



Institute
and Faculty
of Actuaries

Biodiversity: Managing Risk and Uncertainty

Policy Briefing

The Institute and Faculty of Actuaries (IFoA) is a royal chartered, not-for-profit, professional body. We represent and regulate over 32,000 actuaries worldwide, and oversee their education at all stages of qualification and development throughout their careers.

The IFoA is a signatory of the Sustainable Finance Education Charter and the Professional Bodies Climate Action Charter. It is a supporter of the FSB's Task Force on Climate-Related Financial Disclosures (TCFD), the UN's Principles for Responsible Investment and the UN's Principles for Sustainable Insurance.

July 2023

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Summary

The World Economic Forum (WEF) estimates that \$44 trillion or over 50% of global GDP is moderately or highly dependent on nature and ranks biodiversity loss and ecosystem collapse as its 4th greatest risk over a 10-year time horizon in its 2023 global risks report.¹

The Institute and Faculty of Actuaries (IFoA) recognises the significant social, economic, and financial risks posed by biodiversity loss and has issued a Biodiversity Statement to advocate for the development of effective policy frameworks worldwide and support actuaries in their understanding of biodiversity risk.

- **The situation is urgent**

We are currently observing a biodiversity collapse and 6th mass extinction event.

- **There is a global recognition that we need to act now**

Nearly every country² has signed the Kunming-Montreal Global Biodiversity Framework to effectively conserve and manage at least 30% of the world's lands, inland waters, coastal areas and oceans by 2030.

- **Nature-related financial disclosures are coming**

Companies and financial institutions will be increasingly compelled to monitor, assess and disclose the impact on biodiversity of their operations, supply chains and portfolios. Disclosure itself is unlikely to be sufficient to change business practice at the pace required, meaning further direct action or regulation may be needed.

- **The way we are consuming our natural resources is unsustainable**

We are currently consuming 1.6 times the earth's resources³, and the rate for developed countries is five times.

- **We need to take into account not just GDP but also social and natural capital**

Recognising nature as a form of capital is a way of identifying it as an asset and beginning to value the benefits it offers humans.

- **Nature loss is accelerated by climate change; restoring it can help mitigate climate change**

Restoring ecosystems could provide a third of the climate crisis mitigation needed by 2030.⁴ Voluntary carbon markets can help restore carbon sinks⁵ but must not be a substitute for reducing own emissions.

- **Nature-related risk represents a material financial risk**

Nature and biodiversity loss give rise to systemic, physical and transition risks. These feed through to market, credit, liquidity and operational risks. Actuaries have a role in understanding these risks and in directing capital towards sustainable outcomes.

- **Biodiversity loss poses a danger to health**

As well as being vital for nutrition and health, nature is the source of around 70% of our cancer drugs⁶ and 75% of antimicrobials.⁷

Land-use change is a globally significant driver of animal-to-human diseases and accounts for 30% of new diseases reported since 1960.⁸

- **It is not just an economic and social issue but also an equity issue**

A third of global land is owned or governed by Indigenous Peoples and Local Communities. Recognition of their rights and their inclusion in designing and implementing solutions to support global biodiversity goals is imperative. Justice must be brought into considerations regarding the use of natural resources and biodiversity loss, including to future generations.

As risk management experts, actuaries can lead the way in promoting understanding of the risks associated with biodiversity loss. The work of the IFoA's COVID-19 Actuaries Response Group⁹, the Sustainability Board Biodiversity resources collated over the last three years¹⁰, and IFoA's Sustainability Thought-Leadership series¹¹ showcase the importance of bringing together the actuarial community to inform others.



¹ World Economic Forum (WEF) [Global Risk Report 2020](#)

² Signed by 188/195 countries. The United States is the only major world nation not a party to the agreement.

³ [The Economics of Biodiversity: The Dasgupta Review](#) (2021)

⁴ B W Griscom, J Adams, P W Ellis, J Fargione [Natural Climate Solutions](#) (2017)

⁵ Ecosystems that absorb carbon dioxide from the atmosphere.

⁶ Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) [Global Assessment of Biodiversity and Ecosystem Services](#) (2019)

⁷ Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) [Workshop Report on Biodiversity and Pandemics](#) (2020)

⁸ Ibid

⁹ IFoA [COVID-19 Actuaries Response Group](#)

¹⁰ IFoA [Biodiversity](#)

¹¹ IFoA [Thought Leadership webinar series](#)

IFoA Biodiversity Statement

The IFoA recognises the significant social, economic, and financial risks posed by biodiversity loss. The potential impacts of biodiversity loss are global and systemic. The loss of biodiversity threatens the health of ecosystems that provide services to the economy, including animal pollination of food crops, natural water treatment and fertile soil and has significant implications for the population's health, longevity and the entire financial system. Furthermore, support for biodiversity and nature is critical to climate change's net-zero emissions ambitions through its carbon capture and sequestration.

We are a profession specialising in risk management. The risks associated with the destruction of the environment and loss of biodiversity are hard to quantify due to their long-term, uncertain and intangible nature. Mitigating this risk is urgent. The best value insurance premium that society can pay is to reduce our biodiversity and nature loss today in order to avoid the irreversible consequences tomorrow.

The IFoA supports the aims of the UN Convention on Biological Diversity (CBD), which sets out to conserve global biological diversity, the sustainable use of its components and the fair and equitable sharing of its benefits. We support the aims of the 2022 Kunming-Montreal Global Biodiversity Framework (GBF) and seek to support our members in the achievement of its goals and targets.

