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# Nature and the Insurance Industry: Taking action towards a nature-positive economy

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# Nature and the Insurance Industry: Taking action towards a nature-positive economy

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## The Geneva Association

The Geneva Association was created in 1973 and is the only global association of insurance companies; our members are insurance and reinsurance Chief Executive Officers (CEOs). Based on rigorous research conducted in collaboration with our members, academic institutions and multilateral organisations, our mission is to identify and investigate key trends that are likely to shape or impact the insurance industry in the future, highlighting what is at stake for the industry; develop recommendations for the industry and for policymakers; provide a platform to our members and other stakeholders to discuss these trends and recommendations; and reach out to global opinion leaders and influential organisations to highlight the positive contributions of insurance to better understanding risks and to building resilient and prosperous economies and societies, and thus a more sustainable world.

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# Foreword

Nature loss is occurring far more than any of us realise. And it is essentially man-made. Take the Ukraine war, for example. Beyond the tragic loss of lives, the impacts on nature are massive. Warfare disrupts species and destroys habitats, sometimes rare ones. This is in addition to the fact that most military aircraft and ships still run on fossil fuels.

Climate- and nature-related risks do not only exist in parallel; they comprise a dangerous feedback loop. Deforestation contributes to the significant release of carbon into the atmosphere and therefore to global warming. Warming oceans compromise coral reefs – an important buffer for coastal communities and infrastructure against natural disasters such as hurricanes.

Insurers are among those trying to reverse this feedback loop with nature-based solutions. For example, the Mesoamerican Reef System, the largest barrier reef in the Atlantic Ocean, now benefits from an innovative parametric insurance solution that finances restoration in the event of hurricane-related damage. Hurricane Lisa in November 2022 effectively triggered the first pay-out under this policy.

Insurance initiatives on the asset side are arguably more advanced, with insurers investing more in forestry and increasingly divesting from industries that adversely affect the environment.

These are early days. Solutions are nowhere near sufficient scale. Re/insurers are still learning about nature-related risks, particularly when it comes to key, nature-dependent sectors like agriculture and construction. It is also essential to fully assess the environmental impacts associated with producing and deploying the new technologies required for the climate transition.

What is at stake with large-scale, nature-related loss is still being researched. Together with the scientific community, environmental experts and policymakers, insurers will strive to further understand and carry out nature-positive activities and resilience-building towards a sustainable economy.



**Jad Ariss**  
Managing Director, The Geneva Association

# Table of abbreviations

<b>CBD</b>	Convention on Biological Diversity
<b>CBSD</b>	Climate Disclosure Standards Board
<b>CI</b>	Conservation International
<b>EbA</b>	Ecosystem-based adaptation
<b>EFRAG</b>	European Financial Reporting Advisory Group
<b>ESG</b>	Environmental, social and governance
<b>ESRS</b>	European Sustainability Reporting Standards
<b>EVs</b>	Electric vehicles
<b>GA</b>	The Geneva Association
<b>GDP</b>	Gross domestic product
<b>GHG</b>	Greenhouse gas
<b>IFRS</b>	International Financial Reporting Standards
<b>IPBES</b>	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>IPSF</b>	International Platform on Sustainable Finance
<b>ISSB</b>	International Sustainability Standards Board
<b>MAR Fund</b>	Mesoamerican Reef Fund
<b>NatCat</b>	Natural catastrophe
<b>NbS</b>	Nature-based solutions
<b>NGFS</b>	Network for Greening the Financial System
<b>NGOs</b>	Non-governmental organisations
<b>P&amp;C</b>	Property & casualty
<b>PBAF</b>	Partnership for Biodiversity Accounting Financials
<b>PCAF</b>	Partnership for Carbon Accounting Financials
<b>TCFD</b>	Task Force on Climate-Related Financial Disclosures
<b>TNC</b>	The Nature Conservancy
<b>TNFD</b>	Task Force on Nature-Related Financial Disclosures
<b>UN</b>	United Nations
<b>UNEP-FI</b>	United Nations Environment Programme Finance Initiative
<b>WEF</b>	World Economic Forum



# 1. Executive summary

The sustainability of natural capital is vital for socio-economic development and prosperity. Yet, nature has systematically been considered an externality – undervalued and mispriced by the public and private sectors. Since 2019, however, a number of flagship reports have presented clear and concrete evidence of the large-scale impacts of the pollution and depletion of natural capital due to human activity, as well as the significant implications this has for people and businesses.

The World Economic Forum (WEF)'s 2022 Global Risk Report identified large-scale nature degradation and biodiversity loss as one of the five most threatening long-term risks facing the world in the next five to 10 years. Industries that are highly dependent on nature generate 50% of global gross domestic product (GDP), the three largest sectors being construction, agriculture and livestock, and food and beverages. Larger economies, in particular China, the EU and the U.S., have the highest absolute amounts of GDP in nature-dependent sectors.

**Large-scale nature degradation and biodiversity loss is one of the top five long-term risks facing the world in the next five to 10 years.**

Importantly, climate change and large-scale nature loss are interlinked from both cause and effect perspectives. It has been demonstrated that nature-based solutions both increase resilience to physical climate risks (climate change adaptation) and sequester carbon (climate change mitigation). At the same time, the large-scale deployment of new technological solutions for the decarbonisation of energy and other sectors to achieve net-zero targets comes with myriad risks, such as environmental and disposal risks, that could have profound impacts on nature. Addressing climate change and nature and biodiversity loss concomitantly with a system-based approach is therefore necessary if either is to be solved.

The need to protect natural capital is gaining global attention. A number of external factors are transforming nature-related risks and opportunities from a scientific and environmental issue to a core business issue: the evolving public policy and regulatory landscape; efforts to quantify the financial risks associated with nature loss by the Task Force for Nature Related Financial Disclosure (TNFD); sustainable finance frameworks; financial regulatory bodies' increasing attention to the financial risks of large-scale nature loss; rising litigation; the incorporation of nature-related issues in corporate, sovereign and municipal credit ratings; and growing investor and shareholder awareness and actions.

**The need to protect natural capital is gaining global attention.**

For the past 30 years, re/insurers have provided leadership in natural catastrophe (NatCat) risk modelling and pricing; conducting research on, raising awareness of and promoting risk reduction and preventive measures; and offering risk transfer solutions to build societal resilience to extreme events. In 2020, The Geneva Association launched an industry-led task force to advance and accelerate the development of forward-looking climate change risk assessment and scenario analysis tools. These efforts centre on assessing the materiality of physical, transition and litigation risks and their interactions over the short and long term to provide decision-relevant risk information for developing climate targets, strategies and transition plans. In the last few years, some re/insurers have also been supporting science-based research to explore the risks associated with large-scale biodiversity and nature loss, to quantify the benefits of nature-based systems for increasing resilience to extreme events, and for carbon sequestration. Recent reports by AXA, Swiss Re and the Muséum National d'Histoire Naturelle in Paris, later in partnership with the SCOR Foundation, have provided a systemic view of the risks associated with large-scale biodiversity and nature loss, how they relate to the re/insurance business model and the opportunities this presents for the development of innovative insurance products.

This report offers a comprehensive overview of the latest developments in this field, based on a literature review of the scientific evidence. It further explores the interconnectivities of nature- and climate change-related risks and details the factors that are driving these issues into core business decision-making. Building on the literature review and discussions with experts from 25 insurance companies, we frame the risks and opportunities from the insurance business model perspective and offer the following key messages.

1. A paradigm shift in the societal perception of large-scale, nature-related risks is anticipated in the coming years. We expect these risks to become a major driver of future socio-economic development and core business decision-making. More applied research that quantifies the benefits of nature-positive activities for addressing climate change, establishes best practices for assessing the risks of nature and biodiversity loss, and evaluates the impact of mitigation actions is required to encourage meaningful action at scale and attract more coordinated and aligned funding.
2. Re/insurers could experience nature-related risks through four main channels: 1) societal vulnerability to physical climate risks, disease transmission, health issues and pandemics; 2) impacts on insureds and investees with unsustainable business models and supply chains; 3) secondary impacts of unsustainable government developmental approaches; 4) reduction in greenhouse gas (GHG) sequestration.

## Nature-related risks are becoming a major driver of future socio-economic development and core business decision-making.

3. These risks could impact re/insurers in a variety of ways. On the underwriting side, the scale and scope of nature-related risks may threaten insurability in property and casualty (P&C) insurance while there may be implications for longevity, mortality and morbidity rates on the life & health side. The changing landscape may render existing underwriting models obsolete, and a lack of data could be a major bottleneck to assessing and pricing risks and developing effective insurance solutions and investment strategies. Rising physical climate risks also pose threats to insurers' investments, as well as their own real assets.
4. Innovative insurance products and services as well as investment strategies that account for the interlinkages between climate change and nature could lead to win-win situations. On the liability side, insuring nature-based solutions can enhance resilience to physical climate risks and lead to carbon credits. Insurers can also invest in the restoration and conservation of nature-based ecosystems and solutions, and develop investment strategies that support sustainable business practices.
5. Establishing demand for and supply of insurance products targeted at the protection of nature-based systems will take time and comes with four primary challenges: 1) combatting the misperception that nature can be exploited for free, forever; 2) correctly pricing products and identifying customers who would benefit from them – and who are willing to purchase them; 3) a lack of data and tools for quantifying the value of nature-based systems in monetary terms; and 4) policy and regulatory issues.
6. Nature-positive activities and resilience building should be at the centre of a sustainable economy. Acting now can reduce current and future exposures to nature-related risks and lead to business opportunities whereas delaying could exacerbate the risks to a point of no return. Understanding and mapping the risks, raising awareness and developing new, innovative risk management solutions and investment strategies is an exploratory and iterative process that requires cross-sectoral collaboration and alignment, as well as strong buy-in and commitment from stakeholders across the public and private sectors.



## 2. Introduction

Nature encompasses several dimensions of the physical world – oceans, land, the atmosphere and freshwater, as well as different kinds of life (biodiversity). Healthy nature and biodiversity provide numerous benefits to society. In the past decades, both our dependencies and our impacts on nature have increased significantly. Between the 1950s and 1980s, the United Nations (UN) brought the need for ‘sustainable’ development to the forefront of international policy dialogue.<sup>1</sup> Various UN agencies and programmes have also presented evidence on and highlighted the impacts of ‘development’ – as it relates to population growth – on large-scale environmental degradation, ozone depletion, health-related concerns and accessibility to clean water, energy and food. Subsequently, a number of international framework agreements have been facilitated by the UN to address the protection of nature in relation to socio-economic development.

### Healthy nature and biodiversity provide numerous benefits to society.

Several agreements target specific topics, but it is being acknowledged that many of these issues are deeply interconnected. For example, collaborative efforts among UN agencies prior to the three milestone framework agreements of 2015 (i.e. The Paris Agreement,<sup>2</sup> Sendai Framework on Disaster Risk Reduction<sup>3</sup> and Sustainable Development Goals<sup>4</sup>) brought focus to the interlinkages between sustainable development, climate change and disaster risk management.<sup>5</sup> Furthermore, since 2019, a number of reports have led to a paradigm shift in the international dialogue on large-scale nature degradation and biodiversity loss linked to human activity, transforming it from a scientific and environmental issue to a core driver for socio-economic development.<sup>6</sup> These reports have also offered solid evidence on:

- The scale of human impacts (e.g. consumption behaviours, industrial and business practices and government development approaches) on nature degradation and biodiversity loss
- How large-scale nature loss leads to significant and increasing socio-economic and business-related risks
- The importance of nature-based solutions for climate change adaptation and mitigation measures.

1 The Geneva Association 2017. Authors: Maryam Golnaraghi and Patrick Khalil.

2 UN 2015a.

3 UN 2015b.

4 UN 2015c.

5 The Geneva Association 2017.

6 Including Dasgupta 2021; WEF 2020, 2022b; CBD 2020; IPBES 2019; IPBES and IPCC 2021; Organisation for Economic Co-operation and Development (OECD) 2019; Swiss Re 2020a; IPCC 2021, 2022a,b.

There is an urgent need to quantify the pace of nature loss, its impacts on society and the benefits of nature and biodiversity. Current economic and business models exploit nature far more rapidly than it can regenerate itself, with accelerating biodiversity loss and ecosystem degradation directly linked to human activity.<sup>7</sup> Yet, nature is essential to human existence, quality of life and livelihoods. This is evidenced by the heavy reliance of global GDP (USD 87.65 trillion in 2019)<sup>8</sup> on nature, with over 50% of it depending on natural capital and ecosystem services.<sup>9</sup> Assessing and valuing biodiversity and ecosystem services is complex and still under development. However, the most comprehensive global estimates suggest that nature provides a value of USD 125–140 trillion per year, more than one and a half times global GDP.<sup>10</sup> Still, nature remains systematically undervalued in decision-making by all economic and political actors,<sup>11</sup> with the total cost of subsidies that damage nature estimated at between USD 4 to 6 trillion per year.<sup>12</sup>

## Over 50% of global GDP is dependent on natural capital and ecosystem services.

Inconsideration for and undervaluation of nature's worth to society mean that insufficient attention has been given to its sustainable management, as reflected in market prices (externality) and measures of economic well-being.<sup>13</sup> For example, the depreciation of natural capital is not included in GDP.<sup>14</sup> The cost of biodiversity loss is already high, with an estimated USD 6.3 trillion per year due to land degradation only.<sup>15</sup>

Moreover, nature loss risks are non-linear and many ecosystems are close to tipping points, beyond which they may be unrecoverable. This would have significant environmental and socio-economic consequences. Given the exposure to biodiversity loss and its financial materiality, the case for action is gaining attention.<sup>16</sup> Global efforts are underway through the financial sector and leading global, nature-based, non-profit institutions

## Many ecosystems are close to tipping points, beyond which they may be unrecoverable.

to quantify the value of nature and the financial impacts of its degradation through the TNFD.

Importantly, climate change and large-scale nature loss are inextricably linked from both cause and effect perspectives. In 2021, the first joint report of the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) concluded that the world must tackle climate change and biodiversity loss together if either issue is to be successfully solved.<sup>17</sup> The world needs to strive towards a resilient, net-zero, nature-positive economy to tackle the climate and nature crises.<sup>18</sup> The conservation and restoration of natural ecosystems are critical elements of climate adaptation and mitigation strategies.<sup>19</sup> The need for long-term investments to address these issues is also driving sustainable finance frameworks at the regional and national levels to address changes in the financial sector and enable capital allocation towards GHG-neutral and nature-positive activities.<sup>20</sup>

While the insurance industry, through its environmental liability products, has enabled faster response to the clean up of spills, the speed, scale and scope of nature and biodiversity loss linked to human activity present a whole new range of risks and opportunities for the industry. In recent years, some re/insurers have been

## The speed, scale and scope of nature and biodiversity loss present a new range of risks and opportunities for the insurance industry.

