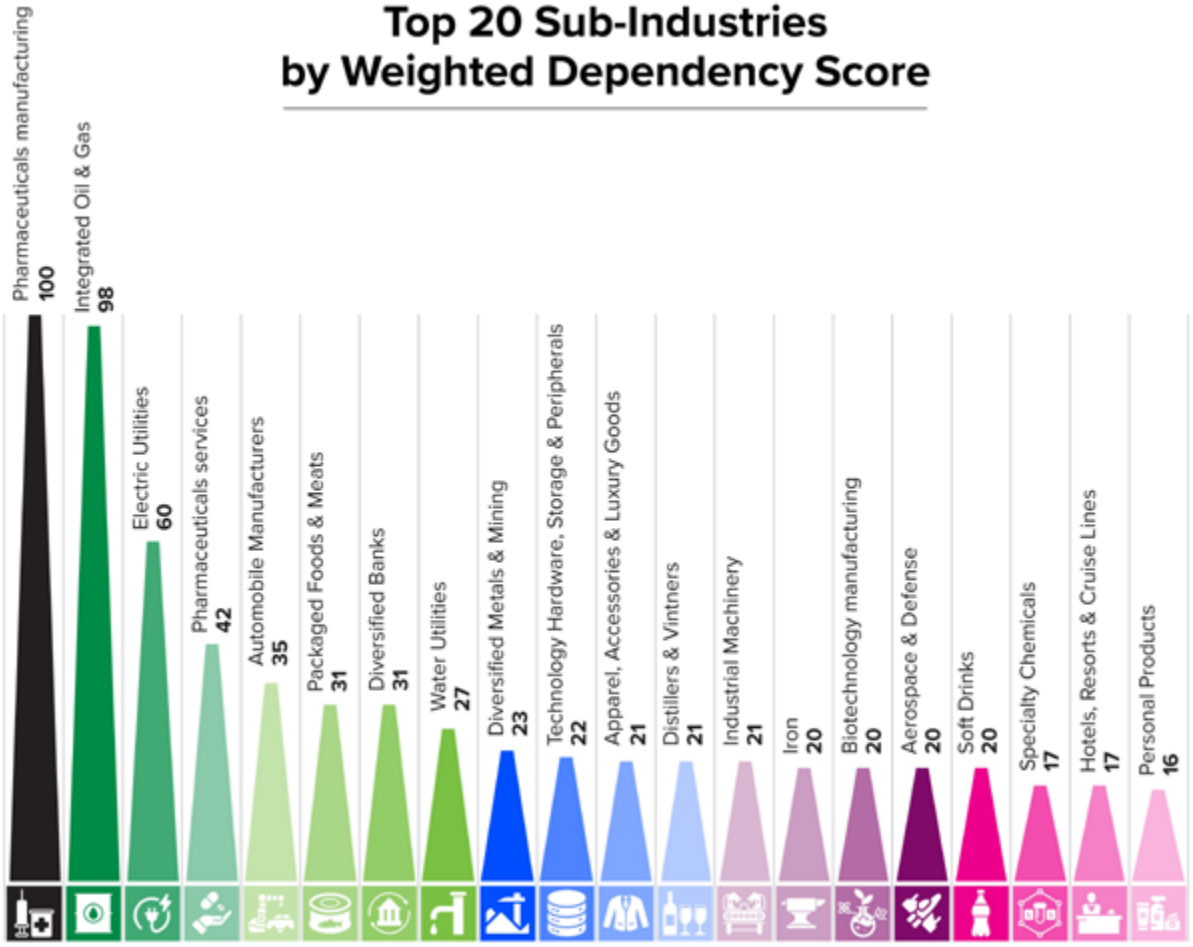

Figure 7: Top 20 Subindustries by Weighted ENCORE Dependency Score in Scottish Widows' Portfolio

COMPANY LEVEL FINDINGS

The 11 'impact drivers' listed on ENCORE did not match perfectly with the 5 drivers of biodiversity loss we wanted to focus on, so **before progressing to look at company specific information we needed to combine drivers into their respective categories. This would allow Scottish Widows to see which subindustries they are exposed to contribute most to each driver of loss. Therefore, each driver could form a distinct thematic area for engagement.** To align with Scottish Widows' existing priorities on nature, we decided to pull out freshwater use as a distinct category as we did not feel it was adequately captured by any of the 5 drivers identified by IPBES as laid out in our literature review summary. Table 12 shows how we allocated the different ENCORE impact drivers, as well as our own research, into each driver.

The following findings (Figures 8, 9, 10, 11, and 12) come from a selection of the top 1000 companies by holding size in the Scottish Widows portfolio. These companies represent 84% of their total corporate investments. Depending on their subindustry and specific production process, companies were allocated an 'Impact Rating' related to each of the five drivers of biodiversity loss. The impact ratings differed in scales between drivers, due to a varying number of inputs, and therefore we placed impact ratings into a simple sore of 1 to 4 to allow for comparison. Those companies with the lowest impact ratings (that is, least impactful) were given a score of 1, and those with the highest in a score of 4. The pie charts show the proportion of the 1000 companies which fall into each score, which have been colour coded to represent severity of impact. This is a simple illustration and the severity of impact between drivers is not meant to be comparable.

The charts identify, out of the top 1,000 corporate exposures (relating to Scottish Widows total assets under management) which of the drivers of loss are being impacted the most. Water use is revealed as the highest risk, with half of companies scoring the highest or second highest impact scores. Pollution is also a risk as although no companies in the top 1,000 scored in the very highest quartile, 24% scored 3 and 41% with the second highest score, suggesting that industries contribute significantly to pollution in some form or other, and therefore pose a potential risk to biodiversity loss.

Land use change was a surprisingly low impact area, mainly due to a lack of material Scottish Widows exposure to companies directly associated with agriculture and other high impact subindustries. Invasive species and direct exploitation of species were also not major risks for this set of companies, with 81% and 91% companies given the least impactful score respectively. Again, the dominance of Financial Services in the top exposures may draw attention away from the most impactful sub-industries.

As the impact ratings only tell us about potential risk, and not about how well specific companies mitigate those risks – if they indeed crystallise – it was important to bring in some performance related metrics to check for company disclosures on specific topics.

