Climate adaptation

How private investors can support adaptation in nature and ecosystems

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Introduction

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In brief

- Nature is vital to our economy and society, both in terms of the natural resources that underpin economic productivity, and the regulating role of ecosystem services in mitigating and helping us adapt to climate change.
- Yet nature faces a multitude of threats, with climate change itself being one of the most important. These threats are compromising nature's ability to sustain the natural capital and ecosystem services on which our economy relies, putting investments at risk as a result.
- Helping nature adapt to these threats is therefore crucial. We look at investable climate adaptation solutions across natural resource-dependent industries, focusing on agriculture, food and beverages, forestry, pharmaceuticals and tourism, as well as exploring solutions that can help nature adapt in the face of rising global temperatures.

Nature is in a state of unprecedented decline. There has been an average 69% drop in species populations globally since 1970 according to the World Wildlife Fund's (WWF's) 2022 Living Planet Index.[1] At the same time, research by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) shows that the condition of natural ecosystems has declined by 47% on average relative to their earliest estimated states.[2] This degradation in natural systems is amplified and complicated by man-made climate change, which is one of five main drivers of nature and biodiversity loss.[3] With global temperatures expected to warm by at least 1.5°C-2.0°C by the end of this century, climate change will dramatically modify the size and quantity of habitats around the world, with severe consequences for species biodiversity and the world's ecosystems.

Climate-driven damage to ecosystems and the accelerating loss of biodiversity have far-reaching consequences for our economy and society. However, as we attempt to respond to these paired crises, it is critical to understand that even degraded natural systems can still adapt, meaning that they retain the ability to respond dynamically to changes in the environment, helping them to mitigate damage, create benefits and maintain their value.[4]

[1] Almond, R. E. A., Grooten, M., Juffe Bignoli, D., and Petersen, T. (Eds): "Living Planet Report 2022: Building a Nature-Positive Society", WWF (Gland, Switzerland, 2022).
[2] Brondizio, E. S., Settele, J., Diaz, S., and Ngo, H. T. (Eds): "Global Assessment Report on Biodiversity and Ecosystem Services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services", IPBES (IPBES Secretariat, Bonn, Germany, 2019).
[3] Other drivers of nature and biodiversity loss as identified by the IPBES are: land-use change; pollution; natural resource use and exploitation; and invasive species. https://www.ipbes.net/models-drivers-biodiversity-ecosystem-change
[4] United Nations Framework Convention on Climate Change, "Adaptation and Resilience". https://unfccc.int/topics/adaptation-and-resilience/the-big-picture/introduction

Introduction continued

Nature can adapt to climate change in many different ways. For example, wildlife populations may relocate in search of more optimal habitats, the timing of key natural processes such as pollination and migration can change, and key bio-physical features such as barrier islands and salt marshes can change their spatial footprint. An effective response to climate change requires impacted communities and economic actors to understand, preserve, and enhance the adaptive processes of natural systems.

Work has been done to quantify the financial value of nature's contribution to the global economy. Recent research by PwC found that 55% of the world's GDP – equivalent to USD 58 trillion – is exposed to material nature risk without immediate action.[5] Some industries, including the agriculture, forestry, and food and beverage industries, were assessed as 100% dependent on nature for the continued viability of their direct operations. The potential risks of nature loss to individual industries are worrying, but the economic impact on a global scale is even more striking.

World Bank analysis found that even a moderate level of collapse in ecosystem services, such as wild pollination, and the provision of food from marine fisheries and timber from native forests, could result in a decline in global GDP of USD 2.7 trillion by 2030.[6] And recent research suggests that a substantial 35% of the MSCI ACWI, equating to over USD 28 trillion in market capitalisation, is exposed to biodiversity risk in some way.[7]

Quite simply, without adaptive measures to reduce the exploitation of natural capital, slow climate change-related ecosystem decline and promote nature-based solutions for adaptation, these prospective losses could become reality.

[5] Evison, W., Ping Low, L., O'Brien, D. "Managing Nature Risks: From Understanding to Action", PwC Strategy + Business (19 April 2023).

[6] Johnson, J. A., Ruta, G., Baldos, U., Cervigni, R., Chonabayashi, S., Corong, E., Gavryliuk, O., Gerber, J., Hertel, T., Nootenboom, C., Polasky, S., Gerber, J., Polasky, S. "The Economic Case for Nature: A Global Earth-Economy Model to Assess Development Policy Pathways", © World Bank (Washington, DC, 2021).

[7] "Unmasking a $28 trillion Biodiversity Risk: A Deep Dive into our New Biodiversity Dataset", Impact Cubed (30 May 2023). https://www.impactcubed.com/unmasking-a-28-trillion-biodiversity-risk-a-deep-dive-into-our-new-biodiversity-dataset/

Why is nature important for climate adaptation and how should we think about it?

There is insufficient awareness of the risks that nature faces from climate change and how it can adapt to these risks. The importance of nature and the need for climate adaptation in natural systems might be viewed from two different angles: adaptation *for* nature and adaptation *by* nature.

1) Adaptation for nature

Our economy is dependent on nature for the natural capital that it provides. Examples of natural capital assets are the atmosphere, habitats, land and ocean geomorphology, minerals, soils and sediments, and species. Every industry is dependent to some degree on natural capital, although this dependence is far greater for some than for others – for example, the pharmaceutical industry relies on nature's genetic resources to fuel drug discovery and innovation.

Nature also provides ecosystem services, which are derived from natural capital (displayed in **Exhibit 1**). Ecosystem services can be split into provisioning, regulating, maintenance and cultural services. Examples include the provision of direct physical inputs, such as fibres and genetic materials, as well as pollination, natural flood and storm protection, and maintenance of soil and water quality, among many others.