7 IPBES 2019; National Footprint and Biocapacity Accounts 2022.

8 World Bank data: <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD>.

9 WEF 2020, 2022a,b; Swiss Re 2020a.

10 OECD 2019.

11 IPBES 2022b.

12 Dasgupta 2021.

13 IPBES 2022b.

14 Ibid.

15 Sutton et al. 2016.

16 Cambridge Institute for Sustainability Leadership (CISL) 2020; OECD 2019.

17 IPCC 2021, IPBES and IPCC 2021.

18 WEF 2020, 2022a,b; WEF and PwC 2020.

19 IPCC 2021, 2022a,b.

20 Finance for Biodiversity Initiative 2022a.



supporting science-based research to explore the myriad risks associated with large-scale nature loss, quantify the benefits of nature-based systems for increasing resilience to extreme events and for carbon sequestration, and develop innovative insurance products and more sustainable investment strategies.<sup>21</sup> The links between climate change and nature-based systems are also being explored by The Geneva Association to address societal resilience to extreme weather events and mobilise support to enable the global net-zero transition.<sup>22</sup> Several preliminary efforts by other stakeholders (e.g. the UN, regulatory and supervisory bodies, insurance brokers and multilateral development banks) are also underway to explore the value proposition of the insurance industry in this area.<sup>23</sup>

Against this backdrop, this report provides a comprehensive overview of the latest developments in this field and offers an overview of:

- The latest scientific evidence on the impacts of human activity on nature, the materiality of large-scale, nature-related loss on society, and the interconnectivities between nature- and climate change-related risks

- The socio-economic benefits of nature-based solutions and the linkages with climate change adaptation and mitigation measures
- The external factors driving nature-positive considerations into core business decision-making for corporates and re/insurers
- The challenges and opportunities for re/insurers associated with the development of a nature-positive economy and business models, and related 'win-win' opportunities to address climate change.

The report is based on an in-depth literature review, as well as discussions with experts from 25 re/insurance companies<sup>24</sup> and two leading global, nature-focused, non-profit organisations working with the insurance industry in this area.<sup>25</sup> The terminology used in this report is detailed in the Appendix.

21 For example, AXA Research Fund 2022; AXA 2019; MNHM and SCOR 2022; Swiss Re Institute 2021; Swiss Re 2020a,b.

22 The Geneva Association 2019. Author: Maryam Golnaraghi; The Geneva Association 2021a-d. Authors: Maryam Golnaraghi et al.; The Geneva Association 2022. Authors: Maryam Golnaraghi et al.; Golnaraghi 2022.

23 Sustainable Insurance Forum (SIF) 2021; UNEP-FI PSI 2019; The World Bank 2022; Marsh McLennan 2022.

24 This involved discussion with members of the Geneva Association Climate Change & Environment Working Group and the Emerging Environmental Risks Advisory Committee from the following companies: ACHMEA, AIG, Allianz, Aviva, AXA, AXA XL, Axis Capital, Chubb, Fidelidade, Hannover Re, IAG, Intact Financial, MAPFRE, MetLife, Munich Re, Phoenix Group, Prudential Financial, Renaissance Re, RGA Re, SCOR, Tokio Marine, Tokio Marine HCC, Swiss Re, Vidacaixa, Zurich.

25 The Nature Conservancy and Conservation International.



### 3. Human activities and large-scale, nature-based risks: A two-way street

*“Although the world’s 7.6 billion people represent only 0.01% of all living things by weight; humanity has already caused the loss of 83% of all wild mammals and half of all plants. The current rate of extinction is tens to hundreds of times higher than the average over the past 10 million years and is accelerating.”<sup>26</sup>*

WEF’s 2022 Global Risk Report<sup>27</sup> identified large-scale nature degradation and biodiversity loss as one of the top five most threatening, long-term issues facing the world (Figure 1). WEF also highlights that the interlinkages of highly damaging environmental risks, including climate change inaction, extreme weather and biodiversity loss, are deeply connected to other social (livelihood crises), geopolitical (social cohesion erosion) and economic risks threatening the world.

#### **3.1 The impact of human activity on nature and biodiversity loss**

Over the last few years, a number of major studies have presented undeniable evidence about the global scale of the impacts of human activity on nature and biodiversity loss.<sup>28</sup> Human consumption and production patterns, governments’ development approaches to urbanisation and land use, as well as industrial practices and business models in a variety of economic sectors (e.g. extraction of natural resources, operations, waste management) have led to what scientists call ‘a massive planetary crisis.’

*“Threats emerging from (1) food, land and ocean use; (2) infrastructure and the built environment; and (3) energy and extractive sectors, together with climate change, impact 79% of near-threatened species.”<sup>29</sup>*

<sup>26</sup> WEF and PwC 2020.

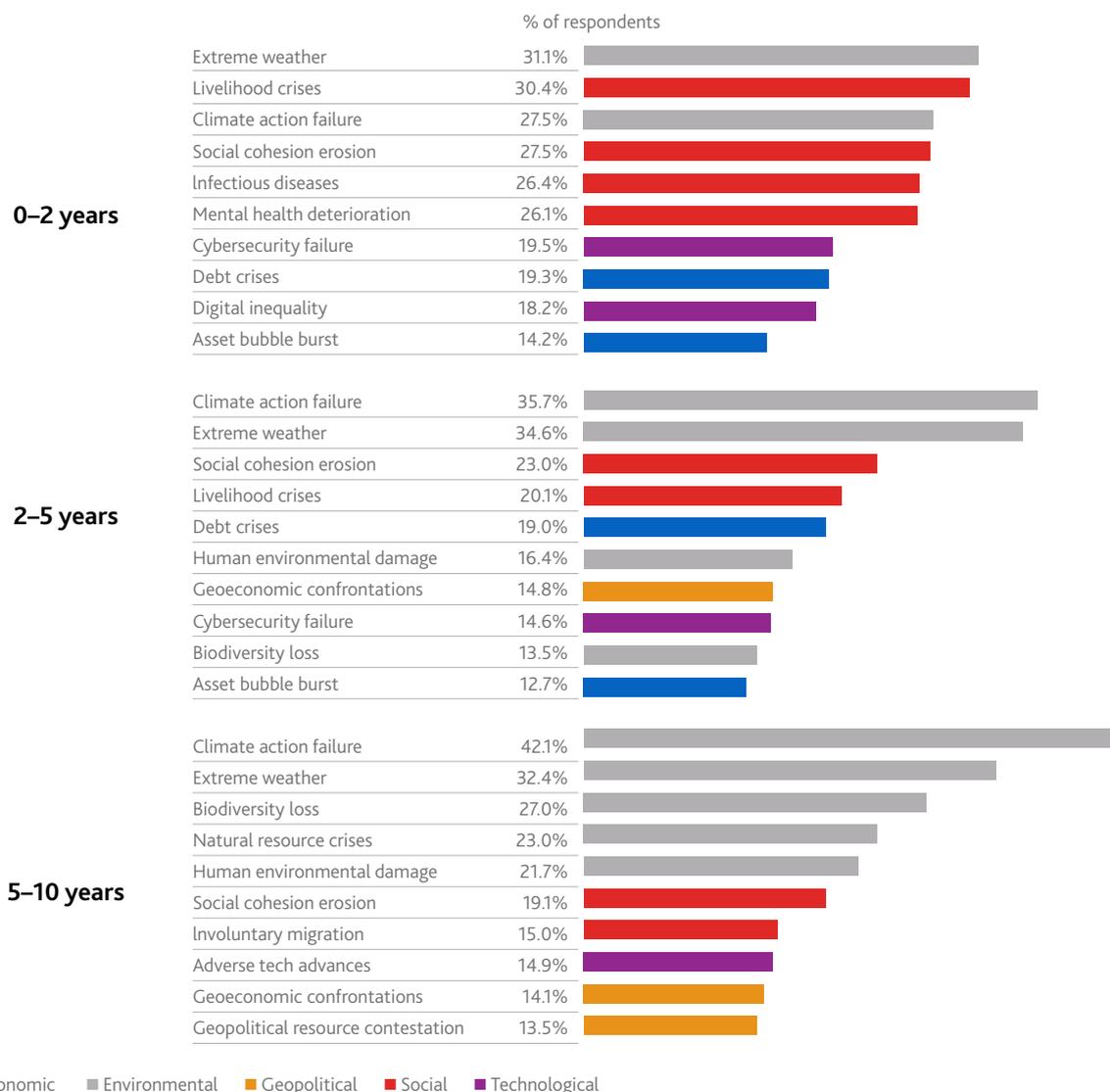
<sup>27</sup> WEF 2022b.

<sup>28</sup> Dasgupta 2021; WEF 2020, 2022b; CBD 2020; IPBES 2019; Swiss Re 2020a; IPBES and IPCC 2021; OECD 2019; IPCC 2021 2022a,b.

<sup>29</sup> WEF 2022b.

A number of flagship reports have captured the extent of the impacts of human activities on oceans, freshwater, land and air, as well as natural ecosystem degradation and biodiversity loss, with some potentially reaching their tipping points. A few examples are highlighted in Table 1. Simply put, we are destroying the very resources that our economy and livelihoods profoundly depend on, in some cases irreversibly.

**Figure 1: Global risks horizon — When will risks become a critical threat to the world?**



Source: WEF<sup>30</sup>

**Table 1: Implications of human behaviour for nature-based capital**

	Oceans	Freshwater
<b>Economic sectors</b>	<p><b>Fishing industry:</b></p> <ul style="list-style-type: none"> <li>• 66% of the total ocean area is subject to intensive fishing activities.</li> <li>• 93% of fish stocks are fished at or beyond maximum sustainable levels.</li> <li>• Globally, 17.9% of marine plastic pollution is derived from fishing. Nearly half of the material recovered from the Great Pacific Garbage Patch is abandoned fishing gear.</li> </ul> <p><b>Plastic industry:</b></p> <ul style="list-style-type: none"> <li>• 1.2–2.4 million tonnes of plastic flow from rivers into oceans every year.</li> <li>• Only 9% of all plastic waste has been recycled.</li> </ul> <p><b>Fashion industry:</b></p> <ul style="list-style-type: none"> <li>• Responsible for approximately 35% (190,000 tonnes per year) of oceanic microplastic pollution.</li> </ul>	<p><b>Fashion industry:</b></p> <ul style="list-style-type: none"> <li>• Responsible for 20% of global wastewater.</li> <li>• Uses &gt;79 trillion litres of water per year.</li> </ul> <p><b>Agriculture:</b></p> <ul style="list-style-type: none"> <li>• Accounts for about 70% of freshwater withdrawals worldwide. This is projected to increase.</li> </ul>
<b>People &amp; communities</b>	<p><b>Consumption practices:</b></p> <ul style="list-style-type: none"> <li>• At least 14 million tonnes of plastic escape into the ocean every year.</li> <li>• Plastic makes up 80% of all marine debris.</li> </ul>	<p><b>Urban development and consumption patterns:</b></p> <ul style="list-style-type: none"> <li>• Freshwater species show the largest decline in population size, with 83% loss since 1970.</li> </ul>

Land	Air	Biodiversity
<p><b>Agriculture:</b></p> <ul style="list-style-type: none"> <li>• 50% of global habitable land is used for agriculture and livestock, with profound impacts on nature, e.g. almost 35% of mineral nitrogen fertilisers enter the oceans. Over three quarters is used for livestock (meat and dairy), which corresponds to only 18% and 37% of global calorie and protein supply, respectively.</li> <li>• 52% of agricultural production land is degraded.</li> <li>• Responsible for 80% of global deforestation.</li> <li>• 80% of global farmland has moderate to severe erosion: 75 billion tonnes of soil erode annually at a rate 13 to 40 times higher than before anthropogenic acceleration.</li> </ul> <p><b>Fashion industry:</b></p> <ul style="list-style-type: none"> <li>• &gt;92 million tonnes of textile waste ends up in landfills/is burnt.</li> <li>• Cotton farming is responsible for 24% of insecticide use and 11% of pesticide spread, despite using only 3% of arable land.</li> </ul>	<p><b>Food industry:</b></p> <ul style="list-style-type: none"> <li>• Represents 29% of global GHG emissions.</li> </ul> <p><b>Agriculture &amp; forestry:</b></p> <ul style="list-style-type: none"> <li>• Produce 24% of all human-induced GHG emissions: 12% from forestry (deforestation and forest degradation) and 12% from agriculture (40% from agricultural emissions from livestock).</li> </ul> <p><b>Transport industry:</b></p> <ul style="list-style-type: none"> <li>• 15% of total global gas emissions and 72% of global transport emissions come from road vehicles.</li> </ul> <p><b>Fashion industry:</b></p> <ul style="list-style-type: none"> <li>• Emits 8–10% of global CO<sub>2</sub> emissions.</li> </ul>	<p><b>Agriculture:</b></p> <ul style="list-style-type: none"> <li>• Responsible for 80% of global deforestation.</li> <li>• 72% of threatened or near-threatened terrestrial, freshwater and marine species are overexploited and 62% are affected by agriculture.</li> <li>• Excessive use of pesticides and herbicides has reduced pollinator populations by 40% in recent decades.</li> </ul> <p><b>Food industry:</b></p> <ul style="list-style-type: none"> <li>• Accounts for 70% of terrestrial biodiversity loss and 50% of freshwater biodiversity loss.</li> </ul> <p><b>Invasive species:</b></p> <ul style="list-style-type: none"> <li>• Cumulative records of alien species have increased by 40% since 1980.</li> <li>• Nearly one fifth of the Earth's surface is at risk of plant and animal invasions.</li> </ul>
<p><b>Deforestation and land use:</b></p> <ul style="list-style-type: none"> <li>• 75% of the Amazon tropical rainforest has lost its resilience capacity (ability to recover from extreme events).</li> <li>• Human use directly affects more than 70% of land surface.</li> <li>• By 2030, urban land cover will increase by 1.2 million km<sup>2</sup>. It will have almost tripled since 2000.</li> </ul>	<p><b>Urban development:</b></p> <ul style="list-style-type: none"> <li>• Cities produce 70% of GHG emissions despite occupying less than 2% of the Earth's surface.</li> <li>• 99% of the global population breathes air that exceeds World Health Organization (WHO) air quality limits.</li> </ul>	<p><b>Urban development:</b></p> <ul style="list-style-type: none"> <li>• 50% of marshes, 35% of mangroves and 50% of reefs are either lost or degraded.</li> <li>• Mangroves declined by 20% from 1980 to 2005, and natural wetlands declined by 35% between 1970 and 2015.</li> </ul> <p><b>Exploitation of wildlife:</b></p> <ul style="list-style-type: none"> <li>• 50,000 wild species globally are used for food, energy, medicine materials and other purposes.</li> </ul>

	Oceans	Freshwater
<b>Governments</b>	<p><b>Lack of coral reef conservation policies:</b></p> <ul style="list-style-type: none"> <li>• 50% of the world’s coral reefs are already destroyed.</li> <li>• 31% of the world’s coral is at risk of bleaching (8% in 1980s).</li> <li>• Projections show a 70–90% decline with 1.5°C global warming and &gt;99% decline with 2°C warming.</li> </ul> <p><b>Anthropogenic oceanic changes:</b></p> <ul style="list-style-type: none"> <li>• Between 84–90% of marine heatwaves between 2006 and 2015 are attributable to anthropogenic oceanic warming.</li> </ul>	<p><b>Wastewater mismanagement:</b></p> <ul style="list-style-type: none"> <li>• Wastewater treatment plants are currently unable to remove all plastic particles from wastewater before their release into the environment or municipal water systems.</li> </ul>

Source: The Geneva Association<sup>31</sup>

### 3.2 The impact of nature and biodiversity loss on society

The primary and secondary effects of large-scale, nature-related loss on society are severe (Table 2).