Driver of Biodiversity Loss	Impact Drivers (from ENCORE data unless stated otherwise)
Changes in Land and Sea Use	Terrestrial ecosystem use, Marine ecosystem use, Freshwater ecosystem use
Direct Exploitation of Organisms	ZSL research (not covered by ENCORE)
Climate Change	GHG emissions
Pollution	Disturbances (light and sound pollution), Non-GHG air pollution, Soil pollution, Water Pollution, Solid Waste, ZSL research on Plastic Pollution
Invasive Alien Species	ZSL research (not covered by ENCORE)
*Water Use	Water use

Table 12: Allocation of Impact Drivers into Biodiversity Loss Drivers

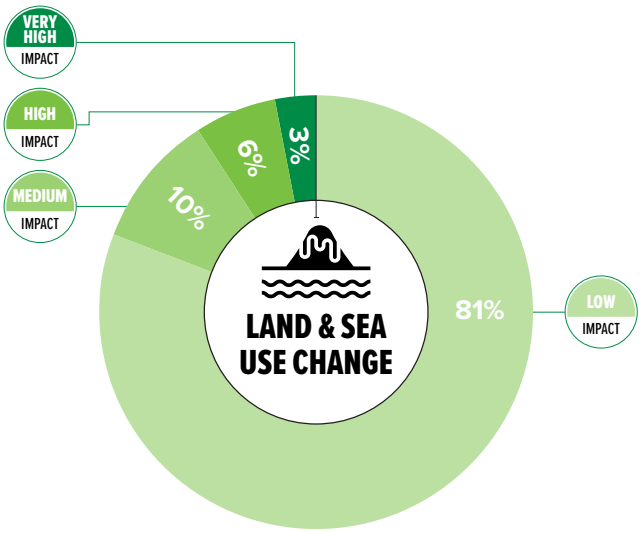

Figure 8: Land and Sea Use Change: Impact Ratings of Top 1,000 Companies Drivers

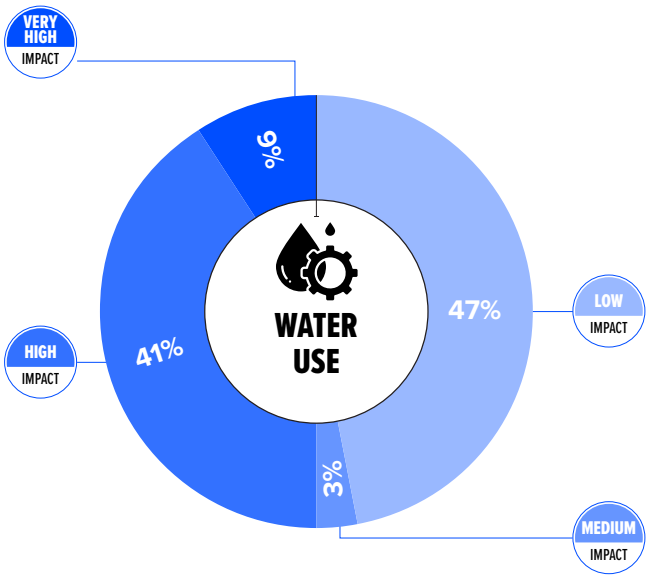

Figure 9: Water Use: Impact Ratings of Top 1,000 Companies

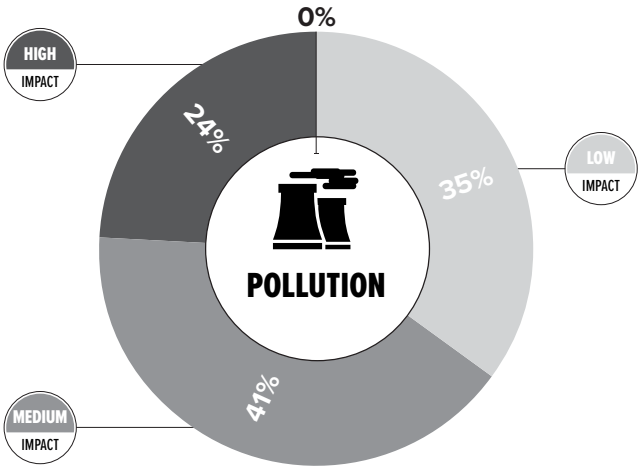

Figure 10: Pollution: Impact Ratings of Top 1,000 Companies

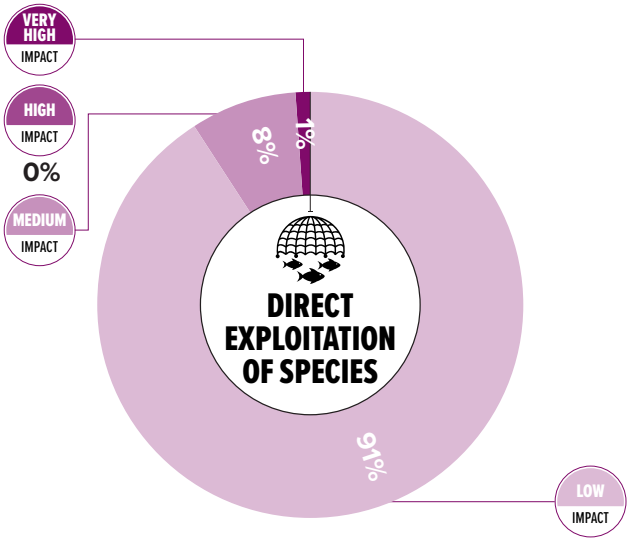

Figure 11: Direct Exploitation of Species: Impact Ratings of Top 1,000 Companies

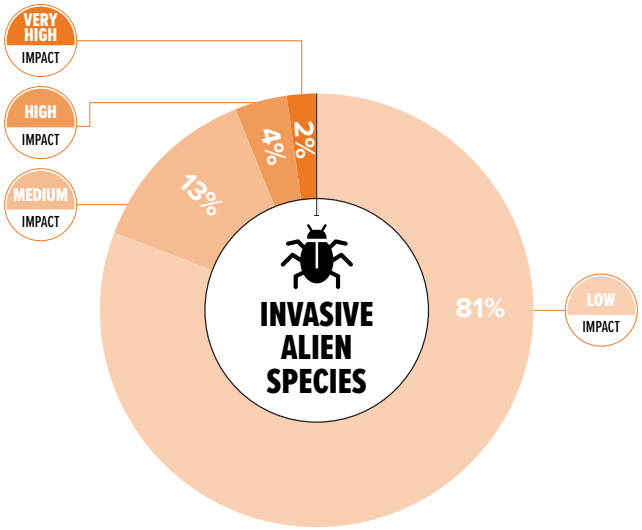

Figure 12: Invasive Alien Species: Impact Ratings of Top 1,000 Companies

HOW ARE CORPORATES MANAGING WATER IMPACTS AND DEPENDENCIES

Focusing on water use as a topic of concern, CDP Water scores can tell us more about how companies are managing their impacts in this area. For those where CDP data was available to Scottish Widows, 102 scored in the 'Leadership' category, with another 137 in the 'Management' category, defined as "awarded for answers that provide evidence of undertaking actions associated with good environmental management, based on awareness of the organization's impact on the environmental issue" (CDP).

However, 77 Companies scored in the C band or 'Awareness' category which indicates little action has been taken to address the issue of water beyond initial risk screenings. A further 9 companies scored a D or D- which represent the lowest grades a company can receive if they have responded to the survey. 157 companies scored an F for not responding to the CDP Water survey when requested. These scores, in addition to other benchmarking and company analysis, can inform further research into key areas of focus for Scottish Widows.

A full list of CDP Water scores available to Scottish Widows for the top 1,000 companies is given in Table 12 (pg. 21), where data was available from the 2023 CDP surveys. This highlights the remaining data-gaps when assessing full coverage, although again, removing Financial Services would benefit the coverage on some themes.

As well as CDP Water, a range of MSCI data points were available to Scottish Widows to reveal company specific water metrics. These added useful context on actual water use volumes, company exposure to geographies of high water stress and the existence of water risk monitoring, amongst other metrics.

We complemented CDP water scores with the MSCI water stress exposure score to understand the dependency different sectors and companies have on water, and their exposure to water stress.

It is important to dig deeper to understand individual companies within a sector and how they differentiate in their exposure and management of water risks. An industry could be more widely dispersed in character due to wide geographic and process variation.

Category	CDP Water Score	No. of Companies in Top 1000
'Leadership'	A	35
	A-	67
'Management'	B	107
	B-	30
'Awareness'	C	77
	C-	0
'Disclosure'	D	8
	D-	1
	F	157
	Not requested	454

Table 12: CDP Water Scores for Top 1,000 Companies in Scottish Widows' Portfolio (2023)

LIMITATIONS

GEOGRAPHIC DATA

