Biodiversity loss: Impossible for investors to ignore

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Contents

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Executive summary

- Biodiversity loss is climbing up the investment agenda, driven by investor demand on sustainability, the changing regulatory environment, changing customer priorities and increased awareness as we see the impacts of this loss.
- Our natural resources are vital for a thriving economy, but the planet faces a crisis as companies, markets and governments have failed to take the financial value of biodiversity into account.
- Concerns for investors include biodiversity-related financial risks such as the impact of increased regulation, changing customer behaviours, reputational risk for companies, and reduced access to financial capital.
- Biodiversity loss has implications across every market and geography. Regionally the rates of biodiversity loss vary considerably, depending on the intensity of the economic activities taking place and the level of biodiversity intactness in that region.
- The sectors most impacted are agriculture/food & beverages; healthcare & pharmaceuticals; fisheries; and extractives.
- But examples of good practice also provide potential opportunities for investors, including nature-based solutions, new products and services, access to new markets and first-mover advantages.

Businesses all have a direct or indirect impact on nature that could in the end affect their operations. Unsustainable economic activities are causing ecosystem services to degrade, while impacting the economic activities that depend on them negatively too.

Tables 1 and 2 (on page 4) provide a summary of the key risks and opportunities from biodiversity loss and gain which investors face. The tables split the risks and opportunities into transition, physical and systemic. Transition risks and opportunities arise from changing strategies, policies or investments necessary to move to a nature positive world. Physical risks are driven by the degradation of biodiversity (for example where over exploitation has reduced stocks), while the physical opportunities come from the enhancement of ecosystems services (for example higher longer-term yields through improvements to soil biodiversity). Systemic risks are those arising from the breakdown of the entire system, rather than the failure of individual parts. More details, including sector and holding examples, are provided in appendices 1 and 2.

While the physical impacts of biodiversity can be current, the timescales for transition risks tend to be medium to longer term. Biodiversity gain is longer term as natural systems take time to regenerate.

Table 1: Key risks from biodiversity loss

Transition	**Policy & legal** – Increased operating costs (for example, higher compliance costs). Write-offs, asset impairment and early retirement of exiting assets due to policy changes. Increased costs and/or reduced demand for products and services from fine and judgements	• Real assets • Agriculture and fisheries • Food and drink • Packaging • Chemicals • Diversified metals and mining
	Technology – Substitution and/or reduced demand for products and services. Research and development expenditures into alternatives. Capital investments in technology development. Costs of deploying new practices and processes	
	Market – Reduced demand for goods and services due to shift in customer preferences. Increased production costs (for example natural disasters and increased water treatment costs) and output requirements. Repricing of assets	All the above as well as apparel, accessories, footwear, retail, consumer staples and restaurants
	Reputation – Reduced revenue from decreased demand for goods/ services and/or decreased production capacity and/or negative impacts on workforce management and planning. As well as potential reduction in capital availability	
Physical	**Acute** – Reduced revenue from decreased production capacity (for example, soil fertility loss, pollination loss, increased water treatment costs). Supply-chain disruption. Reduced revenue and higher costs from negative impacts on workforce (such as health, safety, absenteeism)	• Real assets • Agriculture and fisheries • Food and drink • Tourism, travel and hospitality • Utilities
	Chronic – Increased operating costs (for example, through efficiency loss and cost increases). Reduced production capacity, resulting in reduced revenues. Reduced value of fixed assets	
Systemic	**Ecosystem Collapse** – Risk that a critical natural system no longer functions e.g. tipping points are reaches and the natural ecosystem collapses resulting in wholesale geographic or sectoral losses (summing of physical risks)	• Agriculture and fisheries • Food and drink • Tourism, travel and hospitality • Packaging • Utilities • Transportation and storage
	Aggregated Risk – Linked to fundamental impacts of nature loss to levels of transition and physical risk across one or more sectors in a portfolio (financial or corporate)	
	Contagion – Risk that financial difficulties at one or more financial institutions linked to failure to account for exposure to nature-related risk spill over to the financial system as a whole	• Financials

Source: abrdn in alignment with the **TNFD's beta framework** published in March 2022.

Table 2: Key opportunities from biodiversity gain

Transition	**Markets** – Increased revenue through demand for products which consider biodiversity, new solutions to adaption needs (such as nature-based solutions, or biodiversity offsets). Better competitive position to reflect shifting consumer preferences, resulting in increased revenues	• Agriculture, forestry and fisheries • Food and drink • Real assets • Retail, consumer staples and packaging • Tourism, travel and hospitality • Utilities
	Financing – Increased revenues through access to new and emerging markets (including partnerships with governments and development banks). Increased diversification of financial assets (such as green funds, bonds or loans)	• Financials • Infrastructure and real estate
	Reputation – Positive stakeholder relations as a result of a proactive stance on managing nature-related risks (preferred partner status and improved employee satisfaction)	All sectors
Physical	**Resource efficiency** – Reduced operating costs (from efficiency gains and cost reductions), Increased production capacity resulting in increased revenues.	• Real estate • Agriculture, forestry and fisheries • Food and drink • Consumer staples and packaging • Utilities
	Resilience – Protection from extreme weather and supply issues (e.g. use of different plant species). Increased value of fixed assets (e.g. highly rated buildings).	• All the above and retail, tourism, travel and hospitality

Biodiversity is moving up the investment agenda

Due to its ubiquitous nature, unsustainable use of natural capital has market-wide implications. With expectations of increased regulatory and consumer pressure on this topic in the coming years this paper is relevant for all investors.

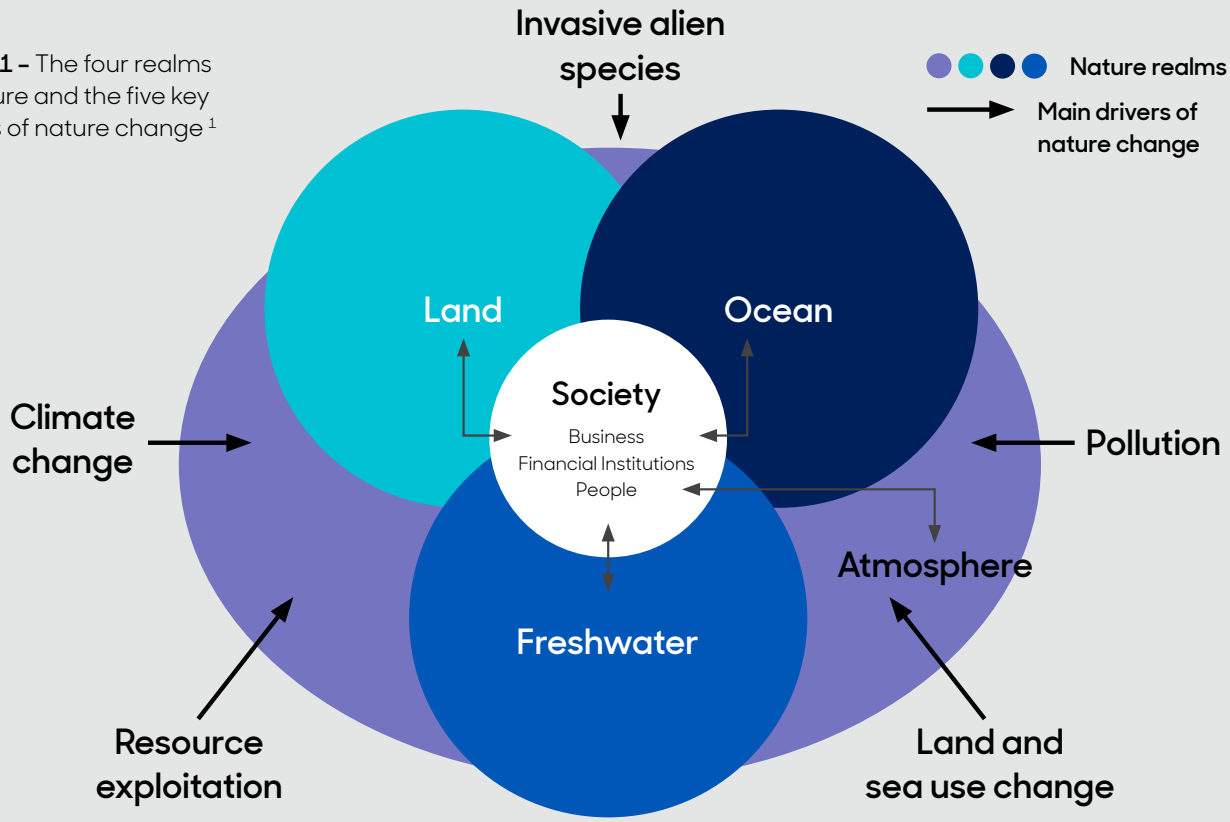
Natural capital and the impact of human activity is fast becoming a major issue of note for investors. Biodiversity loss is climbing up the investment agenda, driven by demand for sustainable investment and increasing awareness of the risks of inaction.

