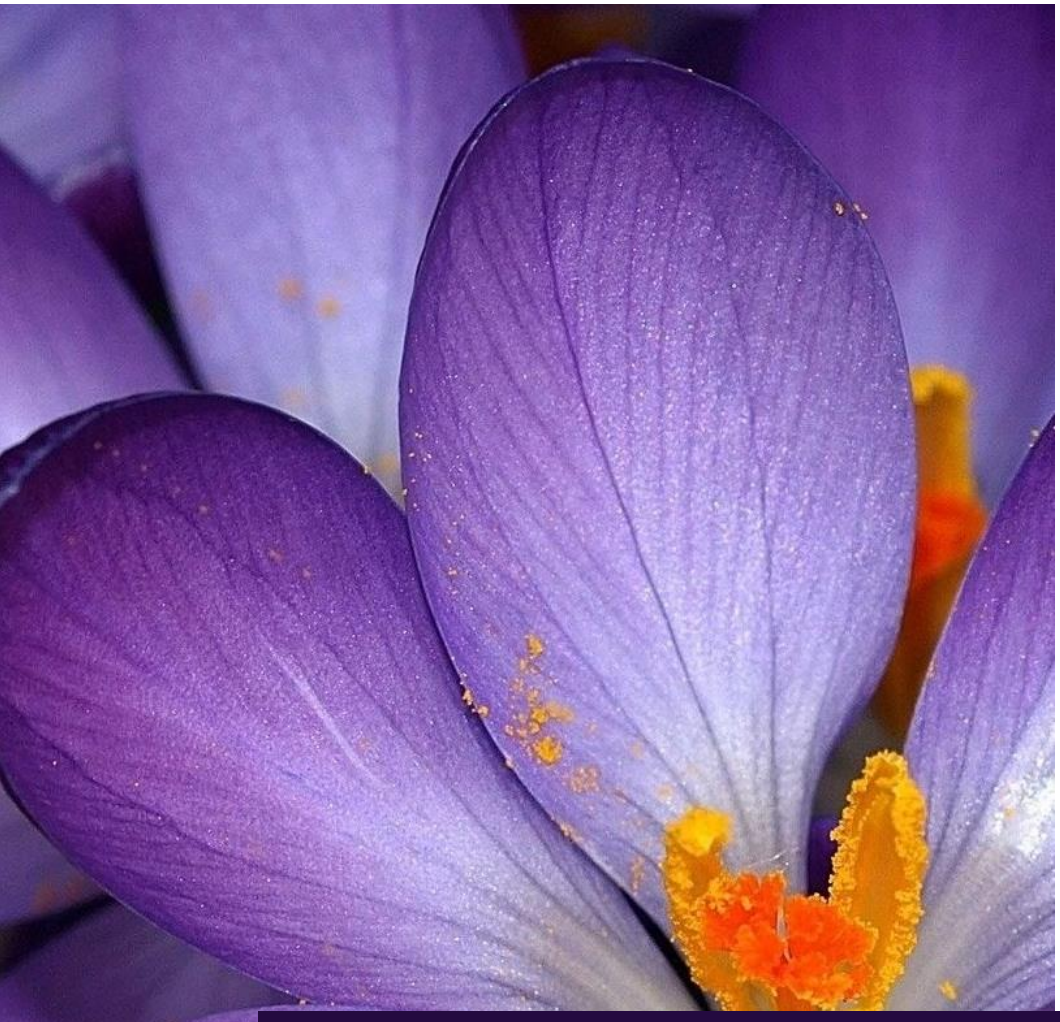


INTEGRATING BIODIVERSITY INTO INVESTMENT DECISIONS

An initial investigation of biodiversity and its consideration within active portfolios by pension funds

July 2021

Report Produced For

Brunel Pension Partnership

University of Bath School of Management

Aman Khanna, Angeliki Mamai, Hin Yu Irene Tsang, Jack Loudon, Yingqian Joanne Jiao, Zhiyong Flora Chen

EXECUTIVE SUMMARY

The recently published Dasgupta Review has highlighted the detrimental impact which our society currently has on the natural world. Despite scientists' increasing warnings of the negative consequences of disruption to our ecosystems, society has carried on regardless. As a result, the natural capital on which our economies rely on is being destroyed, and people, businesses, and countries are beginning to experience the effects. Change is needed at all levels of the economy.

Biodiversity is a relatively new consideration for financial institutions and investors. This report assesses how Sectors invested in by Brunel Pension Partnership are dependent or impact upon biodiversity, as well as discussing challenges and first steps for integrating biodiversity into investment strategy. Selected due to their heavy presence in Brunel's active portfolio and materiality to biodiversity loss, the Industrials, Information Technology, and Financials Sectors are examined in this report.

The report uncovers a number of general and Sector specific relations to biodiversity.

- In the Industrials Sector, companies often have a significant direct impact on biodiversity and may be vulnerable to current and future regulatory and litigation risks.
- In the Information Technology Sector, software companies can leverage their expertise to provide useful tools and insightful data needed to combat biodiversity loss.
- In the Financials Sector, the economic reliance on financial institutions means that companies must suitably integrate and assess biodiversity into their operations.

Multiple challenges exist, with a lack of data and metrics, inadequate biodiversity disclosure, geographical differences in reporting, and partially informed investors being the most reoccurring issues documented in the literature.