At the outset, the scope of the work was to build knowledge and conduct an initial portfolio assessment to understand our exposure to nature related risks and dependencies. With an intention to use open-source data and data readily available to Scottish Widows, lack of access to company specific geographic data was the most significant limitation of this project. Biodiversity is inherently location specific and any portfolio level assessment of biodiversity impacts and dependencies that does not include a geographic element will remain high-level. However, market data available in most cases was not packaged suitably to add material value to this exercise, without partnering with a commercial solution. This exercise was designed to help prepare Scottish Widows for their next steps on biodiversity action.

The following options on asset-location information were considered for this project, but we struggled to find access to the data for a portfolio of this size at a reasonable cost.

1. Country of operation: Lead country of operation data is available in some cases, but the coverage across a 10,000 company plus portfolio is limited and therefore risks skewing results towards those in more data rich industries. Lead country of operation can also be misleading in the case of conglomerates, or industries where the primary biodiversity impact is through their supply chain for example consumer goods manufacturers.

2. Expenditure or revenue % by country: Certain datasets can provide information at the company level for which countries are contributing most to their revenue or expenditure, indicating more about where potential impacts lie than country of headquarters or listing. This isn't dissimilar to company of operation data and is therefore also restrictive in the sense of data coverage and supply chain information.

These data issues are exacerbated for large, diversified asset owners due to the breadth of their portfolio. Therefore we decided that sourcing company specific geographic data would only be suitable for the more select group of companies chosen for further analysis by Scottish Widows. We encourage data vendors to address this issue and incorporate more detailed, open-source information on companies' countries or regions of operation.

OVERDEPENDENCE ON ENCORE DATASET

ZSL and Scottish Widows analysed a few different data options before starting this process and decided on prioritising ENCORE data due to the level of detail and coverage, especially for dependencies, and due to its open-source nature. Although we filled in perceived gaps in the ENCORE research with our own (for example on plastic pollution, species overexploitation and invasive species), we relied heavily on the accuracy of the ENCORE dataset when producing impact and dependency scores at the sub-industry level. The project therefore inherited the limitations of the ENCORE dataset itself, namely the lack of a geographic component and the fact that materiality ratings indicate potential, not actual dependencies and impacts (for which spatially explicit and company specific information is needed). Despite strong detail on sub-industries dependence on ecosystem services, ENCORE does not provide information on how these dependencies translate into business and finance sector risks. There are also 138 subindustries listed on ENCORE, fewer than those sub-industries classified by GICS and held in the diverse portfolio being assessed. ENCORE has since changed its methodology away from GICS.

LACK OF OPPORTUNITIES CONSIDERATIONS

There is growing demand to look beyond risks and into the opportunities for investing in nature. Emerging concepts such as 'nature positive', and the proliferation of carbon projects and nature-based solutions have driven this. However, it is difficult to map a universal owner

investment portfolio for opportunities, primarily due to a lack of readily available frameworks or standards in this area which allow for deep understanding of dependencies and impacts, from which opportunities may emerge. There is also a significant data gap, for example the ENCORE knowledge base currently provides information on dependencies and impacts associated with different economic activities, however it does not yet cover opportunities related to companies' interactions with nature.