In this paper, the second in our series on biodiversity loss, we focus on how financially material and relevant the issue has become for investors. We also explore the issues for those sectors most at risk, providing engagement frameworks that help identify potential risks and opportunities and how these are managed.

We recommend that this paper is read alongside our **first paper**, which gives investors an introduction to the topic of biodiversity loss and sets out the changing regulatory landscape.

This paper also sets how we look at biodiversity loss across the four realms and main drivers.

Figure 1 – The four realms of nature and the five key drivers of nature change [1]



Time to find a better balance

Biodiversity and ecosystem services are vital for a thriving economy, but due to our unsustainable use of natural assets our planet is in a biodiversity crisis.

It's a classic example of market failure. This life-sustaining component of our planet's natural capital has been woefully underpriced and overused. If we are to maintain the systems that provide us with so many important functions, then a better balance must be found.

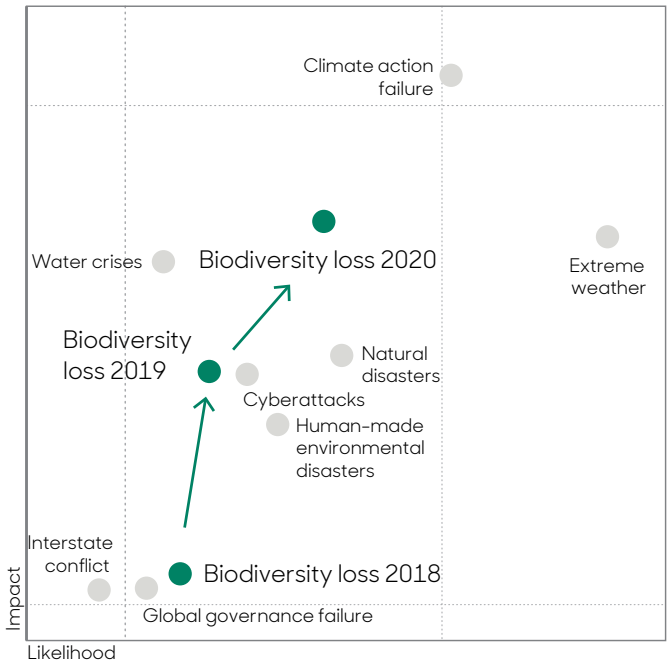
Rising awareness and action

Over the last three years, awareness of the risks associated with biodiversity loss and the potential economic impact have increased significantly. As Figure 1 shows biodiversity loss has been climbing up the annual Global Risks Report. This report produced by the World Economic Forum tracks global risks perceptions among risk experts and world leaders in business, government, and civil society. It examines risks across five categories: economic, environmental, geopolitical, societal, and technological. Investors are increasingly focused on the crisis, its connection to climate change and the other risks it poses. This is compounded by the increasing likelihood of regulation to mitigate/limit loss.

In 2021, at the UN Climate Change Conference (known as COP26), more than 30 financial institutions, representing US$8.7 trillion in assets under management, committed to eliminating agricultural commodity-driven deforestation in their investment and lending portfolios by 2025.

Their stated intention is to reduce deforestation-related risks, while supporting the transition to a sustainable agricultural sector.[1] While this commitment is a start, binding mechanisms and actions need to be evidenced before this is seen as more than words. Land-use change caused by deforestation for agriculture is just one driver impacting on one of the four biodiversity realms. All these realms are equally important and interlinking and the drivers of biodiversity loss impact the realms in complex ways.

Figure 2: Global Risk Report, World Economic Forum 2021



Source: World Economic Forum Global Risk Report, 2021.

Building a stronger framework

Historically, there's been a lack of a clear framework for investors to assess the financial risks posed by biodiversity loss. It is hoped that the recently launched **Taskforce on Nature-related Financial Disclosures (TNFD)**, a post-2020 global biodiversity framework from the biodiversity COP15 along with national pledges to halt deforestation from the climate change COP26 will address this.

There is a strong belief that TNFD will follow the path of the Taskforce on Climate-related Financial Disclosures (TCFD), for which reporting will become mandatory for large listed companies in the UK in 2022, setting global expectations on reporting. These regulatory and reporting changes, along with pressure from non-governmental organisations, highlights that the transition risks linked to biodiversity loss are increasing.

At the time that this paper was being finalised the TNFD beta framework was published and our thinking on this topic is consistent with that.

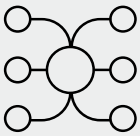
[1] nature-and-tackling-deforestation - Race to Zero & Race to Resilience (unfccc.int).

Risks and opportunities for investors

Biodiversity and the COVID-19 pandemic

While we won't know the total, long-term impact of the COVID-19 pandemic for some time, it is already clear that its had both positive and negative consequences for biodiversity. With human activity stilled, nature initially seemed to prosper. This benefit extended to carbon emissions declining by 5.8% in 2020; the largest decline ever reported.[2] Unfortunately, the benefit to nature was not universal, and in many circumstances was fleeting. Global emissions subsequently rebounded strongly as economies recovered and during lockdowns there was an increase in unlawful activity like illegal fishing and deforestation. Some funding for research and conservation also came to a halt. The balance between the benefits and negatives are difficult to assess.

There has been an obvious impact of the global pandemic on financial markets and the wider economy, though markets have broadly since recovered. As there is a positive relationship between biodiversity loss and the likely occurrence of dangerous infectious diseases, considering biodiversity loss in investment decisions could help to avoid a repeat of the COVID-19 market disruption, or at least make it less likely.



Box 1: Biodiversity Loss and Disease Transmission

There may be a causal link between biodiversity loss and COVID-19, given its suspected origins in bats.

Zoonosis (the transmission of disease from animal species to humans) accounts for roughly 60% of all infectious diseases and 75% of emerging diseases in humans.[3] Land-use change and habitat destruction decrease species diversity, a natural control against disease transmission. At the same time, habitat destruction increases the abundance of generalist species, such as rodents, which tend to be effective transmitters and brings pathogen-carrying wildlife into closer contact with humans and domesic livestock.

As an example, overexploitation through commercial fishing in coastal African waters reduced the viability of fishing for food in local communities. Communities turned to more bush meat as a replacement, which contributed to the spread of the Ebola virus.[4] Similarly, malaria transmission has also been linked to deforestation in the Brazilian Amazon, Asia, and Africa.[5]

[2] All figures in this paragraph from: IEA (2021) Global Energy Review 2021 [**online**] accessed 12/05/2021).

[3] OECD (2020) Biodiversity and the economic response to COVID-19: Ensuring a green and resilient recovery. OECD Policy Responses to Coronavirus (COVID-19) [**online**] (accessed 21/04/2021).

[4] Vogel, J. (2020) Coronavirus has exposed our arrogant relationship with nature [**online**]. Financial Times (accessed 20/04/2021).

[5] OECD (2020) Biodiversity and the economic response to COVID-19: Ensuring a green and resilient recovery. OECD Policy Responses to Coronavirus (COVID-19) [**online**] (accessed 21/04/2021).

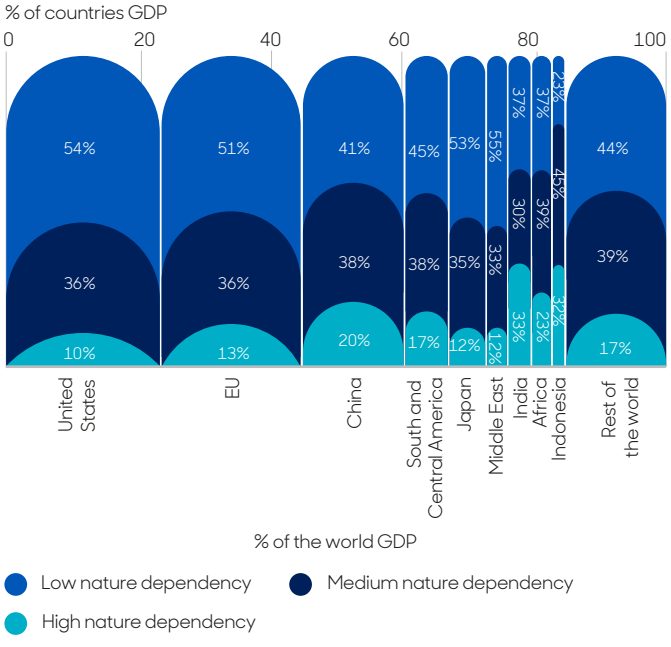
Regional and sector analysis

All sectors rely on ecosystem services to some extent. Risks are greatest where geographically intact biomes are under threat from activities at a large scale. The risks are particularly relevant to those with a global reach or dependence on complex supply chains involving primary production. In the examples below, we focus on a chosen few high-risk sectors, but highlight that businesses connected to food production are particularly sensitive.