The IFoA will:

- Advocate for the development of effective policy frameworks worldwide and methods for managing biodiversity risk including by understanding the unintended consequences of the concept of natural capital and different valuation metrics
- Use the actuarial skill set and influence to help equip the wider global financial services markets to fully incorporate biodiversity risk
- Support actuaries in their understanding of biodiversity risk through a set of think pieces, webinars, education resources and blogs
- Advocate for better disclosure of consistent and robust information about biodiversity risk by corporates and other market participants
- Support collaborations between its members and other organisations to help develop and align national and global financial systems with a just, sustainable economy that manages biodiversity risk and seeks to enhance the natural environment

The IFoA is a signatory of the Sustainable Finance Education Charter, the UN's Principles for Responsible Investment, and the UN's Principles for Sustainable Insurance. We will continue to work with these and other organisations, such as the Taskforce for Nature Related Financial Disclosure (TNFD), to better align the finance system with an understanding of biodiversity risk.

Urgency

Rapid human population growth, and unsustainable production and consumption have led to an unprecedented decline in nature. By 2030, cities are expected to cover three times as much land as they did in 2000.¹ The IPBES estimates that agricultural and industrial expansion over the past 300 years has led to the loss of over 85% of wetlands, altered 75% of land surface and impacted 66% of ocean area. Land degradation has reduced productivity in almost a quarter of all areas, with an estimated \$235-\$577 billion in annual global crop output at risk because of pollinator loss.²

We are currently observing a biodiversity collapse and 6th mass extinction event. Around 1 million species already face extinction, many within decades³. Climate change exacerbates nature loss, which in turn reduces nature's resilience to climate change. The World Economic Forum lists biodiversity loss as the fourth top risk over the next ten years (after climate change mitigation failure, climate change adaptation failure and natural disasters & extreme weather events).⁴

Global recognition

Biodiversity as a global asset was first recognised in the 1992 Convention on Biological Diversity⁵. This was signed by almost every country in the world⁶ and has three main aims: to conserve biological diversity, to use its components sustainably, and to provide fair and equitable access to the benefits of using genetic resources.

The Parties to the Convention meet every two years at the Conference of the Parties (COP). Faced with the ongoing loss of terrestrial and marine biodiversity, in December 2022 COP 15 agreed a new set of international goals under the Kunming-Montreal Global Biodiversity Framework⁷. This set four goals and 23 global targets for 2030:

Global Biodiversity Framework	
Goal A	Goal C
<ul style="list-style-type: none">• Maintain/enhance/restore ecosystems• Halt human induced extinction• Maintain genetic diversity	<ul style="list-style-type: none">• Equitable sharing of the benefits from the use of genetic resources including Indigenous Peoples• Traditional knowledge is protected
Goal B	Goal D
<ul style="list-style-type: none">• Sustainable use of biodiversity• Ecosystem services are valued, maintained and restored	<ul style="list-style-type: none">• Adequate implementation including financial resources, capacity building, technical and scientific cooperation

¹ Seto, K. C., B. Günerlap, and L. R. Hutyrá [Global Forecasts of Urban Expansion to 2030 and Direct Impacts on Biodiversity and Carbon Pools](#) (2012)

² Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) [Global Assessment of Biodiversity and Ecosystem Services](#) (2019)

³ *ibid*

⁴ World Economic Forum (WEF) [Global Risks Report 2023](#)

⁵ [Convention on Biological Diversity](#) (1992)

⁶ US signed but did not bring it into force

⁷ [Kunming-Montreal Global Biodiversity Framework](#) (2023)

The global targets include to:

- Effectively conserve and manage at least 30% of the world's lands, inland waters, coastal areas and oceans
- Reduce global food waste by half and significantly reduce over-consumption and waste generation.
- Reduce by half both excess nutrients and the overall risk posed by pesticides and highly hazardous chemicals.
- Progressively phase out or reform subsidies that harm biodiversity by at least \$500bn per year, whilst scaling up positive incentives for biodiversity conservation
- Reduce by half both excess nutrients and the overall risk posed by pesticides and highly hazardous chemicals.

Three targets are particularly relevant to the financial sector:

- Target 14: To integrate biodiversity into policies and development across all sectors and align fiscal and financial flows with the goals and targets
- Target 15. Enable businesses, in particular financial institutions to monitor, assess and disclose their impacts on biodiversity
- Target 19. Substantially increase financial resources, mobilise \$200bn per year by 2030 from all sources, including \$30bn from developed to developing countries⁸

To help achieve the 30% by 2030 target for oceans, sixty countries signed a further agreement to protect Marine Biodiversity in Areas Beyond National Jurisdiction (BBNJ) in March 2023. This Treaty of the High Seas allows for the establishment of large-scale marine protected areas, the sharing of benefits from marine genetic resources and clear rules to conduct environmental impact assessments.

The UK Government set its own environmental targets in December 2022. This was a key commitment in The Environment Act 2021. These include to:

- Halt the decline in species populations by 2030, and then increase populations by at least 10% to exceed current levels by 2042
- Deliver UK net zero ambitions and boost nature recovery by increasing tree and woodland cover to 16.5% of total land area in England by 2050
- Restore 70% of designated features in our Marine Protected Areas to a favourable condition by 2042, with the rest in a recovering condition

Other countries are starting to mandate biodiversity-related risk disclosures. In France, all financial institutions are required to disclose biodiversity-related risks and climate-related risks, using the concept of double materiality. They will also have to disclose their strategy for reducing biodiversity impacts.⁹

⁸ For full wording see [Kunming-Montreal Global Biodiversity Framework](#) (2023)

⁹ Global Canopy [France's Article 29: biodiversity disclosure requirements sign of what's to come](#)

Supervisory authorities and reporting

International organisations, regulators, and corporates are working on the development of reporting standards for biodiversity and nature-related risks. Their efforts are part of a wider focus on sustainability risk reporting that aims to ensure a consistent approach to disclosures.¹⁰

The Network for Greening the Financial System, comprising central banks and financial supervisors, has published recommendations to address the financial risks associated with biodiversity loss and to support investments that are beneficial to nature.¹¹ An example is the Netherlands Central Bank which has published methods for analysing biodiversity risks for the Dutch financial sector.¹²

The EU's Corporate Sustainability Reporting Directive (CSRD)¹³ brings in new reporting requirements from 2025, including on climate change, pollution, water and marine resources, biodiversity and ecosystems, resource use, and circular economy. It looks at activities that are not only financially impacted by sustainability areas, but that also have a material impact on sustainability areas, such as biodiversity and ecosystems ('double materiality').