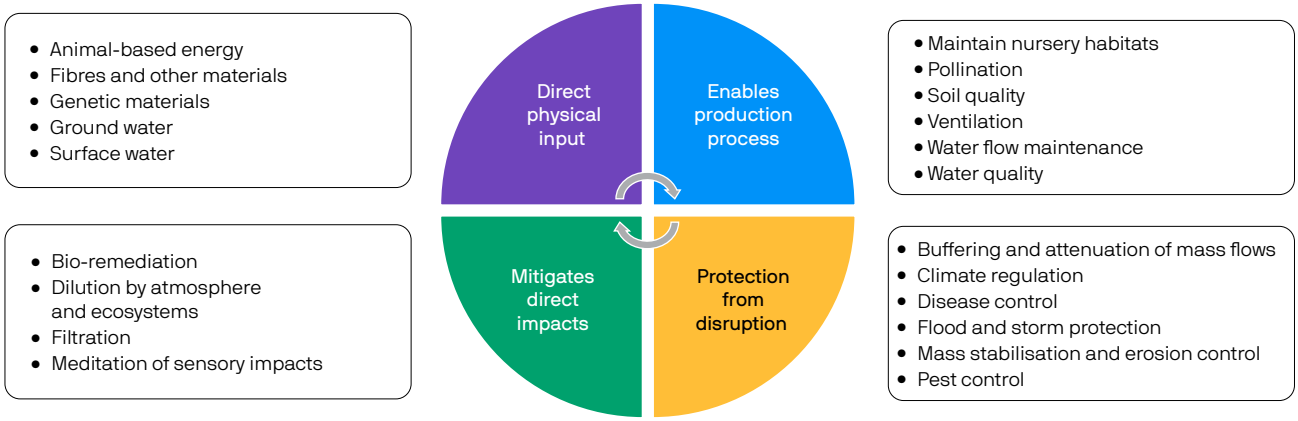
Because of this dependency by industry on nature, measures that facilitate **adaptation *for* nature** are needed to preserve the assets that underpin our economy. Protecting natural capital assets, often via technological interventions that help businesses to reduce natural resource inputs and better monitor risks to the natural assets they have, should be one area of focus for investors interested in allocating capital towards nature adaptation solutions. Ultimately, there is an unavoidable tension between *drawing* on nature for its natural capital assets, and *depending* on nature for its provisioning, regulating, maintenance and cultural services.[8] Effective nature adaptation needs to try to find ways of resolving this imbalanced relationship.

2) Adaptation by nature

Adaptation *by* nature means utilising natural capital and ecosystem services, such as flood and storm protection, or pest and disease control, to help protect communities and maintain economic productivity in the face of climate-related disruption. However, natural capital and ecosystem services face climate risks that threaten their ability to perform this protective role. As the United Nations Environment Programme (UNEP)'s 2020 Adaptation Gap Report notes, "many ecosystems that play a critical role in nature-based approaches to adaptation are themselves highly vulnerable to climate change."[9]

Identifying ecosystem services and natural capital that facilitate climate adaptation should therefore be a key point of focus for investors, not just for the sake of the resources that allow industries to remain viable, but also for the adaptation services that intact natural systems can provide – often via nature-based solutions such as mangrove restoration to protect against coastal hazards.

Exhibit 1: Ecosystem services derived from natural capital



Source: ENCORE.

[8] Dasgupta, P. "The Economics of Biodiversity: The Dasgupta Review", HM Treasury (London, 2021).
[9] "Adaptation Gap Report 2020", United Nations Environment Programme (Nairobi, 2021).

What risks does nature face from climate change?

As climate change intensifies, nature will need to adapt to a range of both acute and chronic physical risks. Acute risks are specific events, such as floods, wildfires and hurricanes. High levels of acute risk translate to an increased frequency of environmental disturbances or disasters, which can be destructive to valuable natural capital assets. To mitigate acute risks to industries, nature-related adaptation can include technologies that enable measurement and rapid adaptive responses to those risks.

Chronic risks are slow changes resulting from rising temperatures, including desertification, aridification, ocean acidification, land and forest degradation, and glacial retreat, as well as the consequent loss of biodiversity. Chronic risks may be less visible, but they are no less potentially destructive. For example, a recent study showed evidence that Alpine river biodiversity is under severe threat from glacial retreat driven by rapid global warming.[10] Adaptation to chronic risks centres around maintaining access to resources for continued production, through technological or nature-based measures that preserve nature's adaptive capacity

The combination of acute and chronic climate risks could have dramatic impacts on natural capital and ecosystem services, and consequently on the many industries that nature supports. These impacts could be severe. For example, growing stress on the provision of water will inhibit the ability of many industries to operate effectively, with half of the world's urban population projected to be living in water scarce regions by 2050.[11] Many livelihoods are also wholly dependent on ecosystem services, such as pollination and pest control, putting economic security and wellbeing at risk when these services are compromised. Mid- and high-end climate scenarios project an increased risk of global extinctions as a result of global warming, which will have significant knock-on effects for ecosystems and natural capital stocks.

Importantly, investors need to be aware that natural capital is not fungible: many of its contributions are difficult or impossible to replace with alternatives – so the irreparable consequences of nature loss may permanently deprive us of opportunities.

