

United Nations Development Programme



Designing Insurance for Nature: A Practical Guide



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Foreword



*Midori Paxton, Global Head – Ecosystems and Biodiversity,
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We insure what we value. We protect our homes, health, livelihoods and lives against risk and uncertainty. Yet the asset upon which these ultimately depend – nature – has long remained largely outside the boundaries of our risk management systems.

Nature underpins human prosperity. It provides clean water and air, food and medicine, cultural and spiritual well-being, and powerful protection against disasters. Its estimated value – at least US\$125 trillion per year – sustains nearly every sector of the global economy. The benefits of nature flow to every individual, community and society. Nature is our most critical public asset – and yet, until recently, we have largely failed to treat it as such.

That is beginning to change. Across the world, there is growing recognition that nature is an asset that must be protected. Insurance is emerging as a powerful (and still underexplored) instrument to help manage nature-related risks. But this raises fundamental questions. How do we insure nature? Can ecosystems, biodiversity and the services they provide be rendered insurable? And as degradation accelerates, are we approaching a future in which nature itself becomes “uninsurable”? Without decisive action, the insurance sector may increasingly retreat from high risk landscapes and communities, leaving governments, businesses and people exposed to escalating losses.

Therefore, responses must go beyond risk transfer to require integrated approaches that embed insurance within broader strategies for prevention and risk reduction. This is particularly evident in contexts such as human–wildlife conflict or the protection of coral reefs from storm damage, where insurance must complement conservation, restoration and resilience-building efforts.

For more than a decade, UNDP has invested in deploying insurance solutions in support of nature conservation. To address the biodiversity finance gap, countries are pursuing interventions that: (i) mobilize additional finance, (ii) avoid future costs, (iii) realign existing expenditures and (iv) use current financing more effectively. Our experience shows that insurance can contribute across all four outcomes – by mobilizing additional resources from governments and insurers to manage risk, paying premiums today to avoid significant future losses – and improving the effectiveness of existing financial flows through a stronger focus on risk management.

This landmark publication brings together the lessons from this journey, developed in partnership with countries and the insurance sector, and charts a clear path forward for the role of insurance in addressing nature-related risks.

Foreword



*Thomas Beloe, Director,
Sustainable Finance Hub, UNDP*

Nature loss is no longer an environmental concern that finance can afford to ignore. It is a systemic risk with direct implications for economies, livelihoods and long-term development.

Left unchecked, ecosystem collapse could reduce global GDP by up to 3 percent annually, or US\$2.7 trillion, by 2030. For developing countries, where households, farmers and small businesses depend directly on natural resources for food, income and energy, the human and economic consequences would be even more severe.

This is where insurance has an important and often under recognized role to play. Its most visible contribution is risk transfer: protecting households, businesses and governments against losses linked to environmental change, helping communities recover more quickly and maintain stability in the face of growing uncertainty. But this is only one part of its potential.

Nature-related investments in restoration, conservation and the sustainable use of natural assets remain difficult to finance. Their risks are often complex, evolving and insufficiently understood, and as a result capital does not flow at the scale required. By improving how risk is assessed, managed and shared, insurance can strengthen the financial viability of these investments and enable greater participation from both public and private actors.

Insurance can also play a more structural role. When insurers integrate nature-related risks into underwriting and investment decisions, they can influence how markets value nature. Over time, this can shift incentives, encourage more sustainable practices and support the transition towards more resilient and nature-positive economies. In this way, insurance does not only respond to risk – it helps shape how risk is understood and addressed across the financial system.

This report examines how insurance solutions are being designed to respond to nature-related risks across different contexts, highlighting emerging approaches, practical applications and areas where further innovation is needed.

For policymakers and industry practitioners, the central argument is this: managing nature-related risk and financing nature-positive outcomes are not separate challenges. Used well, insurance can help close the gap between them – not by solving the underlying problem, but by making the financial case for doing so harder to ignore.

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Executive summary

Nature and biodiversity underpin economies, livelihoods and human well-being. Yet biodiversity is being lost at an unprecedented pace due to climate change, land-use change, pollution and unsustainable economic activities. These trends are creating growing environmental, economic, fiscal and financial risks for countries, businesses and communities. As governments seek solutions to strengthen resilience and mobilize finance for nature, insurance is emerging as an important but underexplored tool for managing nature-related risks and supporting biodiversity outcomes.

This guidebook was written to assist countries in preparing their National Biodiversity Finance Plans and in selecting, screening and designing finance solutions that address risks. It also serves as a practical resource for conservation organizations, insurers, investors, development partners and other stakeholders engaged in biodiversity conservation and restoration efforts.

1. Biodiversity has immense value, but it is being rapidly lost

Biodiversity supports essential ecosystem services including food production, pollination, water regulation, carbon storage, coastal protection and livelihoods. More than half of global gross domestic product (GDP) is moderately or highly dependent on nature and ecosystem services. However, biodiversity loss is accelerating across ecosystems, species and genetic diversity. Since 1970, monitored wildlife populations have declined by an average of 73 percent, while ecosystems such as forests, wetlands, mangroves and coral reefs continue to degrade rapidly. These losses are not only environmental challenges. They create growing risks for food systems, water security, livelihoods, public finance, infrastructure and economic resilience.

2. Biodiversity loss is creating physical, transition and systemic risks

The impacts of biodiversity loss are increasingly affecting economies and financial systems through three broad categories of risk:

- Physical risks, resulting from the degradation of ecosystem services such as flood protection, pollination and water regulation
- Transition risks, driven by evolving regulations, disclosure requirements, market shifts, and changing consumer preferences
- Systemic risks, where ecosystem degradation threatens broader economic, financial and social stability.

These risks affect sectors including agriculture, tourism, fisheries, infrastructure, insurance and public finance. Ecosystem degradation can increase disaster losses, disrupt supply chains, reduce productivity and heighten fiscal pressures for governments.

3. Insurance has an important role to play in addressing nature-related risks

Insurance can contribute to biodiversity resilience through three interconnected pathways:

Protecting nature: Insurance can directly support biodiversity conservation and ecosystem restoration through products that protect ecosystems and species, alongside nature-positive underwriting and investments. Examples include coral reef insurance, wetland insurance and human–wildlife conflict insurance schemes. Underwriting practices and investment portfolios can apply biodiversity filters in decision-making to avoid further biodiversity loss.

Managing nature-related risks: Insurance can help households, businesses, governments and communities absorb financial losses linked to biodiversity degradation and environmental shocks. This includes climate risk insurance, sovereign risk pools and biodiversity-related business interruption coverage.

Reducing risk through nature: Healthy ecosystems themselves reduce risks by buffering storms, regulating water systems, stabilizing coastlines and improving resilience. Protecting nature can therefore reduce insurance losses and support long-term insurability.

4. Insurance must be combined with risk reduction and sustainable financing approaches

Insurance alone cannot solve biodiversity loss. Effective approaches require integrated strategies combining insurance with ecosystem management, conservation, restoration, and risk reduction measures. Successful insurance solutions depend on:

- Reliable data and risk analytics
- Sustainable premium financing
- Public–private partnerships
- Enabling regulation and governance
- Community participation and inclusion.

Insurance should therefore be understood not only as a risk transfer tool, but also as:

- An incentive for better risk management
- An enabler of investment
- A component of broader biodiversity finance strategies.

5. Practical guidance is needed to scale insurance for nature

Insurance for biodiversity remains an emerging field, and many stakeholders require practical guidance on whether insurance is appropriate and how solutions can be designed effectively. This guide provides:

- Foundational insurance concepts for non-insurance audiences
- Decision-support tools
- Practical building blocks for biodiversity insurance
- Case studies from multiple countries
- Guidance on product design, governance and premium financing.

The report aims to support policymakers, practitioners, insurers, and development partners in integrating insurance into broader biodiversity finance and resilience strategies.

Conclusion

Insurance is not a stand-alone solution to biodiversity loss. However, when combined with conservation, risk reduction, and sustainable financing approaches, it can help strengthen resilience, protect ecosystems and support nature-positive development pathways. This report seeks to support countries and stakeholders in understanding and applying insurance as part of broader efforts to address nature-related risks.

Abbreviations and acronyms

BIOFIN	Biodiversity Finance Initiative
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross domestic product
GEP	Gross ecosystem product
GIS	Geographic information systems
HWC	Human–wildlife conflict
IRFF	Insurance and Risk Finance Facility
LIFE	Livelihoods Insurance from Elephants
MAR	Mesoamerican Reef
NBSAPs	National Biodiversity Strategies and Action Plans
NDVI	Normalized difference vegetation index
NGO	Non-governmental organization
PPP	Public–private partnership
SIF	Sustainable Insurance Forum
TEV	Total economic value
UNDP	United Nations Development Programme
WEF	World Economic Forum
WWF	World Wildlife Fund for Nature

Introduction

Biological diversity is “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”.¹ It underpins the health of ecosystems and supports essential processes critical to human life and economic activity. However, despite its fundamental importance, biodiversity is under unprecedented threat from habitat loss, climate change, pollution, invasive species and overexploitation.

Limited financing, misaligned expenditures and a general lack of awareness about financial tools hold back effective action aimed at addressing the drivers of biodiversity loss and increasing investments in biodiversity-positive actions. At the global level, the biodiversity finance gap is estimated at US\$700 billion per year.² Bridging this gap requires a diversified approach: alongside developing new revenue sources, existing financial flows need to be realigned and future environmental costs must be avoided.³ Insurance, as a financial tool, can play a crucial role in biodiversity conservation by providing financial protection against risks to natural assets, incentivizing sustainable practices and securing key investments.

Purpose of this guide

This guide provides an overview of how insurance can contribute to biodiversity protection. It highlights key concepts, case studies and recommendations for designing effective insurance solutions.

