For Investment Professionals only

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Pandemic: The inextricable link between human, animal and ecosystem health and the emergence of communicable disease

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Contents

The value of a fund's assets will go down as well as up. This will cause the value of your investment to fall as well as rise and you may get back less than you originally invested.

Introduction

This research analyses the extent of links between population growth, resource scarcity, unsustainable production and consumption models, climate change and the emergence of communicable diseases.

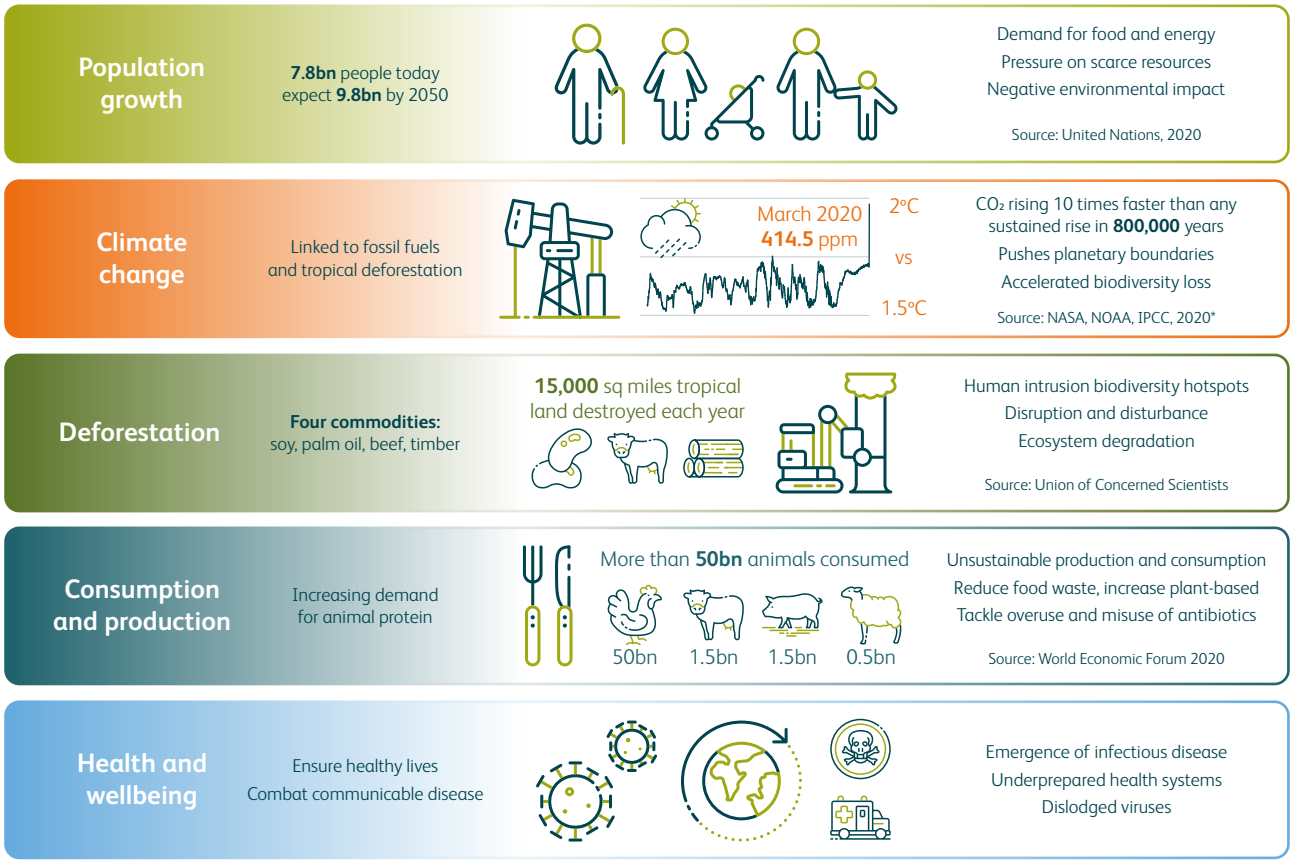
The COVID-19 pandemic continues its spread around the globe, devastating lives and impacting livelihoods, communities and businesses in an unprecedented and still-unfolding situation. It has stretched health systems to breaking point, and destabilised economies and financial markets at an extraordinary rate.

Countries around the world have rapidly shifted from indifference to imposing states of emergency as the crisis escalates and our grasp of its seriousness unfolds. Governments and central banks have rushed to deliver fiscal and monetary policy stimulus packages in an attempt to alleviate the potential adverse, long-term impact on the global economy.

Yet despite the catastrophic consequences, this crisis was not entirely unexpected. For years scientists have forewarned of the 'spillover' of viruses from animals into humans. Today we are experiencing the consequences of the inextricable link between human, animal and ecosystem health[1].

As M&G's head of responsible investment, my role is to broaden the company's knowledge of the global sustainability challenges facing our world and understand where these touch upon the investments we make. This paper is the output of extensive research I have undertaken drawing on scientific knowledge to deliver actionable, forward-looking insight.

Figure 1: The interconnected challenges facing the world today



Source: M&G, illustrative, April 2020.

Understanding these issues and the links between them is of huge significance to M&G as we manage savings and investments for our clients and customers to provide for the years and decades to come.

Investment management has taken huge strides forward in looking beyond the horizon of a company's financial statements when considering investing. Today, our goal is to possess a deep knowledge of the wider context in which a company operates, and demonstrate the academic rigour of our investment process augmenting the financial knowledge our experts already apply.

Utilising greater depth of knowledge of human and environmental influences on the planet holds immense potential to enhance our investment decisions and expand our ability to invest in solutions to the challenges we face.

As active investors, we direct capital flows towards companies and organisations that demonstrate resilience and offer long-term solutions. We seek to identify companies that evidence far-sightedness both in terms of climate change and understanding of the broad sustainability themes. As responsible investors, we can help encourage investee companies, pushing for the development of sustainable consumption and production models that are scalable and manageable for the long-term.