[10] Wilkes, M. A., Carrivick, J. L., Castella, E. et al. "Glacier Retreat Reorganises River Habitats Leaving Refugia for Alpine Invertebrate Biodiversity Poorly Protected", Nature Ecology & Evolution 7 pp. 841-851 (2023). https://doi.org/10.1038/s41559-023-02061-5

[11] He, C., Liu, Z., Wu, J., et al. "Future global urban water scarcity and potential solutions", Nature Communications 12, 4667 (2021). https://doi.org/10.1038/s41467-021-25026-3

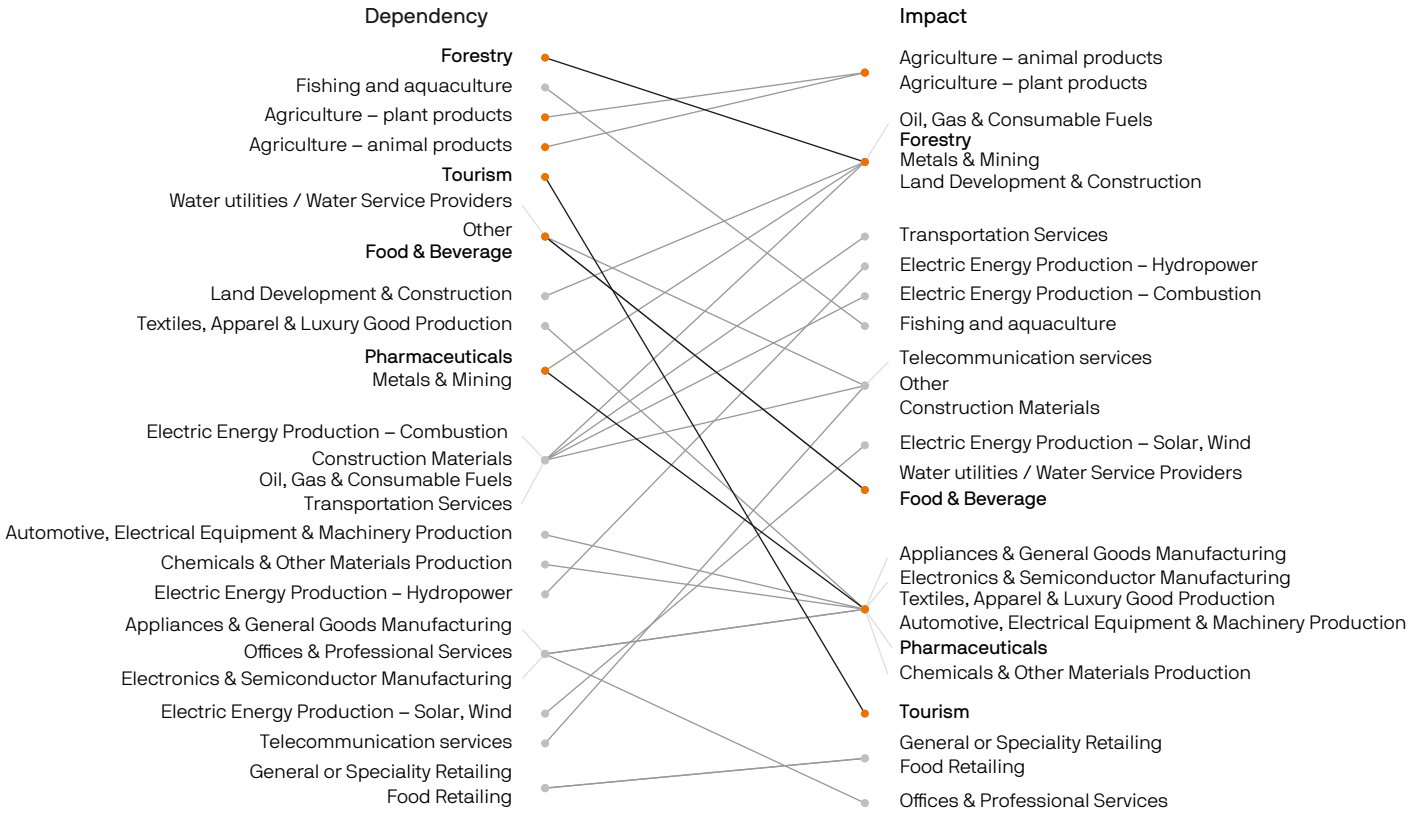
What are the consequences of not dealing with these risks?

Nature's products and services are needed by almost every industry across the globe, and all will need to take measures to adapt to its accelerating loss. To illustrate, we look at five industries with varying levels of dependence on nature, in both their direct operations and supply chains: agriculture and fisheries, food and beverage, forestry, pharmaceuticals, and tourism. These are also the industries where an increasing number of investable options for adaptation are to be found.

Agriculture and fisheries

The agriculture and fisheries industry is almost entirely dependent on nature. Given the need for agricultural production of economic essentials, such as food, fibres, fuels and raw materials, the potential economic impacts of failing to adapt to nature loss are significant. These impacts are further highlighted by the fact that agriculture, shown in **Exhibit 2** as two distinct industries — plant and animal agriculture — accounts for 4% of global GDP and 27% of global employment.[12]

Exhibit 2: Biodiversity risk filter sectors ranked by average impact and dependency on nature



Source: WWF Biodiversity Risk Filter.[13]

[12] The World Bank, "Understanding Poverty". https://www.worldbank.org/en/topic/agriculture/overview#:~:text=Agriculture%20is%20also%20crucial%20to,more%20than%2025%25%20of%20GDP

[13] Please note that for the sake of continuity the names of the following industries in the WWF Biodiversity Risk Filter have been modified: (1) "Hospitality Services" to "Tourism", (2) "Health Care, Pharmaceuticals and Biotechnology" to "Pharmaceuticals", (3) "Food & Beverage Production" to "Food & Beverage", and (4) "Paper & Forest Product Production" to "Forestry."