The International Sustainability Standards Board (ISSB) is looking at how to complement its climate-related disclosures to address disclosures related to natural ecosystems. It notes that a company's ability to deliver value for its investors is inextricably linked to the stakeholders it works with and serves, the society it operates in, and the natural resources it draws on.¹⁴

The Taskforce for Nature-related Financial Disclosures (TNFD) will publish in September 2023 its risk management and disclosure framework for organisations to report and act on evolving nature-related risks. The UK Financial Conduct Authority (FCA) has said it will consult in Q3 2023 on proposals to make TNFD reporting mandatory.

The IFoA is a supporter of TNFD and market-based disclosures. However, disclosure itself is unlikely to be sufficient to change business practice at the pace required, meaning further direct action or regulation may be needed.

“NGFS is of the view that nature-related risks, including those associated with biodiversity loss, could have significant macroeconomic implications, and that failure to account for, mitigate, and adapt to these implications is a source of risks for individual financial institutions as well as for financial stability.”

Network for Greening the Financial System¹¹

¹⁰ For further reading: [IFoA blog on biodiversity-disclosures](#) (2023)

¹¹ Network for Greening the Financial System (NGFS) [Central banking and supervision in the biosphere: an agenda for action on biodiversity loss, financial risk and system stability](#) (2022)

¹² De Nederlandsche Bank (DNB) [Indebted to nature](#) (2020)

¹³ EU [Corporate Sustainability Reporting Directive \(CSRD\)](#) (2023) – applies to 2024 financial year with reporting in 2025

¹⁴ ISSB [News: ISSB describes the concept of sustainability](#) (2022)

NGFS recommendations:

1. Recognise biodiversity loss as a potential source of economic and financial risk and commit to developing a response strategy to maintain financial and price stability
2. Build the skills and capacity to analyse and address biodiversity-related financial risks
3. Assess the degree to which financial systems are exposed to biodiversity loss, e.g. by conducting assessments of impact and dependency, developing biodiversity-related scenario analysis and stress-tests
4. Explore options for supervisory expectations for financial institutions' governance, risk management, strategy, disclosure and financial conduct in relation to biodiversity-related financial risks and opportunities
5. Help build the necessary financial architecture for mobilising investment for a biodiversity-positive economy, including by considering how central banks' monetary policy operations and non-monetary policy portfolio management should be conducted in the context of biodiversity loss.¹⁵

Regulation

Given the long-term nature of biodiversity risks, there is a need for regulation to shape action so that everyone is playing by the same rules and neither free-riding off the back of others in the industry taking action, nor continuing business as usual with other market players bearing the consequences.

A capital-based regime should be developed that helps capital flow to areas of the economy that are compliant with biodiversity preservation (e.g., higher capital requirements for assets related to areas that are disruptive to biodiversity).

Direct prohibition of financing and underwriting activities may be needed for business activities that hasten biodiversity loss where inadequate transition plans are in place. Regulation should consider which stakeholder voices get heard and should reflect differences in terms of valuation from different points of view.¹⁶

The EU Regulation on Deforestation-free Products is an example of new legislation being introduced to protect biodiversity. Under the Regulation, any operator or trader who places commodities on the EU market, or exports from it, must be able to prove that the products do not originate from recently deforested land and have not contributed to forest degradation.¹⁷

The risk of not legislating appropriately is seen in the Dutch Nitrogen Crisis, where the Netherlands' highest court threw out the country's permitting system for nitrogen pollution, leading to the suspension of an estimated 18,000 construction projects. The government is now forcibly buying out livestock farms in an effort to cut its nitrogen emissions by 50% in line with EU greenhouse gas emissions targets.¹⁸

¹⁵ Network for Greening the Financial System (NGFS) [Statement on Nature-Related Financial Risks](#) (2022)

¹⁶ [IFoA response to Environmental Audit Committee inquiry into Aligning the UK's Economic Goals with Environmental Sustainability](#) (2022)

¹⁷ EU [Regulation on Deforestation-free Products](#) (2023)

¹⁸ Farmers Weekly [EU approves Dutch plan to forcibly close farms](#)

Our consumption is unsustainable

The 1987 Report of the Brundtland Commission defined sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”.

Instead, according to the Dasgupta Review¹⁹, which was commissioned in 2019 by HM Treasury, we are consuming the earth’s resources at 1.6 times the sustainable rate. Between 1992 and 2014, produced capital per person doubled globally and human capital per person increased by about 13%, while the stock of natural capital per person declined by nearly 40%.

Dasgupta highlights that to rebalance the system by 2030, our efficiency in converting biosphere’s goods into products would need to improve by 10% per year, whereas historically it has grown by only 3.5% per year. Using numbers in the report, it is possible to illustrate the quantum of change required to rebalance if 3.5% pa remains the efficiency growth rate:

- By 2030, the pathway of global GDP would need to be lower by approximately 45%²⁰
- The high-income countries have 16% of people but consume 47% of the GDP. If GDP was pro rata on the planetary resources this would represent a need to reduce the consumption of resources in high income countries by 80%. Any desire for an incremental adjustment should be set against the challenge of 84% of the global population aspiring to grow their consumption to high-income levels. Rich country levels of GDP consumption reflect five times the sustainable level. At this level of consumption, the sustainable population is 1.6 billion compared to nearly 8 billion today.