In the case of the current pandemic, as we work to adapt and manage the risk of the virus, mitigate the economic impact and heed scientific advice, we are also seeking to address questions that have arisen. How are population growth, increased demand for animal proteins, and an escalation in deforestation, linked to the subsequent deleterious impact on biodiversity – and have these facilitated the emergence of new communicable diseases? How has climate change affected and disturbed our ecosystems – and has it played a role in changing wild animal behaviours, forcing them out of their natural habitats and closer to a more urban, human population?

And how can we, as an investor, use the answers to make better investment decisions, which may address these challenges for the long-term future? This research endeavours to connect some of the dots.

Figure 2: The inextricable link between human, animal and ecosystem health

Source: M&G, illustrative, April 2020.

Anita McBain

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Anita has worked at Deutsche Bank, BNP Paribas and European Credit Management. She has lived and worked in Singapore, is a graduate of City University, holds an MBA from Edinburgh University and is a current student on the MSt in Sustainability Leadership at Cambridge University.

Chapter 1

Communicable diseases

Caused by viruses or bacteria, communicable diseases are spread from one individual to another by a variety of means, but most typically through contact with contaminated surfaces or bodily fluids.

Zoonotic diseases or zoonoses are those transmitted from animals to people (or vice versa) and which, more specifically, exist in animals but can infect humans. These viruses reside comfortably with their 'reservoir hosts' but when disturbed can jump from the animal host, sometimes through an intermediate 'amplifier host' and eventually, to highly abundant human hosts.

Since 1940, hundreds of microbial pathogens have either emerged or re-emerged into new geographies which had never been seen before. Some come from pets and livestock; most, more than two-thirds, originate in wildlife[2].

There are many serious examples. Between 1998 and 1999 the Nipah virus, identified in Malaysia, resulted in acute encephalitis[3]. Initially misdiagnosed as Japanese encephalitis, it became apparent that the virus was as deadly as the Ebola virus disease. The root of the infection was found to reside in a native fruit bat species.

Scientists eventually identified the link to humans. Deforestation in Malaysia, for oil palm conversion, had resulted in habitat loss and fragmented ecosystems. Native fruit bats, forced out of their natural habitat and facing ecosystem degradation, foraged further afield for food. The fruit bats, the reservoir hosts, identified fruit trees in close proximity to pig farms and through natural processes (defecation, urine and saliva) contaminated the underlying land where pigs rummaged for food.

The pigs, who developed a distinctive bark-like-cough, became amplifier hosts. They eventually passed the virus on to farmers and abattoir workers, abundant human hosts, resulting in further transmission and eventual outbreak.

The severe acute respiratory syndrome (SARS) epidemic that affected China in 2002 is now well-understood to be a zoonotic disease. In 2017, years after initially researching the epidemic, a team of epidemiologists discovered its origins in a cave in Yunnan province that was crowded with different species of horseshoe bats[4]. The researchers discovered the genomes of several different coronaviruses, and in these genetic codes, the 'building blocks' of the virus in the bats.

The rise of 'spillover' events

How the virus 'spilled over' from bats to humans remains uncertain today, but the researchers believe that the civet, a cat-like wild animal and a delicacy in some parts of China, played the role of intermediary, or amplifier host, spreading the virus on to highly abundant human hosts.

When 'spillover' events happen frequently enough, animal microbes adapt to human bodies and evolve into human pathogens – although most microbes live harmlessly in animals.

Of course, the consumption of wild animals is not the only route through which disease spreads from animals to people, nor are respiratory viruses, like the new coronavirus, the only diseases that we should be concerned about. Billions of people, particularly those who live in poverty, lack adequate sanitation, and are in close contact with infectious vectors – ie mosquitoes – and domestic animals. In addition, the illicit wildlife trade puts species together that would rarely, if ever, encounter each other in nature, allowing microbes to jump from one species to the next.

Not only does the illegal wildlife trade facilitate inappropriate mixing of species, it facilitates cross-border movements with zero certification or health checks, and inevitably subjects live trafficked individual animals to distress, which will exacerbate the shedding of viruses and bacteria. The international illegal wildlife trade is a disaster for public health, as the recent COVID-19 outbreak demonstrates.

The other major issue, which is subtly different, is the world's system of animal husbandry, food production, and food distribution and is linked to deadly microbes such as strains of E.coli[5]. Furthermore, the tons of excreta produced by livestock introduces yet more opportunities for animal microbes to spill over into human populations.

In addition, antibiotics have been used in livestock bred for human consumption for more than six decades. In Europe, antibiotics were originally given to animals to boost growth. Use of antibiotics for growth promotion was banned throughout the EU in 2006, but is still common practice in the US and a number of developing countries[6]. The current overuse and mis-use of antibiotics in animals bred for human consumption has been identified as a contributing factor to antimicrobial resistance identified by the World Health Organisation as an increasingly serious threat to global public health[7].

Encroachment on nature creates pathways for pathogens

Meanwhile, the destruction of forests, expanding towns and cities, and industrial activities create pathways for animal microbes to adapt to the human body. The destruction and degradation of biodiverse hotspots that disturbs fragile ecosystems is an encroaching threat, exacerbated by a changing climate and unsustainable consumption patterns. Combined, these can contribute to the risks of novel deadly microbes spilling over into human populations.

Speculation about which specific animal originally harboured a virus – a particular media focus – obscures a more fundamental source of our growing vulnerability to pandemics: the accelerating pace of habitat loss[8]. Globally, scientists believe habitat loss is associated with emerging infectious diseases and have proposed the idea that biodiversity conservation can protect humans from emerging communicable disease[9].

We cannot ignore the inextricable link between human, animal and ecosystem health and the unsustainable consumption and production of animal proteins, which is expected to increase as the world's population expands.

Chapter 2

Population growth

Present day calculations estimate that there are currently 7.8 billion people alive today with a median age of 30.9 years, 56.2% of whom live in urban communities[10]. The United Nations predicts that the current population is expected to reach 9.8 billion by 2050, and 11.2 billion by 2100[11]. With roughly 83 million people being added to the world's population every year, the upward trend in population is expected to continue.

In addition, lifespans are increasing, creating an ageing population that is expected to have a profound effect on societies, underscoring fiscal and political pressures that the health care, old-age pension and social protection systems of many countries are likely to face.