**Table 2: How nature-related changes impact economic sectors, governments and people**

	Economic sectors
<b>Oceans</b>	<p><b>Fishing industry:</b></p> <ul style="list-style-type: none"> <li>• Overexploitation of fishing resources leads to a USD 50 billion shortfall each year.</li> </ul> <p><b>Tourism industry:</b></p> <ul style="list-style-type: none"> <li>• The image of tourist destinations can be harmed by marine and coastal litter. This may result in local tourism losses of up to 40%.</li> <li>• The destruction of coral reefs endangers the coastal tourism industry and coastal communities (reef tourism generates USD 36 billion a year).</li> </ul>

31 Based on the review of: AXA 2019; Boulton et al. 2022; CarbonBrief 2018; ClientEarth 2021b; Global Canopy and Vivid Economics 2020; IPBES 2019, 2022a; IPCC 2018, 2019a,b; International Union for Conservation of Nature (IUCN) 2021; Niinimäki et al. 2020; OECD 2019, 2020, 2021a; Our World in Data 2019; Seto et al. 2012; Swiss Re 2020a; UN Habitat 2011; UNEP 2021; Valiela et al. 2001; WEF 2020; WEF and PwC 2020; WHO 2022; World Wildlife Fund (WWF) 2019, 2020.

Land	Air	Biodiversity
<p><b>Lack of land conservation policies:</b></p> <ul style="list-style-type: none"> <li>• Only one quarter of global land mass is unaffected by human activities. This proportion could fall to 10% by 2050.</li> <li>• 32% of the world's forest area has already been destroyed.</li> <li>• One third of global land is severely degraded. Fertile soil is being lost at a rate of 24 billion tonnes a year.</li> <li>• Global land productivity has decreased by 20% due to land degradation and climate change (50% in some regions).</li> </ul>	<p><b>Waste mismanagement:</b></p> <ul style="list-style-type: none"> <li>• Industrial incineration is used to treat 15% of plastic waste. This releases 2.7 metric tonnes of CO<sub>2</sub> into the atmosphere for every metric tonne of incinerated plastic waste.</li> <li>• CO<sub>2</sub> emissions from the incineration of plastics could triple by 2030.</li> </ul>	<p><b>Trade policies:</b></p> <ul style="list-style-type: none"> <li>• Cumulative records of alien species have increased by 40% since 1980.</li> <li>• Nearly one fifth of the Earth's surface is at risk of plant and animal invasions.</li> </ul> <p><b>Development and industrial policies:</b></p> <ul style="list-style-type: none"> <li>• Have already caused the loss of 50% of all plants and 83% of all wild mammals. A million species are facing extinction, many within decades.</li> <li>• Caused an 83% population decline in freshwater species since 1970, 60% in vertebrate species, and 41% of known insect species.</li> <li>• There is an extinction risk of 20% of all species within the next several decades, perhaps twice as much by the end of the century.</li> </ul>

People & communities	Governments
<p><b>Sea-level rise and livelihood loss:</b></p> <ul style="list-style-type: none"> <li>• Sea-level rise leads to accelerated coastal erosion and loss of land to the ocean.</li> <li>• Sea-level rise exacerbates extreme sea-level events and will increase annual expected flood damages by two to three orders of magnitude by 2100 without adaptation.</li> </ul> <p><b>Plastic bioaccumulation and health:</b></p> <ul style="list-style-type: none"> <li>• More than 10 million tonnes of plastic in the ocean are ingested by fish in the form of microplastics, which enter the food chain and are consumed by humans.</li> </ul>	<p><b>Severity of storms and flooding in coastal regions:</b></p> <ul style="list-style-type: none"> <li>• Without reefs, annual global damages from flooding are expected to double. For 1-in-100-year storm events, they would increase by 91% to USD 272 billion.</li> <li>• Loss of coral reef cover will cost the international economy an estimated USD 11.9 trillion. Small Island Developing States will be especially impacted given the ties between their economy and coral reefs.</li> <li>• If mangroves were lost, 15 million more people would be flooded annually across the world. Property losses produced by 1-in-100-year flood events would impact 37 million more people and damages would increase by USD 270 billion.</li> <li>• Mangroves reduce annual expected flood damages from tropical cyclones by USD 60 billion. Between 1996 and 2016, 4.3% of the world's mangroves were lost (up to 7.2% in certain regions).</li> </ul>

	Economic sectors
Freshwater	<ul style="list-style-type: none"> <li>• Droughts have a direct impact on yields and prices, e.g. production of coffee beans fell by 20–30% in 2021, pushing up the global average price by 60%.</li> <li>• The financial impacts of freshwater risks on water-intensive sectors are estimated at USD 301 billion – five times higher than the cost of managing them.</li> </ul>
Land	<p><b>Agriculture:</b></p> <ul style="list-style-type: none"> <li>• Land degradation and climate change will lead to a 20% reduction in global land productivity and a 50% reduction in crop yields in some regions by 2050.</li> <li>• Erosion, salinisation, soil compaction and pollution threaten about 85% of global arable land.</li> <li>• Decreasing soil productivity is observed in 20% of the world’s cropland, 16% of forest land, 19% of grassland and 27% of rangeland.</li> <li>• In 12 million hectares of EU agricultural land, crop productivity falls by an estimated 0.43% annually, costing EUR 1.25 billion.</li> </ul> <p><b>Plastic industry:</b></p> <ul style="list-style-type: none"> <li>• Microplastic pollution on land is significantly higher than at sea.</li> </ul>
Air	<p><b>Solar energy industry:</b></p> <ul style="list-style-type: none"> <li>• Significant particulate matter pollution can cause major drops in solar energy yields because of smog. For example, the most affected areas in India and China exhibit a potential 25% loss of yield.</li> </ul> <p><b>Productivity:</b></p> <ul style="list-style-type: none"> <li>• The annual number of lost working days due to air pollution is projected to reach 3.7 billion in 2060 compared to 1.2 billion today.</li> </ul>

People & communities	Governments
<ul style="list-style-type: none"> <li>Nearly one third of the world's largest cities (e.g. Los Angeles, New York, Rome and Tokyo) depend on nearby protected forests for water availability and quality.</li> <li>40% of the global population is already affected by water scarcity.</li> <li>30% of the global population lack safely-managed drinking water supplies.</li> <li>Every year, nearly 300,000 children under the age of five die of diarrhea linked to dirty water and poor sanitation.</li> </ul>	<p><b>Water scarcity risks for economic growth:</b></p> <ul style="list-style-type: none"> <li>The Middle East and North Africa have the largest expected economic losses from climate-related water scarcity, estimated at 6–14% of GDP by 2050.</li> <li>60% of China's groundwater is polluted and rated as unfit for human contact, threatening economic growth and human health.</li> </ul>
<p><b>Agriculture:</b></p> <ul style="list-style-type: none"> <li>More than 1.3 billion people live on agricultural land that is deteriorating, putting them at risk of worsening hunger, water shortages and poverty.</li> </ul>	<p><b>Risk to economic growth:</b></p> <ul style="list-style-type: none"> <li>The world lost an estimated USD 4–20 trillion per year in ecosystem services from 1997–2011, owing to land-cover change (loss of natural areas), and an estimated USD 6–11 trillion per year from land degradation.</li> </ul>
<p><b>Welfare cost and premature deaths (from exposure to outdoor fine particles and ozone):</b></p> <ul style="list-style-type: none"> <li>Costs were USD 5.3 trillion globally in 2017.</li> <li>Pollution is estimated to cause 7 million premature deaths annually, and millions more die every year from other environment-related health risks.</li> </ul> <p><b>Bronchial asthma:</b></p> <ul style="list-style-type: none"> <li>Affects between 100 and 150 million people worldwide.</li> </ul> <p><b>Wildfires:</b></p> <ul style="list-style-type: none"> <li>Are a major driver of GHG emissions.</li> <li>Wildfire smoke is responsible for 5–8% of annual premature deaths from air pollution.</li> </ul>	<p><b>Economic costs of air pollution on health:</b></p> <ul style="list-style-type: none"> <li>Annual costs are USD 900 billion in China, USD 600 billion in the U.S., and USD 150 billion in India (6.6%, 3% and 5.4% of GDP, respectively).</li> </ul>

	Economic sectors
Biodiversity	<p><b>Agriculture:</b></p> <ul style="list-style-type: none"> <li>• 75% of food crop production depends on pollination services.</li> <li>• Recent decades have seen a 40% reduction in pollinators, leading to falling crop yields.</li> <li>• The loss of all pollinators represents an annual net loss in economic welfare of USD 160–191 billion globally. This incurs additional losses of USD 207–497 billion to producers and consumers in other markets (e.g. non-crop agriculture, forestry, food processing).</li> <li>• Invasive species may cost global agriculture USD 540 billion annually (USD 100 billion in the U.S. alone).</li> </ul> <p><b>Tourism industry: Impact of coral reef destruction</b></p> <ul style="list-style-type: none"> <li>• Ecotourism on coral reefs generates USD 36 billion in global tourism annually.</li> <li>• By 2100, climate change is projected to result in a USD 140 billion loss in the recreational benefits associated with coral reefs under a high emissions scenario.</li> </ul> <p><b>Pharmaceutical industry:</b></p> <ul style="list-style-type: none"> <li>• Up to 50% of prescription drugs are based on naturally occurring molecules from plants.</li> <li>• 70% of cancer drugs are natural or nature-inspired synthetic products.</li> <li>• Approximately 75% of approved anti-tumour pharmaceuticals in the past 70 years have been non-synthetic.</li> </ul>

Source: *The Geneva Association*<sup>33</sup>

The large-scale degradation of natural ecosystems and biodiversity loss could also lead to a whole host of other risks (geopolitical, socio-economic, health etc.) linked to direct and indirect reliance on natural resources and ecosystems.<sup>34</sup> According to WEF, larger economies in particular have the highest absolute amounts of GDP in nature-dependent sectors (e.g. China: USD 2.7 trillion; EU: USD 2.4 trillion; U.S.: USD 2.1 trillion).<sup>35</sup> Some of the fastest-growing regions in the world are also particularly exposed to nature loss.

Large-scale, and in some cases irreversible, impacts of nature loss can have profound consequences on economic sectors and businesses, too.<sup>36</sup> According to WEF, industries that are highly dependent on nature generate 15% of global GDP (~USD 13 trillion), the three largest being construction, agriculture and livestock, and food and beverages (9.2% of global GDP). These sectors rely on nature through direct extraction of resources from oceans and forests or benefit in their operations from healthy ecosystem services, for example, clean water, healthy soil, pollination and stable climate conditions. Insurance, tourism and hospitality sectors are also impacted by ecosystem degradation and loss.<sup>37</sup> These businesses now have the opportunity to embrace nature and develop more sustainable business models.<sup>38</sup>

32 Based on WEF (2020). The percentages were calculated by the authors based on the absolute values of GDP that depend on natural commodities (in 2019 values). Specifically, in China: USD 2.7 trillion of 14.28 trillion total GDP; in the EU: USD 2.4 trillion of 15.69 trillion total GDP; and in the U.S.: USD 2.1 trillion of 21.37 trillion total GDP.

33 Based on the review of: Beck et al. 2018; CBD and WHO 2015; CDP 2020; Centre for Research on Energy and Clean Air (CREA) 2020; Global Canopy and Vivid Economics 2020; IPBES 2016, 2019; IPCC 2018, 2019a,b; IUCN 2018; Landrigan et al. 2020; Lelieveld et al. 2015; Nowak et al. 2014; OECD 2016, 2019, 2021a; Panagos et al. 2018.

34 WEF and PwC 2020.

35 Ibid.

36 Ibid. Such negative impacts may arise for businesses from regulatory, legal, reputational and market-related risks, among others.

37 The Nature Conservancy and AXA 2020; Intact Centre on Climate Adaptation (ICCA) 2017.

38 Marsh McLennan 2022.

People & communities	Governments
<p><b>Vulnerability and exposure to extreme events:</b></p> <ul style="list-style-type: none"> <li>Global loss of mangroves would result in an additional 15 million people flooded and USD 82 billion in damages annually.</li> </ul> <p><b>Infectious diseases:</b></p> <ul style="list-style-type: none"> <li>Zoonotic diseases account for 60–80% of new infectious diseases.</li> <li>70% of zoonoses originate from human-wildlife interactions.</li> </ul>	<p><b>Risks for economic growth:</b></p> <ul style="list-style-type: none"> <li>Ecosystem services provide benefits of USD 125–140 trillion per year i.e. &gt;1.5 times global GDP.</li> </ul> <p><b>Dependency on natural commodities:</b></p> <ul style="list-style-type: none"> <li>In China, the EU and the U.S., nearly 18.9%, 15.9% and 9.8% of GDP, respectively, depends on natural commodities (based on 2019 values).<sup>32</sup></li> <li>55% of global GDP (USD 44 trillion of 87.65 trillion) is moderately/highly dependent on nature due to reliance on ‘high-functioning biodiversity and ecosystem services’.</li> </ul> <p><b>Resource scarcity:</b></p> <ul style="list-style-type: none"> <li>44 countries (one third of the global population) face ‘high’ levels of water stress.</li> <li>17 countries (one quarter of the global population) face ‘extremely high’ levels of water stress.</li> </ul>



Industries that are highly dependent on nature generate 15% of global GDP – these now have the opportunity to embrace nature and develop more sustainable business models.

### 3.3 Nature and climate change

Nature loss and climate change are inextricably interlinked, in terms of both their impacts and solutions. According to the IPCC, ecosystems such as mangroves, wetlands and coral reefs naturally dampen the impacts of floods and storms, while the preservation and restoration of forests and terrestrial ecosystems have among the largest mitigation potential (e.g. carbon sequestration or carbon sinks) of all natural and technological solutions.<sup>39</sup> Any further destruction of natural ecosystems and biodiversity loss will only exacerbate climate change and its impacts (Box 1).

#### Box 1: Linking nature and climate change – Findings from the IPCC’s 6th Assessment Report

Earth’s climate system encompasses land, oceans, freshwater, the atmosphere and their complex interlinkages. The current speed of human activities and GHG emissions disrupts nature’s ability to regulate the climate system. The destruction of nature only exacerbates climate change and its impacts on people and ecosystems. Nature is the ultimate tool that we should seek to protect and restore, using its full potential in climate change adaptation and mitigation. Specifically, the IPCC reports conclude that:<sup>40</sup>

- *Nature is a buffer against extreme events and climate change.* It acts as a crucial natural solution to manage the physical risks of climate change and increased GHG emissions. For example, coral reefs and mangroves buffer flooding through wave attenuation, protecting shorelines from storm surges and cyclones. Nature is also the world’s largest carbon capture system – the land and ocean, as major carbon sinks, have taken up almost 56% of CO<sub>2</sub> emissions associated with human activity per year over the past six decades. However, increased GHG emissions and climate change impacts will reduce the ability of nature to act as a buffer, e.g. through coral bleaching and reduced efficiency of natural carbon sinks.
- *The preservation, protection and restoration of nature-based systems are crucial to climate change adaptation through Ecosystem-based Adaptation (EbA).* For example, the conservation of 30 to 50% of Earth’s land, freshwater and ocean areas can already be leveraged for climate-resilient development, maintaining biodiversity and ensuring essential ecosystem services.
- *Nature-based systems play a critical role in climate change mitigation.* Nature provides a great opportunity for global-scale carbon sequestration and emissions reduction. For example, the Agriculture, Forestry and Other Land Use (AFOLU) sectors of the economy can provide 20–30% of the emissions reductions needed by 2050 to maintain warming below 2°C. The protection, improved management and restoration of forests and other ecosystems (wetlands, savannas and grasslands) have the largest mitigation potential in terms of reducing emissions and/or sequestering carbon and are ready to be deployed at a cheap cost.