These figures highlight the large quantum of change required. It also highlights the urgent need as the damage continues to accumulate, the gap widens and transition will take some time. Failure to urgently engage in the macro-economic shifts to more sustainable outcomes risks national prosperity (and GDP) at all levels – economic stability, geo-political stability, environmental security, food security and border security.²¹

The challenge of sustainable development in short-term financial outlooks can be illustrated through examples such as the “devil and the farmer”.²² In this thought experiment, a tripling of a farmer’s profits costs 1% of topsoil. Financially, the tripling of profits can make sense but leads to a complete exhaustion of topsoil over 200 years. In 2017, the Secretary of State warned that the UK is just 30 to 40 years away from “eradication of soil fertility”.²³

¹⁹ [The Economics of Biodiversity: The Dasgupta Review](#) (2021)

²⁰ 1-(1.035/1.1)

²¹ [IFoA Response to Environmental Audit Committee inquiry into Aligning the UK’s Economic Goals with Environmental Sustainability](#) (2022)

²² Jeremy Grantham [Living on a Finite Planet](#) (2012)

²³ [Guardian UK is 30-40 years away from 'eradication of soil fertility', warns Gove](#) (2017)

Natural Capital

In order to judge whether the path of economic development we choose to follow is sustainable, we need to take into account not just GDP but also social and natural capital.

Recognising nature as a form of capital is a way of identifying it as an asset and beginning to value the benefits it offers humans. The ONS has started to measure the financial and societal value of natural resources to people in the UK.²⁴ In 2020, it estimated the value of UK natural capital services at £1.8 trillion, including £600 billion derived from the health benefits of recreation.

The IFoA Biodiversity and Natural Capital Working Party has looked at potential biodiversity valuation tools actuaries could use in their work²⁵. Its paper, 'Natural capital – an actuarial perspective'²⁶, discusses the importance and opportunities of this approach, as well as some of the risks and pitfalls. Certain features (e.g., biodiversity, cultural or spiritual values) are not amenable to monetary valuation and the value of an ecosystem can differ depending on the user. Any natural capital valuations should, therefore, be carefully assessed to understand which parts of the ecosystems have been included in the calculations and which areas have been omitted due to data availability.

Actuaries in life and general insurance reporting roles are familiar with the requirements for the calculation of the technical reserves of an insurer, and the need to communicate uncertainty in the results via sensitivity and scenario testing. A similar skillset could be used by actuaries to place a monetary value on the environmental impact of a company. Analogous to reserving, there is no single 'correct' value but a range of possible values that depend on the underlying assumptions. There is a need to illustrate this uncertainty by providing sensitivities to the results and to communicating the results effectively to different stakeholders.²⁸

“Monetary values will not fully reflect the importance of ecosystems for people and the economy. Assessing the importance of ecosystems will therefore require consideration of a wide range of information beyond data on the monetary value of ecosystems and their services. This will include data on the biophysical characteristics of ecosystems and data on the characteristics of the people, businesses and communities that are dependent on them.”

*UN System of Environmental Economic Accounting*²⁶



²⁴ONS [Natural Capital Accounts 2022](#)

²⁵ IFoA [Introduction to biodiversity valuation tools](#) (2021)

²⁶ IFoA [Natural capital – an actuarial perspective](#) (2021)

²⁷ UN System of Environmental Economic Accounting (SEEA) [System of Environmental-Economic Accounting– Ecosystem Accounting](#) (2021)

²⁸ *ibid*

Climate change impact and mitigation

Biodiversity loss is intrinsically linked with climate change. Climate change has already altered terrestrial, freshwater and ocean ecosystems at a global scale. Unique ecosystems are expected to be at high risk in the very near term at 1.2°C global warming levels due to mass tree mortality, coral reef bleaching, large declines in sea ice-dependent species and mass mortality events from heatwaves. Deforestation, draining and burning of peatlands and tropical forests and thawing of Arctic permafrost have already shifted some areas from being carbon sinks to carbon sources.²⁹

Natural climate solutions have the potential to provide a third of the climate crisis mitigation needed by 2030³⁰ and at a lower cost than other forms of carbon dioxide removal. Restoring natural forests and peatlands, and improving sustainability of managed forests enhances the resilience of carbon stocks and sinks. Natural rivers, wetlands and upstream forests reduce flood risk, and coastal wetlands protect against coastal erosion and flood.³¹ Sustainable agricultural management reverses land degradation and improves soil health to support CO₂ sequestration, regional economies, livelihoods and health.³²



These efforts may be even more urgent than previously thought. Recent research between the IFOA and Exeter University, “The Emperor’s New Climate Scenarios”³³, highlighted that the amount temperature rises for a given level of greenhouse gas emissions (equilibrium climate sensitivity) may be higher than previously thought. This would lead to even greater temperature rises than previously projected and a more urgent requirement for carbon sequestrations to offset the harmful impacts.

According to the UN Environment Programme’s State of Finance for Nature 2022 report, current finance flows to nature need to double by 2025 and triple by 2030.³⁴ The Dasgupta review notes that that to protect 30% of the world’s land and ocean under Protected Areas would require an annual investment of US\$140 billion – equivalent to only 0.16% of global GDP and less than one-third of the global government subsidies currently supporting activities that destroy nature.³⁵

Financing vehicles include green bonds and loan programmes, debt-for-nature swaps³⁶, blended finance instruments to de-risk investments and nature-linked insurance³⁷ to increase resilience.