With an extra two billion people expected on the planet over the next 30 years, addressing issues related to food scarcity and sustainable food production will play a critical role in alleviating poverty to ensure that we end hunger, improve nutrition and strengthen our capacity to respond to climate change.

Unsustainable consumption and production: overusing finite resources

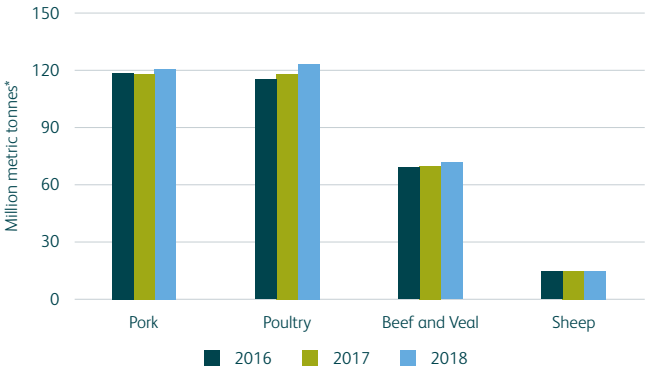
With a rapidly growing global population, demand for goods and services will continue to rise and necessary action will be required to ensure that current material needs do not result in the over-extraction and degradation of environmental resources[12]. There is an urgent need for policies to improve resource efficiency and mainstream sustainability practices across all sectors of the global economy.

The increased demands placed on our natural capital have resulted in an undue burden on environmental resources. More specifically, we eat more meat per person than ever before. In the past 50 years the number of people on the planet has doubled, but the amount of meat we eat has tripled – this is an unsustainable pattern of consumption.

In an average year, according to recent estimates, billions of animals are slaughtered: 50 billion chickens (excludes male chicks and unproductive hens killed in egg production); nearly 1.5 billion pigs, a number that has tripled in the last 50 years in light of growing appetite for pork products; 1.5 billion cows and 500 million sheep.

This demand for animal proteins and animal-based foods – which are more resource intensive and more environmentally impactful than plant-based foods – is expected to continue[13]. Demand is expected to increase to about double the present consumption by 2050, driven by population growth and emerging middle classes in developing countries.

Figure 3: Global livestock consumption per year



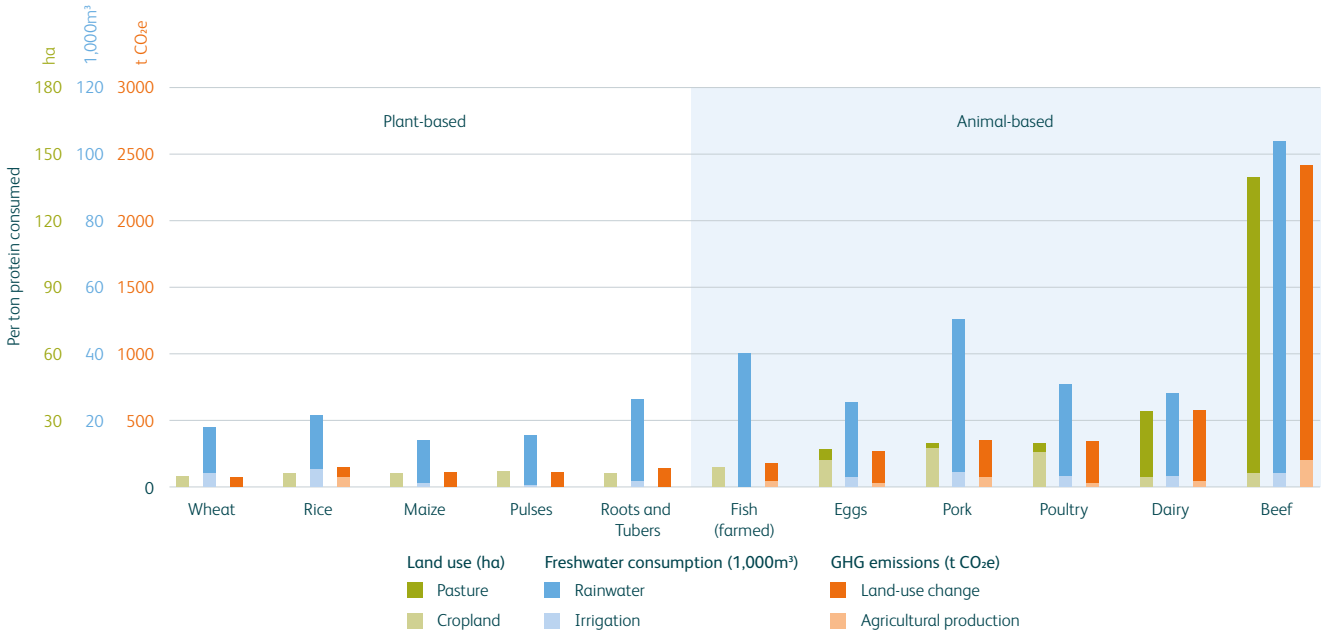
Source: UN Food and Agriculture Organisation 2017; OECD-FAO Agricultural Outlook 2018-2027.

2018 data is projected. *Projection. Carcass weight equivalent (cwe). Figures were rounded to provide a better understanding of the statistic. Figures from 2016 are taken from previous report.

Counting the environmental impact

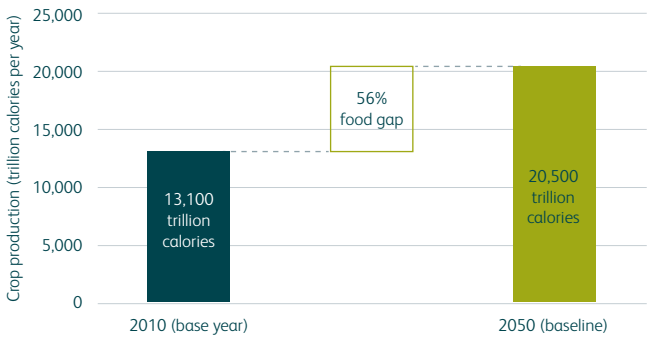
The environmental cost of our growing appetite for meat is considerable. In 2017, the percentage contribution of agriculture to world CO_2e emissions from all human activities was 20%. This included a contribution of 11% from crop and livestock activities and an additional 9% from related land use. The largest contributor to world total CO_2e emissions was the energy sector, which emitted two-thirds of the total, due to the burning of fossil fuels for power and energy generation[14].