What are the consequences of not dealing with these risks? (continued)

The agricultural sector is vulnerable to various physical hazards. Drought, for example, is one of the leading causes of reduced productivity and yield, with the agricultural sector absorbing 82% of the total economic impact of drought.[14] Another example of the dependence of agriculture and fisheries on biodiversity is the effect of the global decline in pollinator populations. More than 75% of global food crop types rely on animal pollination; their loss puts at risk the production of crops with an annual market value of between USD 235 billion and USD 577 billion.[15] The fishing industry is at risk, too: ocean warming could reduce fish catches by 8% and fisheries revenue by 10% by 2050, affecting the livelihoods of up to 800 million people.[16] Adaptation measures are needed to ensure nature remains a viable basis for agricultural production even when faced with climate-related hazards.

Food and beverage

The food and beverage industry is wholly reliant on nature for its direct inputs. In addition to the question of food production, which is also central to the agricultural industry, the entire food supply chain faces risks from climate change that will require efforts at adaptation. Recent analysis by FAIRR, an investor network focused on environmental, social and governance risks in the global food sector, found that a third of the world's 40 largest livestock producers could lose around USD 24 billion by the end of this decade should global temperatures rise more than 2°C above pre-industrial levels.[17] This amount is the equivalent of cost increases of over 30% by 2030. Rising feed costs resulting from heat stress-induced lower crop availability were a major contributor to this increase. Additional new research suggests that major food-producing regions could face climate risks sooner than previously anticipated, with substantial shifts in global yields for crops such as rice, maize and soybean set to occur within the next 20 years.[18]

Against this challenging backdrop, the food and beverage industry faces the task of raising output to cope with a rising global population, while minimising the impacts on nature. Achieving this delicate balancing act entails collaboration with specialist agricultural equipment companies, environmental scientists, and investments in processes, products and practices to ensure farm-to-fork reform.

Capital markets provide investors with an opportunity to help the food and beverage industry address this challenge through adaptation for nature. Climate resilient agriculture solutions include the application of precision agriculture techniques in farming that minimise the use of water and the application of fertilisers while improving crop yields. Farm equipment companies, such as John Deere and CNH, have adopted these software and data intensive techniques in large scale farms in the US and Brazil.

Complementary investment opportunities include companies such as Topcon and Trimble, which provide digital data and mapping solutions for farmers facing water stress from drought and floods. Similarly, irrigation solution provider Valmont Industries uses sensors and data to irrigate fields in a timely, calibrated manner to save water and boost yields. Moving further along the value chain, circular solutions in plastic-free packaging for safer storage and transport of food and beverages that minimises food loss are provided by companies such as Sig Group and Graphic Packaging.

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[14] Carlin, D., Arshad, M., Baker, k., "Climate Risks in the Agriculture Sector", United Nations Environment Programme Finance Initiative (March 2023). https://www.unepfi.org/wordpress/wp-content/uploads/2023/03/Agriculture-Sector-Risks-Briefing.pdf

[15] "New Nature Economy: Asia's Next Wave", Temasek in collaboration with the World Economic Forum and AlphaBeta (2021).

[16] Woetzel, J., Pinner, D., Samandari, H., Engel, H., Krishnan, M., Kampel, C., von der Leyen, J., "Reduced dividends on natural capital? Case Study", McKinsey Global Institute (June 2020).

[17] FAIRR Coller Report.

[18] Jagermeyr, J., et al., "Climate Impacts on Global Agriculture Emerge Earlier in New Generation of Climate and Crop Models", Nature Food 2(11) pp. 1-13 (2021).

What are the consequences of not dealing with these risks? (continued)

Case study: Ethiopia's coffee industry

Ethiopia is the birthplace of coffee and retains a prominent place in the global market. The country now accounts for 4% of the world's coffee supply, making it the largest coffee producer in Africa and the fifth largest in a global industry worth about USD 31 billion per year.[19] The coffee industry accounts for around a third of Ethiopia's export earnings and provides income for about 15 million people, most of them smallholder farmers. The ability of these coffee farmers to produce a consistent and reliable supply is therefore important to the Ethiopian economy and the global coffee value chain alike.

Research by the Royal Botanic Gardens at Kew suggests that up to 60% of the land used to grow coffee in Ethiopia could be unsuitable by the end of the century, creating substantial uncertainty over future return and risk. Yet many participants in Ethiopia's coffee industry do not have the resources to cope with climate change, or are discouraged from making investments in adaptation measures (such as improved seeds and fertilisers) by the increasing frequency of losing crops to drought and other climate hazards.[20]

One study has suggested that the most important enabler of adaptation is accurate, localised climate information, which can enable farmers to take genuinely effective adaptation actions, such as changing crop planting dates and crop types, or planning soil and water conservation. Other climate services can include alert systems, surveillance, and agricultural and crop insurance, as well as more advanced solutions involving artificial intelligence. However, less than 6% of interventions targeting Ethiopia's coffee value chain promote climate adaptation through the provision of climate services to inform decision-making at the coffee farm level.[21] This lack of action suggests there is a blind spot in adaptation planning – which can also be an opportunity for private investors to support innovative solutions. Investing in publicly listed food and beverage companies that are taking action in this area, as well as engaging with investee companies to encourage more targeted adaptation financing towards their smallholder partners, can help coffee farmers adapt to climate risk and maintain long-term productivity.

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[19] Carbon Brief Commodity Profile: Coffee. https://interactive.carbonbrief.org/commodity-profile-coffee/

[20] "Kew Scientists Reveal that 60% of Wild Coffee Species are Threatened with Extinction, Causing Concern for the Future of Coffee Production", Kew Royal Botanic Gardens (16 January 2019). https://www.kew.org/about-us/press-media/kew-scientists-reveal-that-60-of-wild-coffee

[21] Ventocilla, M. et al., "Brewing Resilience for Ethiopia's Smallholder Coffee Farmers: A Closer Look at Ethiopia's Coffee Sector to Help Address Climate Information Gaps", CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) Info Note (November 2020).