Regional exposure

Figure 2 provides an analysis of regional dependency on biodiversity.[7] It highlights that China (with an estimated value of dependent assets of US$2.7 trillion), the EU (US$2.4 trillion) and the US (US$2.1 trillion)[8] have the greatest absolute dependency on nature (a term we are using interchangeably with biodiversity). In relative terms however, the greatest dependencies on nature are found in emerging markets, with India, Indonesia, and the African continent having 33%, 32% and 23% of GDP highly dependent on nature respectively.[9] This is because emerging market economies have a higher reliance on primary sector production.

Figure 3: Distribution of Nature Dependency Classification by Region[6]



Source: PwC, January 2020.

GDP alone is not a sufficient measure to capture regional biodiversity exposure, as it doesn't consider the geographic differences in biodiversity value. If we don't value biodiversity and other forms of natural capital in national accounts, then the negative effects and dependencies will be severely underestimated. Areas of high biodiversity value include those with an abundance of unique or endangered species (such as the Amazon Rainforest) or that have already sustained substantial biodiversity loss (for example, the US). Figure 4 provides an indication of the drivers of deforestation in the Asia Pacific region. The Asia Pacific region has comparatively intact areas of biodiversity but often, as in the case of forest, there is also a high risk of nature loss driven by business activities. abrdn has a history of ensuring biodiversity loss has been considered within its investment decisions in this region. We look at potential impacts on biodiversity protected areas and have criteria for projects to ensure they do no significant harm to the surrounding environment.

One area that has gained much attention in the press is palm oil. While unsustainable palm oil production is linked to deforestation in tropical areas it's a complex issue. abrdn aligns to WWF's thinking on this issue:

"Palm oil is a critical commodity for global food security, and replacing it with other edible oils will require expanding agricultural land, leading to more deforestation and other habitat loss and exacerbating climate change. Sustainable palm oil must therefore be part of the solution to the global climate crisis".[10]

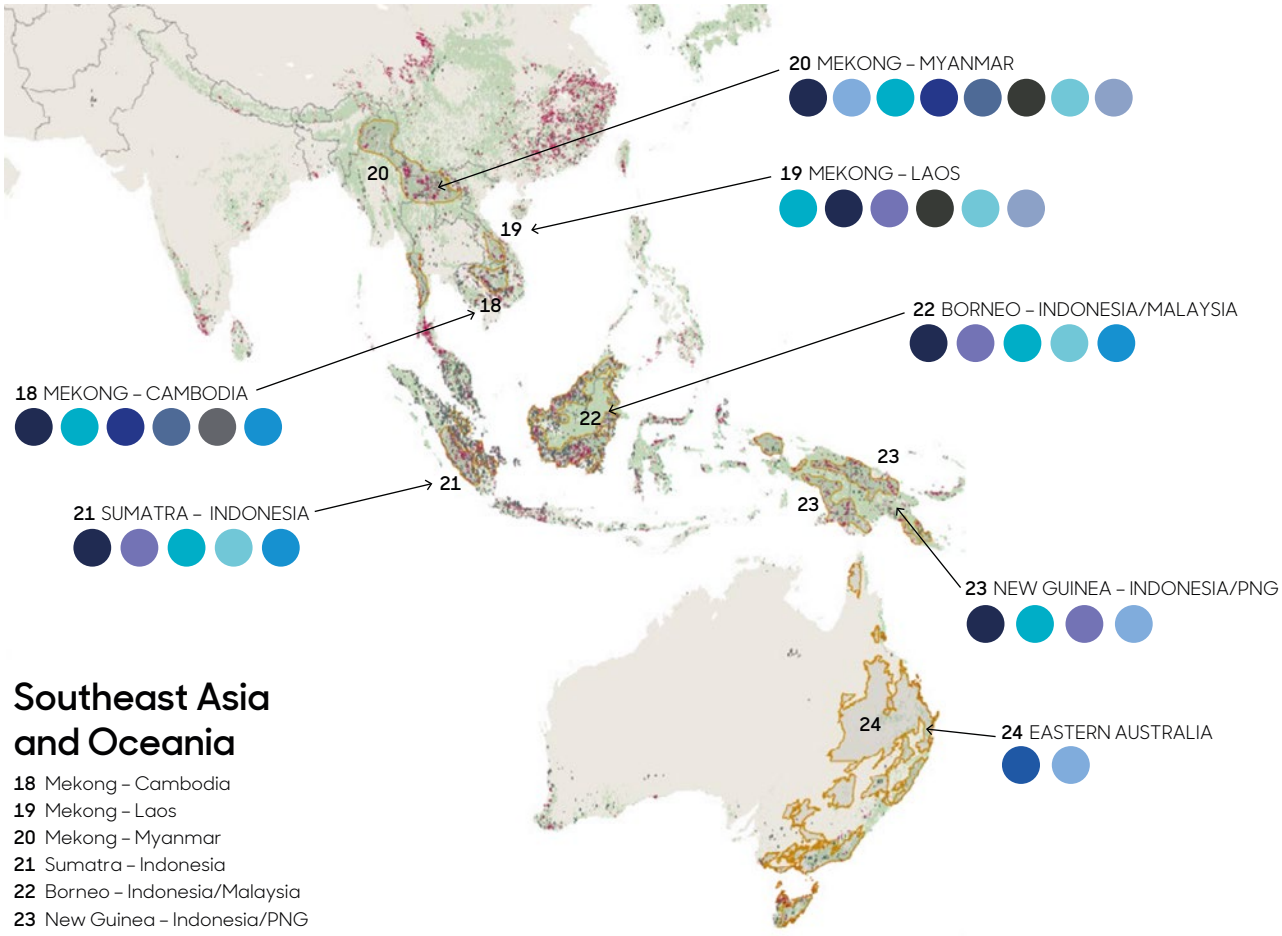
Rather than divest from palm oil supply chains entirely we focus on investing in those companies leading in the production of sustainable palm oil. We expect companies to be transparent in their reporting and to commit to not contributing to deforestation. More information on our expectations can be found in our **Position Statement on Palm Oil**.

[6] Source: **www3.weforum.org/docs/WEF_New_Nature_Economy_Report_2020.pdf**.

[7, 8, 9] World Economic Forum (2020) Nature Risk Rising: Why the Crisis Engulfing Nature Matters for Business and the Economy [**online**] (accessed 22/06/2021).

[10] https://wwf.panda.org/wwf_news/?345432/WWF-to-financial-institutions-Dont-divest-away-our-forests.

Figure 4: Asia Pacific region forest intactness, risk and depletion and the drivers of deforestation



Southeast Asia and Oceania

18 Mekong – Cambodia
19 Mekong – Laos
20 Mekong – Myanmar
21 Sumatra – Indonesia
22 Borneo – Indonesia/Malaysia
23 New Guinea – Indonesia/PNG
24 Eastern Australia

Cattle ranching · Large-scale agriculture · Smallholder farming · Tree plantations
Large -scale logging · Small-scale timber · Fuelwood and charcoal · Mining · Transport infrastructure
Hydroelectric power · Urban expansion · Fires · Forest area (2018) · Deforested since 2004
Deforestation hotspot · Deforestation front

Source: Pacheco, P., Mo, K., Dudley, N., Shapiro, A., Aguilar-Amuchastegui, N., Ling, P.Y., Anderson, C. and Marx, A. 2021. Deforestation fronts: Drivers and responses in a changing world. WWF, Gland, Switzerland.

Key sectors

The following section provides a summary of the key sectors exposed to biodiversity risk. Much of our current engagement focuses on how companies are managing the medium to longer term risks in these areas. However, where companies are exposed to upcoming legislation risks these exist within shorter time frames.

Agriculture, Food, Beverages and Tobacco

Key drivers of biodiversity loss for this sector are: Land use change - Pollution - Resource exploitation.

Food is to biodiversity loss what fossil fuels are to climate change. Four commodities – beef, soy, palm oil and wood – drive the majority of global deforestation which in turn releases more carbon into the atmosphere and reduces the natural cooling effect that forest ecosystems have on the micro-climate. Palm oil, beef, and soy are responsible for around 70% of the 10 million hectares of natural habitat lost to deforestation globally each year.