Figure 4: Resource intensity of animal and plant proteins



Source: World Resources Institute, December 2018.

Figure 5: The world food gap: calories required by 2050



Source: World Resources Institute, December 2018.

But why such a focus on animal protein? This is because the World Resources Institute (WRI) estimates that the world's food gap – the increase above the amount of food produced in 2010, the base year, to the amount the world will require in 2050, based on projected demand – is 56%, driven by population growth[15].

Yet as consumption of meat intensifies, the amount of animal proteins demanded is anticipated to grow by 68% from the 2010 base year.

This increasing demand is expected to place undue pressure on the Earth's natural resources, contributing to rising climate change resulting in biodiversity loss and ecosystem degradation.

Chapter 3

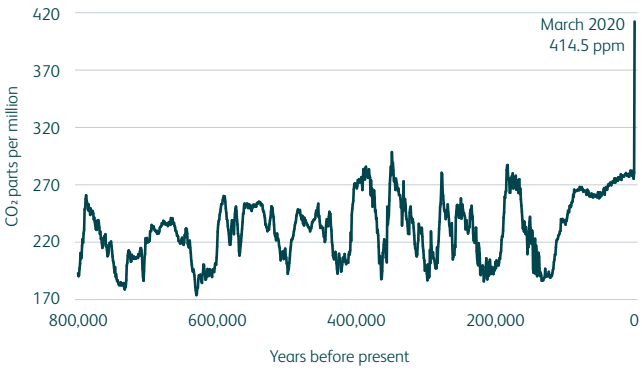
Climate change and biodiversity loss

Climate change presents immediate and material systemic risks to the long-term environmental health of the planet, the financial stability of the global economy, and ultimately the cohesive functioning of society. The loss of global biodiversity is accelerating, moving us closer towards unknown and irreversible changes to the Earth's intact ecosystems.

Scientific evidence suggests that the climate is changing faster than at almost any point in history and the increase of CO_2 in the Earth's atmosphere can be largely attributed to human activity, particularly the burning of fossil fuels, but also tropical deforestation from land-use change and intensive agricultural practices for key forest commodities such as palm oil, soy, timber and beef.

This current period of warming, resulting in more frequent and extreme weather events, has shifted the world out of the Holocene into a new geological era often termed the Anthropocene[a].

Figure 6: Rise in atmospheric carbon dioxide level in the past 800,000 years



Source: M&G, National Oceanic and Atmospheric Administration (NOAA), Luthi, D., M. Le Floch, B. Bereiter, T. Blunier, J.-M. Barnola, U. Siegenthaler, D. Raynaud, J. Jouzel, H. Fischer, K. Kawamura, and T.F. Stocker. 2008. High-resolution carbon dioxide concentration record 650,000-800,000 years before present. Nature, Vol. 453, pp. 379-382, 15 May 2008. doi:10.1038/nature06949 as at March 2020.

[a] The Anthropocene is a proposed geological epoch from the commencement of significant human impact on the Earth's geology and ecosystems

1.5˚C the climate critical threshold

According to the to the Intergovernmental Panel on Climate Change (IPCC) Special Report on Global Warming published in October 2018, to meet a target of a 1.5˚C increase in global temperature will require deep emission reductions and rapid, far-reaching and unprecedented changes in all aspects of society[16].

If achieved, limiting global warming to 1.5˚C compared with 2˚C would reduce challenging impacts on ecosystems, human health and wellbeing and impacts on biodiversity and ecosystems, including species loss and extinction, are expected to be lower at 1.5˚C of global warming.

In contrast, a 2˚C temperature increase would exacerbate extreme weather, rising sea levels, diminishing Arctic sea ice, coral bleaching and loss of ecosystems among other impacts. At current estimates, the world is already at approximately 1˚C of warming above pre-industrial levels.

A recent scientific assessment provided further evidence of escalating climate change in the Earth's climate to support the IPCC statement[17]. The assessment explored the significance of half a degree in terms of various extreme weather outcomes, and determined that staying within a 1.5˚C warming limit would substantially reduce the impact of climate change.

Climate change and biodiversity loss are interconnected[18]. Rapid changes in climate change can damage ecosystems and accelerate biodiversity loss with negative consequences for human health and wellbeing[19].

Climate change is likely to become one of the most significant drivers of biodiversity loss by the end of the century, and is already forcing biodiversity to adapt – whether through shifting habitats, changing life cycles, or the development of new physical traits. The IPCC also identifies ecosystem shifts as the biodiversity and composition of ecosystems is impacted by climate change[20].

Irrespective of human needs and interests, changes in climatic variables have led to increased frequency and outbreaks of pest and communicable disease. For example, the distribution of vector-borne diseases (eg malaria and dengue) and food and water borne disease (eg diarrhoea) are exacerbated by changes in climatic factors.

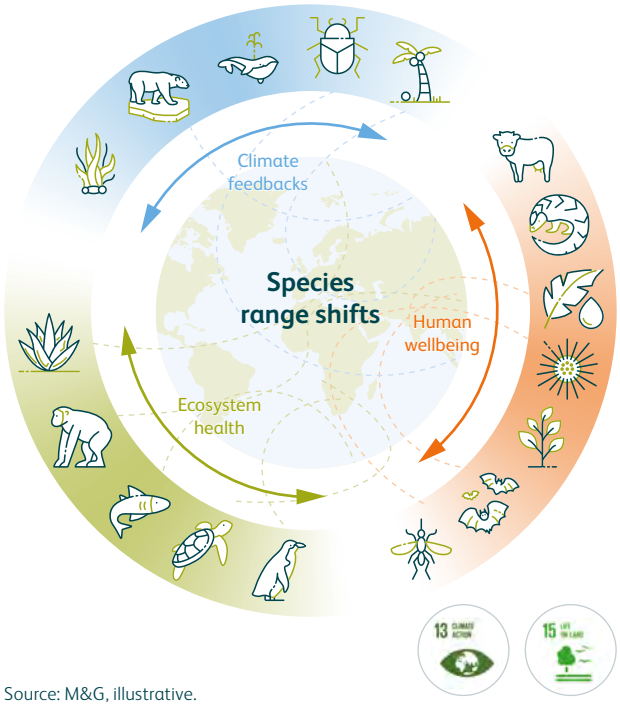
Defence against a warming world

Biodiversity, through the ecosystem services it supports, also makes an important contribution to both climate-change mitigation and adaptation. The conservation and sustainable management of biodiversity will be critical to addressing climate change with human wellbeing tied to the capacity of natural ecosystems to produce goods and services[21].