²⁹ Intergovernmental Panel on Climate Change (IPPC) [AR6 Biodiversity Fact Sheet](#) (2022)

³⁰ B W Griscom, J Adams, P W Ellis, J Fargione [Natural Climate Solutions](#) (2017)

³¹ Intergovernmental Panel on Climate Change (IPPC) [AR6 Synthesis Report](#) (2023) pp.59 & 73

³² EU [Soil Strategy for 2030](#)

³³ IFOA [Emperor’s New Climate Scenarios – a warning for financial services](#) (2023)

³⁴ UN Environment Programme [State of Finance for Nature 2022](#)

³⁵ [The Economics of Biodiversity: The Dasgupta Review](#) (2021)

³⁶ Financial transactions in which a portion of a developing nation's foreign debt is forgiven in exchange for local investments in environmental conservation measures.

³⁷ Such as insurance products that pay out automatically in the case of extreme weather events, [ACRE Africa](#)

Voluntary Carbon Market

Many corporates are incorporating natural climate solutions in their decarbonization strategies.³⁸ Natural climate solutions (NCS) now account for 40% of carbon credits in voluntary carbon markets, up from only 5 percent in 2010.³⁹ Attaining carbon neutrality in this way offers the opportunity to remove carbon from the atmosphere earlier. However, verified carbon measurement and accounting methodologies must be applied to ensure the high integrity of NCS credits. Companies should consider whether these solutions and the emission reductions are genuinely additional.⁴⁰ They should not be viewed as a substitute for own emission reductions and efficiency measures.⁴¹

It is important to note that biodiversity is often unique to the geographical location and not easily replaced; it is not a question of compensating the loss of an ecosystem with another. Greenpeace research suggests it takes a newly planted tree up to 20 years to capture the amount of CO₂ that a carbon-offset scheme promises.⁴²

Material impact

The World Economic Forum reports that more than half of the world's economic output – US\$44 trillion of economic value generation – is moderately or highly dependent on nature.⁴³ US\$10 trillion in global GDP could be lost by 2050, The WWF Global Futures Report⁴⁴ warns, if biodiversity loss continues at its current trajectory.

Biodiversity loss and nature-related risks give rise to systemic risks such as pandemic emergence, geopolitical instability and conflict. It is estimated that by 2050, land degradation and climate change are likely to force 50-700m people to migrate.⁴⁵ Disruption of one ecosystem service can disrupt the delivery of other ecosystem services and can lead to supply chain disruption and demand shocks.

Identifying how deterioration in the underlying ecosystem service(s) might impact a business allows us to understand how risks may materialise across the economy. As with climate change, there are feed-back loops and tipping points with the risk of spillovers/contagion. We need to better understand the impact of worst-case scenarios, and the effects of low-probability but high-impact biodiversity-related tail-risks on the financial sector.⁴⁶

³⁸ Nestlé [Forest positive agenda in cocoa in Ghana and Côte d'Ivoire](#); Amazon [\\$100 million fund to restore and conserve forests, wetlands, and grasslands](#); Walmart [Manage or restore at least 50 million acres of land and one million square miles of ocean](#)

³⁹ World Economic Forum-McKinsey & Co [Nature and Net Zero](#) (2021)

⁴⁰ At least 30 per cent of credits currently being sold globally are for avoided deforestation - Source Material [The Carbon Con](#) (2023)

⁴¹ World Economic Forum-McKinsey & Co [Nature and Net Zero](#) (2021)

⁴² GreenPeace [The biggest problem with carbon offsetting is that it doesn't really work](#) (2020)

⁴³ World Economic Forum (WEF) [New Nature Economy report: Nature Risk Rising](#) (2020)

⁴⁴ World Wide Fund for Nature (WWF) [Global Futures Report](#) (2020)

⁴⁵ Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) [Assessment Report on Land Degradation and Restoration](#) (2015)

⁴⁶ Network for Greening the Financial System (NGFS) [Biodiversity and financial stability: exploring the case for action](#) (2021)

There are obvious physical risks to assets vulnerable to land degradation, decreasing natural resources and water scarcity or flooding. Transition risks can arise from more stringent regulations, litigation, compensation costs and changing consumer preferences. These can feed through to changes to market risk, credit risk, refinancing/liquidity risk and operational risk.⁴⁷

“The financial materiality of underestimating or inaccurately pricing biodiversity-related risks could pose a threat to the solvency of the insurance industry and lead to an increase in exclusions of uninsurable risks.”

The World Bank ⁴⁸

Actuaries will need to understand transmission channels of the risks and how these might impact the actuarial assumptions they recommend such as investment returns, inflation, morbidity and mortality. Pension scheme members and insurance policyholders may increasingly demand that their investments are not contributing to nature loss.