Source: The Geneva Association<sup>41</sup>

In fact, addressing nature and biodiversity loss will be crucial to the net-zero transition. For example, over 90% of major forest, land and agriculture companies that have committed to net zero could be at risk of missing their climate commitments due to a lack of action on deforestation. Nearly 60% of deforestation is driven by agricultural conversion for key commodities like beef, leather, soy, palm oil, timber, pulp and paper. Companies in the forest, land and agriculture sectors therefore have a critical role to play in achieving a net-zero and nature-positive future.<sup>42</sup>

#### 3.3.1 Nature-based solutions and climate resilience

The protection, improved management and restoration of ecosystems can simultaneously increase climate resilience (climate change adaptation) and help to sequester carbon (climate change mitigation). There is scientific evidence that terrestrial ecosystems, blue carbon ecosystems and coral reefs are effective on both fronts, as highlighted in Box 2.

39 IPCC 2021, 2022a,b.

40 Ibid.

41 Based on the review of: IPCC 2021a,b, 2022.

42 Global Canopy 2022.

## Box 2: Co-benefits of nature-based solutions for building resilience to extreme weather events and carbon sequestration

*Terrestrial ecosystems (including forests, grassland, savannas and peatlands):*

- Increase resilience by acting as a natural buffer against landslides and floods. They are also beneficial against extreme heat and air pollution in urban areas.
- Have the potential to reduce emissions and sequester 7.3 GtCO<sub>2</sub>eq/year at < 100 USD/tCO<sub>2</sub>eq, more than 20% of current global carbon emissions.

*Blue carbon ecosystems (including mangroves, tidal marshes and seagrass):*

- Reduce flood risk. For example, mangroves reduce annual expected flood damages from tropical cyclones by USD 60 billion and protect over 15 million people globally, with positive returns on investment (ROI) for flood protection benefits.
- May capture 0.5–3% of our total current emissions if they are preserved, restored and managed. However, since the 20th century, up to 63% of coastal wetlands have already been destroyed.

*Coral reefs:*

- Reduce storm and flood intensity by dampening wave energy by 97%. For example, in the U.S. alone, the hazard risk reduction benefits of coral reefs exceed USD 1.8 billion annually. Globally, for 1-in-25-year events, reefs provide USD 36 billion in avoided damages to build capital. For 1-in-100-year storm events, flood damages would increase by 91% to USD 272 billion without reefs.
- Offer many co-benefits for biodiversity (they support 25% of all marine species) and coastal communities, through tourism (they generate USD 36 billion annually) and fisheries (provide food for one billion people). Yet, between 75% and 90% of the world's reefs are likely to be lost by 2050 without urgent action to preserve and restore them.

Source: The Geneva Association<sup>43</sup>

### 3.3.2 The role of nature-based solutions for resilient and sustainable infrastructure systems

Nature-based solutions should be considered an integral part of the design, construction, operation and maintenance of critical infrastructure systems to reduce extreme weather risks and increase resilience (Box 3). As we look ahead, governments and the private sector need to invest in a variety of sustainable critical infrastructure systems (e.g. energy, transport, water management). There is a need to mobilise capital for upgrading existing infrastructure systems as well as investing in new ones.<sup>44</sup> Disruptions to infrastructure, for example from weather-related extreme events, can have adverse effects on economies, harming people's well-being and impairing economic growth. Rapidly expanding urban areas and high-risk zones like coastal regions and floodplains are particularly vulnerable.

43 Based on the review of: Beck et al. 2018, 2022; ICCA 2017, 2020; Ferrario et al. 2014; Grima et al. 2020; IPCC 2014, 2022a; McKinsey 2022; Menendez et al. 2020; Reguero et al. 2021; WEF 2022; Zeng et al. 2021.

44 The Geneva Association 2019.

### Box 3: Critical infrastructure resilience – The role of government

Approximately 150 million people and USD 9.1 trillion in coastal assets are vulnerable to the impacts of climate change.<sup>45,46</sup> Blending 'green' conservation and restoration (nature-based solutions with a focus on wetlands, coral reefs and mangroves) with 'gray' infrastructure (e.g. seawalls, breakwaters, etc.) capitalises on the best of both and is creating a new generation of climate-resilient coastal infrastructure. The goal is to increase climate resilience for 52 million of the world's most vulnerable coastal people through high-impact, green-gray infrastructure solutions that benefit the climate, biodiversity, community well-being and national economies.

Over the next five years, the Green-Gray Infrastructure Program<sup>47</sup> is implementing a portfolio of large-scale projects at sites in Guyana, Indonesia, the Philippines, Mexico, Brazil and other countries; developing and facilitating the global adoption of standard engineering techniques for green-gray infrastructure to reduce coastal climate impacts (led by Conservation International Green-Gray Community of Practice);<sup>48</sup> working with champion governments to develop national policies that incentivise green-gray infrastructure; and integrating green-gray approaches into at least 5% of the estimated USD 1.8 trillion<sup>49</sup> spent annually on coastal infrastructure development – more than half of it in emerging markets.

Source: Emily Corwin and Miguel Cifuentes-Jara (Conservation International)

#### 3.3.3 Nature-based solutions and carbon credit markets

Global carbon credit markets, both regulated and voluntary, are offering significant incentives to governments and the private sector to invest in nature. The market value of global regulated carbon credits traded in 2021 was approximately USD 851 billion, a 164% increase compared to 2020 as a result of higher carbon prices and a modest surge in volumes.<sup>50</sup> The voluntary market size is currently estimated at USD 1 billion,<sup>51</sup> with significant potential to grow over the next decades as the world transitions to a low-carbon economy (Box 4).

The development of carbon credit markets is also providing new markets for carbon insurance coverage in relation to nature-based systems. For example, the quality of carbon credits can vary significantly and there is the risk that some lower quality credits may be invalidated. There is also a physical risk of loss for some types of credits, for example through wildfires destroying trees or mangroves being destroyed by severe storms.<sup>52</sup> Insurance against these events is an area of increasing interest for both existing insurers and new startups in this space.<sup>53</sup>

45 Kirezci et al. 2020.

46 Nicholls et al. 2019.

47 Conservation International (undated).

48 Conservation International (undated).

49 Global Infrastructure Outlook.

50 MSCI 2022.

51 Ecosystem Marketplace 2021.

52 For example, a carbon offsetting firm accidentally started a fire in July 2022 in Spain, burning 14,000 hectares of forest (Redd-Monitor 2022). Wildfires, extreme heatwaves, droughts and tree diseases are major sources of concern for forest offsetting and carbon credit buyers (National Geographic 2022). Some existing insurance mechanisms have proven insufficient to compensate for the loss of carbon offsets (Financial Times 2022).

53 INSTTECH 2022.

## Box 4: Nature-based solutions and carbon markets

There are two distinct carbon markets: regulated and voluntary. As of 2020, regulated markets were nearly 500 times the size of voluntary markets.

- *Regulated carbon markets* are created by governments, which implement mandatory systems to cap or reduce the emissions of specific industries.
- *In voluntary carbon markets*, parties purchase credits to offset their emissions on a voluntary basis. The size of voluntary markets has increased more than fivefold since 2015, with significant potential to develop extensively over the next year.

Investing in sustainable forestry and reforestation, grassland conservation and agricultural land management, and the preservation and restoration of wetlands and mangroves, are among the nature-based solutions that are being linked to carbon credit markets. Furthermore, nature-based solutions are the least expensive mitigation options, with the majority available at < 100 USD/tCO<sub>2</sub>eq and even 40% of these at less than 20 USD/tCO<sub>2</sub>eq.

During COP26, a new framework for Carbon Trading Market Offsets was decided with revised rules for countries and companies trading carbon. It aims to boost transparency and prevent double counting (i.e. emission reductions counting towards multiple countries' climate targets). However, the use of credits as part of net-zero plans is still heavily debated. A new Voluntary Carbon Markets Integrity (VCMI) Initiative, a global multistakeholder platform, will help ensure that voluntary carbon markets make a positive, significant and measurable contribution to the transition of the global economy to a 1.5°C future.<sup>54</sup>

Source: The Geneva Association<sup>55</sup>

### 3.3.4 Environmental risks of new climate technologies for industrial decarbonisation

The deployment of new technological solutions to transition energy and other sectors to achieve net-zero targets could have profound impacts on nature. As the world expedites the large-scale deployment of these new technologies, their environmental footprint should be assessed with a full life cycle view (from extraction, transportation, manufacturing, construction and operations to disposal and waste management).<sup>56</sup> Reducing GHG emissions cannot be done at the expense of nature loss and other environmental impacts.<sup>57</sup> For example, as the energy transition requires substantial amounts of metals (copper, nickel, cobalt and lithium), their total production is expected to rise more than fourfold from 2021 to 2040.<sup>58,59</sup> The disposal of assets built with these technologies (e.g. electric vehicles (EVs), wind turbines, solar panels) could also have significant large-scale environmental impacts unless solutions are thought out with a circular economy model.<sup>60</sup> For example, the environmental and nature-related risks associated with EVs need to be considered for the entire value chain, including exploration and extraction of rare materials,<sup>61</sup> intermediate processing (e.g. batteries), advanced manufacturing and assembly of components, recycling (e.g. materials used to manufacture batteries) and disposal.<sup>62</sup>

**As the large-scale deployment of new climate technologies is expedited, their environmental footprint should be assessed with a full life cycle view.**

54 VCMI 2021.

55 Based on the review of: International Carbon Reduction and Offset Alliance (ICROA) 2021; UN 2021; IPCC 2022b.

56 Golnaraghi 2022.

57 Golnaraghi 2022; The Economist 2022.

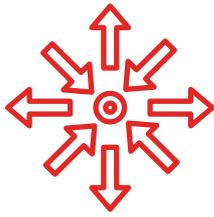
58 International Monetary Fund (IMF) 2021.

59 According to the International Energy Agency (IEA 2021), a typical electric car requires six times the mineral inputs of a conventional car and an onshore wind farm requires nine times more mineral resources than an equivalent gas-fired plant. Since 2010 the average amount of minerals needed for a new unit of power generation capacity has increased by 50% as the share of renewables in new investments has risen.

60 See for example International Renewable Energy Agency (IRENA) and IEA (2016) and European Environment Agency (2021) for an analysis of the end-of-life challenges of solar photovoltaic (PV) cells, wind turbines and batteries in the clean-energy transition.

61 Countries like China that are mining rare materials used in the manufacturing of batteries and solar panels are already wrestling with the aftermath of mining. Standaert 2019.

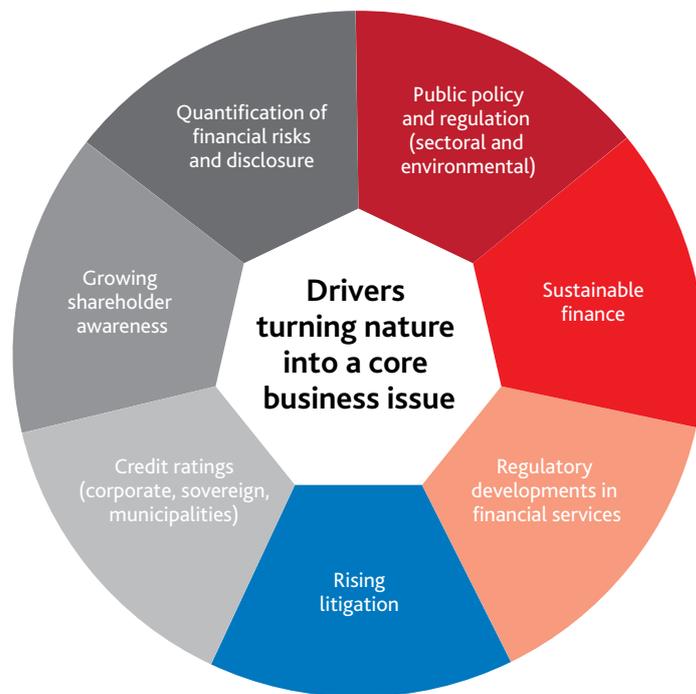
62 Finance for Biodiversity Initiative 2022b; Hepburn 2022.



## 4. External factors driving nature-related considerations into core business decision-making

A number of external factors are making nature-related factors a core business issue. Specifically, we highlight seven drivers in this section (Figure 2).

**Figure 2: Factors driving nature-related considerations into core business decision-making**



Source: The Geneva Association

### 4.1 International agreements and socio-economic policies

The evidence presented and warnings sounded by the aforementioned flagship reports have pumped new energy into the negotiation of international framework agreements and socio-economic policy advancements. For example, negotiations for a new 'Post-2020 Global Biodiversity Framework' through the UN-convened Convention on Biological Diversity (CBD) aim to establish an agreement for nature preservation and restoration similar to the Paris Agreement for climate change.<sup>63</sup> A number of international forums/unions (e.g. G20, G7 and the EU) and coalitions

63 UN 2015a.

(e.g. Coalition of Finance Ministers for Climate Action) are also drawing attention to these issues as a critical element of future policy and regulatory development (Box 5).

### Box 5: Examples of international framework negotiations and economic policy framework developments related to nature and biodiversity loss

**Global Biodiversity Framework.**<sup>64</sup> The 2022 UN Biodiversity Conference (COP15) will convene governments from around the world to finalise a new set of goals for nature over the next decade through the Post-2020 Global Biodiversity Framework process.

**UNEP Environment Assembly.** At the 2022 UN Environment Assembly, representatives from UN member states endorsed a resolution<sup>65</sup> to end plastic pollution and forge an international, legally binding agreement by 2024. The resolution tackles the full life cycle of plastic, from production to disposal.

**G20.** The G20 Environment Communiqué<sup>66</sup> of July 2021 shows that G20 Environment Ministers committed to continue and increase efforts to address the interconnected challenges of climate change and nature loss. In particular, it emphasises the potential of nature-based solutions.

#### G7

- **Environment Ministers:** 2021 saw G7 leaders agree on the 2030 Nature Compact,<sup>67</sup> committing to halt and reverse biodiversity loss by 2030 and conserve at least 30% of land and oceans by 2030. The Compact stresses that the world must not only become net zero but also nature positive. G7 leaders will work across four core pillars: transition, investment, conservation and accountability.
- **Foreign Ministers:** A joint statement<sup>68</sup> on climate, environment, peace and security made in May 2022 acknowledges that the impacts of the climate and biodiversity crises pose a threat to international peace and stability, and stresses that, conversely, peace and stability are decisive in mitigating the consequences of these crises. It further sets out an agenda for action on nature and climate topics.

**The Coalition of Finance Ministers for Climate Action.** The Coalition released a report providing an overview of nature-related risks and potential policy actions.<sup>69</sup> After describing the interlinkages between nature, climate and the global economy, the report discusses nature-related risk transmission channels and proceeds with policy suggestions and recommendations for ministers of finance.