These sectors are hugely dependent on biodiversity. Productive agriculture relies on many ecosystem services (for example, soil quality, ventilation, water flow maintenance, water quality, pollinators and climate stability). Notably, 71 of the 100 most commonly used crops, which produce 90% of our nutrition require pollination. Loss of pollinators risks food shortages, particularly for communities dependent on primary agriculture. But common agricultural practices such as large mono-crops and pesticides (insecticides and herbicides) use are detrimental to these pollinators.

The sector is ripe for innovation and disruption, whether it's from climate-smart and regenerative farming or alternative proteins and technologies that help reduce food waste. According to the World Economic Forum, nature-positive solutions can create US$10 trillion in business opportunities and 395 million new jobs by 2030. A recent thematic report by Barclays forecasts that there's a US$450 billion market opportunity for cultured meat by 2040 – that's 20% of the global meat market. The report states that results from its global survey indicate strong consumer acceptance, and it expects price parity within 5–10 years.[11] **Verticle farming** also offers an opportunity for this sector which we've explored.

Company example

Working with farmers, Diageo is committed to regenerative agricultural practices for the production of barley. The concept is to employ nature based solutions to improve soil health, enhance biodiversity and reduce the need for synthetic fertiliser. With the cost of fertiliser increasing there are strong commercial drivers.

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Engagement questions relevant to companies in the food, beverages, tobacco and agriculture sectors

Risks	Questions for companies in this sector	Best Practice
• Regulation changes • Supply-chain exposure • Reputation risks around deforestation and biodiversity • Reputation risks if not engaging in better AgTech (sustainable agricultural technology) and sustainable production	• Do you sell beef, wood, palm oil, soya, coffee and cocoa within the EU market? If so how are you preparing to meet the proposed regulation on deforestation-free products? • Do you produce or use as raw materials, any commodities with high exposure to biodiversity risk and how do you control this (for example, forest commodities)? • Does your production lead to deforestation? If so, how do you mitigate the biodiversity loss from this? • How are you engaging with your supply chain on managing biodiversity loss? • What percentage of your primary production relies on pesticides or fertilisers? • If using fertiliser, how are you managing efficient application rates? • To what extent do innovations in sustainable agriculture form part of your strategy? • How do you see the balance between biodiversity conservation and necessary food production resolving? The materiality of double materiality in this sector.	• The company is already taking steps within its supply chain to meet the likely regulatory requirements • Company has a biodiversity policy and encourages those within their supply chain to do the same. • Company is supportive of initiatives (such as TNFD and Business for Nature) and encourages supply chain to support as well. • The company is aware of the impact of their primary production on biodiversity and implements appropriate controls • Companies in particularly relevant commodities (such as timber, cattle, palm oil, soy) show a particular awareness and have evaluated their biodiversity impact • The company has explored, or is exploring, innovative approaches to primary production, that they understand the double materiality issues and are working with their supply chain to resolve this

[11] Barclays, Equity Research, 18th Nov 2021, Sustainable & Thematic Investing, Cultured Meat: From Lab to Fork.

Paper products and packaging

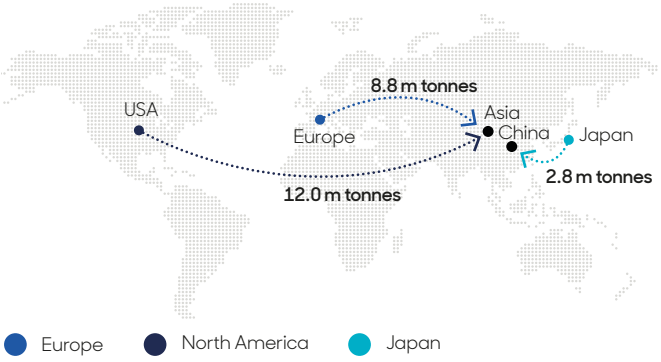
Key drivers of biodiversity loss for this sector are: Resource exploitation - Land use change - Pollution

The global consumption of paper and board was estimated at 400 million metric tons in 2020.[12] Demand is expected to increase steadily over the next decade, reaching approximately 461 million metric tons in 2030.[13] The increase especially in packaging is partially driven by a move towards plastic-free products, but more materially the online-shopping boom.

The growing market for paper and board could increase deforestation risks as demand grows for virgin pulp. Not all paper and board products can be produced from recovered fibres (that is post consumer material from recycling) due to the product requirements. But where recovered fibres can replace virgin pulp high recycling rates and strong international trade in these materials helps to reduce further demand of virgin pulp (250 million tonnes of recovered fibres were use in paper and board production in 2018[14]). As production declines in North America and Europe but grows elsewhere, such as Asia, it's increasingly important that effective collection and processing of fibres increases in these locations to counter the demand growth.

Sustainable forestry practices are also important, given that not all paper and board products can be produced using recycled materials.

Figure 5: Major flows of recovered fibre (millions of tonnes) 2018[14]



Source: BIR, ROSI, EuRIC,and CEPI.

Company example

The Finnish pulp, paper and other forest products company Stora Enso has committed to achieving a net-positive impact on biodiversity in its own forests and plantations by 2050. They aim to achieve this through active biodiversity management to improve biodiversity on species, habitat and landscape levels. The company has also committed to all packaging products being 100% recyclable.

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Engagement questions relevant to paper products and packaging

Risks	Questions for companies in this sector	Best Practice
• Regulatory and policy changes • Supply chain exposure • Reputation risks around deforestation, unsustainable forestry and its link to biodiversity loss	• Is there a commitment to achieve deforestation-free and/or conversion-free production? • Is there are commitment to increase recycled fibre content in the product? • What proportion of production falls under sustainability accreditations and are targets in place to increase this? • Do you disclose to any of the following? CDP Forests Index, Forest 500, the New York Declaration on Forests or similar	• Company has a target in place to achieve this and is able to show progress towards that target • As above • Clear key performance indicators (KPIs) on the proportion of production covered by sustainability accreditations • Company is disclosing to one or more of these initiatives or similar

[12] **Paper demand globally 2020-2030 | Statista**.

[13] **Paper demand globally 2020-2030 | Statista**.

[14] Paper and board recycling in 2018 36 (**bir.org**).

Fisheries

Key drivers of biodiversity loss for this sector are: Resource exploitation and Sea use change

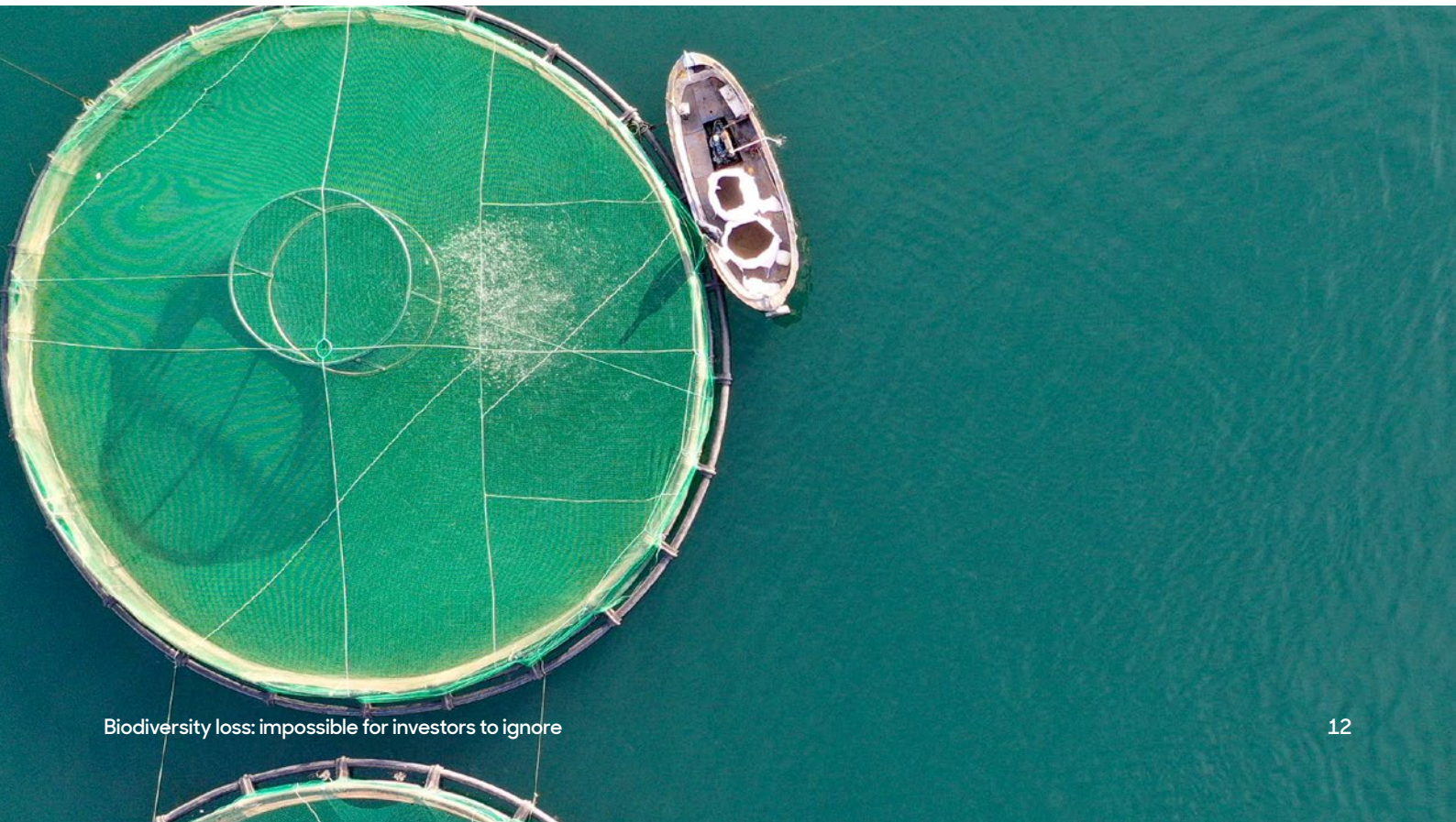
The double materiality principle of impacts and dependencies is particularly relevant for the fisheries industry. Overfishing, illegal, unreported, and unregulated fishing can impact entire marine ecosystems by disrupting natural reproduction rates that replenish fish stocks. Thus, exploitation in the fisheries sector can threaten the very supply it relies on. On average, 34% of fish stocks are already overexploited. Areas with the highest overexploitation include the Mediterranean Black Sea (63%), the Southeast Pacific (55%), and the Southwest Atlantic (53%).[16]