What are the consequences of not dealing with these risks? (continued)

Forestry

Forest economies support more than 45 million direct and indirect jobs globally and make a total contribution of more than USD 1.3 trillion to the world economy. The global timber industry alone employs 13.2 million people and is worth approximately USD 600 billion per year.[22] Aside from timber and fuel production, the wide range of ecosystem services supplied by forests includes non-timber forest products, wildlife habitats, soil and water protection, biodiversity conservation, tourism and recreation, and medicinal plants. Another increasingly commercialised economic service is carbon sequestration: forests account for 45% of terrestrial carbon storage, making them vital from the two perspectives of adaptation for nature and adaptation by nature.

However, climate change is having a negative impact on forests. More frequent extreme weather and climate events, such as storms and droughts, can impact commercial forestry production via reduced access to forestland, increased costs for road and facility maintenance, and damaged tree stocks. Climate change also drives changes in the distribution of insects and pathogens, exposing trees to locally novel diseases and pestilent species.[23]

Adaptation in the context of sustainable forestry relies above all on maintaining healthy, productive, and biodiverse forests. The focus of sustainably managed forests is to enhance a forest's ability to mitigate climate risks while providing renewable wood products, biologically diverse habitats, carbon sinks, recreational areas, and clean water and air.

Case study: Campbell Global[24]

Campbell Global manages all its timberland assets (1.7 million acres/0.7 million hectares) in compliance with sustainable forestry certifications. To monitor the health of its forests, the company leverages several technologies: LiDAR (light detection and ranging) and drones are used to remotely measure trees and assess tree health across large landscapes, while satellite data and predictive models are used to analyse the potential risk and impact of wildfires in certain areas.

Campbell Global takes a systems-based approach to forestry management, which recognises that progress in one element could either undermine or enhance progress in another. Therefore, human intervention in the form of forestry management, while aimed at maximising economic return, is done holistically with respect for nature's own processes. Forests have evolved over millions of years to function as efficiently as possible. One adaptation-friendly practice that Campbell Global uses is improved forestry management (IFM). IFM focuses on maximising carbon stocks within forests while reducing emissions from forestry activities. The strategy encompasses everything from planting of appropriate tree species to providing forests with the best chance of survival, by thinning to maximise tree growth, managing competing vegetation, or considering location-specific physical risks when assessing potential future property acquisitions.

In addition, since the maturity of a tree impacts the composition of species occurring around it, IFM activities are dispersed across a region in order to maintain diverse and safe species habitats. It is equally vital to establish buffer zones alongside waterways to prevent erosion, runoff and landslides. Further benefits to the adaptative capacity of forest ecosystems may also be achieved via climate-smart forestry practices, which aim to optimise the density of trees and reduce risks from pests or wildfire.

[22] Lippe, R.S., Schweinle, J., Cui, S., Gurbuzer, Y., Katajamäki, W., Villarreal-Fuentes, M. & Walter, S. "Contribution of the Forest Sector to Total Employment in National Economies: Estimating the Number of People employed in the Forest Sector", Food and Agriculture Organization of the United Nations and International Labor Organization (Rome and Geneva, 2022). https://doi.org/10.4060/cc2438e

[23] Kirilenko, A. and Sedjo, R., "Climate Change Impacts on Forestry", Easterling, W. (ed.). PNAS vol. 104 no. 50 19697-19702 (December 2007).

[24] Campbell Global (CG) is a 100% owned affiliate of JPMorgan Chase & Co. that sits within the JPMorgan Asset Management (JPMAM) division. JPMorgan Chase is a publicly traded corporation listed on the New York, London, and Tokyo Stock Exchanges (Ticker: JPM). This organizational change occurred on August 31, 2021, when BrightSphere Investment Group, CG's former parent company, and certain CG executives sold all of the equity ownership of CG to JPMorgan Chase & Co. As noted above, CG is now a 100% owned JPMorgan Chase & Co. affiliate.

What are the consequences of not dealing with these risks? (continued)

Pharmaceuticals

The pharmaceutical industry's dependence on nature is often overlooked, largely due to the little-discussed link between biodiversity and biomedical discovery. It is estimated that 70% of drugs used to treat cancer are either natural, or synthetic but inspired by nature. In the marine environment, there could be up to USD 5.69 trillion in cancer medicines awaiting discovery.[25] Meanwhile, the value of global trade in plants used for medicinal purposes may exceed USD 2.5 billion.[26] However, only a fraction of an estimated 400,000 plant species worldwide has been studied for pharmacological potential. Adaptation, through both technological and conservation strategies, is crucial to enable the maintenance of this important library of species for its pharmaceutical potential.

Tourism

Research from the World Travel and Tourism Council has found that over 80% of goods and services in the tourism industry are highly dependent on nature, and that over half of demand for the industry is driven by the desire to explore nature.[27] Tourism generates revenue in many ways, centred around many different types of ecosystems; the Great Barrier Reef alone, for example, supports a USD 5 billion per year tourism industry.

Moreover, many tourism operators have a limited ability to move operations in response to changing climate conditions and must adapt in place to climate driven changes to natural systems.

Approximately 50% of medicines approved by the US Food and Drug Administration are directly or indirectly derived from natural products, with application across major disease categories. One of the best-selling cholesterol lowering drugs, with more than USD 100 billion in sales globally, was developed from a compound produced by the fungus Penicilium citrinum. A key unmet pharmaceutical need is novel treatments for obesity, as seen by patient demand for a recently approved drug developed by Novo Nordisk, which mimics a hormone called glucagon-like-peptide1 (GLP-1). The medicine was developed after the investigation of the composition and activity of venom from the Gila monster, a species of venomous lizard. When considering the development of new medicines it is clear that the pharmaceutical industry requires a full tool-kit to identify novel mechanisms and targets. We fully expect the natural world to contribute to those efforts.