**European Commission.** As part of the European Green Deal and following the publication of the EU Taxonomy, the European Commission is pursuing its efforts to integrate climate and environmental risks into the financial system:

- It adopted a series of ambitious proposals to restore damaged ecosystems and nature through its *Nature Restoration Law*. The law contains legally binding targets for land, rivers and sea restoration (20% restoration by 2030; all ecosystems by 2050), as well as a 50% reduction target for chemical pesticide use by 2030.<sup>70</sup>
- In 2021 it launched a new statistical framework to better account for biodiversity and ecosystems in national economic planning and policy decision-making.<sup>71</sup>
- The European Financial Reporting Advisory Group (EFRAG) released its draft European Sustainability Reporting Standards (ESRS) in April 2022.<sup>72</sup>

Source: The Geneva Association, based on cited sources

64 CBD 2021.

65 UNEP Environment Assembly 2022.

66 G20 2021.

67 G7 2021.

68 Ibid.

69 Coalition of Finance Ministers for Climate Action 2022.

70 European Commission 2022.

71 European Commission 2021.

72 EFRAG 2022.

## 4.2 Efforts to quantify the financial risks associated with nature and biodiversity loss

The TNFD seeks to develop an integrated, nature-related risk assessment and disclosure framework to support the shift in global financial flows away from nature-negative and toward nature-positive outcomes. The TNFD is releasing its framework in a staged process,<sup>73</sup> which is structured around three core components:

- Fundamental concepts and definitions for understanding nature, establishing a common basis for these notions
- Disclosure recommendations for nature-related risks and opportunities, built on four pillars: governance, strategy, risk management, and metrics & targets
- Guidance for undertaking nature-related risk and opportunity assessment using a four-step process.

Importantly, the TNFD's definition of materiality is still evolving. The TNFD believes the location specificity of nature-related dependencies and impacts means that the notion of materiality is meaningfully different in nature and climate contexts.<sup>74</sup>

To ensure the framework is consistent with the emerging global baselines for sustainability or climate reporting, the TNFD framework builds upon the approach taken by the Task Force on Climate-Related Disclosures (TCFD). The TNFD has identified priority topics requiring further consideration and development on scenarios, timeframes, metrics and targets, data-related issues and sector-specific guidance.<sup>75</sup>

Furthermore, the TNFD encourages integrated climate- and nature-related risk management and disclosures,<sup>76</sup> and it recognises the need to align with the emerging global baseline for sustainability reporting standards under development by the International Financial Reporting Standards-International Sustainability Standards Board (IFRS-ISSB).<sup>77</sup>

## 4.3 Investing in natural capital as part of sustainable finance frameworks

Over the last few years, advancements in the development of sustainable finance frameworks in many jurisdictions have aimed to enable the flow of capital to address climate change as well as nature and biodiversity risks. There are already efforts to develop and harmonise regulatory, reporting and disclosure frameworks. However, the incorporation of nature-based issues into regional and national sustainable finance frameworks is at different stages. For example, some implemented frameworks already have a strong focus on biodiversity in addition to climate (e.g. EU, China, Colombia, Malaysia),<sup>78</sup> while other countries remain in the development phase (e.g. Singapore, Australia, Canada).<sup>79</sup> If these frameworks are not coordinated, there are risks of fragmentation across markets for global investors. The International Platform on Sustainable Finance (IPSF) is working to harmonise sustainable finance taxonomies,<sup>80</sup> standards and metrics, with the support of other multilateral organisations such as the G20 Sustainable Finance Working Group.

**Advancements in the development of sustainable finance frameworks aim to enable the flow of capital to address climate change as well as nature and biodiversity risks.**

## 4.4 Attention of financial regulatory bodies to the financial risks of nature and biodiversity loss

Nature-related risks are starting to appear on the agendas of the global financial regulatory and supervisory community. Although, as of May 2022, there are no supervisory expectations pertaining to nature-related risks, there are signs of growing regulatory interest and related activities to raise awareness about the materiality of these issues and the need to explore the extent to which nature-related risks cause macroeconomic and

73 TNFD 2022a,b.

74 There is a gradual convergence in research and market thinking on materiality as it relates to the impact of nature and biodiversity loss on society and vice versa – notions such as 'single materiality', 'double materiality' and 'dynamic materiality' – based on the growing recognition that a business' impacts on nature today in a specific location can accentuate its nature-related dependencies in the medium term and therefore its risks to enterprise value. For more information see: <https://tnfd.global/faq/>

75 These topics include: links between climate change and nature; the scope of disclosures, the social dimensions of nature; the meaning of 'nature-positive'; and the methodologies to assess the materiality of nature-related risks.

76 Yet, the two frameworks capture different concepts and are complementary. For example, unlike the TCFD, the TNFD does not focus on GHGs; the TNFD's focus on nature is broader than climate change, especially as it encompasses non-atmospheric, nature-related risks.

77 ISSB 2022b; TNFD 2022c.

78 European Union's Technical Expert Group 2020; People's Bank of China 2021; Bnamericas 2022; Bank Negara Malaysia 2021.

79 Singapore GFIT 2022; Australian Sustainable Finance Institute (ASFI) 2022; CSA Group 2020.

80 A first attempt was made to harmonise the EU's and China's taxonomies (IPSF 2021).

financial instability (Box 6). For example, the Network for Greening the Financial System (NGFS) has recommended that nature-related risks be considered by central banks and supervisors for the fulfilment of their mandates and provided suggestions to guide them in this process.<sup>81</sup> Furthermore, the UN-convened SIF has published a scoping paper focusing on the links between nature and the insurance industry.<sup>82</sup>

Although the focus of many disclosure standards to date has been on climate, the IFRS-ISSB recently published two draft disclosure standards,<sup>83</sup> including general guidance for sustainability-related reporting as well as the reporting of climate change-related risks.<sup>84</sup> While the sustainability-related standard does not focus on biodiversity directly, it is addressed in the non-mandatory guidance of the Climate Disclosure Standards Board (CDSB) Framework.<sup>85</sup> The progress of the TNFD, along with the recommendations of the NGFS and the expected 'Post-2020 Global Biodiversity Framework', have catalysed developments on the nature-related regulatory front in 2022. Supervisors' expectations around acting and reporting on nature-related financial risks may well be set to rise over the years to come.

## Box 6: Regulatory activities related to nature and biodiversity in financial services

### International

**NGFS:** Following the third and final report of the NGFS-INSPIRE Study Group, which concluded that nature-related risks could have significant macroeconomic and financial implications, the NGFS recommended that nature-related risks be considered by central banks and supervisors in their mandates.

**SIF:** SIF published an extensive scoping study on nature-related risks in the global insurance sector. Through a large survey of insurance-sector participants, the study assesses the current status of tools and methods for the identification, understanding, management and reporting of nature-related financial risks, which are currently all in premature states.

### Regional

**The European Central Bank (ECB):** The ECB issued its *Guidance on Climate-Related and Environmental Risks* in 2020, recognising the loss of biodiversity as a source of risk and setting non-binding supervisory expectations pertaining to climate and environmental risk management and disclosure.

**European Banking Authority (EBA):** The EBA's *ESG Risk Management Supervisory Report* includes guidance on the way ESG factors and risks, including biodiversity loss, could be included in regulatory frameworks.

### National and subnational

**Nederlandsche Bank (DNB):** The DNB was the first central bank and regulator to highlight biodiversity as a material financial risk in its study *Indebted to Nature*, recommending that supervisory authorities develop a reporting standard and ensure that financial institutions report in accordance with it.

**Bank of England (BoE):** The BoE is considering whether environmental risks beyond those directly related to climate change risk give rise to increased financial risk.

**Banque de France:** Although no firm supervisory expectations have been set by the Banque de France, its own responsible investment strategy endorses an analysis of an investment portfolio's impact on biodiversity. Moreover, a working paper assessed biodiversity-related financial risks in France for the first time in 2021.

**Monetary Authority of Singapore (MAS):** MAS' environmental risk management guidelines set out supervisory expectations pertaining to the risk management and disclosure of environmental risks, including loss of biodiversity, pollution and land use.

81 NGFS 2022.

82 SIF 2021.

83 ISSB 2022a.

84 ISSB 2022b.

85 CDSB 2022.

**Bank Negara Malaysia (BNM):** BNM developed a taxonomy in which biodiversity loss is linked to climate change. This taxonomy aims to help financial institutions to assess the impact of investing and financing activities on the health of ecosystems and biodiversity. BNM also led a study exploring the exposure of the economy and financial industry to nature-related risks, in partnership with the World Bank.

**California Department of Insurance:** Though not establishing any supervisory expectations, the *Climate Insurance Report* of the California Department of Insurance has a strong emphasis on nature and nature-based solutions and, in particular, promotes the role of the insurance industry and the Insurance Commissioner as catalysts for developing pilot projects.

**Australia Securities Exchange (ASX):** The ASX's Corporate Governance Council's *Corporate Governance Principles and Recommendations* explicitly recommend that an entity should "disclose whether it has any material exposure to environmental or social risks and, if it does, how it manages or intends to manage those risks", with their definition of environmental risks matching the recent TNFD definition of nature-related risks.

**BaFin:** Although the *Guidance Notice on Dealing with Sustainability Risks* focuses on climate-related risks, sustainability risks extend more broadly to all ESG risks, including those pertaining to nature-related risks. Furthermore, BaFin stresses that other environmental and social trends may also present serious financial risks to supervised entities.

Source: *The Geneva Association*<sup>86</sup>

## 4.5 Nature-related litigation

As scientific evidence of the impacts of human activity on nature continues to grow, similar to climate litigation,<sup>87</sup> nature-related litigation has started to develop and the legal landscape is shaping up along two dimensions. Some claimants are seeking damages to compensate for environmental or social impairments or to fund abatement or restoration efforts. Others are using litigation as a tool to enable/prevent certain actions or policies or to oppose them ('strategic litigation').

**As scientific evidence of the impacts of human activity on nature continues to grow, nature-related litigation has started to develop.**

A number of factors are influencing the development of nature-related litigation and the materiality of the financial risks it poses. Specifically:

- 1. The evolving legal landscape, towards value chain considerations.** Laws are shifting towards tighter regulations and increased scrutiny of a company's actions but also those of its value chain partners, with mandatory Human Rights and Environmental Due Diligences (mHREDD) gaining traction, notably in the EU.<sup>88</sup>
- 2. A growing ability to assess, monitor and quantify impacts and hold specific corporates accountable.** Technological, data and scientific advances enable accurate monitoring and tracking of nature loss. This is increasingly being utilised to gain insight into the value chain impacts of businesses, and as evidence in lawsuits.<sup>89</sup>
- 3. The dynamics and impacts of nature-related lawsuits.** In recent years, a number of nature-related cases have already impacted corporates, forcing them to cancel expansion plans, change their operations and adapt their business strategies.<sup>90</sup> Such cases can enhance the nature litigation movement by raising public awareness and setting precedents. They are also a source of reputational risk<sup>91</sup> and may directly affect re/insurers' stakeholders.

86 Based on the review of: ASX 2019; BaFin 2020; BNM 2021; BNM-World Bank 2022; Banque de France 2021; Svartzman et al. 2021; California Department of Insurance 2021; China Banking and Insurance Regulatory Commission (CBIRC) 2022; DNB 2020; EBA 2021; ECB 2020; HM Treasury 2021a,b; MAS 2020; NGFS and INSPIRE 2022; NGFS 2022; SIF 2021.

87 The Geneva Association 2021c,d.

88 Some concrete examples of this are France's 2017 Corporate Duty of Vigilance Law and Article 29 of the Energy-Climate Law, covering expected disclosures across biodiversity and climate, and Germany's Supply Chain Due Diligence Law, which will enter into force in 2023.

89 ClientEarth 2021b; Clyde & Co 2022.

90 ClientEarth 2021a.

91 ClientEarth 2021b.

**4. Increasing awareness and scrutiny, reinforced by disclosures.** NGOs and society at large are increasingly expanding their awareness beyond climate change to include nature and biodiversity. Along with the TNFD's guidance for systematic disclosures and the increasing attention of policymakers and regulators, additional scrutiny of corporates may occur as their duty of care is enhanced. Just as for climate litigation,<sup>92</sup> this may expose corporates to lawsuits based on miscommunication, misrepresentation, failure to transition towards nature-positive business models and 'nature-washing'.<sup>93</sup>

A growing community of researchers is studying litigation risk in more depth, trying to capture its underpinning drivers and frame how nature-related liability cases may impact the financial sector. Although this area is in an exploratory phase, the Commonwealth Climate and Law Initiative (CCLI), has gone as far as proposing a framework that classifies nature-related liability risks and the avenues through which claims may impact the financial sector.<sup>94</sup> A number of successful nature-based cases have set precedents and could potentially inspire further strategic litigation against corporates and governments.<sup>95</sup>

#### 4.6 Corporate, sovereign and municipal credit ratings

Rating agencies are increasingly aware of nature and biodiversity loss and their impact on governments and businesses.<sup>96,97</sup> The three largest international rating agencies (Moody's, Standard & Poor's (S&P) and Fitch) are acknowledging that biodiversity-related risks are rising up the agendas of companies, investors, policymakers and governments, and expect this trend to continue. Some rating agencies are starting to assess the materiality<sup>98</sup> of these risks at the macroeconomic level, as well as the impacts of companies on nature.<sup>99</sup> However, current assessments of nature-related risks by credit

**Current assessments of nature-related risks are largely insufficient compared to the magnitude of the economy's exposure, posing a significant risk to investors.**

rating agencies are largely insufficient compared to the magnitude of the economy's exposure, posing a significant risk to investors.

A recent study has shown that biodiversity-adjusted sovereign credit ratings could be severely downgraded at the country level, e.g. down by six notches for Malaysia, four for India and two for Brazil, with impacts on their sovereign bonds.<sup>100</sup> The study found that in a partial ecosystem services collapse scenario, 58% of the 26 most important countries or sovereign entities would face a downgrade of one notch or more, leading to USD 28–53 billion in additional annual interest payment costs. This is driven by the fact that the economies of developing countries receive stronger contributions from sectors with a higher dependence on nature.<sup>101</sup> Rating agencies are progressively putting mechanisms in place that integrate nature-related risks into companies' ratings through ESG factors.<sup>102</sup>

#### 4.7 Growing investor and shareholder awareness

Over the last few years, shareholders and investors have become increasingly aware of nature-related issues and their interconnections with business models in different sectors. Indeed, the topic of biodiversity loss is gaining traction among large-scale investors, as evidenced through research and innovative solutions<sup>103</sup> as well as pledges and commitments.<sup>104</sup> Yet, the majority of investors are not actually assessing their impact on biodiversity loss,

92 The Geneva Association 2021c,d.

93 The authors of this report have coined this term.

94 CCLI 2020. The financial sector may be hit through first-order impacts as direct defendants of claims, second-order impacts through stakeholders, and third-order impacts through systemic risks, should their magnitude extend across sectors and geographies. The proposed framework consists of three overarching categories of liability claims, associated with 1) physical or ecosystem impacts, 2) the transition to a sustainable economy, and 3) misrepresentation claims.

95 See e.g. ClientEarth 2021a.

96 Moody's 2021a,b; S&P 2021; Fitch Ratings 2021d,e.

97 Moody's and S&P are both members of the TNFD.

98 The TNFD definition of materiality is more complex and still evolving. The TNFD believes that the location specificity of nature-related dependencies and impacts means that the notion of materiality is meaningfully different in the context of nature than that for climate.