Fishing also exemplifies the international nature of these problems, which adds additional complexity to devising solutions. International fishing waters mean that multiple countries can potentially be affected by overfishing by one actor with limited options for redress. A literal tragedy of the commons.

Bycatch (fishing boats catching and discarding animals they do not want, cannot sell, or aren't allowed to keep) is an area which needs to be addressed. Industrial fishing nets span huge areas of ocean and as a result capture non-target species. 90% of the bycatch that is caught cannot be sold and is discarded.[17] This is worsened by overfishing.

Land-based activities can also harm marine biodiversity, and fisheries in turn. The most obvious example of this is nitrogen pollution from the agricultural use of fertilisers. Excess nitrogen washes away into waterways and into coastal waters, and results in eutrophication (algae blooms, over-oxygenated water, and biological dead zones). In 2019, the seasonal dead zone in the Gulf of Mexico was roughly the size of the state of Massachusetts. It costs the fishing industry at least US$500 million a year.[18]

[16] Bernstein (2021) Global ESG Research: Biodiversity – A risk that cannot be ignored and ta fertile ground for investment [**online**] (accessed 12/04/2021).
[17] Bernstein (2021) Global ESG Research: Biodiversity – A risk that cannot be ignored and ta fertile ground for investment [**online**] (accessed 12/04/2021).
[18] Dasgupta, P. (2021) The Economics of Biodiversity: The Dasgupta Review – Full Report [**online**] (accessed 21/05/2021).



Aquaculture (fish farms) impact biodiversity especially when poor management leads to excessive feeding (nutrient overloading in the ecosystem) as well as escapes and disease damaging natural fish stocks. Poor aquaculture practices have also led to removal of natural disaster protection, such as mangroves. Between 1980 and 2002, the mangrove cover in Southeast Asia was reduced by 28% to make space for commercial shrimp farming. In these areas, the impact of the 2004 South Asian Tsunami was far more severe than in those coastal areas where mangroves were still intact.[19]

Marine biodiversity offers significant potential for climate-change mitigation; the sequestration ability of phytoplankton in the ocean alone is estimated to be equivalent to a tropical rainforest roughly four times the size of the Amazon.[20] There's also increasing interest in the blue carbon market (ocean-based carbon offsets), currently undervalued due to the lack of agreed standards and accreditation for these schemes.

Company examples

Nine of the world's biggest fishing companies with a combined annual revenue of US$30 billion, have signed up to the Seafood Business for Ocean Stewardship (SeaBOS) initiative, which pledges to help stamp out illegal activities and prevent overfishing.[21]

"Marine biodiversity offers significant potential for climate-change mitigation; the sequestration ability of phytoplankton in the ocean alone is estimated to be equivalent to a tropical rainforest roughly four times the size of the Amazon."

Engagement questions relevant to fisheries and aquaculture

Risks	Questions for companies in this sector	Best Practice
Over-exploitation of marine and freshwater resources	**Wild fisheries** • Which marine ecosystem regulation are you subject to and how do you monitor compliance? • How do you control for excessive bycatch? • Are you involved in marine conservation of any form? **Aquaculture** • Do you monitor feed use? • How do you minimise escapes? • What checks do you have on fish health?	• The company aligns with all relevant regulation and has a clear quantitative approach to ensuring fish stocks are maintained at sustainable levels, including by reducing bycatch • Voluntary sustainability accreditation (for example Aquaculture Stewardship Council) • Movement away from unsustainable feed

[19] PwC and WWF (2020) Nature is Too Big to Fail [**online**] (accessed 09/04/2021).

[20] The Sustainable Finance Platform (2020) Biodiversity Opportunities and Risks for the Financial Sector [**online**]. Biodiversity Working Group (accessed 04/05/2021).

[21] The Guardian (2017) Nine of the world's biggest fishing firms sign up to protect oceans [**online**] (accessed 24/06/2021).

Healthcare and pharmaceuticals

Key drivers of biodiversity loss for this sector are: Land and sea use change - Resource exploitation

Biodiversity plays a vital role in modern and traditional healthcare. An estimated four billion people rely primarily on natural resources for healthcare. Between 25–50% of all currently marketed drugs owe their origins to natural products,[22] including 118 of the 150 most prescribed medications in the US.[23] The inspiration for medical innovation provided by nature is a difficult commodity to replace. Biodiversity loss also poses supply-chain disruption risks to the sector and increased costs for research. Production of organic material that constitutes the base of research that is lost must be replaced with synthetic alternatives, often at higher costs.[24]

As shown by the COVID-19 pandemic, biodiversity loss has a further and more blatant impact on healthcare and wider society; the emergence and transmission of zoonotic diseases (see Box 1, page 7). Given the link between biodiversity loss and increased disease transmission rates it follows that biodiversity loss could create new growth markets for the pharmaceutical industry (for example, the company that produced the mRNA vaccine, sold over 527 million shots in 2021 to the UK, EU, US and Japan, at a cost of between US$30–US$36).

Pharmaceuticals can also directly harm biodiversity. For example, a study found that the introduction of ethinylestradiol (found in contraceptive pills) into a lake in Canada led to the collapse of the fish population.[25]

Company example

The German pharmaceutical and life sciences company Bayer lost almost 40% of its market capitalisation following an acquisition. The decline was due to controversy surrounding the alleged carcinogenic properties of the acquired company's key product - as well as accusations that the product adversely affected honeybee populations.[26]

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Engagement questions relevant to healthcare and pharmaceuticals

Risks	Questions for companies in this sector	Best Practice
• Innovative potential of biodiversity in medicine • Resource sharing	• To what extent does biodiversity contribute to your R&D or product development? • Do you participate in the Nagoya Protocol[27] on Access and Benefit Sharing, or similar initiatives? • Do you have an Environmental Management System? If so, is it accredited (for example ISO 14001, EMAS III)?	• The company is aware of the benefit of biodiversity in the sector and has an active approach to its conservation • The company follows the appropriate regulation for acquiring and sharing resources

[22] Bernstein (2021) Global ESG Research: Biodiversity – A risk that cannot be ignored and ta fertile ground for investment [**online**] (accessed 12/04/2021).

[23] PwC and WWF (2020) Nature is Too Big to Fail [**online**] (accessed 09/04/2021).

[24] PwC and WWF (2020) Nature is Too Big to Fail [**online**] (accessed 09/04/2021).

[25] Dasgupta, P. (2021) The Economics of Biodiversity: The Dasgupta Review – Full Report [**online**] (accessed 21/05/2021).