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[25] Erwin, P., Lopez-Legentil, S., Schuhmann, P., "The Pharmaceutical Value of Marine Biodiversity for Anti-Cancer Drug Discovery", Ecological Economics vol. 70, Issue 2 pp. 445-451 (2010). https://doi.org/10.1016/j.ecolecon.2010.09.030.

[26] Romanelli, C., Cooper, D., Campbell-Lendrum, D., Maiero, M., Karesh, W., Hunter, D., Golden, C., et al., "Connecting Global Priorities: Biodiversity and Human Health. A State of Knowledge Review", World Health Organization, Secretariat of the Convention on Biological Diversity, United Nations Environment Programme (2015).

[27] Imbsen, C., Turner, D., Usher, H., "Nature Positive Travel and Tourism: Travelling in Harmony with Nature", Valentin, B., Royds, L-T., Mitcham, J., Jay, D. (eds.), World Travel & Tourism Council (September 2022).

What are the consequences of not dealing with these risks? (continued)

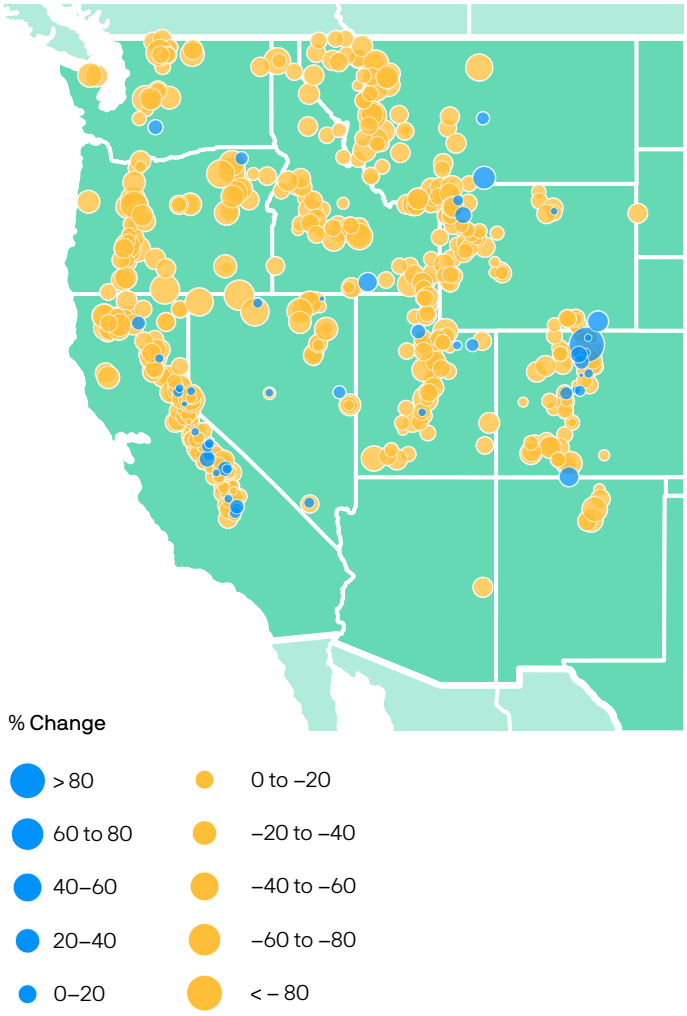
Case study: Ski tourism

Winter tourism is an economically important subset of the tourism industry, contributing significantly to the economies of the regions where it is located and to national economies as a whole. For example, winter tourism contributes around 1% of Swiss GDP, rising to more than 10% for certain Swiss mountain regions.[28]

Climate change poses serious challenges to winter tourism, given the industry's heavy reliance on natural amenities, such as scenery and snow cover. Studies have demonstrated a direct relationship between snow depth and ski area profitability. Unfortunately, both snow depth and the extent of snow coverage in Alpine areas are in decline, creating profound challenges for companies operating ski and snow tourism businesses. **Exhibit 3** shows the change in April snowpack, a key measure of long-term snowpack trends, in another globally significant mountain tourism area— the western United States. The impacts are dramatic and region-wide, illustrating the broad-based impact of climate change.

Declining lift ticket sales and equipment rentals would not be the only potential sources of lost revenues to ski tourism-dependent economies from climate change. Transportation, hotels, shopping and entertainment would also likely suffer losses, affecting resort profitability, local economies and real estate values unless tourism from snow sports is augmented.

Exhibit 3: % change in April snowpack in Northwestern United States, 1955-2022



Source: USDA Natural Resources Conservation Service/EPA.

[28] "The Importance of White Gold to the Alpine Economy", SWI swissinfo.ch, (18 December 2020). https://www.swissinfo.ch/eng/business/the-importance-of--white-gold--to-the-alpine-economy/46233650

Investable solutions for climate adaptation

An overview of potential solutions for adapting nature and nature-dependent industries to climate change is laid out in **Exhibit 4**. This list is not exhaustive; since nature is relevant to almost every industry, any list can only demonstrate the scope of the opportunity and how varied adaptation solutions can be. There are many interlinkages between categories, with solutions to help one industry adapt often having benefits for other industries. And measures to make ecosystems more adaptable (adaptation for nature) also make them better at providing adaptation, as well as offering additional mitigation benefits (adaptation by nature).