DISCLAIMER

The work carried out in this project and the writing of the following report was completed before ENCORE announced their most significant update to their open-source dataset in July 2024. The project partners welcome the increased granularity delivered through the new update – details of which can be found on the ENCORE website – and the addressing of various limitations. However, the update does mean that the *approach* laid out in this report is outdated, and should therefore be viewed more as a case-study than practical guidance. Important differences in the ENCORE update, including the use of Standard Industrial Classification for All Economic Activities or ISIC codes rather than the GICS codes used previously, will change how analysis such as this is carried out, although we believe many of the learnings discussed in this paper are still relevant. Carrying out an exercise such as the one presented in this paper using the new ENCORE data will deliver even more accurate and insightful findings on biodiversity impacts and dependencies than before, and we still encourage this as a first step for asset owners looking to take action on nature.

NEXT STEPS FOR SCOTTISH WIDOWS

The analysis of nature related impacts and dependencies across our portfolio has provided Scottish Widows with actionable insights to take forward. This includes:

1. FOCUSED CORPORATE ENGAGEMENT

We are using the outputs from the project with ZSL to support prioritisation of companies for direct engagement. We are assessing the impact scores of sectors in addition to our exposures to support us determine what sectors to focus our engagement on. As part of this process, we have reviewed peer activity and our active collaborative engagements to reduce duplication of engagement with certain sectors and/or companies. For examples, industry engagement is already heavily focused on metals and mining, where we play a supporting role. Similarly, we will not prioritise food related industries for direct engagement as we are actively engaged through collaborative initiatives such as FAIRR. We also engage with chemical companies already through ShareAction. Saying that, we aim to incorporate any findings from this nature-related assessment into existing engagements where relevant. For example, oil & gas has been identified as a high ranking sector based on impact score- and our exposures. We will incorporate nature-related findings from this assessment when engaging with oil & gas and other extractive sectors on climate change rather than initiating standalone assessments on nature.

As a result, our initial prioritisation suggests construction companies, pharmaceutical companies and water utilities may be suitable targets for direct engagement on nature risks and opportunities. In addition, we will take a deeper look at water use when engaging across a wide range of sectors given this was highlighted as the most impactful driver of nature loss for our top 1000 company holdings.

2. A DEEPER UNDERSTANDING OF COMPANY SPECIFIC RISKS

Limitations of sector average exposure assessments accentuate the importance of spatially explicit and company specific context for nature-related risk management. We aim to enrich initial findings with enhanced data, tools and assessment methodologies. This will help us to move beyond indicative analysis of potential exposures. We aim to assess nature-related data providers in the industry, though recognise that availability of datapoints on nature, as obtained via company reporting, needs to improve. Accordingly, we expect to undertake a progressive journey, during which our insights will improve as company reporting improves. To help accelerate this, our engagement process with investee companies will continue to call for improved reporting. We recognise the importance of risk management and disclosure frameworks such as TNFD to provide the necessary nature-related information in a consistent manner.

3. EXPLORING NATURE-RELATED INVESTMENT OPPORTUNITIES

Identifying opportunities related to nature is as relevant to us as risk management – our focus is on both downside protection and upside potential. The transition to a nature-positive economy is presenting unique prospects which we are actively exploring. Private markets in particular provide exciting potential to support investment in natural capital. Opportunities across productive forest and farmland and nature-supportive infrastructure such as wastewater management are those which are most mature, relative to others. Accordingly, we aim to partner with specialists in nature-related opportunities to identify and access those which are best suited for our portfolio, our customers' financial futures and the planet. Innovation in this space is rapid, so we will continue to monitor industry developments to support our direction of travel.

RECOMMENDATIONS FOR FUTURE RESEARCH

GEOGRAPHIC-LEVEL IMPACTS AND DEPENDENCIES

To give a more accurate picture of the impacts and dependencies of Scottish Widows' portfolio, the integration of a geographic element could form the basis of a new research project.

Scottish Widows could also apply a combination of spatially relevant data and company specific information to uncover actual impacts of some of their more high-risk investments identified through this preliminary analysis. For example, when looking at industries with high water use, this could take the form of comparing company operating locations with areas of water risk (using the WRI Aqueduct tool), and considering actual water consumption and recycling figures from company reporting. Alternatively, if land use change is the primary impact of the industry, a consideration of tree cover loss maps with company landbank areas would give more insight into the impacts of the investment. Tools such as IBAT (the Integrated Biodiversity Assessment Tool) could also show overlaps of company operating areas with areas of high biodiversity value, although detailed company reporting and submission of spatial data would be needed for this, which are not readily available. Ultimately, these forms of analysis can be costly and resource intensive and are unlikely to be done by a pension fund at the same level of detail as an asset manager. However, the conducting of a small batch of case studies will be a productive exercise and would help staff to better understand that there can be significant disparities between aggregated data sets and actual impact on the ground.

EXPLORE THE DIFFERENT TYPES OF BUSINESS RISKS PER DEPENDENCY

As mentioned in the limitations, ENCORE does not draw out the different business and financial risks associated with dependence on specific ecosystem services. For example, it can be assumed that dependence on climate stability will have different risks (likely transition related) to dependence on water quality (that may be more related to physical risk). Conducting further research to reveal these different risks will enable financial institutions to approach investee companies with clear information about how their dependence will impact their business, and the ways in which they can try to mitigate this will become clearer.

ANALYSIS ON THE TAIL

To ensure that high risk companies were not ignored by the research purely because they fell out of the cut-off by holding size that was applied to the portfolio, Scottish Widows could apply the impact and dependency ratings by subindustry to all companies in the 'tail'. Although their holding size may not be sufficient to enable constructive engagement with these companies, Scottish Widows could explore other options, or may be able to join collaborative engagement initiatives with other initiatives to leverage greater influence.

POLICY ENGAGEMENT

By being able to assess how their portfolio contributes to the different drivers of biodiversity loss, Scottish Widows may also be able to prioritise certain policy areas for engagement at the national and supranational level. To achieve this, some mapping of the policy environment and which emerging or existing policies align with the drivers of loss assessed in this project would be needed. However, this would reveal interesting crossovers with the portfolio findings and allow the asset owner to be more active in the policy and regulation space. For example, having information on how their portfolio impacts plastic pollution may encourage Scottish Widows to feed into the UN Global Plastics Treaty.