Addressing a number of these challenges, this report suggests some initial actions which Brunel, and all pension funds, should consider undertaking.

- Through engaging with current and prospective holdings and asking the right questions, pension funds can increase the awareness of biodiversity related risks and the benefits of disclosure.
- By working together with other organisations who are looking to achieve the same goals, change regarding biodiversity integration will likely occur more quickly and effectively.

Brunel Pension Partnership is at the forefront of the industry in trying to understand and assess biodiversity. This report is a preliminary look at the integration of biodiversity into pension funds' investment decisions. Whilst the three most relevant sectors for Brunel have been analysed, further research of the remaining Sectors is required in order to suitably approach the issue.

CONTENTS

INTRODUCTION

Biodiversity[a] underpins all-natural capital and the goods and ecosystem services that they generate. A staggering loss of biodiversity has occurred over the last few centuries, and an empirical link between increasing animal extinctions and human activities can be identified[1]. The recent publication of the Dasgupta Review[2] has highlighted the role of biodiversity in our economy and society, and the upcoming UN Convention on Biological Diversity at COP15[3] means this year should - and must - be a turning point for our treatment of nature.

Biodiversity loss is typically associated with permanent ecological changes in ecosystems, and includes the elimination of local populations of species and temporary or permanent transformation of worldwide biological communities. The WWF illustrates the five major threats of biodiversity as[4]:

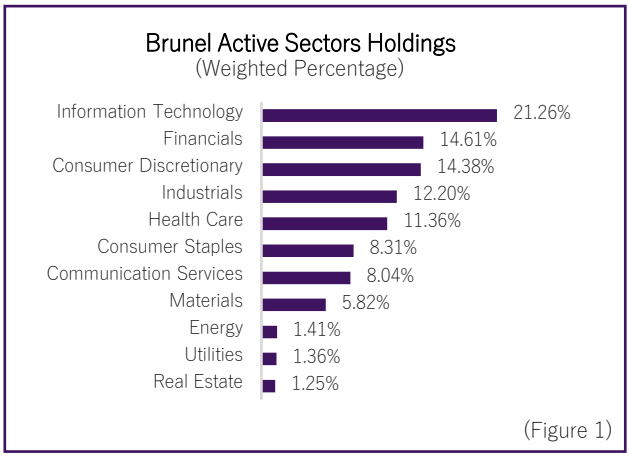
- HABITAT LOSS
- SPECIES OVEREXPLOITATION
- INVASIVE SPECIES AND DISEASE
- POLLUTION
- CLIMATE CHANGE

From the view of nature, biodiversity loss threatens the proper functioning and regulation of the ecosystem. For humans, it poses an immediate danger for food security and health stability[5]. This has been demonstrated most markedly with the COVID-19 pandemic, a situation almost certainly catalysed by human ecological disruption according to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services[6].

In economic terms, the degradation of ecosystems represents an annual loss of at least $479 billion per year[7] and over 55 percent of global GDP depends on a high functioning biodiversity[8]. Globally, it is estimated that $44 trillion of economic value generation is directly dependent on ecosystem services[9]. Presently, a lack of clarity exists about the magnitude of risks associated with biodiversity loss, the sectors most affected, and the best approaches to measure biodiversity related risks in the financial Sector[9]. Even by the standards of sustainability, there is a shortage of data on the topic, and this shortage threatens disruption of business processes and financial losses[10].

Whilst financial institutions have increasingly acknowledged climate change, and how their own operations can contribute negatively towards it, the interconnection and feedback loop which exists between biodiversity and climate change has until recently been less frequently recognised. This is changing. The proliferation of programmes and partnerships, including the recent endorsement of the Taskforce on Nature-related Financial Disclosures (TNFD) by the G7[11] mean that the finance Sector and beyond will increasingly have to acknowledge their impact and dependency on Biodiversity.

As with all Pension Funds, Brunel has strong fiduciary obligations, and agreed return objectives must be achieved. As outlined in Brunel's Responsible Investment Policy Statement[12], a considered approach to investment strategy is required. This report concurs that to conduct sound financial risk management, all Environment, Social and Governance factors – thus including biodiversity – should be considered equitably. Additionally, as a universal owner[b], we considered it important to take Brunel's approach to stewardship into account and consider how engagement regarding Biodiversity can be conducted to ensure long-term returns for Brunel's nearly 700,000 beneficiaries.



(Figure 1)

In order to assess which Sectors should be prioritised, Brunel's active portfolios (as of December 2020) were investigated to determine the value of holdings in each Sector (see Figure 1). Due to Brunel's large holdings in IT, Financials, and Industrials (as defined by the GICS[15]), we believe these sectors may have considerable impact and dependencies on biodiversity and should therefore be prioritised. Subsequent to this, we confirmed each Sectors' direct and indirect materiality to biodiversity loss through analysis of the Dasgupta Review, resources from the Natural Capital Finance Alliance, and the PRI, as well as countless other informative industry and academic sources. Based off these two assessments, we believe Industrials, Information Technology, and Financials should be prioritised first, and our report focuses on them.

[a] Nature provides ecosystem services which benefit business and society[13]. The assets which underpin these services are called natural capital (e.g., plants, animals, air, water, soil, minerals), and biological diversity - or biodiversity for short - is the variety of living components that make up natural capital[14].