Exhibit 4: Adaptation solutions across industries

Industry	Adaptation solutions
Agriculture and fisheries	Regenerative agriculture, including, soil regeneration, cover crops or natural weed suppression
	Agroecological approaches
	Optimal-intensity grazing
	Precision fermentation
	Vertical farming
	Precision agriculture
	Drip-fed precision irrigation or solar-powered irrigation
	Crop diversification
	Using already degraded land to avoid further land conversion
	Accessible crop insurance against extreme weather conditions
	Research into plant disease prevention, for example via beneficial plant bacteria
	Standardised farm datasets and artificial intelligence-powered digital platforms, for example crop and soil-specific analysis reports to monitor crop performance, stress and nutrition
	Improved climate information, for example via localised, commodity-specific climate forecasts
	Improved crop storage
	Ocean-based data collection through autonomous surface vehicles
	Remote-sensing satellites to collect geospatial data
	Improved monitoring of water quality and availability
	Advanced synthetic biology, for example products such as bio-based fertilisers and peptide-powered insecticides for crop growth
	Modifications to cell chemistry allowing plants to grow with fewer input resources
	Sustainable aquaculture and management of wild fisheries
	Offshore aquaculture
	Using eDNA sampling to enable better management of fisheries

Investable solutions for climate adaptation continued

Industry	Adaptation solutions
Food and beverage	Circular models of packaging
	Biodegradable / reusable soft packaging
	Climate information services to enable strategic decision-making
	Sustainable management of water systems
	Improved seeds and fertilisers
	Drought-resistant crops
	Improved livestock breeds that better tolerate warmer conditions
	Alternative proteins to reduce reliance on livestock
	Diversified geographic exposure
	Expanding use of refrigeration in food supply chains
	Mobile-first food marketplaces to reduce landfill waste
	Enhanced digital connectivity, for example instant access to contracts, prepaid commodity balances and market information
	Fully traceable / shortened supply chains to reduce waste and monitor climate risks
	Certified sustainable foods
	Container farming technology enabling on-site food production anywhere (hydroponic growing systems)
	Improved waste management solutions, for example “B2C” (business-to-consumer) marketplaces for surplus food
	Autonomous beehives intended to increase yield, reduce colony loss and eliminate use of chemical pesticides
	Precision pollination
Forestry	Sustainable sourcing of deforestation-free forest products
	Reduced impact logging practices
	Altering forest structure to reduce severity of wildfires
	Sustainable grazing
	Reforestation and afforestation
	Agroforestry
	Cloud-based planning and monitoring tools for adaptive land-management
	“IoT” (internet of things)-enabled remote sensors leveraging AI to detect, evaluate and signal wildfire activity
	Reduce forest product consumption
	Drone-based LiDAR (light detection and ranging) to analyse forest health
	Historical satellite data to assess wildfire risk

Investable solutions for climate adaptation continued

Industry	Adaptation solutions
Pharmaceuticals	Synthetic biology
	Biobanking (using cryopreservation techniques to preserve living samples, providing a snapshot of biodiversity at the point in time when the sample was collected)
	Maintaining species genetic diversity
	Measures to keep ecosystems intact to preserve genetic resources, for example targeted investment in conservation
	Reduced production of active pharmaceutical ingredients (APIs)
	Biological designer devices
Tourism	Diversification (four-season tourism, gastronomy tourism, rural tourism, wellness tourism, community-based tourism, spiritual tourism)[29]
	Designated protected areas for nature-based tourism
	Snow-independent alternatives in winter season
	Technical solutions, for example snowmaking
	Dynamic pricing strategies, for example weather-dependent ticket prices
	Quality climate forecasts and information on potential climate change impacts
	Eco-tourism – can be coupled with awareness raising programmes and ecosystem preservation
	Genetically engineered corals to resist rising temperatures
	Resilient tourism infrastructure, for example hotels constructed to be resistant to climate impacts

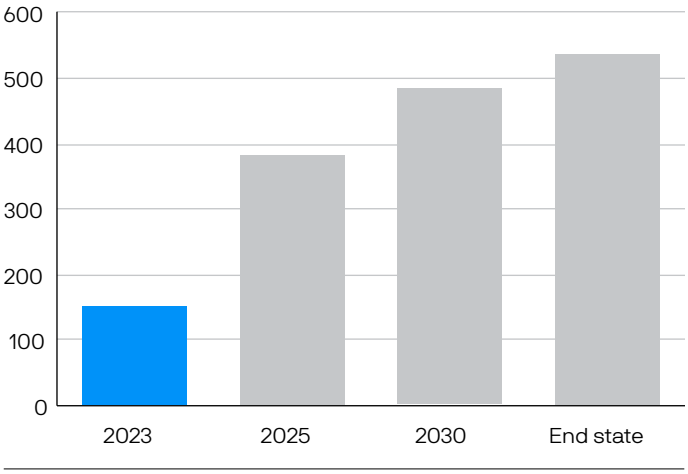
Source: J.P. Morgan Asset Management.

[29] Romeo, R., Russo, L., Parisi, F., Notarianni, M., Manuelli, S., Carvao, S., "Mountain Tourism – Towards a More Sustainable Path", United Nations World Tourism Organization (Rome, December 2021). https://doi.org/10.4060/cb7884en.

How can investors access nature adaptation solutions?

The need for an increased focus on nature adaptation is shown by the current nature financing gap. The UNEP's 2022 State of Finance for Nature Report identifies a total USD 4.1 trillion funding gap between the current level of financing and the level required to halt biodiversity loss. UNEP's assessment suggests that finance for nature needs to eventually reach over USD 536 billion per year to be sufficient, with a good portion of this being targeted to adaptation.[30] But financing flows to nature currently stand at around USD 154 billion per year, less than half of the USD 384 billion needed by 2025 and only a third of the USD 484 billion needed by 2030 (**Exhibit 5**).