CONCLUSIONS

ZSL collaborated with Scottish Widows in conducting this project as a first step to building a greater understanding of the nature related impacts and dependencies across their diversified investment portfolio. Working together on this project, the process proved to be an invaluable knowledge sharing and capacity building exercise for both organisations. It highlighted the benefits of close collaboration between biodiversity-focused organisations and financial institutions in tackling nature-related issues. Regular meetings between ZSL's Sustainable Business & Finance team and members of the Scottish Widows' Responsible Investment team allowed for a deep dive into issues such as data availability and company specific biodiversity metrics, as well as analysis of how our approach fit within existing frameworks such as those provided by TNFD. The project also resulted in a number of decision-useful outcomes and next steps for the Scottish Widows team, allowing them to identify priorities for engagement.

This project relied heavily on the use of the ENCORE tool, and we thank the staff at UNEP-WCMC for their time in discussing the methodology behind the data with us. Despite some limitations discussed in this paper, ENCORE provided us with the double materiality lens we were looking to apply to the portfolio, and as an open-source dataset it is an invaluable resource for any investors looking to better understand nature-related issues of different sectors and sub-industries.

Many financial institutions have used commercial footprinting tools to assess the impacts and dependencies of their portfolios, yet the approach g by doing of framing findings in terms of IPBES' five drivers of loss appears to be an innovation in the asset owner field, and we hope that the work done to incorporate the understudied and generally undervalued drivers of direct exploitation of organisms and invasive alien provides an original contribution to a rapidly evolving field. This element of the project presented a chance to further connect ZSL's scientific expertise through their research centre the Institute of Zoology with the financial sector.

Many financial institutions want to take action on nature but face practical barriers in applying the TNFD approach due to portfolio size and a lack of data. The project partners believe in the importance taking a first step in tackling nature-related issues, even if the results are imperfect. As such, the case study was built as an iterative process and required revising along the way due to data availability and integration challenges. This is by no means a perfected or finalised case study, and it was designed to fit the needs of Scottish Widows specifically.

Nevertheless, the case study is likely to be useful for other pension funds with large and diverse portfolios that create an interesting set of challenges when assessing nature-related issues due to the number of companies involved. We hope that by revealing this level of detail on our approach, and discussing the challenges we faced, it will encourage others in the pensions industry to follow suit and take their first steps towards better understanding both the impact and dependency of their investments on nature. However, hopefully there will also be useful learnings for different types of financial institutions, including asset managers, and the project partners are happy to discuss how this work might be applicable to your organisation.

ANNEX

ANNEX A: COMPARISON OF BIODIVERSITY FOOTPRINTING TOOLS

Here we will provide a brief overview of some of the biodiversity footprinting tools that are available to be applied to investment portfolios, with the limitations explained:

- **Biodiversity Impact Analytics (BIA-GBS)** is co-owned by Carbon4 Finance and CDC Biodiversité, a subsidiary of Caisse des Depots. This tool allows to measure the biodiversity impact of companies. Investors can identify biodiversity hotspots in their portfolios and use biodiversity impact data for decision making and to engage with key stakeholders (carbon4finance, 2023). It covers pressures from commodities and products, emissions and water use, terrestrial ecotoxicity and biodiversity (carbon4finance, 2023). The methodology also considers financial data (such as turnover and purchases by industry and) within the impact analysis. A key limitation to this approach is that it does not cover impacts on marine biodiversity. Furthermore, "invasive species and soil degradation are not factored in yet; overexploitation is factored in only partially" (FFB, 2022). This tool is commercial and requires FI's to pay an annual fee to access it.

- **Corporate Biodiversity Footprint (CBF)** was developed by Iceberg Data Lab in cooperation with I Care. It provides annual biodiversity impact of Corporates, Financial Institutions and Sovereign issuers. It was designed to support the needs of financial actors related to their investment strategies, reporting requirements, stewardship, and engagement policies. The CBF is based on the impact of the underlying activities of businesses which are the sources of impact on nature. (IcebergDataLab, 2022). It provides insights throughout the value chain including upstream and downstream impacts. Its methodology is supervised by a scientific committee including representatives from WWF, Share Action, PRé Sustainability, MNHN, UNEP-WCMC, I care and Solinnen. Notably, Iceberg Data Lab does not provide commercial services to issuers in order to be free of conflict of interest. However, it does have important limitations. Water use is not included and impacts on freshwater and marine biodiversity are only covered partially.

- **Biodiversity Footprint of Financial Institutions (BFFI)** was developed by Dutch ASN Bank, Dutch consultancies PRé Sustainability and CREM. Its purpose is to measure the impact of financial institutions on biodiversity. It is used since 2014 by ASN Bank to monitor progress against its objective to have a net-positive effect on biodiversity by 2030. The methodology covers both the impacts and dependencies of the ASN Bank balance sheet. When covering impact they develop a heat map showing what asset classes lead to a negative or positive/avoided impact. To understand ecosystem dependencies ENCORE is used. They then calculate the percentage of their portfolio that is classified as depending on ecosystem services with a high or very high materiality (ASN Bank, 2020). Important limitations of this tool are that its land-use related impacts are biased towards temperate regions, thus accuracy is lower for tropical regions. This is a commercial tool and costs depend on the project size.

- **Global Impact Database (GID)** is based on 10 years of experience in impact measurement. The GID builds on True Price's Natural Capital Methodologies, developed in collaboration with Wageningen Economic Research. It is a fully quantitative biodiversity impact database. The tool measures the current and future yearly biodiversity impacts attributed to an investment, looking at direct, upstream and downstream impact. Results are expressed either in biodiversity-hectares (based on PDF.m2 or MSA. ha), or in monetary value. The main limitations in terms of coverage are it does not include impact of climate change on marine ecosystems, water use/ scarcity or invasive alien species.

ANNEX B: ALIGNMENT WITH TNFD'S LEAP FRAMEWORK

Where possible, this case study was designed to support Scottish Widows in undertaking the early stages of the TNFD LEAP Approach. The first step in assessing nature-related impacts, dependencies, risks and opportunities for financial institutions is to scope the assessment. For financial institutions such as Scottish Widows, this involved understanding

which sectors and geographies their capital is allocated to and agreeing on a feasible level of assessment. In response to the breadth of their portfolio, a scoping workshop was conducted to establish a manageable sample size. Challenges in sourcing geographic data at scale also led to a portfolio-level analysis conducted at the sector and sub-industry level, with the understanding that these limitations would be addressed through further research.