99 For example, Moody's (2021b) finds that 12 sectors of the economy, including all extractive industries like mining, and with USD 2.1 trillion of rated debt, face high or very high natural capital risk. Regarding impacts, it finds that 38% of 5,300 large, publicly-traded companies have at least one facility associated with habitat loss (Moody's 2021a).

100 Finance for Biodiversity Initiative 2022b.

101 Ibid. By applying the findings from Swiss Re 2020a.

102 Moody's 2021c; Fitch Ratings 2020, 2021a-c; S&P 2022.

103 Responsible Investor 2022.

104 See for instance: Finance for Biodiversity Pledge (<https://www.financeforbiodiversity.org/members/>); BlackRock 2022.



and some are already being called out for greenwashing and not fulfilling their climate change commitments.<sup>105</sup> The lack of ability to transform intentions into nature-positive actions may be attributed to four main issues:

- Stakeholders' general lack of awareness of the financial implications of nature and biodiversity loss
- The lack of tools and methodologies to assess and quantify the impacts of a company's actions on nature and vice versa
- The lack of data and decision-useful reporting on nature- and biodiversity-related risks
- Challenges with identifying nature-related opportunities.

However, as these issues are addressed over time, nature and biodiversity loss and the need for nature-positive activities are expected to become core considerations for investors and shareholders.<sup>106</sup>

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<sup>105</sup> E.g. The global network of NGOs, social movements and advocates, 'BlackRock's Big Problem', is regularly pointing out the inconsistencies and inaction of major asset managers.

<sup>106</sup> Credit Suisse and Responsible Investor 2021; Robeco 2022a,b.



## 5. The insurance industry and nature-related risks and opportunities

Healthy nature offers a wide range of public goods such as clean air, fresh water, fertile soil, sustainable natural resources and climatic conditions, which are foundational to quality of life, livelihoods and socio-economic sustainability.<sup>107</sup>

The Chief Risk Officer (CRO) Forum identifies nature and biodiversity loss as an emerging, 'medium category' environmental risk for re/insurers, with significant potential impacts expected within the next five years. In 2022, climate engineering, including risks of carbon capture and underground storage technologies, was also added as a 'medium category' risk in their Emerging Risk Radar (Figure 3).<sup>108</sup>

**Nature and biodiversity loss are expected to significantly impact re/insurers within the next five years.**

Discussions with 25 re/insurers conducted for this report revealed that some have been addressing nature- and biodiversity-related risks by:

- Supporting innovative research to quantitatively assess the benefits of nature-based solutions for increasing community resilience to physical climate risks and serving as carbon sinks<sup>109</sup>
- Developing tools to assess the impacts of nature loss on society<sup>110</sup>
- Innovating insurance products for the protection of nature-based solutions (see section 5.2.1)
- Investing directly in nature-based solutions (see section 5.2.2)
- Supporting initiatives such as the TNFD to develop methodologies for defining, assessing and disclosing the financial risks associated with nature loss.<sup>111</sup>

<sup>107</sup> Dasgupta 2020.

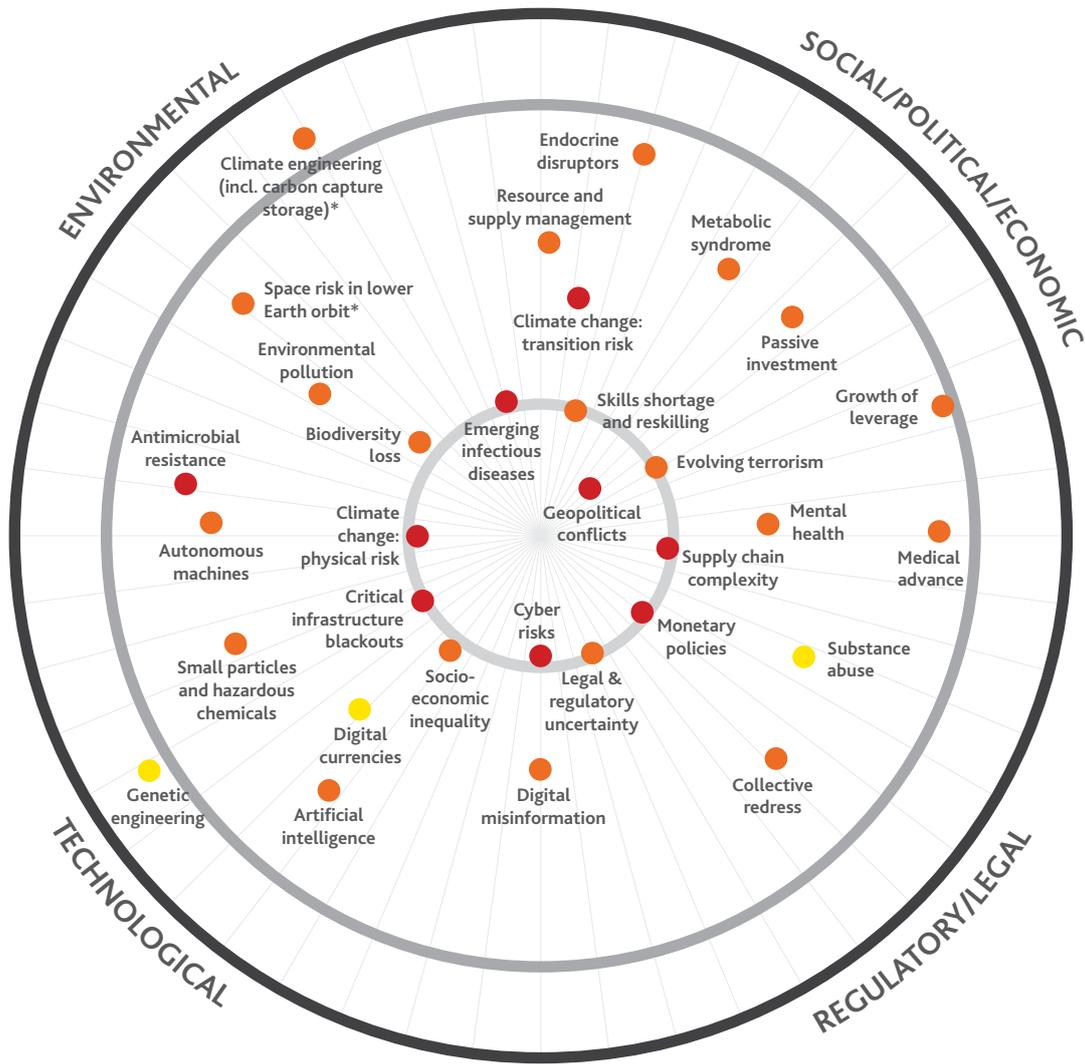
<sup>108</sup> CRO Forum 2022.

<sup>109</sup> MNHN and SCOR 2021; Swiss Re Institute 2021; Swiss Re 2020a; AXA Research Fund 2022; AXA 2019.

<sup>110</sup> Swiss Re 2020a. This tool is available to Swiss Re clients and upon request to other parties.

<sup>111</sup> TNFD 2022a-c.

Figure 3: CRO Forum Emerging Risk Radar 2022 – A reflection on biodiversity loss and climate engineering risks



Trends

- Ageing and health concerns
- Shifting geopolitical landscape
- Economic instability
- Technological developments and impacts on society
- Environment and climate
- Demographic and social change
- ESG Issues

Keys

- Impact assessment
- Risk category:
  - High
  - Medium
  - Low
- Time horizon:
  - Significant impacts already seen on the insurance sector
  - First significant potential impacts on the insurance sector expected within 1-5 years
  - First significant potential impacts on the insurance sector expected within 5-10 years

\* New risk in 2022

Source: CRO Forum<sup>112</sup>

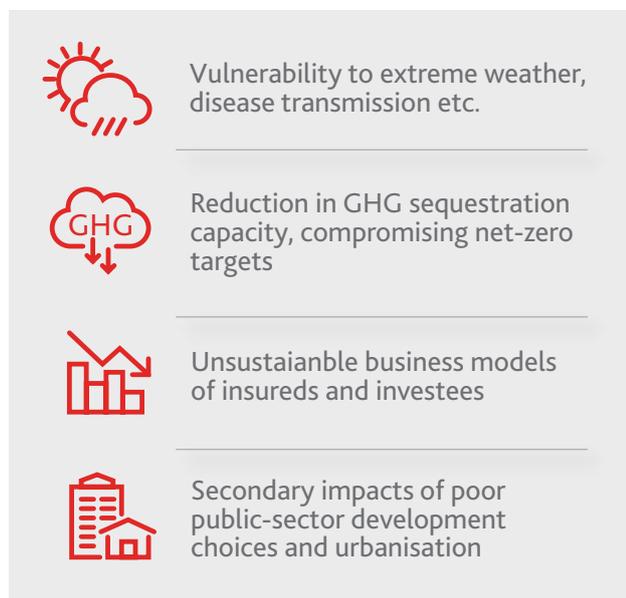
However, nature-based risks and opportunities remain primarily a scientific and environmental issue for most companies.

Over the last decade, research supported by the insurance industry has highlighted the benefits of nature-based solutions to reduce existing – or prevent new – physical and transition climate risks. This research has also allowed the value of the increased resilience and the carbon sequestration benefits provided by nature to be captured in monetary terms.

Re/insurers could experience nature-related risks through four main channels (Figure 4):

1. Societal vulnerability to physical climate risks, disease transmission, health issues and pandemics
2. Direct and indirect impacts on insureds and investees with unsustainable business models and supply chains
3. Secondary impacts of unsustainable development approaches of governments
4. Reduction in GHG sequestration.

**Figure 4: Four ways nature-related risks impact re/insurers**



Source: The Geneva Association

These risks could impact re/insurers in a variety of ways:

### 1. Underwriting<sup>113</sup>

- **For P&C re/insurers**, nature risks directly impact their business models by modifying the resilience of their customers to extreme events. For example, the 2017 storm damage to coral reefs in Florida and Puerto Rico by Hurricanes Irma and Maria increased flood risk by more than USD 180 million annually.<sup>114</sup>

Rising large-scale nature loss and pollution impact commercial lines such as agribusiness, construction and engineering, marine and aviation, with potentially rising litigation against corporations in these sectors and subsequent implications for re/insurers underwriting in areas such as general liability, Directors and Officers (D&O), professional indemnity and Errors and Omissions (E&O) insurance. In some cases traditional environmental insurance is being used to fund environmental restoration and improvement projects.

Discussions with members of the GA Emerging Environmental Risk Advisory Committee indicated that initial risk assessment services with a preventive lens performed by underwriters, biodiversity experts and engineers can help identify potential environmental risks and assist customers with identifying and putting risk management measures (e.g. emergency preparedness measures, preventive procedures, safety devices) into place. The rapid deployment of response contractors, biodiversity experts and engineers could also help to minimise the impacts on nature-based systems, post-incident. Finally, Supplemental Environmental Projects (SEPs) are commonly used in settlements between regulatory agencies and alleged violators, where the latter agree to provide tangible environmental or public health benefits.<sup>115</sup>

**Nature risks directly impact P&C re/insurers' business models by modifying the resilience of their customers to extreme events.**

<sup>113</sup> CISL 2022b, MNHM and SCOR 2021.

<sup>114</sup> United States Geological Survey 2021; Storlazzi et al. 2021.

<sup>115</sup> For examples see: <https://www.epa.gov/enforcement/supplemental-environmental-projects-seps>.



- **For life insurers**, there is growing evidence of the link between nature-based risks and air pollution, food security and malnutrition, increased transmission of vector-borne diseases and even pandemics. More research is needed to explore the materiality of nature and biodiversity loss on longevity,<sup>116</sup> mortality and morbidity for life and health re/insurers. Particular attention should be given to the databases used by life insurers, as the causes of illness and death given in claims data are usually linked to a human condition rather than the underlying source, which may be linked to nature.

## 2. Investments

The financial performance of assets is directly impacted by physical climate risks (rising extreme weather risks linked to climate change and the degradation of natural ecosystems), transition risks (credit, market, policy and regulatory risks), litigation risks and the ability to transition to a nature-positive economy.<sup>117</sup> This is particularly relevant for life insurers given the long-term characteristic of their investments.

## 3. Impacts on real assets and operations

This may be linked to a rise in physical risks to assets, buildings and staff due to large-scale nature loss in specific regions.

## 4. Risk assessment, modelling and pricing capabilities

The ability to assess and quantify nature-based risks requires forward-looking tools. Re/insurers have over 35 years of experience in NatCat modelling.<sup>118</sup> Moreover, the insurance industry is currently supporting initiatives to develop forward-looking climate change risk assessment tools.<sup>119</sup> Building on these and the growing amount of research on the benefits of investing in nature-based solutions, the insurance industry is in a unique position to develop new tools and databases. This is necessary to review existing products and services and identify opportunities for offering new ones, for example:

- For pricing and offering insurance solutions to cover nature-based systems directly
- For assessing how the protection of nature-based systems will impact existing risks associated with current property lines of business and investments, as well as the company's net-zero targets

<sup>116</sup> For life insurance, risk assessment is based on a given mortality rate, the evolution pattern of health risks and a health check. Biodiversity loss is an increasing factor in health issues. The lack of diversity in diets can cause malnutrition leading to health issues, diseases and premature deaths. It has been established that air pollution is responsible for 3.3 million premature deaths each year (IPBES 2019e) and biodiversity loss can increase the spread of vector-borne diseases, such as malaria or zika (IPBES 2019e), with an increasing prevalence due to climate change. If not taken into account by life insurers, risk assessments and risk pricing might increasingly be underestimated, affecting profitability.

<sup>117</sup> MNHM and SCOR 2021.

<sup>118</sup> The Geneva Association 2018. Author: Maryam Golnaraghi.

<sup>119</sup> The Geneva Association 2021a,b, 2022.

- To help commercial and public-sector customers transition to more sustainable business models and minimise their own nature-related risks.

An example of a current tool is the Swiss Re Institute Biodiversity and Ecosystems Services Index (Swiss Re BES Index),<sup>120</sup> which is designed to map the exposure of economic activities to biodiversity and natural ecosystem services. The index is also relevant for corporates and governments looking for re/insurance, as well as screening locations to inform investment exposure to BES degradation. Importantly, the index can be aggregated at both country and economic-sector levels for macroeconomic analysis, by combining it with other tools and databases such as ENCORE. This allows the links between sector dependency and the impacts on ecosystem services to be captured, as well as the importance of specific sectors in a given country, thereby providing a macroview of country-specific GDP dependency on ecosystem services.