Exhibit 5: Annual requirements for nature financing by 2050



Source: United Nations Environment Programme.

So far, private sector finance has been conspicuously absent from the space, with 86% of funding coming from government budgets according to the UNEP's report. For private sector involvement to become viable, there is a need to identify and raise awareness of the emerging range of adaptation solutions, and scale innovations to enable participation.

Investors can relatively easily direct capital towards measures that facilitate adaptation for nature by investing in the equity and debt of public and private companies providing or utilising these adaptation solutions. Bonds may be specifically labelled as green or resilience-focused, while investors can also access more specialised funds focusing on, for example, circular economy solutions for minimising resource extraction. These solutions in turn should result in healthier and more resilient ecosystems, which are more effective at providing adaptation services (adaptation by nature).

Investing specifically in adaptation by nature via nature-based solutions can require more complex and innovative structuring in order to generate a return. But the potential value to investors should not be in doubt: the World Economic Forum suggests that the economic benefits of protecting at least 30% of the world's land and oceans outweighs the costs by a ratio of at least five to one.[31] Marine Protected Areas (MPAs), for example, can be an investable mechanism for achieving this objective. These are areas of the oceans where limits are placed on human activity; however, many MPAs still allow for low impact but economically productive and monetisable activities, such as recreational activities and carefully regulated fishing.[32]

The challenge for investors is identifying opportunities that offer both adaptation benefits and financial return. Fortunately, mechanisms and instruments are emerging that will allow investors to take advantage of the opportunities in this space. A 2021 analysis of the nature-based solutions market found that many of the opportunities identified had attractive investment characteristics, providing non-correlated and often inflation-proofed return profiles through asset-backed activities.[33] The same analysis also noted that nature-based solutions typically require active management and specialist management teams. The primary investment instruments for accessing nature-based solutions span public, private and blended finance investments, as well as across asset classes.

[30] "State of Finance for Nature. Time to Act: Doubling Investment by 2025 and Eliminating Nature-Negative Finance Flows", United Nations Environment Programme (Nairobi, 2022). https:// wedocs.unep.org/20.500.11822/41333

[31] "Scaling Investments in Nature: The Next Critical Frontier for Private Sector Leadership", World Economic Forum (February 2022).

[32] "Mitigating Climate Change Through Coastal Conservation", The Blue Carbon Initiative. https://www.thebluecarboninitiative.org.

[33] "A Market Review of Nature-Based Solutions: An Emerging Institutional Asset Class", Finance Earth, commissioned by the Green Purposes Company (2021).

How can investors access nature adaptation solutions? continued

Sovereign debt, for example, offers attractive opportunities to invest in nature adaptation. There has been a resurgence of debt-for-nature swaps, often in the form of blue bonds, which are growing in popularity as an instrument to protect ocean and coastal ecosystems. These instruments represented less than 0.5% of the sustainable debt market in 2021, but transactions grew at a 92% compound annual growth rate between 2018 and 2022.[34] In 2021, the Nature Conservancy, a non-profit organisation focused on advancing conservation, worked with the government of Belize to structure and issue a catalytic blue bond focused on ocean conservation, fisheries management reform, and blue carbon. The instrument was de-risked by a development bank partner, making the offering attractive to private sector investors.[35] Such bonds may not always require complex and concessional structuring, but could move to an increasingly commercialised and scalable model. Debt- for-nature-swaps are not limited to ocean conservation, with many past examples being used to conserve terrestrial ecosystems.

Other public market options include specialised equity funds and corporate or commercial bonds. Traditional corporate bonds might be used by, for example, water utility companies to raise investment for delivering water security solutions, including nature-based solutions. In the alternatives space, meanwhile, we may see companies beginning to use nature credit markets, which trade credits representing – for example – areas of restored land or conserved species, along the same model as carbon markets, to monetise conservation. However, these markets are still at very early stages of development.[36] Companies can also produce a financial return through nature-based solutions, generally via the sale of commodities or linked services. These solutions can be accessed via investment in alternative assets, such as sustainable forestry companies that produce a return from timber sales at the same time as maintaining a healthy forest environment to support continued biodiversity.

[34] Bosmans, P., de Mariz, F., "The Blue Bond Market: A Catalyst for Ocean and Water Financing", Journal of Risk and Financial Management 16, no. 3, 184 (2023). https://doi.org/10.3390/jrfm16030184.

[35] "The Government of Belize Partners With The Nature Conservancy to Conserve 30% of its Ocean Through Debt Conversion", The Nature Conservancy (Arlington, Virginia, 5 November 2021). https://www.nature.org/en-us/newsroom/blue-bonds-belize-conserve-thirty-percent-of-ocean-through-debt-conversion/

[36] "Biodiversity Credit Markets: The role of law, regulation and policy", Pollination (April 2023). https://pollinationgroup.com/global-perspectives/biodiversity-credit-markets-the-role-of-law-regulation-and-policy/

Conclusion

The foundational role of nature in sustaining the global economy is gaining increasing recognition, as are the systemic challenges posed by climate change. However, there is still insufficient discussion of the measures that must be taken to facilitate the adaptation of natural systems, and the industries that depend on them, to climate change.

Investors need to understand the scale and scope of nature's economic contribution, the wide-ranging nature dependencies of key industries, and the various ways in which nature-related adaptation can be effective. They should also be aware of the significant nature financing gap, particularly in relation to adaptation, and the emerging mechanisms for overcoming barriers to investment in nature adaptation.

The increasing extent of solutions to help preserve the adaptive capacity of natural capital and ecosystem services means investors can direct capital to benefit from opportunities across sectors and regions, while helping to enable essential adaptation for and by nature in the process.

For more information on our approach to Sustainable investing, contact your J.P. Morgan Asset Management representative.

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