[26] Dasgupta, P. (2021) The Economics of Biodiversity: The Dasgupta Review – Full Report [**online**] (accessed 21/05/2021).

[27] Business and Biodiversity Campaign (2021) Cosmetics and Pharmaceutical [**online**] (accessed 23/06/2021).

Extractives and mineral processing

Key drivers of biodiversity loss for this sector are: Climate change - Land use change - Pollution

Extractives and mineral processing and the industries surrounding them can have significant negative impacts on biodiversity, through habitat destruction, environmental degradation and in the case of some minerals (including fossil fuels) climate change.

If sufficient attention is paid to conservation in the extraction and production of hard resources (such as fossil fuels, metals and minerals, and mined/extracted commodities) then there is potentially a less consequential relationship with biodiversity loss than forest commodities on a localised level, since the supply does not directly depend on biodiversity.

However, in many cases, the largest impact from this sector is in the processing or use of the minerals. The prime example being fossil-fuel use, which is the main driver of climate change. In turn, climate change is one of the leading causes of biodiversity loss. The sector is also linked to disastrous spills and other pollution incidents, which cause long-term reputational impacts for companies and exposure to litigation.

There is also an increasing risk that demand for minerals and depletion of readily accessible resources is pushing the sector into remoter more biodiversity-rich ecosystems.[28] For example, 20% of global mines owned by constituents of the MSCI ACWI Investible Market Index are now located in biodiversity hotspots.[29]

A hotspot is defined as an area that meet two specific criteria:

1. It must contain at least 1,500 species of vascular plants (more than 0.5% of the world's total) as endemics
2. It has to have at least 70% of its primary vegetation.

Myers, Norman; Mittermeier, Russell A.; Mittermeier, Cristina G.; da Fonseca, Gustavo A. B.; Kent, Jennifer (2000). "Biodiversity hotspots for conservation priorities" (PDF). Nature. 403 (6772): 853–858. Bibcode:2000Natur.403..853M. doi:10.1038/35002501. ISSN 0028-0836. PMID 10706275. S2CID 4414279.

One of the main drivers for the expansion into remoter, more biodiverse-rich ecosystems is the growing market for those minerals linked to the growth of low carbon energy. For example the electrification of vehicles requires cobalt, lithium, nickel and manganese. The Democratic Republic of Congo, a global biodiversity hotspot, also holds the world's largest known reserves of colbalt.[30] Nickel mining is of particular concern as some of the largest nickel operations on the planet are located in biodiverse areas such as Indonesia.

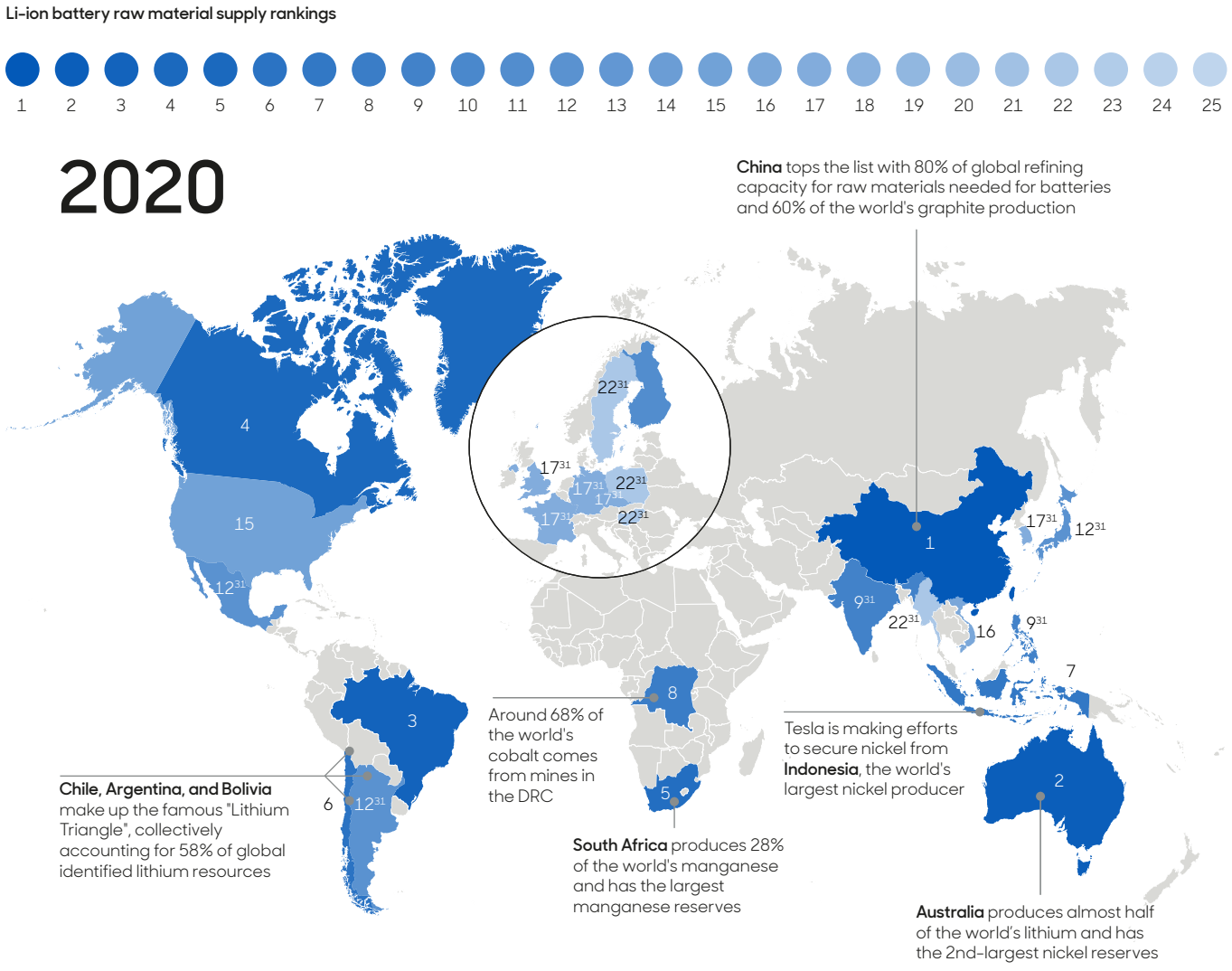
[28] Bernstein (2021) Global ESG Research: Biodiversity – A risk that cannot be ignored and ta fertile ground for investment [**online**] (accessed 12/04/2021).

[29] Block, S. and Mollod, G. (2020) Biodiversity Threats from Mining. MSCI ESG Research, Industry Insight: Metals & Mining.

[30] Ogundiya, K., Patel, H. and Challawala, A. (2020) Biodiversity: Investing in Nature [**online**]. Barclays. (accessed 12/04/2021).

Figure 6 shows the top 25 countries for raw materials in the lithium-ion battery supply chain in 2020 and 2025 based on BloombergNEF's rankings. Countries are ranked according to resource availability, mining capacity, and refining capacity.

Figure 6: Top 25 nations for mining in the EV battery supply chain



Source: BloombergNEF, Reuters, USGS Mineral Commodity Summaries (2021).

[31] Represents countries that are tied.

Company examples

Mining company Anglo American have committed to a Net Positive Impact, that is to leave the biodiversity of an area in a better state than when they arrived. Developed in partnership with NGOs, the United Nations bodies, and business, their Nature Positive approach mandates the inclusion of nature and its role in managing impacts and dependencies on water, society and climate. [32]

Anglo American have stated that they will not explore or develop new mines in World Heritage sites and that they commit to respecting legally designated protected areas, and to design or operate any new operations in a way that is compatible with the biodiversity for which such areas were designated.

In 2010 BP was responsible for a huge accidental oil spill that resulted in oil flowing into the ocean for many weeks and hundreds of miles of shoreline being covered with oil and thousands of birds and marine creatures killed. This oil spill will have a long-term environmental impact and the claims cost the company multiple billion US dollars.