As anticipated as a financial institution, the primary drivers of nature-related impacts and dependencies for Scottish Widows were found to stem from their portfolio investments, rather than their direct operations. However, due to the complexity of corporate value chains and limited asset location data, pinpointing exact interfaces with nature proved difficult. Despite these challenges, the analysis allowed for the identification of sectors and sub-industries that were most material to Scottish Widows, based on their impacts and dependencies on nature as well as their portfolio exposure.

This work has supported Scottish Widows in beginning to evaluate the impacts and dependencies associated with their portfolio to develop a deeper understanding. The analysis provided insights into the environmental assets and ecosystem services most relevant to the portfolio, assessed the dependencies and impacts on nature, and identified the sub-industries with the highest and lowest reliance on ecosystem services. These findings helped to inform the portfolio's engagement priorities, with a focus on identifying which sub-industries were most dependent on nature, and which were contributing significantly to biodiversity loss.

In addition, the project highlighted the need for further research and helped position Scottish Widows to build from their understanding of their portfolio-level impacts and dependencies on nature as they continue to assess and manage nature-related issues.

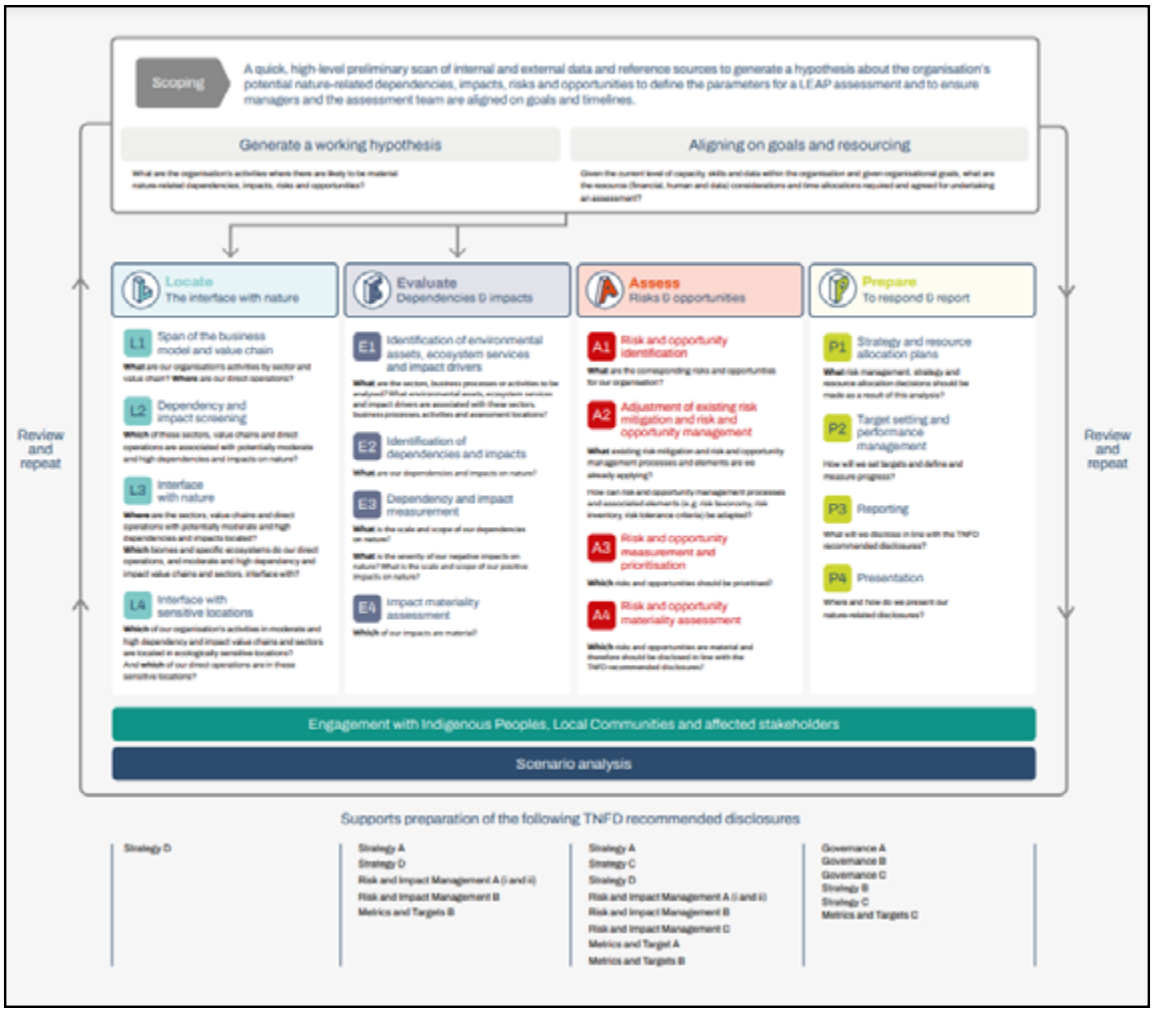

Figure 13: The LEAP Approach (TNFD, 2023)

ANNEX C: APPROACH IN FULL

Phase 1: Preparation of the analysis template

1.1 Literature Review

Approach: ZSL completed a thorough literature review, considering a range of sources including academic journals, media articles and NGO reports. The key findings of the literature report are outlined earlier in this report.

1.2 Scoping Exercise – Planning the Approach

Approach: It was through this workshop that it was agreed to take a double materiality approach. Due to a lack of adequate location-specific data in the current mix of data available to Scottish Widows at the portfolio level, our scoping here revealed that geographic data would be more suitably applied to a smaller selection of companies of most interest to Scottish Widows based on financial exposure, associated influence and potential risk. This would form an important next step from the findings of this project. The approach would therefore be on a sectorial basis and enriched with relevant datasets already available to Scottish Widows and ZSL.