In order to address ecosystem degradation, deforestation, food security and sustainable development, the IPCC report on land use change suggests the upscaling of sustainable food production, ecosystem conservation, reduced deforestation and efforts to tackle food waste[22].

Biodiversity protection and effective action on climate change are not mutually exclusive: reducing deforestation can make a major contribution to climate mitigation. Solutions to preserve and restore natural ecosystems, such as carbon-rich peatlands and tropical forest, have the potential to lower GHG emissions with significant climate mitigation potential.

Figure 7: Climate change, ecosystem degradation and biodiversity loss[b]



Source: M&G, illustrative.

[b] Pecl, G. T., Araújo, M. B., Bell, J. D., Blanchard, J., Bonebrake, T. C., Chen, I. C., ... Williams, S. E. (2017). Biodiversity redistribution under climate change: Impacts on ecosystems and human well-being. Science, 355(6332). https://doi.org/10.1126/science.aai9214

Future climate-related risks could be reduced by accelerating far-reaching, cross-sectoral climate mitigation strategies that recognise the relationship between biodiversity, ecosystem services and climate change.

The biosphere, upon which humanity depends, is being altered across all spatial scales. Nature plays a critical role in providing food, energy, medicines and genetic resources and a variety of materials fundamental for physical wellbeing.

Goals for conserving and sustainably using nature, and achieving sustainability, cannot be met with current trajectories, and goals for 2030 and beyond may only be achieved by rapid, far-reaching and unprecedented changes to all aspects of society.

The choice, however, is stark: if we do not change course, we risk missing moving beyond the point where we can avoid runaway climate change, with disastrous consequences for people and the ecosystems that sustain us.

Dual threats: deforestation and ecosystem degradation

Tropical forests cover about 7% of Earth's dry land, but it is estimated that they harbour about half of all species. Many of these are so specialised to microhabitats within forests that they can only be found in small areas[23].

However, habitat destruction forces those wild species that aren't eliminated to cram into smaller fragments of remaining habitat, increasing the likelihood that they will come into repeated, intimate contact with human settlements expanding into newly fragmented habitats.

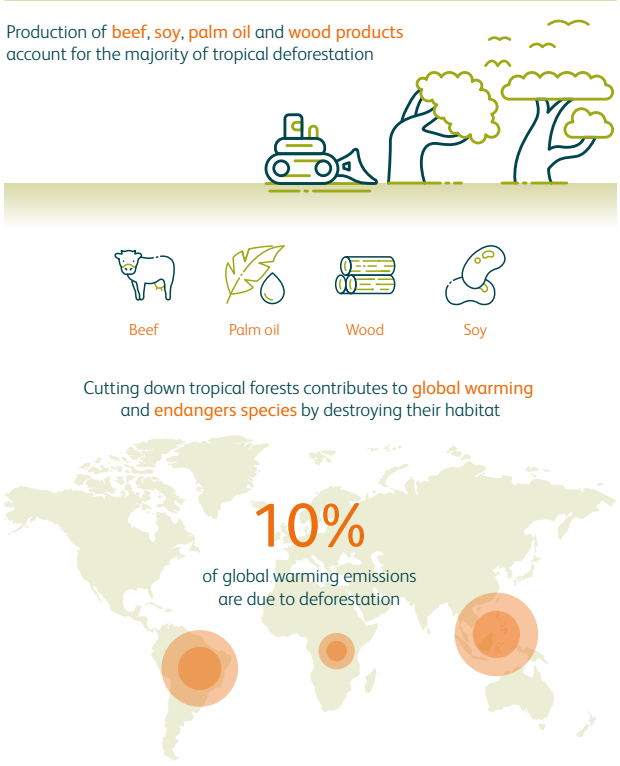
The impact of deforestation and degradation of tropical forests is widely recognised as a constituent in global GHG emissions, but what is often overlooked is the critical importance that protecting biodiversity hotspots offers to human health and wellbeing.

Global demand for key 'forest risk' commodities such as palm oil, soy and beef are largely responsible for the deforestation of tropical forests. On the island of Borneo, at least 50% of all deforestation between 2005 and 2015 was related to palm oil development[24].

Today, we can directly link the deracination of tropical forests with the deleterious impact on biodiversity, as biodiverse hotspots are converted into monoculture plantations. Conversion of natural ecosystems, mostly in the tropics, tends to harm biodiversity, resulting in ecosystem degradation and biodiversity loss and disturbance. This disrupts intact ecosystems and dislodges viruses from reservoir hosts and internal ecosystems, freeing them to pass onto new, highly abundant hosts.

Protecting our natural capital and keeping our ecosystems intact will play a critical role in avoiding the future spilling over of viruses[25]; portentously highlighted by leading epidemiologists in recent years.

Figure 8: Production of key commodities is driving forest and habitat destruction



Source: Union of Concerned Scientists, illustrative.

Chapter 4

Interconnectedness

So how do we bring this all together? We have discussed the emergence of new, communicable disease, specifically zoonotic diseases at the animal-human interface, population growth, unsustainable consumption and production patterns and escalating climate change. We have examined the link between climate change and biodiversity loss and covered the trafficking of animals out of their natural habitats to be bred for human consumption and the link to highly infectious communicable diseases.