[b] Brunel can be considered a universal owner as its highly-diversified and long-term portfolios are sufficiently representative of global capital markets, they effectively hold a slice of the entire market, making their investment returns dependent on the continuing good health of the overall economy[25].

SECTOR ANALYSES

INDUSTRIALS

Due to significantly impacting and being dependent upon biodiversity, the Industrials Sector faces substantial risks[17]. Specifically, the Transportation industry, and Construction and Engineering industry directly impact upon ecosystems in which they are located. Many industrial processes are - to varying degrees - sources of air, water, soil, noise, and light pollution, with all these directly impacting upon ecosystems[18]. Indirect impacts exist also yet are easily overlooked.

TRANSPORTATION INDUSTRY

Due to the burning of fuels and subsequent air pollution, these industries are typically associated with climate change rather than biodiversity loss. However, climate change is likely to become the leading cause of biodiversity loss in the next half-century[19]. Besides air pollution, the sub-industries also release water, soil, and noise pollution. In the Aviation sub-industry, noise pollution from landing, take-off, and ground manoeuvres particularly impacts on biodiversity by reducing wildlife reproduction[20,21]. Similarly, the noise of commercial shipping can have both short- and long-term negative consequences on marine mammals[22]. Both aviation and commercial shipping provide the perfect opportunity for non-native species, pests, and pathogens to spread from and into isolated ecosystems, where they thrive at the expense of native species[23,24]. The Shipping industry is also highly vulnerable to ecological disasters when accidents occur (see Case Study), and even at the end of their life cycles, assets may still heavily impact upon nature. Shipbreaking for example, considerably impacts upon the biodiversity of the coastlines on which it occurs through the release of toxic heavy metals[25].

Research suggests only 15% of firms in the transport Sector report on the risks they face due to biodiversity loss[10].

Being consumer-facing, the Aviation industry may experience severe changes in demand due to concerns about our natural world[2]. Climate regulation, which is provided by the atmosphere, habitats, species, and water, will deteriorate in line with biodiversity[2]. The resulting increase of severe weather patterns are likely to impact upon the Transportation firms' operations and profitability[26]. The impact of COVID-19 severely impacted upon the Shipping[27] and Aviation industry[28]. Such disruption may be repeated more frequently with the increasing risk of pandemics due to biodiversity loss.

CONSTRUCTION AND ENGINEERING INDUSTRY

The Construction and Engineering industry currently sees around 25% of companies reporting on the risk of biodiversity loss to their business[10]. To develop nature sensitive projects, ecological mitigation work is required in the initial design stage through to the end of the useful life after construction is completed. During construction processes, local wildlife is disturbed by noise and light generated onsite, which impacts on breeding and feeding habits and can lead to long-term biodiversity loss[29]. During construction, chemical run-offs pollute water bodies surrounding the construction site spreading toxicity and damaging marine life, and construction processes often lead to soil compaction and damaged plant roots[30]. Finally, if proper waste management procedures are not in place, the disposal of unused materials can damage or pollute ecosystems[17].

The increasing risk of biodiversity loss is likely to lead to increased legislation and regulation - a significant number of countries already have 'biodiversity offset' policies in place. Projects are required to follow a mitigation hierarchy in which impacts should be avoided, if possible, mitigated if they cannot be avoided, and residual impacts should be compensated for. In the UK, a net gain in biodiversity is required by law, however other countries with weaker institutions are less likely to see net zero policies adhered to[2]. The use of biodiversity offsets has been criticised however, because offsets may not be effective, and they principally provide a license to degrade the environment[31]. Regulations mean that the industry has already had to take biodiversity into account, but the industry will have to continue to adapt. Furthermore, opportunities for the construction of green buildings and infrastructure should be explored.

Case Study

The MV Wakashio Oil Spill

In July 2020, the MV Wakashio operated by Japanese company Mitsui O.S.K. Lines ran aground off the coast of Mauritius. Despite efforts by authorities, within a month over 1,000 tonnes of fuel leaked from the ship and started to infiltrate environmentally sensitive areas. Wetlands protected under the Ramsar convention, a marine park, as well as local beaches were contaminated. The incident has been called the worst environmental incident in Mauritian history, and research suggests the affected ecosystems may never recover completely.

Alongside the significant biodiversity impacts, the resultant financial impact is yet to be fully confirmed. Mitsui O.S.K. Lines have set aside just under $10 million for a recovery fund, but it is estimated compensation claims may reach closer to $10 billion. Insurers have warned that the increased size of vessels has led to a large accumulation of risk and disproportionately large costs when accidents occur. The opacity of the maritime industry means that financial costs may never be recovered fully, and the local 1000-year-old coral will certainly never recover. Such incidents, however rare, need to be considered when investing in the industry and Sector. [2, 32, 33, 34]

SECTOR ANALYSES

INFORMATION TECHNOLOGY

The Information Technology Sector has seen remarkable growth over the last few decades, resulting in its industries being exposed to a variety of environmental risks including biodiversity loss. Within the Sector, the main industries are Hardware and Equipment, Semiconductors and Equipment, and Software and Services, with the former two having the highest environmental exposure[35].