The guide⁴ was written to assist countries in preparing their National Biodiversity Finance Plans as recommended by Kunming Montreal Global Biodiversity Framework Target 19(b), which focuses on a “[significant increase in] *domestic resource mobilization, facilitated by the preparation and implementation of national biodiversity finance plans or similar instruments according to national needs, priorities and circumstances*”. This guide is a critical input during the stage in which finance solutions are selected, screened and designed. It recognizes that biodiversity loss not only is an environmental challenge but also an emerging fiscal risk for governments, as degraded ecosystems increase public expenditure, reduce sectoral revenues, create contingent liabilities and heighten liquidity pressures, making insurance relevant as a sovereign risk financing instrument.

1 Convention on Biological Diversity, Article 2. Use of Terms (Nairobi, Kenya, 1992). Available at <https://www.cbd.int/convention/articles?a=cbd-02>.

2 UNDP Biodiversity Finance Initiative, *BIOFIN Workbook 2024: Finance for Nature* (New York, 2024). Available at <https://www.biofin.org/knowledge-product/biofin-2024-workbook>.

3 Ibid.

4 An earlier version of this guidebook was published in May 2025. See UNDP BIOFIN, UNDP IRFF and AB Entheos, “How insurance can address nature-related Risks: A summary guide” (New York, 2025). Available at <https://irff.undp.org/paper/how-insurance-can-address-nature-related-risks>.

The guide is also intended to be used by other stakeholders, such as conservation agencies, community-based organizations, research institutions, non-governmental organizations (NGOs), private-sector investors, insurers and development partners involved in developing biodiversity conservation and restoration plans.

The guide primarily focuses on insurance product design and does not capture the design of underwriting practices and investment policies that can also contribute to positive biodiversity outcomes.

While the guide is not intended to serve as a technical manual for product design, it can nonetheless inform insurance industry actors as they develop insurance products related to nature and biodiversity. Overall, the guide positions insurance as a potential finance solution for managing and reducing risks associated with the loss of ecosystems, species and genetic diversity.



1. Understanding biodiversity and risks



1.1 The value and loss of biodiversity

Biodiversity sustains our lives and supports functioning economies. It forms the foundation of ecological processes that result in goods and services benefiting humans across all ecosystems. Regarded as natural assets, forests, coral reefs, wetlands and freshwater ecosystems can provide various goods and services indefinitely because of their regenerative capacity.⁵

Forests illustrate this dependency clearly. Around 350 million people living within or near dense forests depend on them for subsistence and livelihoods, with households deriving up to 22 percent of their incomes from forest resources.⁶ Forests also generate more than 5,000 types of wood-based products, valued at over \$600 billion annually.⁷

Similarly, coral reefs are among the most valuable ecosystems on the planet. Although they cover less than 1 percent of the ocean floor, they are home to at least one-quarter of all marine species.⁸ Healthy coral reefs provide sustainable food sources, livelihoods, income generation and protection from storm surges.⁹ More than 1 billion people depend directly on reefs for their livelihoods.¹⁰

Coastal zones, which make up just 4 percent of the Earth's total land area and 11 percent of the world's oceans, contain more than one-third of the global population and account for 90 percent of marine fisheries catch.¹¹ These areas provide habitats for flora and fauna, support tourism and recreation, and act as buffers against storms and wave action.

Given both the importance of biodiversity and its continued decline across species and ecosystems, significant efforts have been made to make nature less “invisible” through natural capital accounting and valuation work. A seminal study in 2014 estimated that the global value of ecosystem services in 2011 ranged between \$125 trillion and \$145 trillion, equivalent to more than 150 percent of global GDP.¹² More recently, the World Economic Forum (WEF) estimated that over half of global GDP, valued at nearly \$44 trillion, is moderately or highly dependent on nature.¹³

Valuation studies further illustrate the scale of ecosystem contributions. Groot et al. estimated that an average hectare of open ocean provides \$490 per year in ecosystem services, while an average hectare of coral reefs provides \$50,000 annually.¹⁴

5 P. Dasgupta, *The Economics of Biodiversity: The Dasgupta Review* (London, HM Treasury, 2021).

6 World Bank, “Forests for people, the planet and climate”, 19 March 2020. Available at <https://www.worldbank.org/en/news/feature/2020/03/19/forests-for-people-the-planet-and-climate>.

7 Ibid.

8 United Nations Environment Programme, *Summary for Policymakers – Status of Coral Reefs of the World: 2020 Nairobi*, (2022). Available at <https://www.unep.org/interactives/status-world-coral-reefs/>.

9 F. Ferrario et al., “The effectiveness of coral reefs for coastal hazard risk reduction and adaptation”, *Nat Commun* vol. 5, 3794 (May 2014). Available at <https://doi.org/10.1038/ncomms4794>.

10 United Nations Environment Programme, *Summary for Policymakers – Status of Coral Reefs of the World: 2020*.

11 E.B. Barbier, “Marine ecosystem services”, *Current Biology*, vol. 27, No. 11 (June 2017). Available at [https://www.cell.com/current-biology/fulltext/S0960-9822\(17\)30289-0](https://www.cell.com/current-biology/fulltext/S0960-9822(17)30289-0).

12 R. Costanza, et al., “Changes in the global value of ecosystem services”, *Global Environmental Change*, vol. 26, No. 1 (May 2014). Available at <https://www.sciencedirect.com/science/article/abs/pii/S0959378014000685>.

13 World Economic Forum, “Nature positive transitions”. Available at <https://initiatives.weforum.org/nature-positive-transitions/home>.

14 R. de Groot, et al., “Global estimates of the value of ecosystems and their services in monetary units”, *Ecosystem Services*, vol. 1, No. 1 (July 2012). Available at <https://www.sciencedirect.com/science/article/pii/S2212041612000101>.

Some ecosystem services such as food, wood, water and energy can be directly valued using market prices. However, ecosystem services such as regulating, habitat and cultural services often represent indirect use or non-use values, including bequest value (preserving nature for future generations), option value (maintaining the potential for future use) and existence value (valuing biodiversity simply for its existence). Although more difficult to measure than market-based services, these values can be substantial when expressed in monetary terms and are equally significant in understanding the full contribution of biodiversity. The regulating services of coral reefs (climate regulation, moderation of extreme events, water purification and biological control) have been valued at an average of \$26,000 per hectare annually, and cultural services such as recreation and tourism are valued at approximately \$88,700 per hectare.¹⁵

Despite its value, biodiversity loss has accelerated dramatically in recent decades, posing a grave threat to ecological stability and human well-being. Since 1955, human activities have driven biodiversity loss at an unprecedented rate.¹⁶ Monitored wildlife populations have declined by 73 percent since 1970, with freshwater species experiencing an 85 percent drop.¹⁷

This decline, described by Dasgupta as an “asset management problem”, is driven by a combination of pressures, including land- and sea-use change, overexploitation of organisms, climate change, pollution and invasive species, all influenced by broader

socioeconomic factors. Agricultural expansion alone contributes to nearly 90 percent of global deforestation.¹⁸ Just seven agricultural commodities have accounted for 26 percent of global tree cover lost between 2001 and 2015, replacing 71.9 million ha of forest.¹⁹ As habitats shrink and ecosystems degrade, wildlife is increasingly forced into closer contact with human settlements, intensifying human–wildlife conflict and further threatening the survival of vulnerable species (**Box 1**).

The threats to biodiversity are well recognized by the Kunming Montreal Global Biodiversity Framework, specifically Target 4, which addresses species extinction and managing human-wildlife conflict; Target 5, which addresses legal harvesting and trade of wild species; and Target 10, on the sustainable management of areas under agriculture, fisheries and forestry.

The decline is not confined to individual species only; it affects entire ecosystems that provide essential services such as clean air, water filtration, climate regulation and pollination. These interlinked drivers compromise the resilience of ecosystems, reduce their ability to regenerate and, ultimately, impact the economic and social systems they support. The consequences are systemic and wide-ranging, spanning physical damage, financial instability, food and water insecurity, and changes in social dynamics, especially regarding the role of women.

15 Diversitas, “What are coral reef services worth? \$130,000 to \$1.2 million per hectare, per year”, ScienceDaily. ScienceDaily, 28 October 2009. Available at <https://www.sciencedaily.com/releases/2009/10/091016093913.htm>

16 Center for Sustainable Systems, University of Michigan, *Biodiversity Factsheet*, Pub. No. CSS09-08 (Ann Arbor, 2022). Available at <https://www.wwf.org.uk/sites/default/files/2024-10/living-planet-report-2024.pdf>

17 WWF, *Living Planet Report 2024 – A System in Peril* (Gland, 2024). Available at <https://www.wwf.org.uk/sites/default/files/2024-10/living-planet-report-2024.pdf>

18 FAO, “FAO Remote Sensing Survey reveals tropical rainforests under pressure as agricultural expansion drives global deforestation” (Rome, 2021). Available at <https://openknowledge.fao.org/server/api/core/bitstreams/fe22a597-a39d-4765-8393-95fbcaed6416/content>

19 M. Weisse and E. Goldman, “Just 7 commodities replaced an area of forest twice the size of Germany between 2001 and 2015”, World Resources Institute, 11 February 2021. Available at <https://www.wri.org/insights/just-7-commodities-replaced-area-forest-twice-size-germany-between-2001-and-2015>

Box 1. Human–wildlife conflict in selected countries

Human–wildlife conflict in Argentina

In Argentina, jaguars have lost 95 percent of their original habitat due to agricultural expansion, livestock grazing, infrastructure development and urbanization.²⁰ Fewer than 200 jaguars remain in the country, mostly in the tropical forests of Misiones, the Yungas and the Chaco region.²¹ Nearly half of the jaguar population (84 individuals) is concentrated in Misiones province.²² Despite legal protections, retaliatory killings by cattle ranchers remain a common response to livestock predation, placing the species at continued risk.