Investors have a role in directing capital towards sustainable outcomes through lending, or investing in green or blue bonds.⁴⁹ Investment products can be designed with nature goals in mind. Regulators and central banks could use policy levers such as capital requirements, maximum exposure limits, collateral eligibility and asset purchase programmes to steer capital away from brown and towards green activities.⁵⁰

Insurers can promote investment by providing insurance coverage for natural assets and Nature Based Solutions, and by offering catastrophe bonds or parametric (or index based) cover which pay out when a triggering event occurs.⁵¹

Understanding ecosystems and their interactions will help target investments that are closer to irreversible tipping points and in which the drivers of degradation are more deeply connected to economic and business activities. Stakeholders will be more engaged and have a greater ability to influence changes.⁵²

The World Economic Forum estimates that moving to nature-positive models in three key socio-economic systems (food, land and ocean use; infrastructure and the built environment; and extractives and energy) could generate up to \$10.1 trillion in annual business value and create 395m jobs by 2030.⁵³

The UK Government is seeking more flexibility for insurance companies to invest in long-term assets such green infrastructure through Solvency II reform.⁵⁴ The Mansion House Compact announced in July 2023 aims to unlock up to £50bn of investment, with the UK’s largest DC pension providers committing to allocating 5% of assets in their default funds to unlisted equities by 2030.⁵⁵ The

⁴⁷ Network for Greening the Financial System (NGFS) [Biodiversity and financial stability: exploring the case for action](#) (2021)

⁴⁸ World Bank [Insuring Nature's Survival](#) (2022)

⁴⁹ United Nations Development Programme (UNDP) [Exploring Blue Bonds potential to support the Ocean Economy](#) (2022)

⁵⁰ K Kedward, J Ryan-Collins, H Chenet, Institute for Innovation and Public Purpose (IIPP) [Managing nature-related financial risks](#) (2020)

⁵¹ For further reading: IFoA [Biodiversity & Nature Related Risks for Actuaries: An Introduction](#) (2023)

⁵² World Economic Forum (WEF) - AlphaBeta [The Future of Nature and Business](#) (2020)

⁵³ *ibid*

⁵⁴ Green Central Banking [UK seeks to boost green investment with insurance rules overhaul](#) (2022)

⁵⁵ HM Treasury [Mansion House 2023](#)

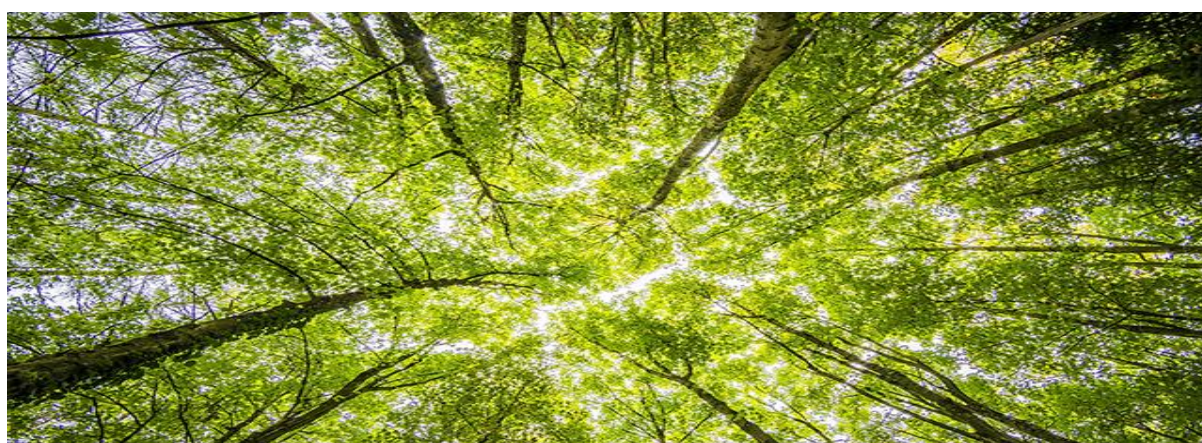
Government has recognised that private finance will need to play a key part in funding its sustainability ambitions. Under its Green Finance Strategy it has set a target to raise at least £500 million in private finance to support nature’s recovery every year by 2027 in England, rising to more than £1 billion per year by 2030.⁵⁶ Globally, the Nature Conservancy estimates that about US\$722 - \$967 billion per year of additional financing is needed to close the funding gap and effectively address the biodiversity crisis.⁵⁷

To support investment, the Government will need to provide long-term certainty in biodiversity-related policy and ensure that consistent policy signals are sent to investors.

Indigenous Peoples and Local Communities

At least 32% of global land and associated inland waters is owned or governed by Indigenous Peoples and Local Communities (IPLC).⁵⁸ The Global Biodiversity Framework stipulates their “full, equitable, inclusive, effective and gender-responsive representation and participation in decision-making”, respect for their territorial rights and protection of their traditions.⁵⁹ Goal C of the Framework states that any benefits from the utilisation of genetic resources must be shared fairly, as appropriate, with indigenous peoples and local communities.

Whilst nature managed by IPLCs is deteriorating less rapidly than elsewhere, it is still facing pressure from resource extraction, deforestation, agriculture and some climate change mitigation programmes. This leads to negative impacts on the health of these communities, loss of traditional livelihoods, local knowledge and management practices, as well as cultural losses related to tangible and intangible heritage. Recognition of the rights of IPLCs and their inclusion in designing and implementing solutions to support global biodiversity goals is imperative.



⁵⁶ Department for Energy Security and Net Zero (DESNZ) [Green Finance Strategy](#) (2023)

⁵⁷ The Nature Conservancy [Closing the Nature Funding Gap: A Finance Plan for the Planet](#) (2020)

⁵⁸ WWF, UNEP-WCMC, SGP/ICCA-GSI, LM, TNC, CI, WCS, EP, ILC-S, CM, IUCN [The state of Indigenous Peoples’ and Local Communities’ lands and territories](#) (2021)

⁵⁹ Targets 22,3,5,9,19,21 [Kunming-Montreal Global Biodiversity Framework](#) (2023)