HARDWARE, EQUIPMENT AND SEMICONDUCTORS

During the production processes of Hardware and Semiconductors, large quantities of hazardous waste disposal are released in the form of soil and water waste, or greenhouse gas emissions (GHG). Soil waste, generated in the production process, often contains hazardous chemicals, such as arsenic and harsh acids. These chemicals are retained in the soil for extended periods, causing ground pollution. Equally toxic, wastewater can include large amounts of heavy metals and toxic chemicals leading to water pollution[36]. A requisite in the production of semiconductors is extreme quantities of ultrapure water – for daily production a facility could use over 2 million gallons of water. This can cause severe disruption to water supply in local ecosystems. Finally, the use of fluorinated gases which are subsequently released into the atmosphere as GHG emissions is also concerning. The manufacturing processes of these industries can therefore have significant impacts on biodiversity, either directly through pollution or indirectly through GHG emissions advancing climate change[2].

The increased focus on nature has also meant the firms involved in the Hardware and Semiconductors industries face increased risks and impacts on their finances. Firstly, operating costs and capital expenditure are increasing due to the need of clean-up processes of hazardous water and soil waste. Companies that fail to effectively manage their waste are exposed to high regulatory fines. The large quantities of water required for semiconductors create an increasing supply cost. Especially as fresh water becomes scarcer worldwide, production may be disrupted impacting upon firm revenues.

SOFTWARE AND SERVICES

The Software and Services industry is often assumed to have a limited impact on biodiversity. Such companies make limited use of physical infrastructure or facilities, and mostly have no manufacturing operations. Accordingly, they produce comparatively low GHG emissions and environmental waste, and utilise relatively little natural resources such as water and land[35]. However, operating data centres and providing cloud-based computer services use significant amounts of energy, therefore there are rising associated GHG emissions[35]. As the need for computing and data storage is dramatically increasing, operational costs are also likely to increase as energy demands increase, especially around the use of renewable energy sources. Whilst better than alternatives, renewable energy sources such as wind farms and biofuel can also increase extinction risk of species[37].

SECTOR OPPORTUNITIES

A challenge of biodiversity loss remains the lack of knowledge we currently have on species, biodiversity, and ecosystems. This Sector and the Software industry in particular are perfectly placed to simplify the job of monitoring our planets' health by leveraging their expertise. Spatial Finance[38] is an example of an emerging field in which AI and machine learning are used to help with data gathering and analysis, with the purpose to manage the planet's natural resources (see Case Study).

Case Study
Microsoft Corporation

Since 2017, Microsoft has been working towards a goal of reducing their impact on biodiversity. The company introduced AI for Earth, a $50 million 5-year programme financially supporting projects using technology to address biodiversity issues, climate change, water supply, and agriculture. As a low ESG risk firm, they announced in 2020 that their sustainability efforts will focus on the preservation of biodiversity. The plan is comprised of four main foci:

Planetary Computer: As part of the AI for Earth initiative, Planetary Computer is an online platform which contains and analyses environmental datasets (e.g., satellite imagery) collected in space and on earth.

This helps scientists better monitor the planet's natural resources and consequently will help prioritising and preserving various ecosystems on earth.

Empowering consumers: Through the creation of tools and offering of specialist services, Microsoft can help consumers better understand the ecosystems around them.

Encouraging ecosystem policies: Through dialogue with governments the company aims to encourage policies relating to, for example, land and water conservation and national ecosystem assessments.

Taking responsibility: Through methods such as land acquisition and national park creation, the company will protect more land than they use by 2025. [39, 40, 41]

SECTOR ANALYSES

FINANCIALS

Playing an important economic intermediary role throughout the global economy, the finance Sector is distinctly involved and exposed to the risks of changing biodiversity, despite close to zero direct interaction between the Sector and biodiversity. The Sector faces distinct opportunities, and certain sub-industries play a fundamental role in transitioning the real economy towards a greener future. Companies' operations do not immediately impact upon biodiversity, but their operations enable other industries, which are heavily dependent or impact upon biodiversity. Specifically, diversified banks and multi-line insurance companies have dependencies and the potential to impact upon biodiversity.

DIVERSIFIED BANKS

Financials is considered a medium risk Sector from biodiversity loss as risks may be significant[42]. Compounding this, the Sector is the weakest at disclosing biodiversity related risks[10]. Diversified banks face increased credit risk because they have exposures to investees that may default on obligations. As evident from our discussion of the other sectors, severe disruption or collapse of ecosystems can disrupt supply chains, leading to asset quality deterioration and non-performing assets. This reduces both the debt- servicing capacity and the collateral of the financial institution, and increases the credit risk on their loan books, as both the probability of default and the loss given default increase[2]. Risk during transition may also lead to stranded assets – the European financial Sector's exposure to high-carbon assets has been estimated to be over €1 trillion[43]. Additionally, reputational losses as a result of failing to meet public expectations regarding biodiversity are likely to increase due to greater interest[44].