The jaguar is a keystone species in its ecosystem. It plays a vital role in regulating wild herbivore populations, which helps prevent overgrazing, soil erosion and the degradation of biodiversity throughout the forest. In 2024, the Argentine government estimated the environmental damage associated with the killing of a single jaguar at \$1.8 million.²³ Without localized and concrete solutions to these incidents of human–wildlife conflict, jaguars could face extinction in Argentina by 2050.

20 K. Stringer, “Jaguars, a keystone species, are reintroduced to the Iberá wetlands”, 18 March 2021. Available at <https://www.rewild.org/blog/jaguars-a-keystone-species-are-reintroduced-to-the-ibera-wetlands>.

21 Ibid.

22 Noticias Ambientales, “Warning issued for a decline in jaguar population in the Misiones rainforest”, 26 June 2025. Available at <https://noticiasambientales.com/animals/warning-issued-for-a-decline-in-jaguar-population-in-the-misiones-rainforest/>

23 Argentina, National Parks Administration, “Cálculo de daño ambiental de yaguareté (Panthera onca) cazado en Formosa” [Estimate of environmental damage from jaguar hunting in Formosa] (Formosa, 2024). Available at <https://chacodiapordia.com/storage/2024/08/Informe-Yaguarete-APNAC.pdf>.



Human–wildlife conflict in Bhutan

Bhutan has consistently met its conservation commitments in line with its constitution, which mandates that at least 60 percent of the country remain under forest cover. Approximately 71 percent of land area in Bhutan is forested, while 51.4 percent is designated as protected area.²⁴ At the same time, the government strategy promotes food security, higher farm incomes and a greater contribution of agriculture to GDP through high-value crops and livestock.²⁵ As population growth and agricultural expansion increasingly extend into protected areas and buffer zones, however, these development objectives have contributed to rising human–wildlife conflict.

Data indicate that livestock predation in Bhutan is mostly associated with tigers and leopards, while human casualties are caused by elephants and Himalayan black bear.²⁶

The scale of crop destruction is significant, with estimates during the same period at 420 tons, attributable to elephants, wild boar and monkey.²⁷ The Department of Forests and Park Services estimated that current costs of human–wildlife conflict between \$1.6 million and \$2.44 million per year, mostly borne by the rural poor.²⁸ Women-led households suffer more economic losses due to wildlife damage than do male-dominated households due to conflicting tasks and the inability to conduct night patrols. These conditions are affecting peaceful human–wildlife coexistence in Bhutan.

24 Bhutan, Ministry of Agriculture and Forests, *National REDD+ Strategy & Action Plan of Bhutan* (Thimphu, 2020). Available at <https://redd.dofps.gov.bt/wp-content/uploads/2022/06/REDD-Strategy-Action-Plan.pdf>.

25 United Nations Food Systems Coordination Hub, "Bhutan's Food Systems Strategy 2034: A framework for progress", 2 April 2025. Available at <https://www.unfoodsystemshub.org/latest-updates/news/detail/bhutan-s-food-systems-strategy-2034--a-framework-for-progress/en>.

26 National Plant Protection Centre and WWF Bhutan, "Human wildlife conflict SAFE strategy: Nine gewogs of Bhutan" (Thimphu, 2016). Available at <https://pestsofbhutan.nppc.gov.bt/wp-content/uploads/2017/03/Safe-System-Report.pdf>.

27 Bhutan, Ministry of Agriculture and Forests, *Bhutan State of Parks* (Thimphu, 2016).

28 Yeshey, R.J. Keenan, R.M. Ford and C.R. Nitschke, "Sustainable development implications of human wildlife conflict: an analysis of subsistence farmers in Bhutan", *International Journal of Sustainable Development & World Ecology*, vol. 30, No. 5 (July 2023). Available at <https://www.tandfonline.com/doi/full/10.1080/13504509.2023.2167242>.



Human–wildlife conflict in Nepal

In Nepal, wildlife populations have increased significantly in recent decades, largely due to the promotion of community-based conservation measures, the strong enforcement of protective legislation and the deployment of security forces in protected areas, particularly national parks. Nepal has achieved significant conservation gains, with its tiger population reaching 355 in 2022, an increase of more than 190 percent since the 2009 census. Meanwhile, its rhino population rose to 752 in 2021, marking a 16 percent increase from 2015.²⁹ This increase has led to an increase in human–wildlife conflict.³⁰ Infrastructure development, including road and transmission line construction, has fragmented habitats and climate change has intensified forest fires and droughts, leading to further habitat degradation. These combined pressures have contributed to worsening human–wildlife conflict.

In particular, three large cat species (the tiger, common leopard and snow leopard) and two megaherbivores (the elephant and rhinoceros) are responsible for substantial financial losses to rural communities through livestock depredation and crop damage. Nepal presents a unique case where the recovery of wildlife populations has led to increased human–wildlife conflict, which must be effectively managed to avoid adverse impacts on both wildlife and local communities.

29 30

29 S.L. Hyolmo, “Amid challenges, Nepal plans its latest tiger & rhino counts”, 1 October 2025. Available at <https://news.mongabay.com/2025/10/amid-challenges-nepal-plans-its-latest-tiger-rhino-counts/>.

30 B. Neupane, J. Jamaludin, A.P. Gautam et al., “Balancing act: navigating increasing human-wildlife conflict amidst megafauna recovery in the tropical lowlands of Nepal”, *Scientific Reports*, vol. 15, 31201 (August 2025). Available at <https://www.nature.com/articles/s41598-025-16707-w>.



1.2 Threats to biodiversity

Threats to biodiversity manifest across three critical dimensions: the ecosystem level, the species level and the genetic level. These dimensions are interconnected, with disruptions in one often cascading into the other, accelerating degradation and diminishing ecosystem resilience.

- **Ecosystem-level threats:** Among the most vulnerable terrestrial and aquatic ecosystems are forests, coral reefs, wetlands, mangroves and freshwater systems. Forests are threatened by deforestation for agriculture, infrastructure development and logging. Between 1990 and 2020, an estimated 420 million ha of forest was deforested (converted to other land uses).³¹ Coral reefs face multiple stressors, including ocean acidification, rising sea temperatures and pollution. Between 2009 and 2018, approximately 14 percent of the world's coral reef cover, around 11,700 square kilometres, was lost.³² The main driver of this decline was a rise in sea surface temperatures, leading to coral bleaching. Wetlands are also particularly vulnerable, facing degradation from urbanization and conversion to agricultural land. Since 1970, an estimated 35 percent of natural wetlands have been lost, at a rate even faster than that of forested areas.³³

Mangrove ecosystems, which sequester carbon and shield coastlines, are being cleared for aquaculture and urban development at alarming rates. These pressures significantly compromise the ecological integrity of these critical ecosystems.

- **Species-level threats:** Many species are being driven to extinction due to habitat loss, poaching, retaliatory killings, climate change and pollution. Between 1970 and 2020, monitored wildlife populations declined by an average of 73 percent.³⁴ Freshwater species saw the most severe drop, at 85 percent, followed by terrestrial populations at 69 percent and marine populations at 56 percent.³⁵ The leading species-level threats include habitat loss, degradation and overexploitation, primarily driven by global food systems, along with invasive species, disease and climate change. Invasive alien species intensify threats by outcompeting native species for resources and altering habitats. For example, the introduction of the Nile perch in Lake Victoria led to the collapse of native biodiversity, affecting food security and regional economies.³⁶ Species extinction not only represents a loss of genetic diversity but also erodes cultural identities and traditional knowledge systems linked to nature.

31 FAO, *The State of the World's Forests 2022: Forest pathways for green recovery and building inclusive, resilient and sustainable economies* (Rome, 2022), Chapter 2. Available at <https://openknowledge.fao.org/server/api/core/bitstreams/8f599970-661d-45f5-a598-2ea46ca1605f/content/src/html/deforestation-land-degradation.html#ref-note-1>.

32 D. Souter, S. Planes, J. Wicquart, M. Logan, D. Obura and F. Staub, eds., *Status of the Coral Reefs of the World: 2020 Report* (Townsville, Global Coral Reef Monitoring Network and International Coral Reef Initiative, 2021). Available at <https://gcrmn.net/2020-report-v1-2023/>.

33 Convention on Wetlands, *Global Wetland Outlook: Special Edition 2021* (Gland, 2021). Available at <https://www.global-wetland-outlook.ramsar.org/report-1>.

34 WWF, *Living Planet Report 2024 – A System in Peril*.

35 Ibid.

36 Tokyo Institute of Technology, "Nile perch invasion triggered genetic bottlenecks in lake Victoria's endemic cichlids, analyses suggest", *Phys.org*, 17 June 2024. Available at <https://phys.org/news/2024-06-nile-perch-invasion-triggered-genetic.html>.

- **Genetic-level threats:** Genetic-level biodiversity loss is occurring across species and ecosystems, yet it remains one of the least visible dimensions of biodiversity decline. Based on the findings of the Living Planet Index, species populations have declined by 58 percent, which translates to genetic diversity loss of at least 50 percent.³⁷

The loss of genetic diversity affects the ability of ecosystems and species to adapt to climate change, diseases and new pests. Occurring across species and across ecosystems, the loss of genetic biodiversity precludes the discovery and use of genetic material to support food security, traditional medicines and overall ecosystem health.