1.3 Sourcing Corporate Exposures

Approach: Using learnings from the literature review and the scoping exercise conducted with Scottish Widows, we built out a skeleton spreadsheet which would provide aggregate exposure of all companies within the relevant investment universe to combine with information impacts and dependencies and their relative magnitude by sector, subindustry and production process based on data sourced from ENCORE and ZSL. There would be one analysis deck for portfolio level findings, and another for company specific findings to which additional data points licensed to Scottish Widows could be added. Data on Scottish Widows' holdings would be able to be inserted into this template to allow for analysis to occur, having first been prepared by the SW team.

Phase 2: Preparation of the data

2.1 Sector Coding

Approach: The market offered several alternatives in terms of sector coding offering different levels of granularity for our sector analysis. Because our primary dataset of choice ENCORE was aligned to GICS codes we used this classification. Future or alternative iterations might consider ISIC codes (UK classification), or NACE codes (EU classification) as ENCORE is changing its sector classification in 2024.

For companies operating in multiple sectors, revenue-based portfolio assessment (such as use of FactSet's RBICS) may improve accuracy of output by better mapping company exposure by revenue to different sectors, adding more granularity and nuance to findings, especially for large diverse conglomerates. Again, this data could be added as a next step to the research.

Challenges: ENCORE covers a total of 138 sub-industries of the 163 sub-industries covered by GICS level 4. Additionally, for the 138 sub-industries covered there are several instances where the match is not perfect, according to the most up to date GICS classifications.

Solutions: For imperfect matches, we looked to match the most similar sectors together manually, while acknowledging potential gaps. No assessment has been made for this challenge in respect to the new ENCORE methodology.

2.2 Data Sourcing

Approach: Once GICS codes were applied to the holdings, we matched the Level 4 GICS with ENCORE's subsectors. ENCORE further determines the production processes that align with the subsectors. In total there are 86 production process, as some processes are common among two sectors.

Challenges: The first challenge was to align production processes with companies. A company might or might not carry out all processes within a sector leading to possible under or over estimation of dependency. Further comparing the materiality rating for two sectors would have been impossible as all sectors had varying amounts of production processes.

Solutions: To address this challenge, we applied the methodology developed by S&P in collaboration with the UN Environment Programme: the Nature Risk Profile Methodology. According to this approach, when a sector or sub-sector is comprised of more than one production process, the methodology distinguishes between complementary and mutually exclusive processes. For complementary processes, the highest rating is taken as the final score. For mutually exclusive processes, an average

of the ratings is calculated. In this approach, we defined mutually exclusive processes, typically performed by different companies, and averaged their ratings. For these mutually exclusive production processes, the highest materiality rating was selected as the final rating.

2.3 Removing the Tail

Approach: With holdings more than 16,000 companies, it was unlikely to apply detailed analysis to all the companies in the portfolio with any sort of granularity. Therefore, it was important to set parameters for the analysis to come, keeping in mind the need for this exercise to inform Scottish Widows' stewardship activity (which requires a certain holding size to be able to have any influence). Due to the nature of the portfolio, with aggregated look-though data from hundreds of funds of varying sizes, the data naturally had a long tail, and basic information for smaller exposures is often incomplete. It was therefore jointly decided that, while there would be sector level findings relating to the entire portfolio, for the company specific analysis we would only consider the top 1,000 largest holdings, which represents over 85% of total exposure. We believed this represented a significant enough size of their total holdings to be comprehensive, while considerably reducing the time and resources needed to complete the next steps of analysis.

Challenges: Ultimately, applying such a strict cut off at a relatively arbitrary point was going to present issues, for example there were likely to be holdings which were having a severe impact on biodiversity, or operating with a very high level of dependence on nature, that fell below the threshold of holding size and therefore were not considered for deeper analysis.

Solutions: The further steps of this approach (namely the impact and dependency scores by sector) could be easily applied to the set of companies below the threshold to identify any of these potential outliers in the tail. However, with stewardship being a key outcome of this project, the position was agreed that even if there is such an exception below the threshold, Scottish Widows would potentially not have adequate influence to impact the company's mitigation and adaptation efforts through engagement. Further analysis on the tail could form part of the future research carried out by Scottish Widows.

Phase 3: Sector analysis at portfolio level

3.1 Dependency and Impact Analysis (using ENCORE)

Approach: For the sector-level analysis, we needed to use ENCORE data for both impacts and dependencies.

ENCORE applies 'materiality' ratings to a subindustries' dependency on ecosystem services or contribution to biodiversity impact drivers. For dependencies, these range from Very Low Materiality up to Very High Materiality (with Low, Medium and High in between). For impacts, there is no Very Low Materiality rating, ratings just go from Low to Very High. To allow us to combine several impacts and dependencies as they relate to a single subindustry, we needed to apply a numerical value to these materiality or 'risk' ratings. We decided on straightforward scales of 0-5 for dependencies (with 0 signifying no data, 1 as Very Low and 5 as Very High) and 0-4 for impacts (due to the lack of a Very Low rating).

Furthermore, we chose to follow the guidance outlined in the S&P Nature Risk Profile Methodology, which recommends using the average of individual ratings for sub-industries with multiple mutually exclusive production processes, whilst the highest rating is selected when the processes are complementary. This method facilitates a reasonable aggregation of data at both the sub-industry and sector levels, ensuring that material risks are appropriately captured.

3.2 Impact Analysis (looking beyond ENCORE to cover understudied drivers of biodiversity loss)

Approach: One of the main objectives of this exercise from its outset was to base the analysis on the five drivers of biodiversity loss (i.e., land and sea use change, overexploitation of species, climate change, pollution and invasive alien species). When it came to impacts, we found that these key drivers were not all covered by the ENCORE dataset. The most significant gaps were the overexploitation of species, plastics pollution (which may be covered by 'solid waste' but not as a distinct driver and not in great enough detail) and invasive alien species. Failing to incorporate these drivers would not give a broad depiction of overall biodiversity impact.

For these drivers, we therefore conducted an additional review of literature to ascertain the sectors contributing most to these issues. We undertook a literature review of at least the top

10 articles on the causes of these drivers, and listed all sectors, processes and companies mentioned. Where quantitative data or relative impacts by sector were mentioned, these were used to create some preliminary relative materiality ratings (following the ENCORE designations of Low to Very High materiality to allow for integration with existing impact ratings per sector). Where this information was not available, a rationale was used to determine relative magnitude based on a.) direct versus indirect impacts and b.) the relative importance of the activity creating the impact to sector.