INSURANCE COMPANIES

Whereas the investing side of insurance companies face similar risks to those of other financial institutions, significant risks also relate to underwriting and are transmitted from policy holders[45]. As biodiversity related risks are systemic, uninsurability risk may occur due to a knock-on effect considerably increasing maximum losses suffered. Consequently, the standard insurance practices relying on risk diversification and pooling are ineffective and insurers may be unable to cover the losses in a given geographic or sectoral area. Additionally, many currently insured risks may become uninsurable (or prohibitively expensive), and reinsurers may be unable to provide solutions for emerging risks. Pricing, claims, and liability risk are all forms of operational risks which can impact the ability of insurers to remain profitable. The insurance Sector is also exposed through increases in their protection gap – as unidentified losses rise due to higher claims related to severe events that are caused, or exacerbated, by the depletion of natural assets[2]. The chain of causality has previously been complex to identify due to the sophistication of the underwriting process[45], however the loss of biodiversity poses a real threat to the industry.

SECTOR OPPORTUNITIES

As a universal holder, the impact on Brunel if financial institutions do not appropriately consider biodiversity loss would likely be catastrophic. Engagement is therefore required with financial institutions to encourage change. Specifically, Brunel may wish to ask questions about companies' biodiversity impact assessment procedures. Multiple assessment techniques are under development, and tools such as the Global Biodiversity Score (GBS) have already been utilised to create biodiversity footprints (see Case Study). Brunel may wish to recommend a tool if financial holdings are not already considering using biodiversity impact assessment. Brunel may also wish to identify whether financial holdings seek out biodiversity related opportunities. By channelling credit and investments towards projects that enhance, rather than degrade natural capital, the Sector is exposed to investments with relatively lower risk and greater certainty around yields[2]. For example, a diversified bank may lend to an agricultural client which has taken action to reduce soil erosion on its land, leading to increased yield, thus enhancing the ability of the business to service its debt. In turn, this would improve the credit quality of the bank's portfolio.

Case Study
BNP Paribas Group

BNP Paribas Group and in particular their asset management arm are considered leaders regarding their approach to biodiversity. The group has based its approach around Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) studies and has published semi-frequently about its position on biodiversity.

Working alongside French public finance institute CDCs specialised biodiversity subsidiary, BNP Paribas has used the GBS to assess the biodiversity footprint of portfolios with large food and agrobusiness holdings.

The biodiversity footprint of the portfolio was limited, yet it highlighted the importance of fully assessing companies' value chains for an accurate estimation. It is unsurprising that BNP are at the forefront of biodiversity – the report 'Bankrolling Extinction' suggests they have the sixth largest exposure to biodiversity impact risk of all global banks. [16, 46, 47, 48, 49]

THE PATH AHEAD

CHALLENGES

Our extensive research suggests that four crucial barriers for biodiversity in investment exist:

Lack of Data And Metrics: A challenge exists for the scientific community regarding the collection of data on species and ecosystems that may contribute to accurate assessment and treatment of biodiversity loss. Simultaneously, the development of suitable metrics and standards for the financial institutions that can help investors identify potential risks and biodiversity business opportunities are insufficient[50].

Inadequate Biodiversity Disclosure: Only 49 of the top 100 Fortune 500 global companies include biodiversity in their reporting[51]. From these, only five of them have clear, measurable, and time-bound commitments. Therefore, the extent and quality of reporting on businesses' biodiversity performance remains a significant challenge. Should the TFND see similar success and high rates of adoption as its climate related forerunner (the TCFD), this challenge may not be as insurmountable as it first seems.

Geographical Differences: Currently the level and standard of reporting varies significantly globally. Whereas Latin America is at the forefront, North American companies are the least likely to report on biodiversity[10]. The disparity may be due to varying concentration of industries (e.g., large amounts of mining in Latin America), or differing rates of biodiversity loss between regions (e.g., greater loss in Latin America than in North America[4]). These differences present a challenge to investors who wish to target certain markets, but also wish take biodiversity into account.

Informing Investors: Although investors have an increased concern about biodiversity loss, a majority do not intend to act promptly[52]. This discrepancy is in part due to the lack of data and metrics, and asset managers need to ensure they provide clear information on biodiversity-linked investments and opportunities.

FIRST STEPS

From our analysis, we suggest the following seven initial actions which may help Brunel better account for biodiversity in their investment approach:

- Conduct a thorough analysis of the eight remaining sectors to better assess their relationship with our natural world.
- Consider adding biodiversity loss as an eight priority in Brunel's responsible investment approach, as not all biodiversity related aspects are currently considered under 'supply chain management'.
- Engage with the work of organisations such as the PRI, TNFD, and the Finance for Biodiversity Pledge, in order to better integrate biodiversity into Brunel's investment decisions.
- Push for greater and more accurate disclosure of biodiversity related risks by companies. Work alongside likeminded investors and the other LGPS pools to encourage creation and adoption of a standardised biodiversity impact assessment tools.
- Collaborate with current data providers such as Sustainalytics and TruValue Labs to ensure biodiversity is appropriately assessed in their data.
- Work with Federated Hermes EOS, the LAPFF, and its own asset managers to engage with current and prospective holdings on biodiversity related topics. Using the same active ownership approach which Brunel uses for climate change will result in the most effective results for Brunel's beneficiaries.
- Brunel may wish to pose the following example questions to companies:

1. To what extent is your company taking action on biodiversity?
2. How aware are you of your firm's impact on biodiversity?
3. Has your organisation set any measurable biodiversity-linked targets? If not, why?
4. How are you measuring the impact of your operations? Are you using any specific tools?
5. To what extent, if at all, are you already addressing biodiversity themes within your organisation?