These factors are interconnected: the pressure we are placing on the Earth's finite resources; the insatiable demand for more; the destruction of biodiverse hotspots and climate change.

The increased interconnectedness and interdependence of peoples and countries, include two elements: (i) the opening of international borders to increasingly fast flows of goods, services, finance, people and ideas; and (ii) the changes in institutions and policies at national and international levels that facilitate or promote such flows[26].

Globalisation has lifted millions of people out of poverty and offers interdependence, interactivity and virtually instantaneous exchange of information, but competition to meet our global demand has resulted in overexploitation of natural resources and unsustainable production and consumption practices.

Today, we seek to link the great acceleration in population growth, socio-economic and earth system trends to forest destruction, biodiversity loss, climate change and emergence of new, communicable disease[27].

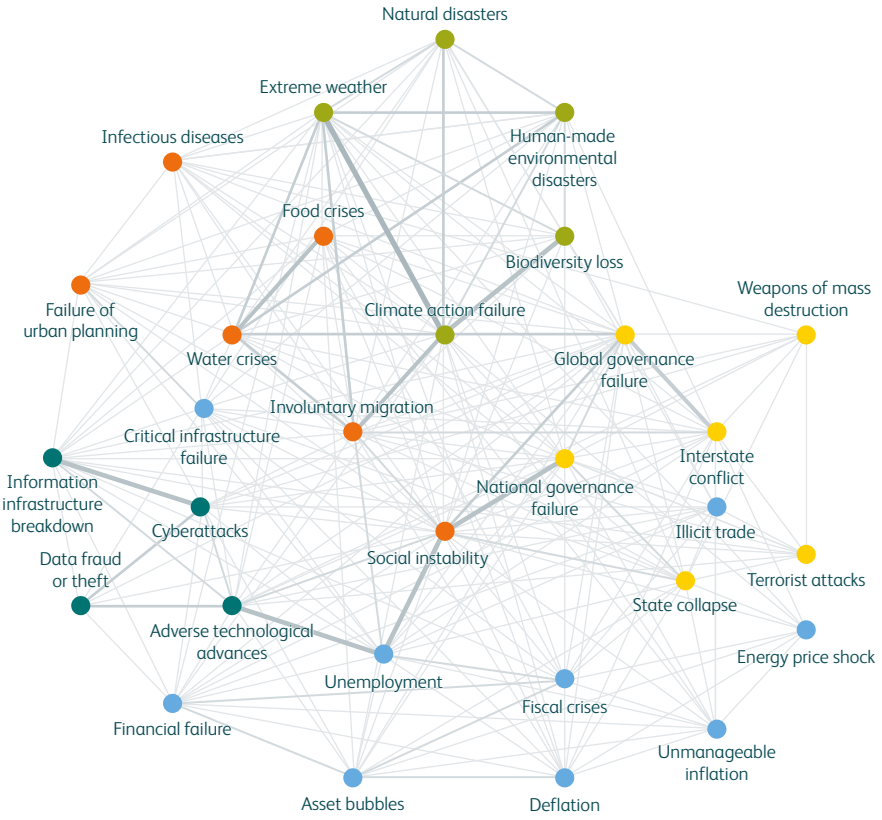
Hyperconnectivity: a boon for infectious diseases

Assessments by the World Economic Forum (WEF) on a hyperconnected world give us new tools and perspectives to address the science of complexity[28]. This science is not so much a subject of research as a new way of looking at phenomena. It is inherently interdisciplinary, meaning that it derives its problems from the real world and its concepts and methods from all fields of science.

For centuries, scientists have worked by reducing the object of study down to its constituent components. Complexity science, by contrast, provides a complementary perspective by seeking to understand systems as interacting elements that form, change, and evolve over time.

The WEF identified infectious diseases as one of the top ten risks in terms of impact, yet progress against pandemics has been undermined by vaccine hesitancy, anti-microbial resistance and underprepared health systems. This has made it increasingly difficult to eliminate some of the most virulent, existing infectious diseases and tackle new and emerging pandemics posing a global health security risk (see Figure 9).

Figure 9: Global Risks Interconnections Map 2020



Long-term risk outlook

Top 10 risks by likelihood and impact over the next 10 years

Multistakeholders

Likelihood

- Extreme weather
- Climate action failure
- Natural disaster
- Biodiversity loss
- Human-made environmental disasters
- Data fraud or theft
- Cyber attacks
- Water crises
- Global governance failure
- Asset bubble

Impact

- Climate action failure
- Weapons of mass destruction
- Biodiversity loss
- Extreme weather
- Water crises
- Information infrastructure breakdown
- Natural disasters
- Cyberattacks
- Human-made environmental disasters
- Infectious diseases

In terms of impact, failure to deliver on climate action, biodiversity loss, human-made environmental disaster and infectious disease were all identified by the WEF in their long-term risk outlook

Source: World Economic Forum, The Global Risks Interconnections Map 2020.

Declining vaccination levels against communicable diseases such as measles also pose an enormous public health risk. Worldwide health systems are underprepared for a significant outbreak of an emerging infectious disease, as we have seen in cases such as COVID-19, SARS, Zika virus and Middle East respiratory syndrome (MERS)[29] [30].

An infectious disease outbreak involves a complex interplay of human, animal and ecosystem health. Set against an environment that includes global travel, underprepared healthcare systems and social mixing. Lapses in environmental health are increasingly recognised as major contributors to illness and death. This is further exacerbated by human-made environmental problems including deforestation, biodiversity loss and climate change[31].

Initiatives, frameworks and solutions: the United Nations SDGs

The SDGs are interlinked, indivisible and set out a blueprint for building a better, more sustainable world that works for both people and the environment.

They provide us with a useful framework to communicate and contextualise a blueprint for shared prosperity in a sustainable world. They have been widely adopted by the financial community and with just over a decade to go towards 2030, the coming years will be a vital period to tackle climate change, address biodiversity loss and achieve long-term sustainable outcomes for human, animal and ecosystem health.

Nature is essential for achieving the SDGs, recognising the fact that the goals are integrated, indivisible, and nationally implemented. Current negative trends in biodiversity and ecosystems have the potential to undermine progress towards 80% of the assessed targets, highlighting the critical importance of biodiversity conservation and ecosystem services[32].