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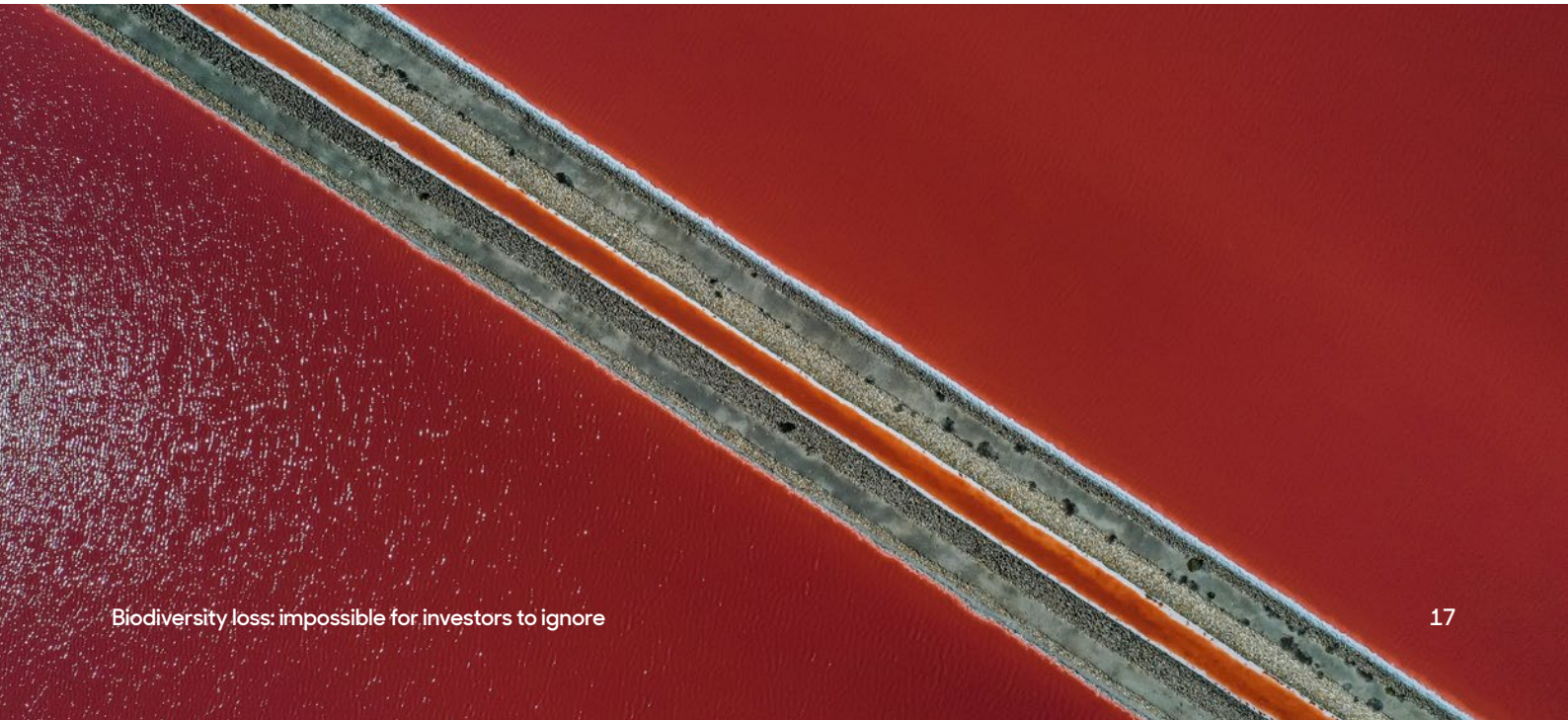
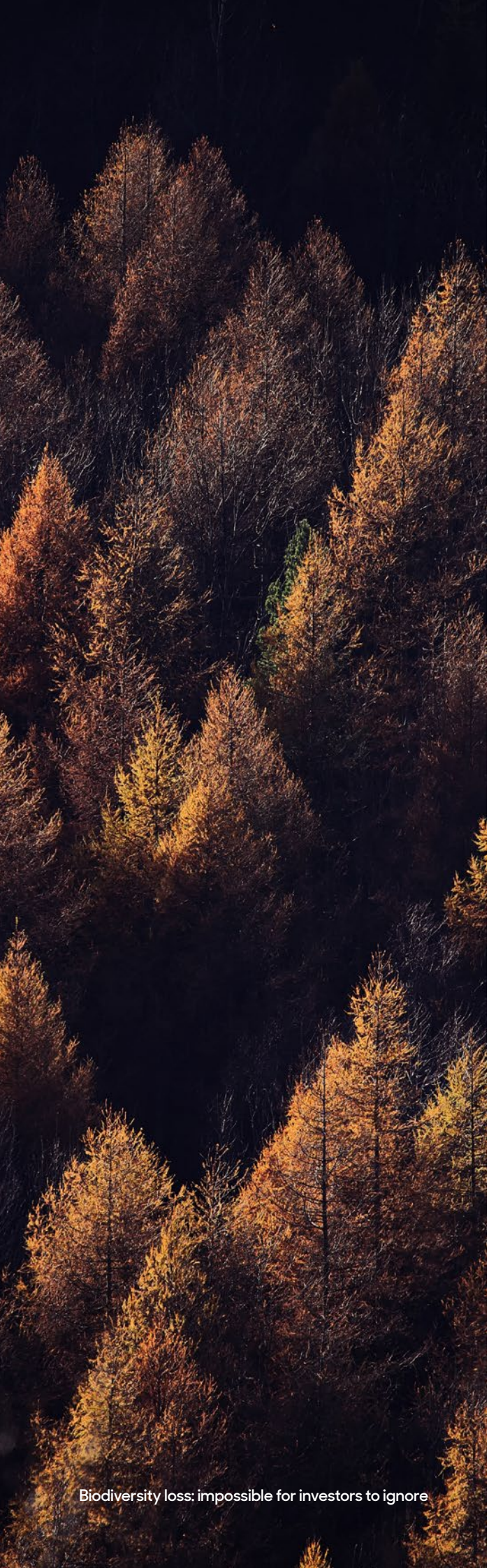
Engagement questions relevant to extractives and mineral processing

Risks	Questions for companies in this sector	Best Practice
• Regulatory and policy changes • Supply chain exposure • Litigation or fines for pollution incidents • Reputation risks if locations are in biodiversity hotspots or in close proximity to biodiversity protected areas	• How do you monitor and ensure compliance with local legislation on sites? Where local regulation is lacking, do you set any minimum standards for biodiversity protection? • Do you operate in biodiversity hotspots? If so, how do you mitigate your impact on biodiversity? • How does your infrastructure impact biodiversity and how do you monitor this? • Do you engage in biodiversity offsetting? If so, how do you approach this?	• Clear governance procedures on legal compliance • The company is aware of the impact it has on biodiversity and has an active approach to its conservation • Offsetting is likely to be particularly relevant for extractives. The company has a clear approach aligned with the mitigation hierarchy and best practice guidelines

[32] Anglo American Sustainability report 2021 [online https://www.angloamerican.com/~/media/Files/A/Anglo-American-Group/PLC/investors/annual-reporting/2022/aa-sustainability-report-full-2021.pdf] (accessed 25/04/2021).





Next steps

While biodiversity sustains life as we know it, it is decreasing at a faster rate than ever before. The contribution of economic activity to this loss is beyond doubt, with most companies both significantly dependent on biodiversity but also responsible for accelerating its loss.

There is a significant increase in interest from regulators, markets and shareholders on this topic. As a result, it must become the next big consideration for investors.

Data to measure biodiversity loss and gain is a major challenge, comparable data especially. This topic is complex and will be covered in the next paper of this series in which we will look to show how the data and frameworks are developing and how we can integrate this into our decision-making to support our clients and meet regulatory demands.

The engagement frameworks provided in this paper act as a starting point when engaging with companies in those sectors most exposed to risks linked to biodiversity loss. The frameworks also help identify the companies positioned to grow in a market that's much more aware of biodiversity loss.

Our next steps:

1. **Engagement** - we will engage with companies using these frameworks.
2. **Initiatives** - we will continue to support initiatives such as TNFD and Business for Nature.
3. **Data** - we also commit to further research into the data required to better integrate the implications of biodiversity loss into our investment process.