CONCLUSION

This report is the start of a longer process looking at biodiversity in the context of Brunel Pension Partnership. Whereas the three most material sectors were focused upon in this analysis, all 11 Sectors require careful investigation, as each offers its own set of risks (and opportunities) relating to maintaining biodiversity. In summary, the report identifies that:

Industrials: The Sector has a significant direct impact on biodiversity and due to industry-specific biodiversity regulations (for example, biodiversity offset policies in the Construction and Engineering sub-industry), pension funds should carefully assess companies on current and potential future regulatory and litigation risks.

Information Technology: Certain industries within Information Technology contribute to the disruption of ecosystems. However, through fields such as Spatial Finance, the Sector provides conservation tools and solutions, and therefore offers investment opportunities.

Financials: The Sector must appropriately consider biodiversity loss, as systemic risk means failure to do so would lead to impacts being exponentially magnified and affecting the entire global economy.

Whilst the four challenges previously outlined present a barrier to integrating biodiversity, the first steps suggested provide Brunel with an opportunity to highlight their reputation as a innovating responsible asset manager. As with other ESG criteria, Brunel should ensure its asset managers weigh up biodiversity as part of their wider evaluation of investment risk and returns.

REFERENCES

1. Ceballos, G., Ehrlich, P.R., Barnosky, A.D., García, A., Pringle, R.M. and Palmer, T.M. (2015) *Accelerated Modern Human-Induced Species Losses: Entering the Sixth Mass Extinction. Science Advances* [online]. 1 (5), pp.1-5. [Accessed 28 June 2021].

2. Dasgupta, P. (2021) *The Economics of Biodiversity: the Dasgupta Review* [online]. Report number: PU 3069. London. Available from: https://www.gov.uk/government/publications/final-report-the-economics-of-biodiversity-the-dasgupta-review [Accessed 28 June 2021].

3. United Nation (2021*) Convention on Biological Diversity* [online]. Available from: https://www.un.org/en/food-systems-summit-2021-en/un-biodiversity-conference [Accessed 29 June 2021].

4. World Wide Fund (2020a) *Living Planet Report 2020 Bending the Curve of Biodiversity Loss* [online]. Switzerland: WWF. Available from: https://www.zsl.org/sites/default/files/LPR%202020%20Full%20report.pdf [Accessed 28 June 2021].

5. Cardinale, B. J., Duffy, E., Gonzalez, A., Hooper D. U., Perrinigs, C., Venail, P., Narwani, A., Mace, G. M., Tilman, D., Wardle, D. A., Kiinzig, A. P., Daily, G. C., Loreau, M., Grace, J. B., Larigauderie, A., Srivastava, D. and Naeem, S. (2012) *Biodiversity Loss and Its Impacts on Humanity. Nature* [online]. 468(7401), pp. 59-67. [Accessed 28 June 2021].

6. Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (2020) *IPBES Workshop on Biodiversity and Pandemics* [online]. Germany: IPBES Secretariat. Available from: https://ipbes.net/sites/default/files/2020-12/IPBES%20Workshop%20on%20Biodiversity%20and%20Pandemics%20Report_0.pdf [Accessed 28 June 2021].

7. World Wide Fund (2020b*) Global Futures, Assessing the Global Economic Impacts of Environmental Change to Support Policy-making* [online]. Switzerland: WWF. Available from: https://wwfint.awsassets.panda.org/downloads/global_futures_summary_report.pdf [Accessed 28 June 2021].

8. Swiss Re (2020) *Why Managing Biodiversity Risk is Critical for the Global Economy* [online]. Zürich. Available from: https://www.swissre.com/dam/jcr:a7fe3dca-c4d6-403b-961c-9fab1b2f0455/swiss-re-institute-expertise-publication-biodiversity-and-ecosystem-services.pdf [Accessed 28 June 2021].

9. Price waterhouse Company and World Wide Fund (2020) *Nature is Too Big to Fail* [online]. Zürich. Available from: https://wwfint.awsassets.panda.org/downloads/nature_is_too_big_to_fail_en_web.pdf [Accessed 28 June 2021].

10. Klynveld Peat Marwick Goerdeler (2020) *The Time Has Come: The KPMG Survey of Sustainability Reporting 2020* [online]. Amstelveen. Available from: https://assets.kpmg/content/dam/kpmg/xx/pdf/2020/11/the-time-has-come.pdf [Accessed 29 June 2021].

11. Taskforce on Nature-related Financial Discolsures (2021) *G7 Backs New Taskforce on Nature-related Financial Disclosures*. Available from: https://tnfd.info/news/g7-backs-new-taskforce-on-nature-related-financial-disclosures/ [Accessed 29 June 2021].

12. Brunel Pension Partnership (2020) *Responsible Investment Policy Statement* [online]. Bristol. Available from: https://www.brunelpensionpartnership.org/wp-content/uploads/2020/08/Brunel-RI-Policy-2020.pdf [Accessed 28 June 2021].

13. Principles for Responsible Investment (2020) *Investor Action on Biodiversity: Discussion Paper* [online]. London. Available from: https://www.unpri.org/download?ac=11357 [Accessed 28 June].