The loss of biodiversity presents multifaceted and far-reaching risks that impact economic, social and environmental systems on a global scale. These risks are escalating and increasingly interconnected, making them harder to predict, prevent and manage. They emerge as physical, transition and systemic threats that can destabilize industries, governments, communities and ecosystems.³⁸

- **Physical risks:** These encompass the direct, tangible impacts of biodiversity loss on natural systems, economies and human well-being. The degradation of ecosystems leads to a reduction in the essential services they provide, such as pollination, soil fertility, carbon sequestration and natural disaster buffering. For example, the loss of mangroves compromises their ability to reduce the impact of storms and floods – an ecosystem service that is estimated

to prevent over \$65 billion in property damage each year and protect more than 15 million people.³⁹ As biodiversity-rich areas are depleted, agricultural productivity also declines, endangering food security and increasing commodity price volatility. Agricultural productivity is highly dependent on animal pollination.⁴⁰ Therefore, the collapse of pollinator populations will directly affect crop yields, undermining livelihoods and creating economic instability in regions dependent on agriculture.⁴¹

- **Transition risks:** These risks arise from societal responses to biodiversity loss, including shifts in policies, markets, technologies and consumer preferences. As awareness of biodiversity-related risks grows, governments are implementing stricter regulations aimed at conservation and sustainable resource management. New legislation, such as protected area expansions, deforestation bans and mandatory biodiversity disclosures for corporations, increases compliance costs and necessitates changes in operational practices. For example, the European Union's Deforestation Regulation requires companies placing certain forest – linked commodities⁴² on the European Union market to demonstrate that their products are not linked to deforestation, increasing due diligence obligations and compliance costs across global supply chains. In 2019, the Netherlands introduced stricter regulations to curb nitrogen emissions from intensive livestock farming.

37 WWF, *Living Planet Index*. Available at https://www.panda.org/discover/knowledge_hub/all_publications/living_planet_index2/.

38 Taskforce on Nature-related Financial Disclosures, *The TNFD Nature-related Risk and Opportunity Management and Disclosure Framework* (London, 2022).

39 P. Menéndez, I. J. Losada, S. Torres-Ortega, S. Narayan and M. W. Beck, "The global flood protection benefits of mangroves", *Scientific Reports*, vol. 10, No. 1 (March 2020). Available at <https://www.nature.com/articles/s41598-020-61136-6>.

40 A.M. Klein, B.E. Vaissière, J.H. Cane et al., "Importance of pollinators in changing landscapes for world crops", *Proceedings of the Royal Society B: Biological Sciences*, vol. 274, No. 1608 (February 2007). Available at <https://royalsocietypublishing.org/doi/10.1098/rspb.2006.3721>.

41 C. A. Taylor and H. Druckenmiller, "Wetlands, flooding, and the Clean Water Act", *American Economic Review*, vol. 112, No. 4 (April 2022). Available at <https://www.aeaweb.org/articles?id=10.1257/aer.20210497>.

42 For more information, see https://environment.ec.europa.eu/topics/forests/deforestation/regulation-deforestation-free-products_en.

As a result, permits for high-emission activities were suspended, leaving some farms unable to operate.⁴³ Market trends are also shifting, as investors increasingly scrutinize companies' biodiversity footprints and integrate nature-related risks into their financial assessments. Technological changes aimed at mitigating biodiversity loss, such as regenerative agriculture, could disrupt traditional industries that fail to adapt. Companies with unsustainable practices may face reputational damage and loss of market share as consumers demand more ethically sourced and environmentally responsible products.

- **Systemic risks:** The most profound and potentially catastrophic threats posed by biodiversity loss are systemic in nature, affecting not just localized ecosystems but entire socioeconomic and ecological frameworks. As biodiversity degradation progresses, the resilience of natural systems declines, amplifying the risk of abrupt, large-scale collapses. More than half of global GDP, equivalent to \$41.7 trillion, is dependent on healthy biodiversity and ecosystem services.⁴⁴ Yet, one in five countries faces a high risk of ecosystem collapse due to declining biodiversity and the loss of critical natural functions.⁴⁵ The degradation of ecosystem services impacts a wide range of sectors – including agriculture, health and energy – by reducing productivity, increasing vulnerability to climate extremes and undermining natural processes.

Furthermore, as natural systems degrade, financial systems become increasingly vulnerable. Insurers face rising claims from natural disasters exacerbated by ecosystem loss, while investors face depreciating assets linked to declining biodiversity. Interconnectedness between ecosystems and economic activities means that the collapse of one system can trigger cascading failures across multiple sectors in society, affecting many segments of the population (including the most vulnerable ones, such as women) and leading to widespread instability.

43 France, French Development Agency, "Biodiversity degradation: 3 risks for finance", 29 October 2021. Available at <https://www.afd.fr/en/actualites/biodiversity-degradation-3-risks-finance>.

44 Swiss Re, "A fifth of countries worldwide at risk from ecosystem collapse as biodiversity declines, reveals pioneering Swiss Re index", 23 September 2020. Available at <https://www.swissre.com/media/press-release/nr-20200923-biodiversity-and-ecosystems-services.html>.

45 Swiss Re Institute, *Biodiversity and Ecosystem Services: A Business Case for Re/insurance* (Zurich, 2020). Available at <https://www.swissre.com/institute/research/topics-and-risk-dialogues/climate-and-natural-catastrophe-risk/expertise-publication-biodiversity-and-ecosystems-services.html>.

Table 1. Categories of risk caused by biodiversity loss

RISK CATEGORY	DESCRIPTION	STAKEHOLDERS AFFECTED	EXAMPLES
PHYSICAL	Direct impacts resulting from the degradation of natural ecosystems and the subsequent loss of ecosystem services	• Agriculture • Fisheries • Healthcare communities	Pollination decline: Reduction in bee populations, leading to crop decreases Increased climatic losses: Decline of natural barriers such as mangroves, leading to increased losses from cyclones and other weather events
TRANSITION	Risks arising from shifts towards sustainable practices, including policy changes, regulatory measures and evolving market preferences aimed at mitigating biodiversity loss	• Businesses • Investors • Consumers	Regulatory changes: Implementation of stricter environmental laws, affecting operational costs Market shifts: Consumer demand moving towards sustainably sourced products, impacting businesses that do not adhere to such practices
SYSTEMIC	Broad, interconnected risks that can lead to the collapse of entire ecosystems or social or economic systems due to cumulative environmental degradation	• Global economy • Financial institutions • Countries	Financial instability: Increased insurance claims and reduced asset values in biodiversity-dependent sectors Public health crises: Emergence of new diseases due to ecological imbalance Increased instability and inequality, erosion of social cohesion, and heightened livelihood insecurity, particularly affecting already vulnerable and marginalized populations

2. The insurance sector and biodiversity



2.1 Understanding insurance fundamentals

As these guidelines are primarily intended for users who may be less familiar with insurance concepts – including representatives of governments, conservation agencies, community-based organizations, research institutions, non-governmental organizations, private-sector investors and development partners – this section summarizes key principles and components that underpin the design of insurance solutions for biodiversity.

How insurance works

Insurance is a financial tool that helps individuals, households, businesses and governments transfer financial risks from uncertain events to an insurer. Instead of bearing the full cost of a risk event alone, policyholders pay a premium to an insurance provider, who then compensates them if a covered risk occurs.

For biodiversity stakeholders, insurance products can provide financial protection against ecosystem degradation, adverse weather events and human–wildlife conflict. For governments, insurance can act as a sovereign risk financing instrument that can provide rapid liquidity following nature-related shocks. For example, a coral reef parametric insurance policy can provide rapid funding for reef restoration after a defined extreme weather event. When wave heights or sea surface temperature exceed a predefined threshold, funds are rapidly disbursed to the policyholders, enabling quick recovery and minimizing damage to marine biodiversity.

Key insurance concepts

To understand how insurance works, it is important to grasp some key concepts.

Main actors and concepts

- **Insurer:** The institution that assumes the financial risk and provides compensation when a covered event occurs.
- **Policyholder:** The entity that purchases and holds the insurance contract, pays the premium and has the legal rights and obligations under the policy. In nature-related insurance, this may include governments, conservation funds, NGOs or private entities acting on behalf of broader beneficiaries.
- **Insured:** The individual, community, ecosystem or asset that is protected under the insurance policy and for whom the financial benefits of coverage are intended. In nature-related schemes, the insured may differ from the policyholder, with payouts directed towards ecosystem restoration or community support.
- **Regulator:** A public authority responsible for overseeing and supervising insurance markets to ensure financial stability, consumer protection and compliance with legal and prudential standards.
- **Ombudsman:** An independent body or official responsible for investigating and resolving complaints between policyholders and insurers, providing dispute resolution outside the formal court system.

- **InsurTech:** Technology-driven firms that support the design, distribution and delivery of insurance solutions, often working in partnership with licensed insurers. These entities provide technical services such as digital product innovation, data analytics, pricing support and claims processing to enhance efficiency and accessibility.
- **Risk pooling:** The practice of combining risks from multiple individuals, communities or entities into a single group so that losses are shared across a broader base. By spreading risk among many participants, insurance reduces the financial impact of individual losses and makes coverage more affordable and predictable.
- **Peril:** The specific event that may cause damage or loss, such as a cyclone, flood, wildfire, crop loss due to wildlife predation or livestock loss resulting from human–wildlife conflict.
- **Hazard:** A condition or circumstance that increases the likelihood or severity of a peril occurring, such as rising temperatures that heighten wildfire risk or habitat encroachment that increases human–wildlife conflict.
- **Risk:** The probability and potential severity of loss arising from exposure to a hazard. In insurance terms, risk reflects the likelihood of a peril occurring and the magnitude of its financial consequences.
- **Exclusion:** A risk or circumstance not covered under the policy.
- **Deductible:** The portion of a loss that the insured must bear before receiving a payout.
- **Reinsurance:** Allows insurers to transfer a portion of their own risk to another insurer (the reinsurer), protecting them from large or catastrophic losses.

Types of insurance mechanisms

Different insurance mechanisms can be applied to biodiversity conservation and protection depending on the risk type, data availability and financing structure:

- **Parametric insurance:** Provides payouts based on predefined environmental triggers (e.g. wind speed, rainfall or sea surface temperature) rather than measured losses, as is done with indemnity insurance. It allows for the rapid disbursement of funds for restoration.
- **Indemnity insurance:** Pays compensation based on the actual value of damage or loss, assessed after an event.
- **Microinsurance:** Designed for low-income or vulnerable communities to protect against local risks, such as crop loss or human–wildlife conflict.
- **Community-based insurance:** Insurance schemes that are owned, managed or governed at the community level, often through cooperatives or local institutions, with risk pooling and decision-making tailored to local needs and contexts.
- **Regional risk pools:** Multistate and multicountry insurance arrangements that pool risks across several governments to spread exposure and improve affordability, particularly for large-scale climate or disaster risks. By aggregating risk across countries, these mechanisms reduce volatility and enable access to reinsurance markets. For example, regional facilities such as the Caribbean Catastrophe Risk Insurance Facility and the Southeast Asia Disaster Risk Insurance Facility provide parametric coverage to member states for hurricanes, floods, excess rainfall and other natural hazards.