This stresses the importance of upscaling and accelerating progress towards far-reaching, multilevel cross-sectoral climate mitigation strategies that encompass solutions to protect our biodiversity and prevent further ecosystem degradation. Protecting wildlife habitats, so animal microbes stay in animal bodies and don't cross over into ours, will be a critical part of the solution.

Chapter 5

A nexus approach to sustainable development

Many global challenges, though interconnected, are addressed singularly – whereas a nexus approach to sustainable development examines interactions among multiple sectors[33]. A nexus approach can uncover synergies and, if well implemented, can deliver progress towards the SDGs.

Global challenges such as climate change, population growth, food scarcity, biodiversity loss and emerging communicable disease are deeply interconnected. The nexus approach emphasises the importance of understanding connections (interconnectedness), synergies and trade-offs and has the potential to deliver outcomes that deliver cross-sectoral solutions. The nexus framework put forward by the WEF looks at risks across sectors and this paper attempts to identify a nexus that could deliver positive outcomes.

With the global population projected to exceed 9 billion people by 2050, global challenges to reduce food insecurity, improve health and wellbeing, protect biodiversity rich hot spots and combat communicable diseases are deeply interconnected. Major threats from climate change compound the challenge, adding further interlinkages. The nexus approach offers a framework that could inform an investment thesis seeking to deliver forward-looking, ambitious investment solutions to tackle the sustainability issues identified in this paper, alongside climate action. A nexus approach can also help identify unexpected consequences and enhance planning, decision-making, governance and management.

In this paper alone, we have identified a nexus of five SDGs that are deeply interconnected when tackling the issue of food scarcity, sustainable production, health and wellbeing, climate action and communicable disease.

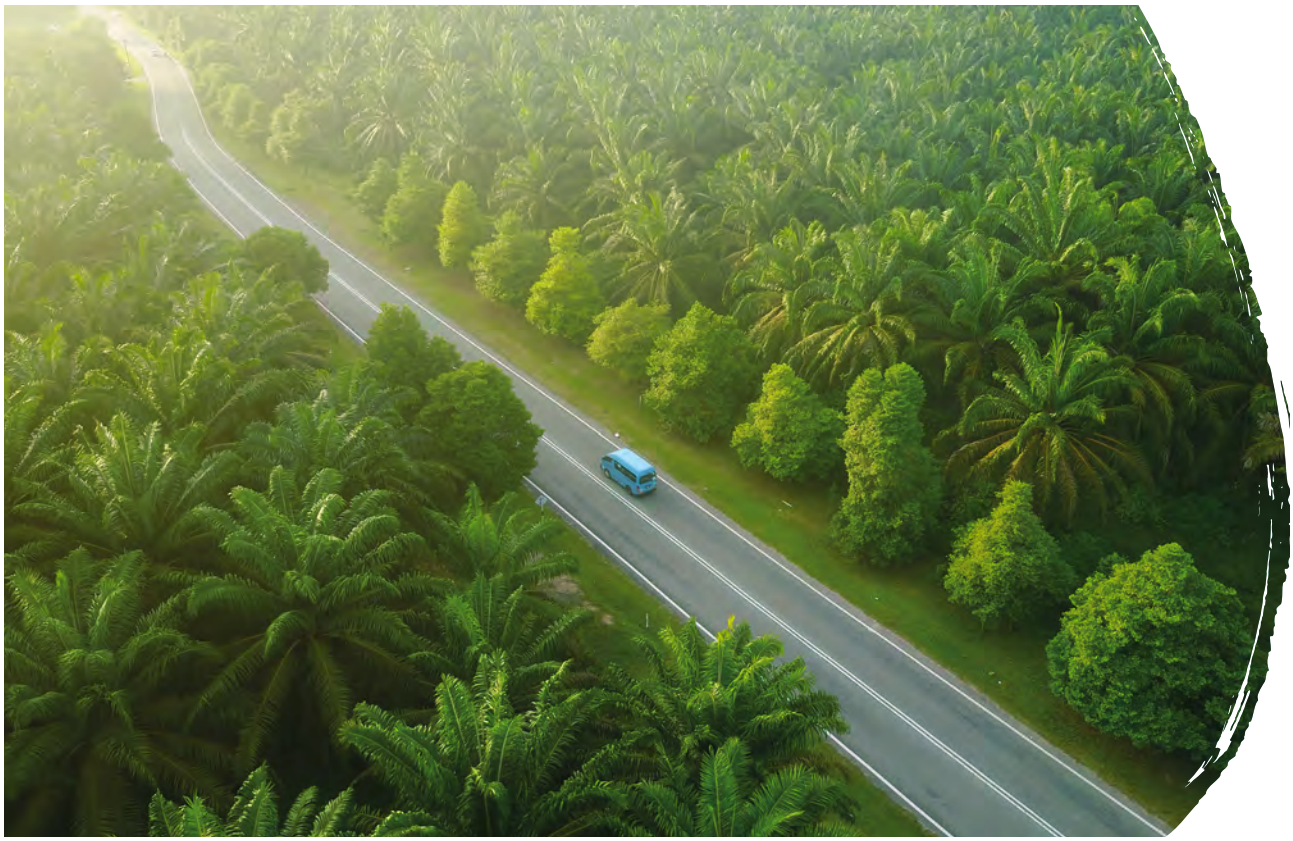


Figure 10: Climate action is core to this nexus of food and security, responsible consumption and production, health and wellbeing, and life on land