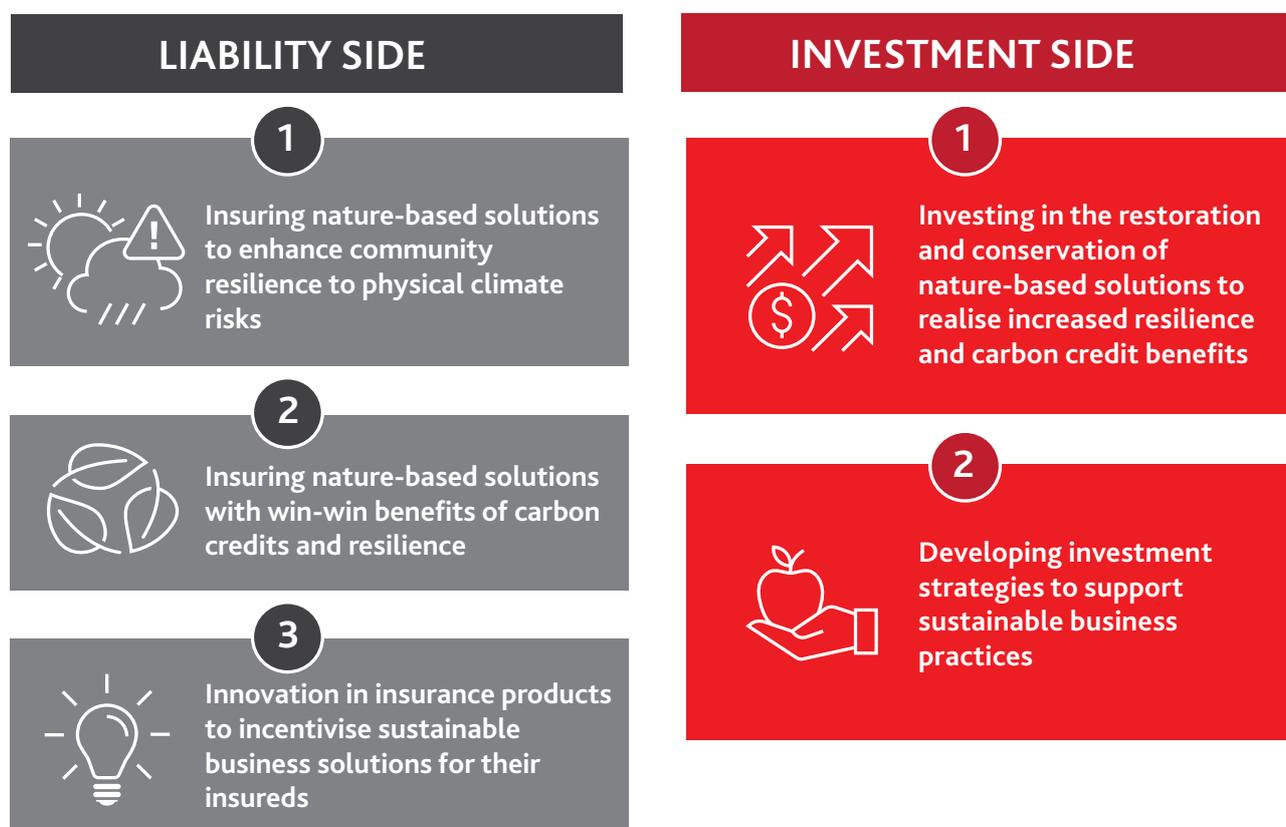
## 5.1 Opportunities for re/insurers

Acting now can reduce current and future exposure to nature-related risks and lead to business opportunities; delaying action could exacerbate the risks to a point of no return. Re/insurers could encourage behavioural changes for the preservation, restoration and management of nature, and support their insureds and investees to develop more resilient, GHG-neutral and nature-positive business models.

**Re/insurers have an opportunity to help increase the resilience of their clients through underwriting and investing in nature-based solutions.**

Re/insurers have an opportunity to increase the resilience of their clients through underwriting and investing in nature-based solutions.<sup>121</sup> In this section, we offer examples of innovation in insurance products, services and investment strategies (Figure 5).

**Figure 5: Opportunities for re/insurers to support a nature-positive transition**



Source: The Geneva Association

<sup>120</sup> Swiss Re 2020a. This tool is available to Swiss Re clients and to others upon request.

<sup>121</sup> Beck et al. 2022; ICCA and University of Waterloo 2021.

### 5.1.1 Innovations on the liability side

#### Insuring nature-based solutions to enhance community resilience to physical climate risks

#### Wildfire resilience insurance: Risk reduction through ecological forestry

The Nature Conservancy and Willis Towers Watson joined forces to demonstrate how insurance combined with ecological forest management, which reduces the risk of severe wildfires in fire-adapted forests, can reduce insurance costs significantly.

Forests cover about 33 million acres in California – about one third of the state’s land area – and more than 2.7 million Californians live in very high wildfire hazard severity zones. Northern California saw record losses in excess of USD 10 billion in 2017 and 2018.<sup>122</sup>

Taking into consideration land ownership and stakeholders in forestland in California, the study analysed the risk reduction benefits and premium savings associated with ecological forestry for a range of parametric wildfire insurance structures. Parametric insurance for wildfire risk could pay out when a certain threshold of ‘acres burned’ is exceeded, as opposed to traditional indemnity insurance where the insured has to prove that it suffered damage and loss to insured assets. It can provide quick access to funds to pay for costs not covered by indemnity insurance, such as heavy debris removal, sediment removal and/or erosion and sediment mitigation expenses.



The findings indicate that ecological forestry practices can lead to significant insurance premium savings. For parametric insurance it resulted in 10–80% reductions across all modelled scenarios, and 20–40% reductions for case study scenarios consistent with the scale of the French Meadows ecological forestry project. This could cover various fire-related costs for a water and power agency or for a timber company, for example, as well as reducing the cost of traditional indemnity insurance for commercial and residential structures vulnerable to wildfires.

The study also examines how insurance premium savings might be used to fund or finance additional investments in ecological forestry in national and other forest lands, thereby maximising the potential of California’s extensive forests to help mitigate climate change.

Source: Lerner, *The Nature Conservancy and Willis Towers Watson*<sup>123</sup>

122 Previously, the only event in Northern California to exceed the billion-dollar insured loss threshold was the Tunnel Fire of 1991, with insured losses of USD 1.7 billion.

123 Lerner 2021; The Nature Conservancy and Willis Towers Watson 2021.

## Insuring coral reefs and other ecosystems that protect communities

Coral reefs, one of the most biologically diverse ecosystems on earth, can reduce up to 97% of wave energy before it reaches the shore, thus increasing the resilience of coastlines, businesses and communities to storms and erosion. In addition to coastal protection, many coastal communities rely on reefs for tourism, fisheries and sustenance. However, hurricanes can damage coral reefs, diminishing their ability to protect valuable coastal infrastructure.

The Nature Conservancy (TNC), the Government of Quintana Roo, and the National Commission of Protected Areas (CONANP) worked with Swiss Re to establish the world's first insurance policy for a natural asset by insuring a coral reef in Quintana Roo, Mexico. The parametric insurance coverage has three key elements:

- The parameter (wind speed) and the threshold (e.g. 100 knots) that triggers the insurance
- The geographic area concerned
- The payout scheme to the policyholder

This parametric insurance supports the rapid repair of hurricane damages, helping to protect and restore these biological habitats and support the communities relying on them.

Policyholders may be planning authorities, tourism departments or environment and fisheries agencies, who may hold a legal mandate and authority to carry out reef restoration work, or private-sector hospitality and hotel chains or fisheries that directly benefit from the increased resilience related to healthy natural ecosystems.

TNC is now working with partners to scale this model to new geographies, ecosystems and risks. The model has been adopted by and adapted to other areas, such as by the Mesoamerican Reef (MAR) Fund and the Governments of Honduras and Belize, and the first insurance product for nature in the U.S. is under development – a reef insurance policy for hurricanes in Hawaii. To expand this novel tool to new ecosystems, TNC is assessing the feasibility of insurance for mangroves in the Caribbean and for salt marshes in California and Georgia. TNC has also explored the feasibility of insurance for risks such as coral bleaching, sedimentation and excessive rainfall in Hawaii.

Recent work by the UN Development Programme (UNDP), in collaboration with the Ocean Risk and Resilience Action Alliance (ORRAA) and key insurance industry stakeholders, has identified solutions for securing natural capital and risk financing mechanisms for coral reefs.

*Source: Contributed by Tamaki Bieri, Kim Hum, Eric Roberts and Fernando Secaira (TNC)<sup>124</sup>*



<sup>124</sup> Based on Zepeda-Venteno et al. 2018; The Nature Conservancy 2020a,b; The Nature Conservancy and Quintana Roo Government 2021; and UNDP 2022.

## Insuring nature-based solutions that offer carbon credits and increased resilience

### Blue Carbon: Insuring the buffer to unlock greater finance

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The world has set ambitious goals toward limiting planetary warming to 1.5°C. Blue carbon systems (mangroves, seagrasses and saltmarshes) are the Earth's most carbon-dense ecosystems. Carbon markets can help blue carbon systems realise their potential as a climate change solution.

Conservation International and partners have made blue carbon credits possible as a finance mechanism for on-the-ground coastal conservation and restoration initiatives, which provide climate mitigation, adaptation, biodiversity and community benefits. Projects trade these credits on compliance or voluntary platforms and reinvest the payments into on-the-ground activities.



However, current certification processes require an allocation of 'buffer credits' to cover the non-permanence-related risk associated with projects. Credits allocated to the buffer pool are not eligible for trade, thus reducing the project's funding. In partnership with Swiss Re, Conservation International has been exploring insurance as a potential alternative to aspects of the buffer system. The insurance covers the loss and damage to the asset (e.g. mangroves) from unexpected natural and weather-related events that result in reduced carbon benefits, which may negate the need to set aside a portion of the buffer credits related to those specific risks. Instead, a premium would be paid by the project proponent, which is ideally less than the equivalent buffer credit value. The difference in premium cost and gained carbon credit value could unlock greater finance for the project and allow for more credits to enter the market where they can be applied to climate commitments by governments or toward corporate carbon footprints.

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Source: Contributed by Jennifer Howard (Conservation International) and Cherie Gray (Swiss Re)

## Innovative insurance products that incentivise sustainable business solutions

### Insuring mass timber: A new class of building materials

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As the building sector transitions towards a sustainable economy, there is a need for low-carbon, sustainable and yet high-quality, safe, solid and aesthetically pleasing building materials. Perhaps surprisingly, an innovative solution originates from wood: mass timber is a new class of engineered building materials fabricated from layers of wood.

Importantly, mass timber's characteristics come with a number of environmental benefits:

- Using it reduces the amount of concrete and steel needed in structures, making the overall structure lighter. This may reduce foundation requirements and shorten project schedules.
- Buildings with mass timber may be more resilient and perform better against seismic stresses.
- The manufacturing process reduces GHG emissions compared to equivalent concrete and steel structures, cutting emissions by up to 25–40%.
- For the duration of the building's lifetime, wood will sequester carbon.



Combined, all of these advantages make mass timber an innovative alternative to today's large-scale building materials. To enable the use and growth of mass timber, Zurich Insurance expanded its 'builders risk' coverage, offering up to USD 50 million in capacity for commercial construction projects using mass timber. The new Mass Timber Builders Risk proposition is available either as a standalone solution, or incorporated as part of a master Builders Risk programme. Through this new product, Zurich shows how insurance can enable a nature-based solution to incentivise more sustainable, environmentally-friendly and yet economically competitive products.

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Source: Zurich North America<sup>125</sup>

### 5.1.2 Innovations on the investment side

#### Investing in the restoration and conservation of nature-based solutions for increased resilience

##### The Nature Force

The Nature Force is an action-oriented, climate resilience initiative funded by a collective of 15 P&C insurance companies (Aviva Canada, can Canada, Definity, Gallagher, Gore Mutual, HUB International, Intact, Navacord, Northbridge, SGI, Travelers Canada, Trisura, Wawanesa, Westland and Zurich Canada) in partnership with a national non-profit conservation organisation, Ducks Unlimited Canada, to invest in nature-based solutions, including upstream wetlands in high flood risk urban areas. The industry significantly benefits through the reduction of flood risk to people, communities and businesses.



Source: *The Nature Force 2022*<sup>126</sup>

#### Development of investment strategies to support sustainable business practices

##### Integrating a sustainable investment strategy for agriculture and timber

Managing, preserving and restoring forests and related land for agriculture is crucial for both biodiversity and climate change mitigation. Hancock Natural Resource Group (HNRG) has adopted a sustainable approach to investing in agriculture and timber, focusing on positive climate impacts and regenerative agricultural practices that can improve soil health and biodiversity.

The Sustainable and Responsible Investing (SRI) framework of HNRG, a company of Manulife Investment Management, is centred around five themes: 1) climate stability, 2) ecosystem resiliency, 3) watershed protection, 4) people empowerment, and 5) community prosperity.

Importantly, HNRG adopted a systematic and thorough materiality assessment of SRI issues, involving key stakeholders (e.g. the investors) and peers to enhance the process. A rigorous SRI Due Diligence Toolkit is used from a preliminary stage to the final valuation of a deal. The entire approach allows a careful assessment of the risks and opportunities associated with each investment, with a long-term view.



Source: *HNRG and Manulife Investment Management*<sup>127</sup>

126 The Nature Force 2022.

127 HNRG 2021; Manulife Investment Management 2021.

## 5.2 The challenges of scaling up nature-related underwriting and investing

While protecting and restoring nature is an urgent matter, markets and activities need time to take off and create demand and supply for insurance products that support nature-positive approaches. We highlight four key challenges towards scaling up these opportunities (Figure 6).

### 1. The general perception of nature and biodiversity.

Despite rising evidence about the impacts of human activity on nature and biodiversity loss, the misperception among some governments, businesses and the general public that nature may be exploited for free persists. Some corporations, investors and re/insurers may consider nature-related risks and opportunities as a scientific, environmental and, at most, a philanthropic or corporate social responsibility issue. Furthermore, as nature-positive activities and investments are not correctly priced, they currently carry extra premiums, which few stakeholders may be willing to pay.

### 2. Identifying customers who could benefit from insurance products targeted at the protection of nature-based systems and who are willing to purchase them.

Customers may be individuals, public or private entities or a quasi-public entity that purchases on behalf of many individuals and/or entities. Despite short-term extra premiums, many stakeholders stand to benefit from investments in nature-related activities over the long term. Identifying and engaging with these customers is essential to developing product offerings. For example, hotel chains along coastlines, whose property will be protected from floods and storms by healthy wetlands, mangroves and reefs, should reassess and consider the value of healthy nature in terms of reducing risk, as potential insurable assets and services that support their business. In some cases, sources of funding to pay for the policy may be an issue.

### 3. The availability and accessibility of data and tools to quantify the risks and benefits associated with nature-based systems.

This could be a critical bottleneck for taking innovative action. The lack of consideration for nature is exacerbated by the difficulties in valuing and pricing the risks and opportunities. Quantifying the value of nature's protection in monetary terms is crucial to help re/insurers, investors and corporate clients understand the value and integrate it into decision-making. This would require:

- Standard approaches for assessing the financial risks and opportunities associated with the protection and preservation of nature and biodiversity (in line with the TNFD)
- Accessible data and tools to allow the assessment of nature and biodiversity loss on business models (dependencies and impacts). Similar to climate change,<sup>128</sup> capacities for developing decision-useful nature loss risk assessment will need to be developed with a forward-looking approach
- More research to develop these capacities to identify and integrate nature-related risks into the decision-making of governments, companies, their investors and insurers.

Examples of existing tools are provided in Box 7. Much work lies ahead to develop and extend these capacities so they can serve as an integral part of companies' risk assessment toolbox.