Components of an insurance product

Understanding how an insurance product is priced helps clarify the flow of funds and the sustainability of coverage.

Table 2. Components of an insurance product

COMPONENT	DEFINITION
RISK PREMIUM	The expected average cost of claims, calculated as the probability of loss multiplied by the value of the loss. For example, if 20 percent of reefs face potential \$50 losses, the risk premium is \$10.
ADMINISTRATIVE EXPENSES	Costs added to cover policy management, data collection, sales and claims processing.
COMMISSION/ DISTRIBUTION FEES	The fee paid to intermediaries such as brokers or agents for selling or managing policies.
REINSURANCE COST	The price of transferring all or part of the insurer's risk to another company.
CONTINGENCY RESERVE	A small additional charge ensuring long-term solvency and the ability to absorb unforeseen fluctuations in claims.
GROSS PREMIUM	The total amount paid by the insured, which includes the risk premium, administrative expenses, commissions and profit margin.
COMPENSATION (CLAIM PAYOUT)	The financial indemnification made by the insurer to the policyholder or insured following a covered loss. In biodiversity insurance, payouts may fund restoration, habitat protection or community recovery related to the covered loss or as defined in the policy.

Principles of insurance and their application in biodiversity

Insurance is guided by several principles that ensure fairness, transparency and sustainability. For stakeholders without an insurance background, understanding these principles and how they apply to biodiversity insurance is important for contributing effectively to product design.

Table 3. Principles of insurance and their application in biodiversity

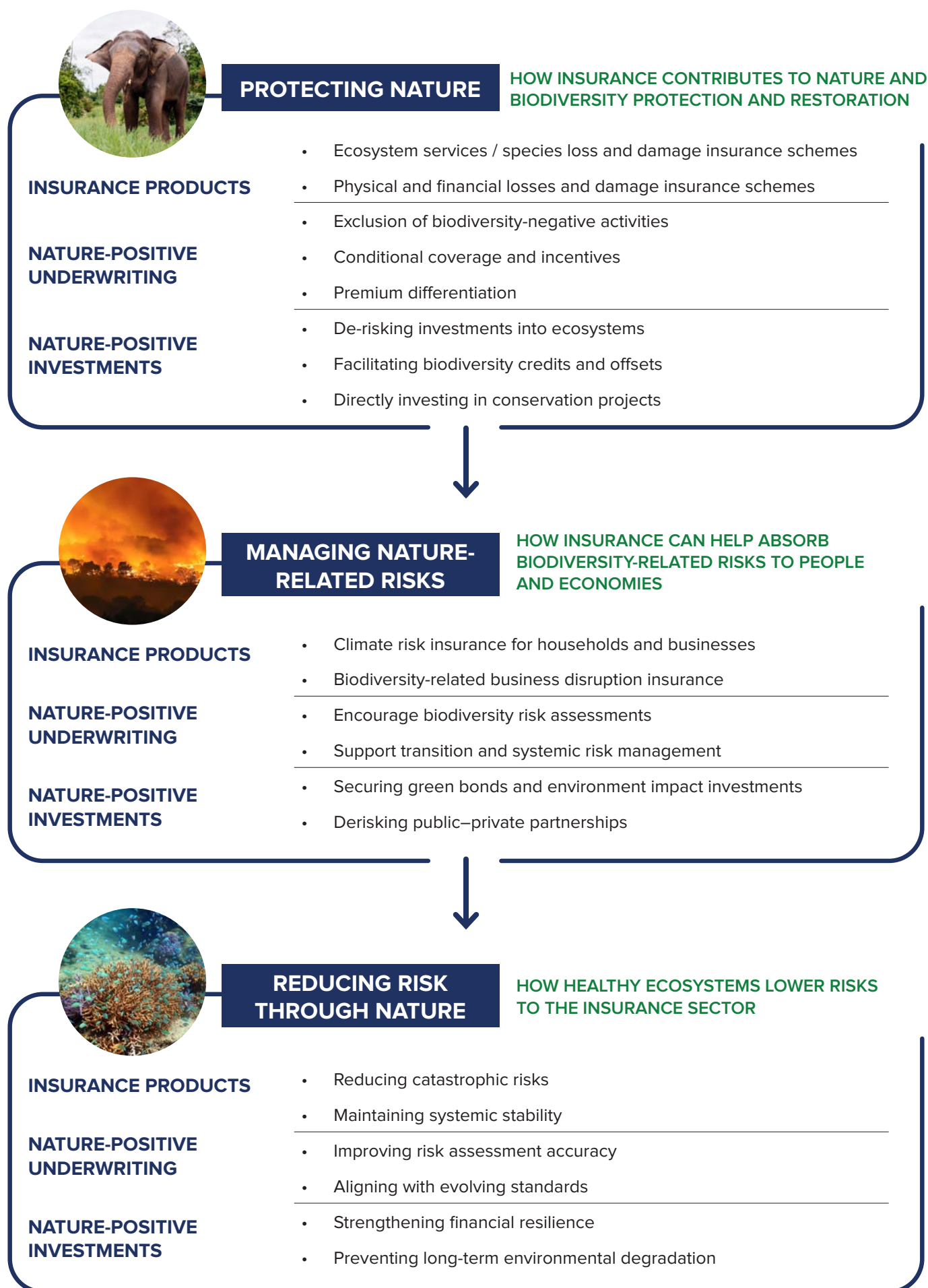
PRINCIPLE	DEFINITION	APPLICATION IN INSURANCE FOR BIODIVERSITY
UTMOST GOOD FAITH	Both the insurer and insured must provide complete and accurate information about the risk.	Accurate ecosystem data are required when insuring mangroves, coral reefs or forests. The misrepresentation of biodiversity conditions could lead to policy disputes.
INSURABLE INTEREST	The policyholder or insured must have a legally recognized financial stake in the asset being insured.	Governments, conservation organizations, local communities or businesses must demonstrate an economic or legal stake in the ecosystem being insured.
PROXIMATE CAUSE	The main cause of a loss must be identifiable and covered by the policy.	If a mangrove forest is damaged, the insurer must determine whether the main cause, such as a natural event (e.g. a cyclone) or a human-driven factor (e.g. illegal deforestation), is covered by the policy.
INDEMNITY	Insurance compensates for actual losses but does not provide profits.	If a coral reef insurance policy pays for restoration after a hurricane, the payout covers recovery costs but does not generate surplus funds.
LOSS MINIMIZATION	Policyholders must take reasonable steps to reduce risks and losses.	Coastal communities with reef insurance may be required to participate in conservation activities to maintain coverage.
SUBROGATION	After paying a claim from an indemnity, the insurer can recover costs from third parties responsible for the loss, as allowable by law.	If an oil spill damages a wetland, the insurer may sue the responsible company to recover the payout costs.
CONTRIBUTION	If multiple insurers cover the same risk, they share the claim payment proportionally.	If a conservation trust and a government both insure a wildlife reserve, both insurers will share the cost of compensation if damage occurs.

The escalating loss of biodiversity poses significant risks not only to ecological balance but also to economic stability and human well-being. The insurance industry, with its expertise in risk management and financial protection, is uniquely positioned to mitigate these risks and to contribute to biodiversity conservation. This chapter explores the multifaceted role that insurance can play in safeguarding biodiversity. It details mechanisms through which insurers can support conservation efforts, the investment potential within the insurance sector and the reciprocal benefits that biodiversity confers upon the insurance industry.

Figure 1 summarizes this section and introduces three interlinked pathways between insurance and biodiversity. It illustrates how insurance can help prevent biodiversity loss and manage the risks arising from ecosystem degradation, while also showing how healthy biodiversity can, in turn, strengthen the resilience of the insurance sector.



Figure 1. The insurance–nature nexus: three interlinked pathways



2.2 How insurance can protect biodiversity

Insurance can protect biodiversity through multiple mechanisms that recognize nature as a valuable asset in its own right. These mechanisms include insurance products that safeguard species and ecosystems, underwriting approaches that discourage biodiversity-negative activities and incentivize conservation, and investment decisions that align insurer capital with nature-positive outcomes.

INSURANCE PRODUCTS

Ecosystem services / species loss and damage insurance schemes: This category recognizes the asset value of species and ecosystems even if there were no active use, similar to the concept of indirect or non-use value espoused in valuation literature. As such, ecosystems such as non-production forests, protected areas or no-take zones in coastal waters are considered as assets providing vital ecosystem services. Threats such as cyclones, wildfires or wildlife mortality resulting from human–wildlife conflict can directly undermine these values. Insurance schemes in this category can support ecosystem restoration and rehabilitation or protect option values, such as the carbon storage capacity of forests damaged by wildfire. **Table 4** offers examples of insurance products for different types of ecosystems and species-level risks.