Appendix 1: General engagement framework on biodiversity – all sectors

	Indicators	Questions companies	Best Practice
General engagement questions relevant to all companies (TCFD aligned as TNFD framework not yet released)			
Governance	Governance around biodiversity-related risks and opportunities	• Does the board or executive have oversight of biodiversity-related risks? • To what extent is biodiversity integrated into core decision-making or risk-management frameworks?	• Biodiversity is recognised at board or management level as a key environmental challenge and market driver • Biodiversity is an integral part of the executive decision-making framework
Strategy	The actual and potential impacts of biodiversity-related risks and opportunities on the company's strategy	• How does biodiversity loss represent a risk to your company, strategy, or operations over the short, medium, and long term? • How do you manage negative impacts on biodiversity resulting from your activity? • Do you operate in, or any of your key core materials originate from biodiversity hotspots? • Are there any biodiversity-related opportunities for the business, if so are you positioned to capture these?	• The company understands the nature-related financial risks and opportunities for its business • The company goes beyond adherence to regulations and has developed or is developing its own biodiversity approach policy • The company conducts impact assessments to assess the value of its sourcing or production regions and can demonstrate governance policies to protect biodiversity hotspots • The company explores biodiversity-related opportunities in a way that supports sustainability
Risk Management	The processes used by the company to identify, assess and manage biodiversity-related risks	• How do you identify, assess, and manage biodiversity-related risks? • To what extent do you engage with biodiversity initiatives, such as the TNFD, NCFA, EU Business@Biodiversity Platform, or Finance for Biodiversity Pledge? • How do you assess the exposure of your supply chain to biodiversity risk? • Do you ensure compliance with conservation best practice across the supply chain?	• The company recognises the importance of biodiversity in the broader risk framework and has conducted, or is conducting, a review of its significance relative to their own activities • The company recognises the need for collaboration on developing a unified industry approach to biodiversity. It may not be involved in specific initiatives, but should be aware of their existence and evidence of exploring engagement is valued • Company has a certified environmental management system (such as ISO 14001) that extends to its supply chain
Metrics & Targets	The metrics and targets used to assess and manage biodiversity related risks and opportunities	• What targets have you set in relation to biodiversity? • Do you measure your impact on biodiversity? If so, how, and do you disclose this?	• The company sets, or intends to set, targets on biodiversity, such as no net loss or net gain of biodiversity by 2030 • Given the measurement challenge, the company may not actively measure biodiversity, but best practice would be a willingness to do so and evidence that they have explored measuring and reporting

Appendix 2:
Key risks from biodiversity loss

Type	Risks	Potential Financial Impacts	Example	Sectors potentially impacted[33]
Transition	**Policy & legal** • Increased pricing for biodiversity offsets • Enhanced reporting obligations • Mandates on regulation of existing products and services • Exposure to litigation	• Increased operating costs (for example, higher compliance costs or increased insurance premiums) • Write-offs, asset impairment and early retirement of exiting assets due to policy changes • Increased costs and/or reduced demand for products and services from fines and judgements	• US, Australia, New Zealand, UK and Europe use biodiversity offsetting as a tool within planning systems • To meet COP26's deforestation pledges forest protection regulation will increase. Proposed EU legislation will require due diligence on key forest-based commodities • The Netherlands is considering farm closures to reduce ammonia pollution • In 2017 JBS were fined US$7.7 million by Brazil's environmental regulator for buying from ranchers carrying out illegal deforestation	• Real assets • Agriculture /food & beverages specifically those producing forest risk commodities – beef, palm oil, coffee and soy • Packaging • Diversified metals and mining
	Technology • Substituting existing products/services with lower impact options • Unsuccessful investment in new technologies • Cost of moving to lower impact products	• Reduced demand for products and services • Research and development expenditures into alternatives • Capital investments in technology development • Costs of deploying new practices and processes	• The agriculture, fisheries and food sectors are ripe for innovation and disruptors. The Good Food Initiative reported that in 2020 US$366 million was invested in cultured meat development • There are likely to be significant compliance costs and increased evidence demands which will likely need to be meet through remote sensing	• Agriculture/food & beverages, specifically those producing beef, coffee, palm oil or soy • Fisheries
	Market • Changing customer behaviour • Uncertainty in market signals • Increased cost of raw materials and replacement of ecosystem services	• Reduced demand for goods and services due to shift in customer preferences • Increased production costs due to changing input prices (such as paying for services previously provided freely by ecosystems - pollination being a clear example) and output requirements. • Repricing of assets	• Supermarkets and food companies look to boycott agricultural products from Brazil over a bill they believe will encourage deforestation in the Amazon • More than 2 million honeybee colonies transported around the US to pollinate crops, increasing crop yield and quality by more than US$14.6 billion • Land valuations and securities valuations likely to be impacted as legislation forms • Inadequate biodiversity approach threatens access to capital as banks and lenders increasingly consider it within strategies	• Apparel, accessories and footwear • Automobiles through leather • Retail - all major multiples as well as home improvement retail which is exposed to timber costs
	Regulation • Shifts in consumer preferences • Stigmatisation of sector • Increased shareholder concern or negative shareholder feedback	Reduced revenue from: • decreased demand for goods/ services • decreased production capacity • negative impacts on workforce management and planning • Reduction in capital availability	• According to a 2021 survey by Deloitte,[34] nearly 1 in 3 claimed to stop buying a product or brand due to sustainability related concerns • Risk of 'follow-the-money' campaigns against investors • At COP26 financial institutions, representing US$8.7 trillion of global assets, committed to eliminate forest-risk agricultural commodity-driven deforestation activities by 2025	All the sectors mentioned above as well as personal care, pharmaceuticals, household products and restaurants
Physical risks	**Acute** • Loss of ecosystem services reduce productive potential • Increased severity of extreme weather events • Increased spread of disease	Reduced revenue and/or increased costs from: • decreased production capacity (such as soil fertility, pollination loss), increased treatment costs • impacts on workforce (including safety and absenteeism)	• Loss of ecosystem services reduce companies' profitability as it impacts supply chains, cost of production and demand • Flooding in China due to deforestation led to > $20 billion in damages and loss of 4,000 lives • Biodiversity loss contributes to spread of infectious disease, threatening market disruption (such as COVID-19)	• Real Assets • Agriculture • Food and Drink • Fisheries
	Chronic • Loss of genetic resource • Regulation of air quality, temperature, erosion and water • Recreation and ecotourism	• Increased operating costs • Reduced production capacity, resulting in reduced revenues • Reduced value of fixed assets	• Soil erosion costs European countries €1.25 billion in annual agricultural productivity loss and €155 million in gross domestic product (GDP) loss • In 2018 unsustainable tourism led to Maya Bay (Thailand) closing - losing the local economy £800,000 a month	• Agriculture • Food and drink • Real Estate • Tourism • Food and Drink

[33] Note this table highlights that the risk is present but doesn't comment on how effectively it is being managed.

[34] **Sustainability & Consumer Behaviour 2021 | Deloitte UK.**

Appendix 3: Key opportunities from biodiversity gain

Type	Opportunities	Potential Financial Improvements	Example	Sectors potentially benefiting
Physical	**Nature as a solution** • More efficient production • Reduced energy use • Reduced water purification costs • More productive workforce	• Reduced operating costs (such as efficiency gains and cost reductions) • Increased production capacity, resulting in increased revenues • Increased value of fixed assets (for example, highly rated buildings) • Benefits to workforce management and planning (for example, improved health and safety satisfaction)	• Opportunities in AgTech (for example. regenerative/ circular agriculture, vertical farming) • Trees and vegetation lower surface and air temperatures (by 11-25oC of peak temperature of the equivalent areas not shaded by vegetation), creating large energy and cost saving on air conditioning • Correlation between water treatment costs and forested land in catchments (that is, in heavily forested catchments treatment costs more than 68% less than in those with low tree cover) • Savings from better management of water, energy and materials which also reduce demands on natural systems	• Real estate • Forestry • Agriculture • Food and Drink • Personal products
Transition	**Products and services** • Development and/ or expansion of nature-positive goods and services • Nature based solutions • Development of new products or services through R&D and innovation • Ability to diversify business activities • Shift in consumer preferences	• Increase revenue through demand for products which consider biodiversity • Increased revenue through new solutions to adaption needs (such as nature-based solutions, or biodiversity offsets) • Better competitive position to reflect shifting consumer preferences, resulting in increased revenues	• A company producing an algae-based omega-3 oil. 1 tonne of this can replace traditional fish-based omega-3 oil which took 60 tonnes of wild caught fish to produce • Carbon credits from nature-based solutions may increase in value from around US$5/tCO2e today to around$50/ tCO_2e by 2040 • Opportunities for technology to monitor biodiversity and improve asset-level data via remote sensing/monitoring/ spatial technology • A company aiming to make cow's milk with no cows - using microorganisms – which recently raised a record US$13m in seed funding • Plant-based food sales in 2020 grew twice as fast in the US than overall food sales	• Food and Drink (companies offering plant-based products) • Real assets (in development of NBS and net positive developments) • Agriculture • Fisheries
	Markets • Access to new markets • Use of public-sector incentives	• Increased revenues through access to new and emerging markets (such as partnerships with governments, development banks) • Increased diversification of financial assets (including green bonds and infrastructure)	• There is an early-mover opportunity for asset-managers to provide scalable biodiversity-positive financial instruments (for example, green bonds, biodiversity-positive funds, debt-for-nature swaps) • A finance gap of US$598–US$824 billion per year is needed for broad action on biodiversity	• Financials • Infrastructure • Real estate

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