Addressing the challenges related to the availability of data, methodologies and tools for nature-related risk assessment in insurance will require the industry to capitalise on its extensive experience in the field of climate change risk assessment. Combined with industry-level collaboration, this will help to:

- Expedite the development of such methodologies
- Capture the interlinkages of nature and climate change with a more integrated approach to risk modelling
- Build stronger collaboration with regulatory bodies through sharing expertise to shape future regulatory developments in this area.

### 4. Policy and regulatory issues and the role of governments in enabling and investing in nature-based solutions.

Given the lack of market and price signals, the public sector plays a critical role in the protection and conservation of natural capital through public policy and regulatory requirements as well as incentivising investments in nature-based solutions. For example, from 3 July 2021, EU member states banned single-use plastic plates, cutlery, straws, balloon sticks and cotton buds from their markets in an effort to combat plastic waste and pollution.<sup>129</sup> Governments could also consider investing in nature-based solutions. For example, the draft EU's Nature Restoration Law is an ambitious plan for the preservation and restoration of nature, with legally binding targets. The EU Commission set

128 The Geneva Association 2021a,b, 2022.

129 European Commission 2019.

## Box 7: Examples of databases and tools for assessing the financial risks of nature and biodiversity loss

**GLOBIO** was developed by the PBL Netherlands Environmental Assessment Agency, with the aim of quantifying global human impacts on biodiversity and ecosystems. Initially designed to inform policymakers, the IPBES and the CBD, GLOBIO has also been used by financial institutions to assess the impacts of nature loss and biodiversity footprints.

**ENCORE** was developed by the Natural Capital Finance Alliance in partnership with UNEP-WCMC. It guides users in understanding how businesses across all sectors potentially depend and impact on nature, and how this might translate into a business risk.

**The Cambridge Institute for Sustainability Leadership (CISL)** is working with a number of financial institutions to develop a framework for identifying nature-related financial risks for the financial sector, allowing companies to assess the materiality of certain nature-related risks on their business.

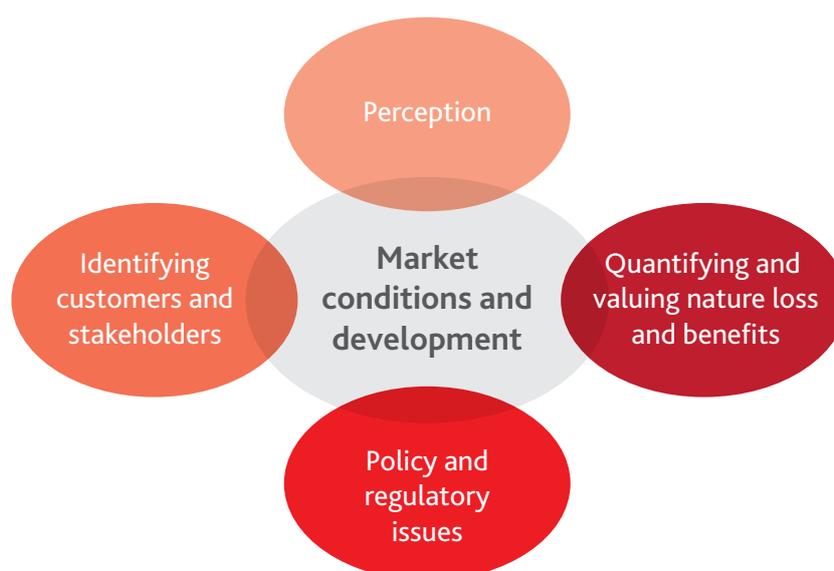
**The Partnership for Biodiversity Accounting Financials (PBAF)** is an international partnership of banks, asset managers and investors and a sister initiative to the Partnership for Carbon Accounting Financials (PCAF) related to climate change. The PBAF aims to offer new standards for financial institutions to measure the impact of loans and investments on biodiversity.

Source: *The Geneva Association*<sup>130</sup>

an overarching target to restore at least 20% of the EU's land and sea area by 2030 and plan to extend it to all ecosystems in need of restoration by 2050.<sup>131</sup> In 2021, as part of a CAD 4 billion investment over 10 years in the Natural Climate Solutions Fund, the Government of Canada announced a CAD 25 million investment in the conservation, restoration and management of wetlands and grassland habitats in the Prairies.<sup>132</sup>

Collaboration within and across sectors and opportunities for public-private partnerships, financing and risk sharing solutions need to be further explored.

**Figure 6: Challenges of scaling up action towards nature-positive activities**



Source: *The Geneva Association*

<sup>130</sup> Based on the review of: Schipper et al. 2019; SCOR 2020; Natural Capital Finance Alliance 2018; CISL 2022a; CISL and Robeco 2022; CISL and UBP 2022; CISL and HSBC 2022; CISL and NatWest Group 2022; CISL and Aon 2022; PBAF 2022a-c.

<sup>131</sup> European Commission 2022.

<sup>132</sup> Government of Canada 2021.



## 6. Recommendations

Considering the latest scientific evidence on the direct, large-scale impacts of human activity on nature-based systems and their subsequent socio-economic impacts, we anticipate a paradigm shift in societal perceptions of nature-related risks over the next few years.<sup>133</sup> We offer the following recommendations to the global research community, re/insurers, governments and policymakers.

### Research community

Tackling this complex global crisis will require more multi-stakeholder applied research, with more coordinated funding from the private and public sectors as well as philanthropic sources. There are five key areas where research needs to be scaled and expedited:

1. **Defining and classifying nature-related risks and their interlinkages; identifying critical indicators on which to base mitigation actions; and establishing measurable ways to define their impacts.** For example, for climate change, the clear metric of carbon (and other GHG) emissions provides a global measuring stick on which to base actions. Given the complexity and myriad factors driving nature loss, there is currently no clear corresponding set of indicators.
2. **Quantifying the benefits of nature-positive activities for strengthening resilience to physical climate risks, expediting climate change mitigation and enabling sustainable, nature-positive business models in different sectors.**
3. **Understanding, assessing and mapping the types and scale of environmental footprints of full value chains.** As the world moves to invest at scale in a wide range of new climate technologies for sectoral decarbonisation, environmentally sustainable industrial and development practices need to be considered. Research should be conducted with a circular economy lens, exploring environmental footprints across the value chain on a technology-by-technology basis (e.g. exploration and extraction of rare materials, intermediate processing (e.g. batteries), advanced manufacturing and assembly of components, recycling (e.g. materials used to manufacture batteries) and disposal).
4. **Establishing best practices for assessing the materiality of risks of large-scale biodiversity and nature loss.** This will require companies from

<sup>133</sup> Similar to the shift in perceptions of climate change, in the past several years, since the launch of the TCFD recommendations.

various sectors to engage in global initiatives such as the TNFD and invest in relevant research and development.

**5. Improving the availability and accessibility of data and tools to enable the quantification of the risks and benefits tied to nature-based systems.**

Unaddressed, this could be a bottleneck to innovative actions. Building on the above research, there is a need for inter and intrasectoral coordination and collaboration to develop methodologies for forward-looking nature-based risk assessment, also taking into consideration the interlinkages with climate change, to produce decision-relevant information to underpin future actions. Efforts in this area can benefit from and leverage current industry collaborations on climate change risk assessment.<sup>134</sup>

**Re/insurers**

Risk is the raison d'être of the insurance industry, and risk assessment is already deeply embedded in organisations' risk management, underwriting and investment processes. While some re/insurers have already started on their journey to assess, understand and quantify the risks and opportunities related to nature-based systems through investing in research and development, raising awareness and innovating new solutions, the industry can go further by helping to shape more nature-positive behaviour. We recommend that companies:

- 1. Stay abreast of the latest research**, as well as invest in relevant research and development, in this area. Engage in company-wide discussion and raise awareness among the board, executive management and employees regarding the risks and opportunities associated with nature-based systems.
- 2. Recognise and keep pace with the latest developments** in areas that are driving nature-related risks and opportunities into core business decision-making. These include emerging sustainable finance frameworks,<sup>135</sup> regulatory and supervisory actions, the litigation landscape, the incorporation of nature-related factors in credit ratings, the environmental and sectoral public policy and regulatory landscape; and the sensitivity of investors and shareholders to these issues.
- 3. Explore, identify and assess the materiality of nature-related risks** in their business model. This will take time, but it is important for shaping future strategies, policies and business models.

Re/insurers can engage in global efforts such as the TNFD to identify methodologies, share lessons learned and help expedite convergence towards best practices. This will also allow them to initiate internal discussions around the risks and opportunities associated with nature-based systems in relation to their core business and further enhance internal awareness.

- 4. Further explore the interlinkages of nature-based solutions and climate change adaptation and mitigation measures.** Addressing nature and biodiversity loss together should be an integral part of companies' net-zero transition strategies. Realising the benefits of nature-based solutions should be central to companies' approaches to developing more resilient, carbon neutral and nature-positive business models.
- 5. Raise awareness among insureds and investees** about the scale of nature-related risks and biodiversity loss to incentivise more sustainable behaviours and business models. As re/insurers build a deeper understanding of nature-based risks and how they transmit, they have an opportunity to offer risk expertise and related services to their clients in fields where standard insured risks are connected to climate change or the decline of nature and their interactions.
- 6. Explore opportunities for new product and service innovation** to mitigate nature loss and its impacts. This may have implications for risk analysis and the pricing and development of more integrated insurance solutions. In this regard, it is important to consider the interactions, feedback loops and competing interests of various industries around nature and climate change, and engage with other sectors such as banking, IT and digital communications to assess and price these risks.
- 7. Consider the environmental risks associated with producing new climate technologies** for decarbonisation when underwriting and investing in their large-scale deployment. These technologies may come with significant environmental and disposal risks. Gone unmanaged, these may also lead to financial and reputational risks to organisations, as well as litigation risk.<sup>136</sup>
- 8. Identify and potentially realise investment opportunities** in nature-based solutions that would lead to increased resilience and carbon credit benefits for clients and their own business models.

<sup>134</sup> The Geneva Association 2021a,b, 2022.

<sup>135</sup> UNEP-FI 2019.

<sup>136</sup> In the U.S., a number of litigation cases have been brought against developers and operators of large-scale wind and solar farms. Golnaraghi 2022; The Geneva Association 2021c,d.

**9. Recognise the shortfalls in the availability and accessibility of data and tools** to quantify the risks and benefits tied to nature-based systems. Consider industry-level collaboration and proactive engagement with regulatory bodies to identify major data gaps and expedite the development of forward-looking methodologies for nature-related risk assessment.

### Governments and policymakers

Given the lack of price signals and market considerations of nature, the public sector must take the lead in educating society about the harms of nature and biodiversity loss and incentivise action towards more sustainable approaches by:

- 1. Committing more funding** to coordinated multi-stakeholder research.
- 2. Considering policy and regulatory frameworks that incentivise nature-positive behaviour and business models.** Sectoral and environmental policy and regulatory frameworks can play a critical role in changing unsustainable behaviours (e.g. consumption patterns) and corporate business models. Further developing sustainable finance frameworks is another critical step towards institutionalising long-term, nature-positive investment approaches.

**3. Acting on, purchasing insurance for, and investing in the restoration and preservation of nature-based systems.** By purchasing insurance, governments can strengthen community resilience to nature loss. Direct investments in nature-based solutions should be integral to governments' climate change adaptation and mitigation strategies. Governments from emerging and low-income economies could collaborate with the international development community and multilateral development banks to boost nature-based investments<sup>137</sup>

**4. Making considerations for the preservation and restoration of nature-based ecosystems a requirement** for future development plans. Resilient and sustainable infrastructure and community development projects should consider the valuation of nature-based ecosystems.

**5. Considering public-private partnerships** and opportunities, for example with the insurance industry for risk assessment and risk management, as well as broader engagement with the private sector for co-financing and risk sharing.

<sup>137</sup> For example, since 2021, the Inter-American Development Bank leads multilateral development banks to boost nature-based investments (Inter-American Development Bank 2021).

# Appendix: Nature- and climate change-related terminology<sup>138</sup>

## Nature-related terminology:

**Biodiversity:** The variability among living organisms from all sources, including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

**Ecosystem:** A dynamic complex of plant, animal and microorganism communities and the non-living environment, interacting as a functional unit.

**Ecosystem services:** The contributions of ecosystems to the benefits that are used in economic and other human activities.

**Materiality:** Generally refers to being relevant or statistically significant. Materiality definitions in the context of financial risks associated with climate change and nature-loss are being addressed by the TCFD and TNFD, respectively.

**Nature-related financial risks:** Potential threats posed to an organisation linked to its and other organisations' dependencies on nature and nature impacts. These can derive from physical, transition and systemic risks.

**Physical risk:** Risks arising when natural systems are compromised, due to the impact of climatic (e.g. extremes of weather) or geologic (e.g. seismic) events or changes in ecosystem equilibria, such as soil quality or marine ecology. These can be event driven (acute), chronic or both.

**Transition risk:** Risks that result from a misalignment between an organisation's or investor's strategy and management and the changing regulatory and policy landscape in which it operates. Developments aimed at halting or reversing the damage to nature, such as government measures, technological breakthroughs, market changes, litigation and changing consumer preferences can all impact risks.

**Nature:** The natural world, with an emphasis on the diversity of living organisms (including people) and their interactions among themselves and with their environment.

**Nature-based solutions:** Actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits.

**Nature positive:** A high-level goal and concept describing a future state of nature (e.g. biodiversity, ecosystem services and natural capital) which is greater than the current state.

**Systemic risk:** Risks arising from the breakdown of the entire system, rather than the failure of individual parts. Characterised by modest tipping points combining indirectly to produce large failures and cascading interactions of physical and transition risks (contagion), as one loss triggers a chain of others and stops systems from recovering their equilibrium after a shock.

**System-based thinking:** Holistic approach focusing on the way the system's constituent parts are interrelated with feedback loops as the system works overtime.

## Climate-related terminology:

**Physical risk:** The potential negative financial impacts that could arise from direct physical effects, such as the destruction of property and infrastructure, and indirect impacts, such as business or supply chain interruptions, due to the increasing severity and frequency of extreme weather events (acute risks) and long-term shifts in climate patterns (chronic risks) caused by climate change.

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138 TNFD 2022.

**Transition risk:** Any risk which could result from the process of transitioning towards a low-carbon economy. The TCFD notes that transitioning to a lower-carbon economy may entail extensive policy, legal, technology and market changes to address mitigation and adaptation requirements related to climate change. Depending on the nature, speed, and focus of these changes, transition risks may pose varying levels of financial and reputational risk to organisations.

**Litigation risk:** Cases brought before administrative, judicial and other investigatory bodies, financial supervisory authorities and ombudsman schemes or in domestic or international courts and organisations, that raise issues of law or facts regarding the science of climate change and climate change mitigation and adaptation efforts. Note that the definition of litigation risk used here goes beyond that of the TCFD definition to include cases that can be directly linked to physical risk.<sup>139</sup>

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<sup>139</sup> The Geneva Association 2021c.

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This report provides the latest scientific evidence on the impacts of human activity on nature and their socio-economic implications, laying out the challenges and opportunities facing re/insurers and how they, as risk managers and investors, can support the development of a nature-positive economy and incentivise sustainable business models. It also explores the profound inter-connectivity between nature loss and climate change in terms of both risks and solutions and highlights seven factors that are driving nature-positive considerations into core business decision-making in insurance.

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