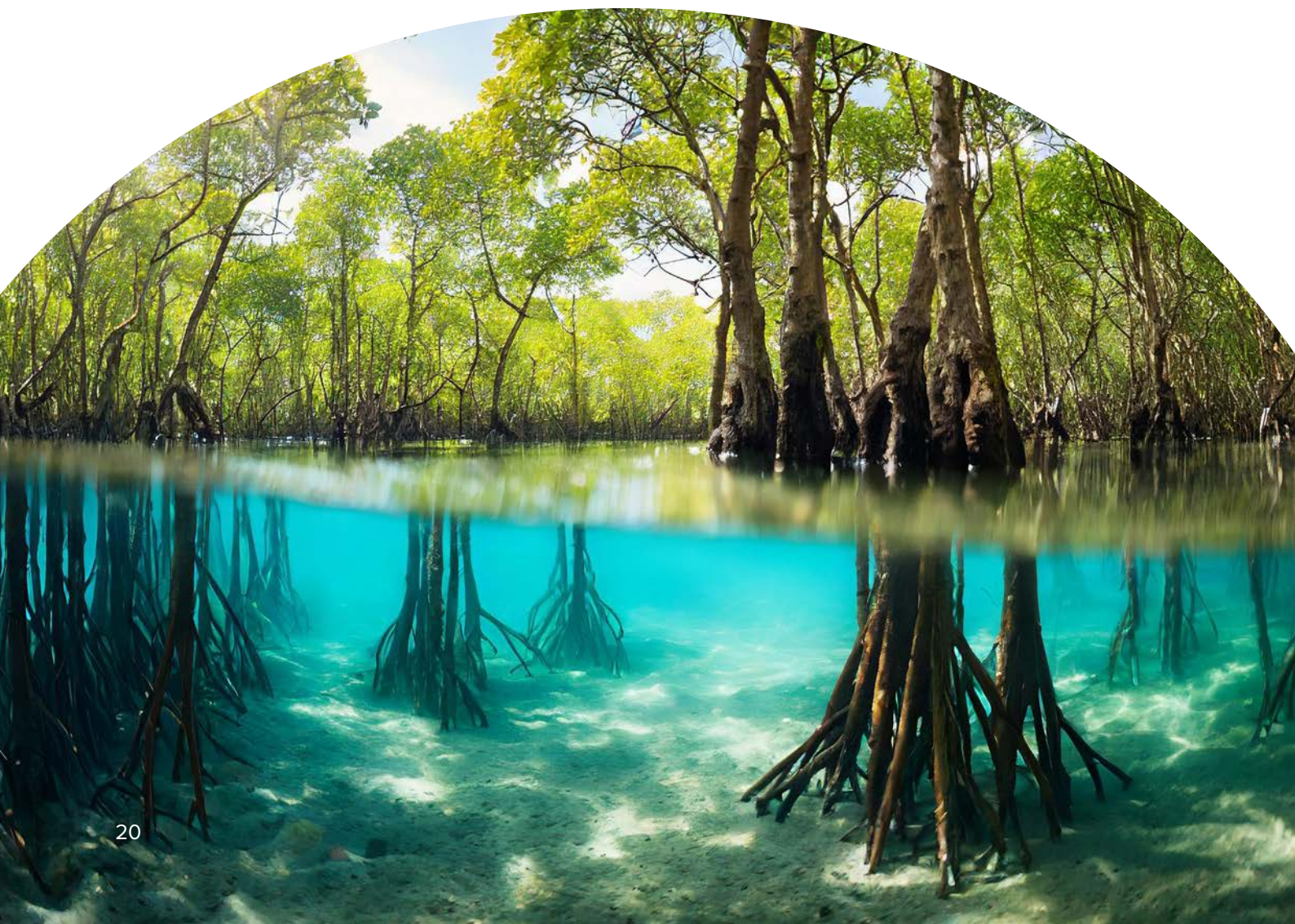


Table 4. Insurance products for threats to ecosystem and species-level risks

FOREST AND STEPPE FIRES		
Threat	Insurability	Examples of insurance
Forest and steppe fires caused by naturally occurring events, such as droughts	Yes	Potential insurance product: Forestry insurance Perils covered: Fire (wildfires, lightning and accidental ignition); windstorms; snow, ice and hail damage; floods; earthquakes; pest infestations and diseases (in certain markets)
Forest and steppe fires caused by human-related activities, such as unattended campfires, discarded cigarettes, burning debris, slash-and-burn farming, etc.	Yes	Example: Swiss Re's forestry insurance has been deployed in multiple countries, including Chile, China, France, South Africa and Sweden.⁴⁶ In Chile, for example, insurance coverage for forestry plantations includes protection against fire, hail frost and wind damage. The policies also include firefighting cost reimbursement, ensuring rapid response to minimize damage.

DESTRUCTION OF WETLANDS		
Threat	Insurability	Examples of insurance
Destruction of wetland ecosystems due to droughts	Yes	Insurance product: Parametric wetland ecosystem insurance Perils covered: Hurricanes and tropical storms, flooding, drought and wildfires Example: National Wetland Park Insurance in China: A parametric insurance solution was implemented to protect the gross ecosystem product value of a National Wetland Park in China against risks from typhoons and droughts.⁴⁷ This innovative approach ensures that financial resources are available to support the park's ecological functions after such events.

46 P. Welten, "Forestry insurance: A largely untapped potential" (Zurich, Swiss Re). Available at <https://www.swissre.com/dam/jcr:0b1ba752-40e7-40a6-9e29-4895dc66804b/2023-08-sr-forestry-insurance.pdf>.

47 Swiss Re, "Using innovative insurance to help protect the economic value of natural ecosystems: China: Wetlands typhoon and drought cover". Available at <https://www.swissre.com/our-business/public-sector-solutions/case-studies/china-typhoon-and-drought-cover.html>.

DESTRUCTION OF GRASSLANDS		
Threat	Insurability	Examples of insurance
Destruction of grasslands due to forest fire	Yes	Insurance product: Parametric páramo ecosystem insurance Perils covered: Wildfires Example: Water Fund Insurance for Páramos in Colombia: UNDP Colombia is supporting an anticipatory parametric insurance product to protect páramo ecosystems through water fund in the Chinchiná River basin.⁴⁸ Designed in partnership with World Wildlife Fund for Nature (WWF) Colombia and Suramericana, the product triggers payouts when temperature and humidity thresholds indicate heightened wildfire risk, allowing funds to be released before damage occurs. A regional water fund will serve as the policyholder, ensuring that payouts finance coordinated prevention, response and restoration activities.

CORAL REEF DESTRUCTION DUE TO MARITIME INCIDENTS		
Threat	Insurability	Examples of insurance
Coral reef destruction due to oil spills, massive pollution and mining accidents	Yes, but taken up by potential polluting industries	Insurance product: Environment liability insurance Perils covered: Covers the financial liability of the insured party as defined by legal frameworks (such as international maritime liability)
Coral reef destruction due to maritime accidents, including ship grounding		Example: Incidents involving ships such as MS Caledonian Sky and MV Wakashio have caused damage to reefs in countries such as Indonesia and Mauritius.⁴⁹ After the MV Wakashio oil spill in Mauritius, insurance paid compensation to fishers and fishmongers affected by the incident.⁵⁰ Liability as determined by various local and international frameworks is being paid by insurers for other such occurrences.

48 UNDP Insurance & Risk Finance Facility, “Insurance innovation challenge to protect investments in biodiversity in Colombia”, 24 September 2024. Available at <https://irff.undp.org/press-release/insurance-innovation-challenge-protect-investments-biodiversity-colombia>.

49 G. Ollano, “‘Insurance is not enough,’ says government on damaged coral reef”, *Insurance Business Magazine*, 17 March 2017. Available at <https://www.insurancebusinessmag.com/asia/news/breaking-news/insurance-is-not-enough-says-government-on-damaged-coral-reef-62997.aspx>.

50 AllAfrica, “Insurer pays compensation to Mauritian fishers after oil spill”, 21 December 2021. Available at <https://allafrica.com/view/group/main/main/id/00080579.html>.

CORAL REEF DESTRUCTION DUE TO NATURALLY OCCURRING EVENTS

Threat	Insurability	Examples of insurance
Coral reef destruction brought about by naturally occurring events such as storms, increases in sea surface temperatures and hurricanes	Yes	Insurance product: Parametric coral reef insurance Perils covered: Tropical cyclones, increases in sea surface temperature, floods. The policy uses a parametric trigger mechanism, meaning payouts are automatically activated based on predefined parameters such as the cyclone's maximum wind speed and its proximity to the reef. Example: The Mesoamerican Reef (MAR) Insurance Programme is a regional parametric coral reef insurance scheme that provides rapid funding for post-hurricane reef restoration across Belize,⁵¹ Honduras and Mexico. Payouts are triggered based on hurricane wind speed and proximity to insured reef sites, with higher intensity and closer events generating larger payouts. Funds are channelled through the MAR Fund to support coordinated reef response activities, including debris removal and coral reattachment.⁵² The insurance product triggered and paid out funds for restoration in 2022.⁵³ Example: In Indonesia, UNDP's Insurance and Risk Finance Facility is partnering with Swiss Re and the Government of Indonesia to design a parametric insurance product that protects coral reefs in the Gili Islands against increases in sea surface temperature. Backed by the Ocean Risk and Resilience Action Alliance Blue Planet Fund, the initiative is supported by a new ministerial regulation that establishes the Marine Biodiversity Trust, managed by the national environmental fund, as the financing mechanism. The programme aims to safeguard reef ecosystems that support coastal livelihoods and tourism while enabling rapid restoration after reef damage.

51 J. Wharton, "The MAR Insurance Programme: A nature-based solution to enhance resilience", Guatemala City, MAR Fund, (2024). Available at <https://marfund.org/en/wp-content/uploads/2024/06/MARInsurance-Brief-2024-a.pdf>.

52 Ibid.

53 International Coral Reef Initiative - ICRI, "First pay-out of Mesoamerican Reef Insurance Programme in Belize", 22 November 2022. Available at <https://icriforum.org/first-reef-insurance-payout-belize/>.