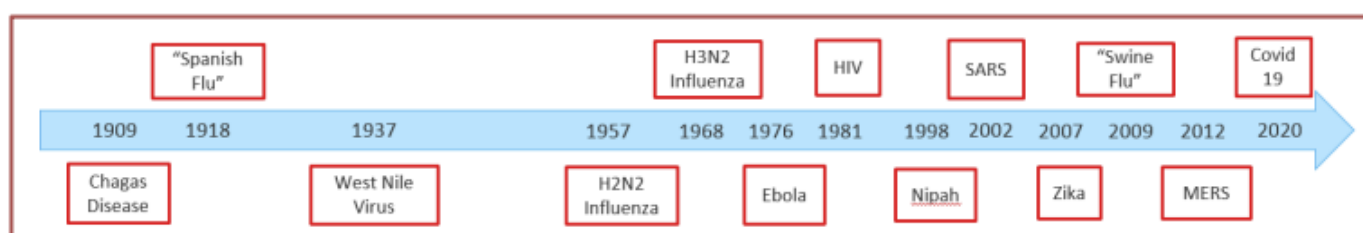
Health impact

Human health is dependent on biodiversity. Soil health and nutrients impact the quality and availability of food, while genetic diversity within species provides resilience to pests and climate change. We are farming more intensively as the global population grows. Higher yields often require inputs such as fertilizers or pesticides, which can reduce the pollinator populations on which three-quarters of crop types rely.⁶⁰

Biodiversity supports societal needs such as economic opportunities and leisure activities that contribute to wellbeing. Pollution, climate change and other causes of ecosystem degradation can harm communities and livelihoods, contributing to poor physical and mental health.

An estimated 4 billion people rely primarily on natural medicines for their health care. Nature is the source of around 70% of our cancer drugs⁶¹ and 75% of antimicrobials⁶². This fact is even more important when considering the increase in antimicrobial drug resistance through human activities such as intensive livestock farming, healthcare, pharmaceuticals and chemical pollution. The World Health Organisation has named antimicrobial resistance as one of the top ten global public health threats facing humanity.⁶³

Climate change and biodiversity loss lead to changes in the geographical ranges of animal populations, including disease vectors such as mosquitoes and ticks. Wildlife, livestock and people are living in closer contact, allowing animal microbes to move into people. The IPBES reports that 70% of emerging diseases, such as Ebola, Zika, Nipah encephalitis, and almost all known pandemics (e.g., influenza, HIV/AIDS, COVID-19) are zoonoses – i.e., are caused by microbes of animal origin. The risk of pandemics is increasing rapidly, with more than five new diseases emerging in people every year, any one of which has the potential to spread and become a pandemic.^{64, 65}



⁶⁰ Our World in Data [Pollinator Dependence](#) (2021)

⁶¹ Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) [Global Assessment of Biodiversity and Ecosystem Services](#) (2019)

⁶² Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) [Workshop Report on Biodiversity and Pandemics](#) (2020)

⁶³ World Health Organisation (WHO) [Factsheet Antimicrobial Resistance](#) (2021)

⁶⁴ *ibid*

⁶⁵ For further reading: IFoA [The Importance of Biodiversity Risks: Link to Zoonotic Diseases](#) (2021)

Justice and fairness

Actuaries already work with frameworks that bring fairness into decision-making. When considering justice and biodiversity this can be subjective and people may ascribe different values and monetary value to the same ecosystem. However, in advising on the equitable allocation of resources, they should consider the following:

- Recognition - inequality and discrimination must be recognised and considered
- Participation- all those affected must be involved in the decision-making process
- Distribution - resources must be allocated as fairly as possible
- Socio-ecological justice – nature must be considered as a participant⁶⁶

Actuarial input into ecosystem governance models and effective communication of the results could be useful, particularly to illustrate the sensitivity of projections to changes in inputs and assumptions. The IFoA's Biodiversity and Natural Capital Working Party has explored some of the issues in case studies looking at rainforests, water, farming and fishing.⁶⁷

Actuaries can inform and influence public debate by engaging with financial regulators and appropriate agencies to ensure a fairness that not only supports the growth of financial institutions but is achieved in tandem with global environmental conservation to reduce the risks we are passing on to future generations.



⁶⁶ E Shoreman-Ouimet, H Kopnina [Reconciling ecological and social justice to promote biodiversity conservation](#), *Biological Conservation* (2015), 184, 320–326

⁶⁷ IFoA [Biodiversity & justice](#) (2021)

Further reading

For further IFoA reading and guidance, including biodiversity curated libraries, research papers, podcasts, and blogs, please see our [biodiversity lifelong learning page](#).

The Actuary articles

Title	Description
Nurturing nature with biodiversity scenarios , July 2023	While most businesses scenario-test for climate change, hardly any do for biodiversity. This needs addressing, argue Aled Jones and Ian Trim.
Blended finance explained , July 2023	What opportunities do developing nations have to secure the funds they need to tackle climate change? Blended finance is one way, say Neha Bhatia and Ranjan Pant.
Actuaries' role in the game of 'Earth Jenga' , April 2023	Like a game of Jenga, we keep whittling away at the building blocks of the Earth to make new things to precariously pile on top. But actuaries can help anchor the wobble, says Sandy Trust
Natural capital investing , February 2023	Chris Howells and Andrew Dreaneen discuss how today's investments in natural capital can profit portfolios as well as the planet and humanity
Interview: chemist and climate expert Sir David King on how actuaries can save the Arctic , February 2023	Actuaries can save the Arctic, according to esteemed chemist and climate-change expert Sir David King. He tells Alex Martin that risk management is as relevant to preserving the planet as groundbreaking science
Can we embrace a circular economy? February 2023	With our pull on the planet's resources, are we bold enough to embrace a circular economy? The potential benefits are not just material, argues Travis Elsum
A steep decline - actuaries must get to grips with the biodiversity crisis , November 2022	Alex Martin and Ryan Allison discuss the upcoming UN Biodiversity Conference – and why biodiversity is an aspect of the sustainability crisis that actuaries must not ignore
Interview: Professor Paul Dalziel on changing the focus of economies from growth to wellbeing , November 2022	Paul Dalziel talks to Alex Martin about the true purpose of economics and the lessons we can draw from the 2019 New Zealand wellbeing budget
Interview: Catherine Howarth on shaping responsible investing , September 2022	Catherine Howarth talks to Travis Elsum about shaping responsible investing, and the changes needed to accelerate the transition to a sustainable and ethical economy
A tale of three capitals: preserving natural capital , September 2022	Ian Trim explores The Dasgupta Review's findings on the importance of preserving natural capital, and the role actuaries can play in achieving this
Show your working: new standards from the ISSB , September 2022	Wendy Walford outlines the need for consistent and comparable sustainability disclosures, and discusses why two new standards from the International Sustainability Standards Board are a step in the right direction
A fairer measure: does GDP fail to measure up? August 2022	GDP is increasingly being seen as too crude a tool, failing to reflect factors such as well-being and sustainability. Nick Spencer and Aled Jones consider some alternatives, and the implications for actuaries.
Nature and society: examining the scope of the Taskforce on Nature-related Financial Disclosures , August 2022	Monica Filkova discusses the scope and activity of the Taskforce on Nature-related Financial Disclosures