14. Capitals Coalition (2020) *Framing Guidance [online]. London*. Available from: https://naturalcapitalcoalition.org/wp-content/uploads/2020/03/FramingGuidance_Consultation March2020.pdf [Accessed 28 June 2021].

15. Morgan Stanley Capital International (2020) *Global Industry Classification Standard Methodology*. Available from: https://www.msci.com/documents/1296102/11185224/GICS+Methodology+2020.pdf/9caadd09-790d-3d60-455b-2a1ed5d1e48c?t=1578405935658 [Accessed 28 June 2021].

16. Principles for Responsible Investment (2017) *Macro Risks: Universal Ownership* [online]. Available from: https://www.unpri.org/sustainable-development-goals/the-sdgs-are-an-unavoidable-consideration-for-universal-owners/306.article [Accessed 28 June 2021].

17. Mission Économie De La Biodiversité (2019) *Global Biodiversity Score: A Tool to Establish and Measure Corporate and Financial Commitments for Biodiversity* [online]. Report number: N.14. Paris. Available from: http://www.mission-economie-biodiversite.com/wp-content/uploads/2019/05/N14-TRAVAUX-DU-CLUB-B4B-GBS-UK-WEB.pdf [Accessed 28 June 2021].

18. Curwell, S. and Cooper, I. (1998) *The Implications of Urban Sustainability. Building Research and Information* [online], 26(1), pp.17-28. [Accessed 20 June 2021].

19. Newbold, T. (2018) *Future Effects of Climate and Land-use Change on Terrestrial Vertebrate Community Diversity Under Different Scenarios. Proceedings of The Royal Society B* [online]. 285(1881), pp.1-9. [Accessed 20 June 2021].

20. Altuntas, H. (2019) *Biodiversity Management. Sustainable Aviation* [online]. pp. 81-95.

21. Alquezar, R. D. and Macedo, R. H. (2019) *Airport Noise and Wildlife Conservation: What are We Missing?. Perspective in Ecology and Conservation* [online]. 17(4), pp.163-171. [Accessed 20 June 2021].

22. International Maritime Organisation (2021) *Ship Noise*. Available from: https://www.imo.org/en/MediaCentre/HotTopics/Pages/Noise.aspx [Accessed 20 June 2021].

23. Carlton, J. T. (2010) *The Impact of Maritime Commerce on Marine Biodiversity. The Brown Journal of World Affairs* [online], 16(2), pp.131-142. [Accessed 20 June 2021].

24. Tatem, A. J. and Hay, S. I. (2007) *Climate Similarity and Biological Exchange in the Worldwide Airline Transportation Network. Proceedings of the Royal Society B: Biological Sciences* [online], 274(1617), pp.1489-1496. [Accessed 20 June 2021].

REFERENCES

25. Hossain, M, M. (2020) *Environmental Impacts of Shipbreaking. Environmental Impacts of Ships* [online]. Cambridge: Cambridge University Press. (pp. 303-328). Available from: https://www.cambridge.org/core/books/environmental-impact-of-ships/environmental-impacts-of-shipbreaking/57722F93CF7F93F8F6E539F9FD5D91C3 [Accessed 20 June 2021].

26. European Environment Agency (2019) *European Aviation Environmental Report 2019* [online]. Available from: https://ec.europa.eu/transport/sites/default/files/2019-aviation-environmental-report.pdf [Accessed 20 June 2021].

27. United Nations Conference on Trade and Development (2020) *COVID- 19 Cuts Global Maritime Trade, Transforms Industry.* Available from: https://unctad.org/news/covid-19-cuts-global-maritime-trade-transforms-industry [Accessed 20 June 2021].

28. International Civil Aviation Organization (2021) *Covid Economic Impact Analysis* [online]. Montreal: ICAO. Available from: https://www.icao.int/sustainability/Documents/COVID-19/ICAO_Coronavirus_Econ_Impact.pdf [Accessed 25 June].

29. Zolfagharian, S., Noubrakhsh, M., Irizarry, J., Ressang, A. and Gheisari, M. (2012) *Environmental Impacts Assessment on Construction Sites. Construction Research Congress 2012* [online], pp.1750-1759. [Accessed 20 June 2021].

30. Kein, A. T. T., Ofori, G. and Briffett, C. (1990) *ISO 14000L Its Relevance to The Construction Industry of Singapore and Its Potential as the Next Industry Milestone. Construction Management and Economics* [online], 17, pp.449-461. [Accessed 20 June 2021].

31. Maron, M., Gordon, A., Mackey, B. G., Possingham, H. P. and Watson, J. E. M. (2015) *Conservation: Stop Misuse of Biodiversity Offsets. Nature* [online]. 523, pp.401-403. [Accessed 20 June 2021].

32. Allianz (2019) *Safety and Shipping Review 2019* [online]. Munich: Allianz Global Corporate and Specialty. Available from: https://www.agcs.allianz.com/content/dam/onemarketing/agcs/agcs/reports/AGCS-Safety-Shipping-Review-2019.pdf [Accessed 20 June 2021].

33. Deutsche Welle (2020) *Who Will Pay for The Mauritius Oil Spill?* [online]. Available from: https://www.dw.com/en/mauritius-oil-spill-compensation-pay/a-54725675 [Accessed 24 June 2021].