MANGROVE DESTRUCTION		
Threat	Insurability	Examples of insurance
Mangrove destruction due to typhoons, hurricanes and cyclones	Yes. Unlike coral reefs, mangroves do not usually require rapid post-storm interventions to survive. In this case, an indemnity insurance policy (non-parametric) can also be used.	Insurance product: Parametric mangrove ecosystem insurance Perils covered: This insurance policy is designed to provide financial protection against damage to mangrove forests resulting from hurricanes. The policy uses a parametric trigger mechanism, meaning payouts are automatically activated based on predefined parameters such as the hurricane's wind intensity and its proximity to the protected mangrove area. Example: The San Crisanto Mangrove Insurance Programme in Mexico provides protection against the effects of hurricanes.⁵⁴ Insurance is automatically activated when a hurricane hits the protected area. The community receives up to \$100,000 to repair damage caused by the hurricane, depending on wind intensity and proximity to the centre of the protected area. The programme is supported by a sustainable financing mechanism whereby insurance premiums are directly linked to carbon credit revenues, with the project developer incorporating a marginal price increase to fund coverage.

54 A. Pachon, "AXA Climate, AXA Seguros Mexico and ClimateSeed are jointly creating the 1st insurance policy for the protection of mangrove forests in Mexico", AXA, 11 December 2023. Available at <https://climate.axa/publications/1st-insurance-policy-for-the-protection-of-mangrove-forests-in-mexico/>.

HUMAN–WILDLIFE CONFLICT		
Threat	Insurability	Examples of insurance
Human–wildlife conflict, possibly resulting in species extinction	Yes	Insurance product: Human–wildlife conflict insurance Perils covered: This insurance scheme is designed to compensate small-scale farmers for losses resulting from interactions with wildlife – specifically, crop damage (the destruction or loss of crops due to wildlife incursions) and livestock predation (the loss of livestock caused by predatory wildlife species). Additionally, coverage is provided for human injury or fatality (incidents in which individuals are harmed or killed by wildlife). The product also covers the destruction of property due to negative interactions with wildlife. Example: In Argentina, the Government of Misiones, UNDP, Río Uruguay Seguros and local conservation organizations have introduced a pioneering insurance product to mitigate human–jaguar conflict and conserve critically endangered jaguars.⁵⁵ The policy compensates livestock owners for losses while promoting improved livestock management and community awareness. Claims are verified through collaboration between conservation NGOs and park rangers, ensuring credibility and rapid support. This government-purchased scheme demonstrates how insurance can strengthen coexistence, protect an iconic species valued for its ecological and economic importance, and unlock new models for biodiversity finance. Example: The first livestock insurance scheme in Sri Lanka for human–wildlife conflict was launched by UNDP together with the Wildlife and Nature Protection Society and LOLC Insurance, under the guidance of the Department of Wildlife Conservation.⁵⁶ The programme provides rapid compensation to farmers whose livestock are killed by the endangered Sri Lankan leopard, helping protect rural livelihoods while reducing retaliatory killings of this keystone species. By combining financial protection with preventive measures such as predator-proof enclosures and communal livestock management, the scheme aims to foster long-term coexistence between communities and wildlife.

More examples are provided in the BIOFIN Catalogue, a compendium of more than 150 finance mechanisms, including 17 insurance and risk financing solutions, used by countries in developing their biodiversity finance plans.

55 UNDP Insurance & Risk Finance Facility, “World-first jaguar-protection insurance launched in Argentina by UNDP and the Government of Misiones”, 22 May 2025. Available at <https://irff.undp.org/press-releases/jaguar-protection-insurance>.

56 BIOFIN, “Sri Lanka launches first livestock insurance scheme to protect leopards and livelihoods”, 20 August 2025. Available at <https://www.biofin.org/news-and-media/sri-lanka-launches-first-livestock-insurance-scheme-protect-leopards-and-livelihoods>.

Nature-positive approaches to underwriting and investment decisions: This category refers the investment and underwriting functions of insurance companies rather than to risk transfer insurance products and thus includes actions that align investments and underwriting with sustainability standards and disclosure frameworks.

NATURE-POSITIVE UNDERWRITING POLICIES

- Insurers can influence biodiversity outcomes through their underwriting practices by excluding activities that cause significant harm to ecosystems, applying conditional coverage linked to conservation or risk management measures, differentiating premiums to reward nature-positive behaviour and using standards-based due diligence to assess the quality of nature-related projects. For example, SCOR (the global reinsurer), in collaboration with the Society for Ecological Restoration, has developed a standards-based framework, the Ecological Due Diligence Review, that grades restoration projects, with only those meeting a minimum quality threshold eligible for insurance coverage, thereby strengthening confidence in ecological outcomes.⁵⁷ Together, these approaches help align insurance coverage with biodiversity protection objectives while reducing long-term risk exposure.

NATURE-POSITIVE INVESTMENTS

- **Securing investments:** Investments towards ecosystem-based economies can be encouraged by de-risking investments through insurance products. In Colombia, UNDP is supporting the development of an innovative insurance solution with local stakeholders.⁵⁸ The solution is designed to safeguard the outcomes of investments in conservation projects, habitat banks and protected areas, ensuring benefits for local communities and helping mitigate human–wildlife conflict.⁵⁹ Similarly, insurance can be used to de-risk investments in nature-based enterprises, such as sustainable fisheries and ecotourism, by protecting against environmental and revenue-related risks. For example, initiatives supported by the Global Fund for Coral Reefs demonstrate how risk transfer mechanisms combined with blended finance can enhance the bankability of reef-positive businesses and attract private capital.⁶⁰
- **Facilitating biodiversity credits and offsets:** Insurers can support the creation of markets for biodiversity credits, enabling companies to offset their ecological footprint by investing in conservation projects.
- **Investing in conservation projects:** By allocating funds to initiatives aimed at preserving and restoring natural habitats, such as reforestation or wetland restoration, insurers can contribute to the overall health and resilience of ecosystems. As some of the largest institutional investors globally, insurers can integrate nature-positive screening criteria into investment

57 SCOR, “Nature Restoration & Conservation Insurance Initiative”. Available at <https://www.scor.com/en/nature-restoration-conservation-insurance-initiative>.

58 Local stakeholders include La Previsora Seguros, South Pole, AON, Banco Contactar and Pipra.

59 UNDP Insurance & Risk Finance Facility, “Insurance innovation challenge to protect investments in biodiversity in Colombia.”

60 Global Fund for Coral Reefs, “Blending of enterprise development for fisheries with de-risking mechanisms”, 2026. Available at <https://globalfundcoralreefs.org/reef-plus/finance-solutions/enterprise-development-for-fisheries-and-ecotourism/>.

decision-making. This includes applying biodiversity and nature-related filters such as alignment with sustainability taxonomies and compliance with emerging disclosure frameworks.

2.3 How insurance can manage risks arising from biodiversity loss

The decline in biodiversity introduces physical, transition and systemic risks to people, governments and economies that can disrupt economies and societies. The insurance sector can mitigate these risks through developing insurance products, enhancing biodiversity-aware underwriting and enabling investments.

DEVELOPING INSURANCE PRODUCTS

- **Climate risk insurance solutions:** Ecological disasters due to biodiversity loss, such as floods intensified by deforestation or coral reef loss, can cause massive financial losses. Insurers can provide policies that provide immediate financial support based on predefined triggers to businesses and communities. These products can help reduce the recovery time and fiscal shock associated with ecosystem-driven disasters.
- **Business interruption insurance:** Coverage can be offered for businesses affected by biodiversity-related disruptions, such as supply chain interruptions due to the loss of natural resources (including, for example, fishery collapse or crop failures from pollinator decline).
- **Insurance-backed sovereign response mechanisms:** Insurance schemes can be established to provide rapid liquidity to governments after biodiversity-related disasters, enabling immediate action for controlling zoonotic disease outbreaks, restoring ecosystem services or supporting affected communities, thereby reducing long-term economic impact.

Regional or global sovereign risk pools can help share the financial risks of biodiversity and climate-related shocks. These pooled instruments increase affordability and access to payouts for member countries while enabling coordinated investments in ecosystem resilience and nature-based disaster risk reduction.

ENHANCING BIODIVERSITY-AWARE UNDERWRITING

- **Encourage biodiversity risk assessments:** Insurers can incorporate biodiversity risk assessments into underwriting criteria to identify and manage potential exposures related to biodiversity loss. This proactive approach can help policyholders in implementing mitigation measures, which can be incentivized by insurers through mechanisms such as premium discounts.
- **Support transition and systemic risk management:** Insurers can collaborate with policyholders to develop risk mitigation strategies that address biodiversity-related challenges such as regulatory penalties, reputational damage or raw material scarcity. New mechanisms, such as those being developed by AXA, are exploring transition insurance models that protect farmers during shifts to more sustainable practices.⁶¹ These schemes ensure that farmers are not

61 AXA Climate, "Agricultural Transition: How to Succeed and Manage its Economic Risk", (Paris, 2025). Available at <https://climate.axa/publications/opportunities-risks-agricultural-transition/>.

financially worse off by comparing actual performance, such as yield or income, against a counterfactual baseline without the change, with compensation triggered if a significant gap arises.

ENABLING INVESTMENTS

- **Securing environment-related financial instruments:** Biodiversity loss can undermine the performance of financial instruments such as green bonds, biodiversity credits and environmental impact investments by increasing physical risks and disrupting project outcomes. Insurance plays a role in managing and transferring risks that threaten the financial viability of such investments, for example through coverage for operational disruption or performance shortfalls linked to ecosystem degradation.
- **Derisking public–private partnerships in conservation:** Insurers can collaborate with governments and conservation organizations to de-risk large-scale biodiversity project investments, such as the establishment and management of protected areas, ensuring long-term conservation efforts. An example of this approach is the use of insurance for habitat banks, which are conservation areas created or restored to generate biodiversity credits that can be sold to developers needing to offset their environmental impacts.

2.4 Reducing risk through nature: how healthy biodiversity can reduce risks to the insurance sector

Insurers should view biodiversity conservation as integral to their core business strategy. Biodiversity offers essential natural defences that help mitigate physical, transition and systemic risks, thereby strengthening the resilience of insurance markets and reducing long-term financial exposure.