The lists of sectors, relative magnitude and underlying rationale was then sense checked with experts in the driver to obtain greater confidence in the results. We held discussions internally at ZSL with academic experts on plastic pollution and invasive species and sought insight from relevant NGOs such as TRAFFIC to sense check our findings on the overexploitation of wild species. These findings were then factored into the main spreadsheet to sit alongside ENCORE impact ratings.

Challenges: As we were drawing on data from multiple sources to form a preliminary view of relative impacts, rather than a single dataset i.e. ENCORE, there was likely to be a degree of subjectivity in the materiality ratings given for drivers of loss such as invasive species and overexploitation. More research is required on the relative impacts of different sectors on the 'missing drivers' to form a robust and comprehensive view of portfolio biodiversity impacts

Solutions: It was agreed that due to a lack of quantifiable data available relating to these drivers of biodiversity loss, that a qualitative approach was sufficient. Furthermore, to address possible subjectivity, suggestions of high impacting sectors to come out of the expert interviews were cross-referenced with media and NGO reports, as well as academic journals where possible, to ensure each selection was made with multiple reference points. As these understudied drivers of biodiversity loss are not factored into many of the existing biodiversity footprinting tools, or ENCORE itself, we consider this aspect of the work to be unique to this project.

3.3 Data Integration

Approach: A complete dataset of impact and dependency ratings for all sectors covered by GICS level 4 was then applied to the portfolio holdings, and input into the spreadsheets prepared in Phase 1. There would be two spreadsheets for use by the Scottish Widows team,

Portfolio level findings: impact and dependency ratings for sectors and subindustries were weighted by the total holdings across these subindustries, helping to uncover which industries were posing the largest dependencies and impacts - and potential risks - in the portfolio.

Company specific findings: Impact and dependency scores were assigned to each of the 1000 companies based on their sector, subindustry and specific production process. Information on additional analysis on this batch of 1000 companies is provided in the next phase.

Phase 4: Company specific analysis

4.1 Splitting out Findings by Driver of Loss

Approach: The 11 'impact drivers' listed on ENCORE did not match perfectly with the 5 drivers of biodiversity loss we wanted to focus on, so before we moved on to look at company specific information, we needed to combine drivers into their respective categories. This would allow Scottish Widows to see which subindustries they are exposed to contribute most to each driver of loss. Therefore, each driver could form a distinct thematic area for engagement. To align with Scottish Widows' existing priorities on nature, we decided to pull out freshwater use as a distinct category as we did not feel it was adequately captured by any of the 5 drivers identified by IPBES as laid out in our literature review summary. Table 12 (page 18) is a chart showing how we allocated the different ENCORE impact drivers, as well as our own research, into each driver:

Having done this, we create an Excel spreadsheet with six sheets, one for each driver as laid out here. The company holdings, alongside the sum of their Impact Driver ratings per category and their total ecosystem service dependency scores by subindustry were then added.

Challenges: For drivers of loss with multiple impact drivers rolled into them (for example pollution which is the combination of six different data points) a sum of impact scores would not be comparable to a driver of loss with only one data point (for example water use).

Solution: We rebased the total impact scores, so they were all on the same scale (a percentage), allowing for direct comparison across drivers

of loss.

4.2 Addition of Company Specific Data

Approach: Scottish Widows could now see, at a subindustry and production process level, which of their holdings operated in subindustries with the greatest impact on each driver of loss. However these impact and dependency ratings were related to subindustries and processes rather than companies themselves, and therefore it was important to add some additional, company-specific data sources. Data from CDP, MSCI and Forest IQ was added, providing a range of new water, land use change and pollution related insights.

Challenges: Linking back to the limitation with the sector level focus on ENCORE, the lack of geographic data integration means that individual company selection is missing an important element which tells us about biodiversity risk.

Due to data gaps, it was not possible to source any company specific data points relating to the topics of direct exploitation of organisms and invasive alien species. This means it may be easier for the Scottish Widows Responsible Investment team to conduct precise engagement with companies on more data-rich topics such as water use.

Solutions: As laid out in the 'next steps' section of this report, Scottish Widows will look to bring in geographic datasets on a more select subset of companies they have chosen for engagement.

The company specific data gaps on direct exploitation of organisms and invasives is conceded to be a limitation, however the ENCORE and ZSL research still provided Scottish Widows with a good starting point on these topics, as they can identify key subindustries to focus attention and further research on. The project partners welcome efforts to expand the research and data collection on these important topics.

4.3 Selecting Companies for Further Analysis

Approach: Scottish Widows could now see, at a subindustry and production process level, which of their holdings had the greatest impact on each driver of loss. They could use this to select a smaller batch of companies for deeper dive analysis, with an eye to constructive engagement on nature topics such as 'pollution' or 'water use' in the future.

From this batch, Scottish Widows were to select companies to engage with, using the different drivers of loss as themes. By selecting companies who are potentially contributing to less studied drivers of loss such as direct species exploitation or invasive species, we will avoid purely focusing on the 'usual suspects' who will come out on top of many aggregated biodiversity impact datasets.

The following factors were taken into consideration during this company selection process:

1. Company subindustry, and the relative impact on the driver (e.g. specialty chemical companies potentially contribute highly to pollution according to their subindustry rating)

2. Company subindustry, and their total dependency score on nature (e.g. agricultural product companies have a particularly high dependency on nature, according to their subindustry rating)

3. Company holding size as well as pre-existing contacts or relationships (i.e. the potential influence that SW could have on the company through engagement)

4. Company specific data coverage, based off a gap analysis on the top 1000 companies with datasets SW have access to e.g. Forest IQ, CDP.

Challenges: There is potentially a bias against companies in data rich industries, as well as towards companies SW have pre-existing relationships with. The selection was left up to judgement of SW team, who were encouraged not to select companies that are already being targeted through collective finance sector engagement initiatives such as Nature Action 100 or PRI Spring.

Solutions: Justification is that we are not simply selecting the companies that will verifiably have the biggest impact on these drivers of biodiversity loss, nor those with the biggest dependency. It is more about the potential for impact that SW can have, which may be lower in industries they do not have close contacts in.

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