34. Degnarain, N. (2020) *Legal Loophole Opens $10 Billion Compensation Claim for Mauritius Oil Spill* [online]. Available from: https://www.forbes.com/sites/nishandegnarain/2020/11/24/legal-loophole-opens-10-billion-compensation-claim-for-mauritius-oil-spill/?sh=c561fb91ab83 [Accessed 25 June 2021].

35. S&P Global Ratings (201) *ESG Industry Report Card: Technology* [online]. New York: S&P Global. Available from: https://www.spglobal.com/_media/documents/esg-industry-report-card_technology.pdf [Accessed 20 June 2021].

36. Natural Capital Finance Alliance (2021) *Exploring Natural Capital Opportunities, Risks and Exposure*. Available from: https://encore.naturalcapital.finance/en/explore [Accessed 20 June 2021].

37. Cambridge Conservation Initiative (2015*) Impacts of Renewable Energy on Global Biodiversity – an Overlooked Cost of Climate Change Mitigation?*. Available from: https://www.cambridgeconservation.org/project/impacts-of-renewable-energy-on-global-biodiversity-an-overlooked-cost-of-climate-change-mitigation/ [Accessed 20 June 2021]

38. World Wide Fund (2021) *Nature and Spatial Finance*. Available from: https://www.wwf.org.uk/what-we-do/projects/nature-and-spatial-finance [Accessed 20 June 2021].

39. Sustainalytics (2021) *Company ESG Risk Ratings: Microsoft Corp*. Available from: https://www.sustainalytics.com/esg-rating/microsoft-corp/1007900081 [Accessed 26 June 2021].

40. Bakker, A. (2019) *AI for Earth.* Available from: https://www.livingoceansfoundation.org/ai-for-earth/ [Accessed 26 June 2021].

41. Smith, B. (2020) *A Healthy Society Requires a Healthy Planet.* Available from: https://blogs.microsoft.com/blog/2020/04/15/a-healthy-society-requires-a-healthy-planet/ [Accessed 26 June 2021].

42. CDC Biodiversité (2018) *Common Ground in Biodiversity Footprint Methodologies for the Financial Sector [online]. Report number: N.12. Paris.* Available from: https://www.mission-economie-biodiversite.com/wp-content/uploads/2018/11/N12-WORKING-PAPER-MD.pdf [Accessed 28 June 2021].

43. Weyzig, F., Kuepper, B., Willem van Gelder, J. and van Tilburg, R. (2014) *The Price of Doing Too Little Too Late: The Impact of the Carbon Bubble on the EU Financial System* [online]. Brussels. Available from: https://reinhardbuetikofer.eu/wp-content/uploads/2014/03/GND-Carbon-Bubble-web1.pdf [Accessed 28 June 2021].

44. The Bureau of Investigative Journalism (2020) *Revealed: UK Investors' $2bn Backing for Meat Giants Linked to Amazon Deforestation. The Bureau of Investigative Journalism* [online] 4 April. Available from: https://www.thebureauinvestigates.com/stories/2020-06-04/revealed-uk-banks-and-investors-2bn-backing-for-meat-giants-linked-to-amazon-deforestation [Accessed 27 June 2021].

45. Chandellier, J. and Malacain, M. (2021) *Biodiversity and Re/Insurance: An Ecosystem at Risk* [online]. Paris. Available from: https://hal.archives-ouvertes.fr/hal-03213905/document [Accessed 27 June 2021].

46. BNP Paribas (2021a) *Biodiversity Position* [online]. Paris: BNP Paribas Group. Available from: https://group.bnpparibas/uploads/file/biodiversity_position_2021.pdf [Accessed 28 June 2021].

47. BNP Paribas (2021b) *BNP Paribas Reaffirms its Commitments to Help Preserve Biodiversity.* Available from: https://group.bnpparibas/en/news/bnp-paribas-reaffirms-commitments-preserve-biodiversity [Accessed 28 June 2021].

REFERENCES

48. Nagrawala, F. and Springer, K. (2020) *Point of No Returns: A Ranking of 75 of the World's Largest Asset Managers' Approaches to Responsible Investment* [online]. London. Available from: https://shareaction.org/wp-content/uploads/2020/03/Point-of-no-Returns.pdf [Accessed 28 June 2021].

49. porfolio.earth (2020) *Bankrolling Extinction* [online]. London. Available from: https://portfolio.earth/wp-content/uploads/2021/01/Bankrolling-Extinction-Report.pdf [Accessed 28 June 2021].

50. Lambooy, T. and Levashova, Y. (2011) *Opportunities and Challenges for Private Sector Entrepreneurship and Investment in Biodiversity, Ecosystem Services and Nature Conservation. International Journal of Biodiversity Science, Ecosystem Services & Management* [online]. 7 (4), pp. 301-318. [Accessed 03 July 2021].

51. Houdet, J. (2020) *Biodiversity impact disclosure underpins any form of economic recovery*. Available from: https://www.greeneconomycoalition.org/news-and-resources/biodiversity-impact-disclosure-underpins-any-form-of-economic-recovery [Accessed 22 June 2021].

52. Credit Suisse (2021) *Unearthing investor action on biodiversity* [online]. USA: Credit Suisse. Available from: https://www.credit-suisse.com/media/assets/microsite/docs/responsibleinvesting/unearthing-investor-action-on-biodiversity.pdf [Accessed 22 June 2021].