Climate change guidance published for actuaries , June 2022 (news)	The Joint Forum on Actuarial Regulation (JFAR) has published an extensive report on the science of climate change and how actuaries can help mitigate risks.
Reversing the decline: understanding nature-related risks , June 2022	Oliver Schelske places nature-related risks within an actuarial context, and explains why it is so important for insurers to understand such risks
Fabiola Schneider: Keeping up appearances , May 2022	Fabiola Schneider talks to Travis Elsum about detecting and addressing corporate greenwashing, the new EU Taxonomy, and investors' role in the journey to a low-carbon economy
A sustainable solution: is sustainability-linked lending the answer? May 2022	Wojciech Herchel, Sam Taylor, Clarence Er and David Devlin consider whether sustainability-linked lending is the answer to changing corporate behaviour
Better than cure , April 2022	Actuaries are well placed to help humanity prevent many of the gravest risks it faces, argues Sanjay Joshi
Biodiversity loss to become 'material risk' for global businesses by 2024 , March 2022 (news)	Businesses may soon struggle to access financial services as requirements to protect biodiversity raise significant liability and litigation risks over the next two years, Clyde & Co has warned.
Natural Justice: issues of fairness posed by the environmental crisis , March 2022	Aled Jones sets out the issues of fairness posed by the environmental crisis, and why actuaries are well placed to help in this area
Jørgen Randers: An end to growth? , December 2021	Professor Jørgen Randers talks to Chris Seekings almost 50 years after the publication of The Limits to Growth, and outlines what we can expect for the world during the next half-century
Caught on camera: how data can help preserve biodiversity , November 2021	Olga Mierzwa-Sulima, Robin Whytock and Jędrzej Świeżewski share their experience of building a machine-learning algorithm that helps track biodiversity in Gabon's tropical forests
The butterfly defect: Global connectivity makes us vulnerable to collapse , November 2021	Aled Jones discusses how the environmental pressures of a complex global economy increase the risk of collapse, and which parts of the world are best placed to survive such an event
Unhealthy planet, unhealthy people , October 2021	Richard Purcell and Anna Spender present a selection of experts' opinions on how climate change could affect health, care and protection, drawn from a recent IFoA Health and Care webinar
Fall of the wild? October 2021	Gillian Rutherford-Liske and Samantha Dunn explain the role general insurers can play in tackling extreme weather and ecosystem loss
Taking responsibility on ESG investment and risk management , October 2021	Rui Wang provides a primer for how general insurance firms should approach ESG investment and risk management
James Dyke: Almost out of time , September 2021	James Dyke talks to Travis Elsum about the hidden pitfalls of net-zero policies and the need for more academic activism
Hand in glove: aligning SDGs and the Paris Agreement , September 2021	Lucy Saye, Melissa Leitner, Shyam Gharial and Thrinayani Ramakrishnan discuss how the UN Sustainable Development Goals and Paris Agreement are aligned in their aim to balance climate action and poverty eradication
The human error in biodiversity loss and the rise of zoonotic diseases , August 2021	Georgina Bedenham, Amy Shields and Andrew Kirk present the findings from their recent IFoA Biodiversity Working Party paper on the link between biodiversity and zoonotic diseases
Taskforce on Nature-related Financial Disclosures launched , June 2021(news)	A new market-led initiative has today been launched to support financial institutions and corporates in assessing and managing emerging nature-related risks and opportunities.
Interview with Cassandra Coburn: Age Concern , May 2021	Cassandra Coburn talks to Travis Elsum about healthy longevity, diet and sustainability, and how they are connected

Act natural: how the economy and biodiversity loss can impact actuarial work , May 2021	Aled Jones and Lucy Saye discuss the link between the economy and the environment, and how biodiversity destruction and loss could impact on the work of actuaries
Preserving ecology to prevent pandemic risk , April 2021	Gordon Woo considers the effects of ecological change on pandemic risk, and when it is likely we will face an even worse pandemic than COVID-19
Vanishing wilderness , March 2021	Travis Elsum assesses the financial consequences of biodiversity loss.
New economic framework needed to protect nature, review finds , February 2021(news)	The world must rethink how it measures economic success to ensure that humanity's demands on nature can meet supply, an independent review on global biodiversity has concluded today.
Nature-based solutions in tackling climate change , September 2020	John Carstensen discusses the role of nature-based solutions in tackling climate change.



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