Goal 2: Zero Hunger Target 2.2		End hunger and malnutrition. Sustainable food production systems. Resilient agricultural practices to maintain ecosystems. Strengthen capacity for adaptation to climate change.
Goal 3: Good Health and Wellbeing Target 3.3 Target 3.8 Target 3.B Target 3.D		Ensure healthy lives and promote wellbeing. Combat neglected tropical diseases and other communicable diseases. Universal health coverage including vaccines for all. Support R&D of vaccines and medicines for communicable and non-communicable diseases. Strengthen capacity of all countries for risk reduction and management of global health.
Goal 12: Responsible Consumption and Production Targets 12.6 and 12.7		Urgent action to ensure needs do not lead to over-extraction of resources or degradation of environmental resources. Increased demand for resources has resulted in undue burden on natural capital. Highlight the role that large global companies can adopt to deliver sustainable outcomes and promote sustainable procurement.
Goal 13: Climate Action		Climate change occuring much faster than anticipated and effects felt worldwide. In 2020, GHG concentrations reached new highs, with globally averaged atmospheric CO_2 at 414 ppm. Moving towards 2030 emission objectives compatible with the 2°C and 1.5°C pathways requires a peak to be achieved as soon as possible, followed by rapid reductions. A changing climate is also driving humans and animals closer together.
Goal 15 Life on Land Target 15.2 Target 15.5 Target 15.9		Seeks to protect terrestrial ecosystems and biodiversity. Slowing down forest loss and protect biodiversity hotspots. Land degradation continues, biodiversity loss occuring at alarming rate, invasive species and illicit poaching and trafficking of wildlife continues. Thwarts efforts to protect and restore vital ecosystems. Explicit management of all types of forests, halting of deforestation and restoration of degraded lands. Urgent and significant action to reduce degradation of natural habitats. Halt loss of biodiversity. Protect and prevent extinction of threatened species. Integrate ecosytem and biodiversity values into planning, development processes and poverty reduction strategies.

Source: M&G, UN.

Further research on what this nexus could look like in relation to specific investments in order to tackle the issue and offer solutions would necessitate a comprehensive sector mapping exercise.

Nexus models help us understand and elucidate the consequences of various scenarios and identify complex and dynamic interactions such as the aforementioned co-benefits and synergies among different sectors. It is now abundantly clear that we need a deeper, faster and more ambitious response to unleash the social, environmental and economic transformations to achieve the 2030 SDGs.

In conclusion

How does this inform an investment thesis?

Investors, such as ourselves, seek to engage with companies to ensure they have understood the risks and opportunities to their business from a changing climate, resource scarcity and extreme weather events. Going forward, we would like to see investee companies demonstrate awareness of how natural capital and biodiversity loss, ecosystem degradation and the emergence of communicable diseases can impact their business and, where appropriate, evidence measures to mitigate risks.

The crippling effect of the current pandemic on complex supply chains and companies' ability to operate with a diminished workforce has impacted their ability to operate efficiently and deliver on goods and services. Understanding how companies are positioned to deal with immediate supply-chain disruption and a sudden loss of consumer confidence will force us, as responsible investors, to reappraise how we evaluate our investee companies through an ESG lens.

And in reverse, there are companies that are emerging as winners, demonstrating dynamism, agility, innovation and adaptation; credentials that responsible investors actively seek out, as we too evolve in response to this crisis.

Importantly, much of what investors have embedded into ESG engagement frameworks to evaluate company preparedness for climate change can be quickly adapted to today's crisis, as we seek dexterity.

We expect our investee companies to demonstrate innovation, resilience, technological advancement, adaptation and mitigation. We expect the boards of our investee companies to evidence strong leadership, oversight and ownership of the risks and opportunities. A best-in-class approach could involve scenario analysis and the modelling of catastrophic risks, such as pandemics, supply chain failure or cyber-attacks.

In light of the current situation, there will certainly be intense focus on disaster recovery procedures as we emerge from this crisis. For investee companies with complex and global supply chains, can they provide assurance that their procedures are able to protect those supply chains, as well as the health and wellbeing of the employees that operate them?

We have also witnessed the emergence of innovations and collaborations. Global pharmaceutical companies and universities are racing to develop a vaccine or treatment for COVID-19 coronavirus infection[34].

In the UK, engineering and manufacturing companies have received the green light from the government to start producing new medical ventilators in order to supply thousands of devices to help the UK's National Health Service (NHS)[35].

Global clothing manufacturers have used their capacity to produce and deliver surgical face masks and clothing for medical staff[36]. A major French luxury goods manufacturer pivoted its supply chain towards the production of anti-bacterial gels and pledged to donate 12 tonnes to Parisian hospitals[37], while a leading drinks producer pledged to create over eight million bottles of free hand sanitizer intended for frontline care workers[38].

And, in a joint industry statement on COVID-19, tech giants Microsoft, Facebook, Google, LinkedIn, Reddit, Twitter and YouTube announced their willingness to help millions of people stay connected and important factor for our wellbeing[39].

In times of economic stress, while facing a threat to health and wellbeing, the willingness of companies to collaborate, offer accessible consumer solutions and adapt demonstrates agility and receptivity to new challenges.

Capital supply: the crucial role of finance

The financial sector, a critical component of a well-functioning economy, has a role to direct capital flows towards the companies invested in the solutions to prevent future outbreaks. For example, we already engage with our pharmaceutical companies on anti-microbial resistance, identified as a major threat to human health and wellbeing, as we face the risk of antibiotic resistance from the over-use and misuse of antibiotics in animals bred for human consumption.

We are now broadening our anti-microbial engagement with pharmaceutical companies to discuss anti-viral therapeutics as well as those focused on developing and manufacturing vaccines against both bacteria and viruses.

We have a number of levers through which to engage with our investee companies and today we are acutely aware that we have an ever-more critical role to identify those companies that demonstrate the astuteness to acknowledge the impact and likelihood of global risks as identified by the WEF.

By integrating this into an engagement framework and using the SDGs to communicate and contextualise our efforts we, as investors, have a unique opportunity to identify solutions that allow us to upscale and accelerate far-reaching, multilevel cross-sectoral strategies.

And if we do nothing?

Investors have a fiduciary duty to integrate financially material risks into the investment process and it is becoming increasingly important that investment analysis identifies all material risks related to climate change, ecosystem degradation and biodiversity loss. As highlighted above, tackling communicable disease, supporting sustainable production and consumption and maintaining ecosystem strength to build capacity for adaptation to climate change will all, without a doubt, have a long-term effect on financial returns.

We believe our clients and customers need us to evidence that we have understood the inextricable link between human, animal and ecosystem health and that our company engagements are now far-reaching and exploratory in a way that we may never have engaged before.

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