PHYSICAL RISK REDUCTION

Healthy ecosystems protect investments against catastrophic risks and promote stability in sectors such as agriculture, potentially reducing financial losses and lowering claims numbers:

- **Reducing catastrophic risks:** Natural barriers, such as mangroves and coral reefs, reduce storm surge energy significantly, minimizing flood damage to coastal properties and infrastructure.⁶² The degradation of these barriers can result in higher claims for property damage, business interruptions and costly disaster recovery.
- **Supporting ecosystem functions:** By maintaining ecosystem functions such as water regulation, soil stability and natural pest control, healthy ecosystems limit the extent of damage to economic activities and reduce associated insurance losses. For example, in agriculture, biodiversity supports crop production through pollination, pest control and soil health, helping reduce crop failures and stabilize yields.⁶³

⁶² Ferrario et al. "The effectiveness of coral reefs for coastal hazard risk reduction and adaptation".

⁶³ Dainese et al. "A global synthesis reveals biodiversity-mediated benefits for crop production". *Science Advances*, vol. 5, No. 10 (October 2019). Available at <http://science.org/doi/10.1126/sciadv.aax0121>.

TRANSITION RISK MANAGEMENT

Biodiversity enhances insurers' ability to adapt to changing regulatory, market and technological landscapes:

- **Improving risk assessment accuracy:** Stable ecosystems provide more predictable environmental conditions, facilitating precise risk modelling and premium calculations. Biodiversity enhances agricultural productivity and reduces disaster impacts, for example by supporting stable crop production⁶⁴ and through ecosystems such as mangroves and coral reefs that buffer communities from storms and flooding.
- **Aligning with evolving standards:** Insurers that incorporate biodiversity considerations into their underwriting and investments are better positioned to comply with emerging regulations and market expectations tied to frameworks such as the Kunming-Montreal Global Biodiversity Framework.

SYSTEMIC RISK REDUCTION

Biodiversity supports the stability of broader financial and economic systems, reducing the potential for market-wide disruptions:

- **Strengthening financial resilience:** Ecosystem degradation can cause economic shocks that impact supply chains, public health and financial markets.⁶⁵ Therefore, preserving biodiversity promotes economic stability, keeping risks insurable and premiums affordable.
- **Preventing long-term environmental degradation:** The loss of ecosystem services such as water purification, carbon sequestration and disease regulation can exacerbate risks across insurance sectors such as agriculture, infrastructure and healthcare. A proactive focus on biodiversity conservation mitigates these systemic threats, ensuring long-term industry sustainability.

Insurers that recognize biodiversity's role in mitigating physical, transition and systemic risks can integrate nature into their risk management strategies, which can strengthen financial resilience and support a more sustainable global economy.

⁶⁴ Ibid.

⁶⁵ M. Jones et al., Summary for Policymakers of the Methodological Assessment report on the Impact and Dependence of Business on Biodiversity and Nature's Contributions to People (Bonn, Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, 2026). Available at <https://zenodo.org/records/20714890>.

2.5 Negative impacts and unintended consequences

Alongside the positive impacts of the insurance sector on biodiversity, it is important to acknowledge the negative consequences that may arise from the complex interconnections between the insurance sector and biodiversity. Insurance has historically supported activities that harm biodiversity, such as fossil fuel extraction,⁶⁶ deforestation and industrial agriculture. For instance, insurers collectively earn around \$30 billion each year in premiums linked to oil and gas extraction. Moreover, several leading insurance providers continue to underwrite coal activities, highlighting a persistent gap between current industry practices and global climate ambitions.

Underwriting can also create moral hazard by shielding businesses from the consequences of environmental damage, a risk often associated with certain liability insurance products. Insurance programmes can have unintended consequences in sectors such as agriculture. Soil Association has reported that crop insurance schemes can negatively affect biodiversity and soil health while also driving the increased use of agrochemicals and land-use change by promoting more intensive practices and the expansion of monoculture cropping.⁶⁷

Table 5 outlines how insurance can exert negative impacts on biodiversity.

66 WWF Switzerland, “Underwriting our planet: How insurers can help address the crises in climate and biodiversity” (Gland, 2023). Available at <https://www.deloitte.com/ch/en/issues/climate/underwriting-our-planet.html>.

67 Soil Association, “Lessons to Learn from Crop Insurance Programmes Worldwide”, Bristol, (2017). Available at <https://www.soilassociation.org/media/12992/lessons-to-learn-from-crop-insurance-programmes-worldwide.pdf>.



Table 5. Negative impacts and unintended consequences of insurance on biodiversity

CATEGORY	ROLE OF INSURANCE SECTOR	BIODIVERSITY OUTCOME
Enabling environmentally harmful activities	Underwriting or investing in activities such as fossil fuel extraction, large-scale monocultures, deforestation, deep-sea mining	Accelerated land-use conversion, habitat loss, species decline
Moral hazard through shielding risk	Providing of liability insurance coverage without appropriate preventative measures, reducing incentives for the policyholder	Increased risk of environmental damage, delayed ecosystem recovery
Misaligned incentives in product design	Crop insurance or indemnity models that reward yield maximization without sustainability safeguards	Intensified resource use (water/soil/pesticides), degradation of ecosystems
Investment portfolio impacts	Insurers investing in companies whose operations drive biodiversity loss (e.g. mining, deforestation, unsustainable agriculture)	Reinforcement of biodiversity loss, ecosystem degradation, increased systemic risk
Protection gap and affordability issues for nature-dependent sectors	Lack of appropriate, affordable and accessible inclusive insurance products for communities in biodiversity-dependent activities (forestry, fisheries, etc.)	Reduced financial resilience of communities and ecosystems dependent on nature services

To ensure that insurance supports biodiversity rather than undermines it, products and investment strategies should be designed with clear conservation and sustainability criteria. Underwriting and premium-setting processes need to incorporate biodiversity-impact assessments and encourage nature-positive actions. Insurers should monitor and report not only financial metrics but also biodiversity outcomes linked to their portfolios. At the same time, regulators and standard-setting bodies must establish frameworks for assessing and disclosing biodiversity impacts (see **Box 2**), while development partners can help embed ecosystem and nature-positive metrics across product design and investment decisions.

Box 2. Regulatory preparedness for nature-related risks: Findings from the UNDP Sustainable Insurance Forum survey

Insurance regulators have a clear interest in integrating nature-related risks, as ecosystem degradation can translate into financial risks and affect both insurers' liabilities and assets. This has implications for solvency and claims-paying capacity, which fall squarely within prudential mandates. In addition, supervisors are concerned with the availability and affordability of insurance as risk levels evolve, since widening natural catastrophe protection gaps can undermine policyholder outcomes and pose broader challenges to financial stability and resilience.

While awareness of nature-related financial risks is increasing, regulatory preparedness remains limited. Findings from a recent UNDP Sustainable Insurance Forum (SIF) survey of 27 insurance regulators and supervisors highlight significant gaps in how nature-related risks are understood, monitored and managed within supervisory frameworks.⁶⁹

Just 63 percent of respondents reported incorporating nature-related risks into their internal work programmes, and a similar proportion (59 percent) have not yet undertaken any assessment to determine whether such risks pose material financial impacts. Many regulators cited competing priorities, limited data and a lack of clear definitions as key barriers. In particular, most respondents rely on climate-focused frameworks and have yet to align their approaches with nature-related international standards.

The survey also found that just 26 percent of respondents have issued or plan to issue guidance on identifying, assessing, managing or disclosing nature-related risks. Similarly, just 19 percent have conducted or are planning to conduct stress testing or scenario analysis on the potential financial impacts of biodiversity loss. Only 15 percent have developed metrics to monitor these risks.

68 UNDP, *Nature-insurance Nexus: Results of SIF Survey on Nature-related Risks*, New York, (2024). Available at <https://sustainableinsuranceforum.org/wp-content/uploads/2025/04/Nature-%E2%80%93-Insurance-Nexus-Results-Final.pdf>.

Despite these challenges, there are encouraging signs of progress. Two-thirds of respondents (67 percent) reported undertaking capacity-building activities, often through partnerships with organizations such as the Taskforce on Nature-related Financial Disclosures and WWF for Nature. Some authorities have appointed dedicated staff to focus on nature-related work, while others have integrated these responsibilities into existing climate and sustainability teams.

These findings underline that while the recognition of nature-related financial risks is growing, regulatory preparedness remains at an early stage. Strengthening supervisory capacity, developing clear taxonomies and guidance, and investing in nature-related data and analytics will be essential to integrating biodiversity loss and ecosystem degradation into financial risk management frameworks. Without such measures, both insurers and regulators may underestimate the systemic risks that nature loss poses to financial stability and long-term resilience.



Summary of UNDP Sustainable Insurance Forum Regulatory Survey Results

METRICS FOR TRACKING NATURE-RELATED RISKS

15%

Only 15 percent of participants have metrics to monitor nature-related risks, using tools like Mean Species Abundance, ENCORE and the Global Biodiversity Score.

CLIMATE-NATURE FINANCIAL RISK NEXUS

33%

33 percent of participants have examined the interaction between climate-related and nature-related financial risks.

ISSUANCE OF NATURE-RELATED RISK GUIDANCE

26%

26 percent of respondents have issued or are planning to issue guidance on identifying, assessing, managing or disclosing nature-related risks.

STRESS TESTING/ SCENARIO ANALYSIS ON NATURE IMPACT

19%

19 percent of participants have conducted or are planning to conduct stress testing or scenario analysis on nature-related impacts.

3. Designing insurance for biodiversity



Developing insurance solutions for biodiversity protection requires a structured approach that integrates ecological, financial, legal and social considerations. Effective design involves first identifying whether insurance is the correct financing mechanism and then defining the building blocks essential to the creation of biodiversity-related insurance products.

The proposed framework is informed by practical insights from several UNDP-supported programmes, including human–wildlife conflict insurance in Argentina and Sri Lanka, biodiversity-linked agricultural insurance in Nepal, water fund insurance in Colombia and coral reef insurance in Indonesia.

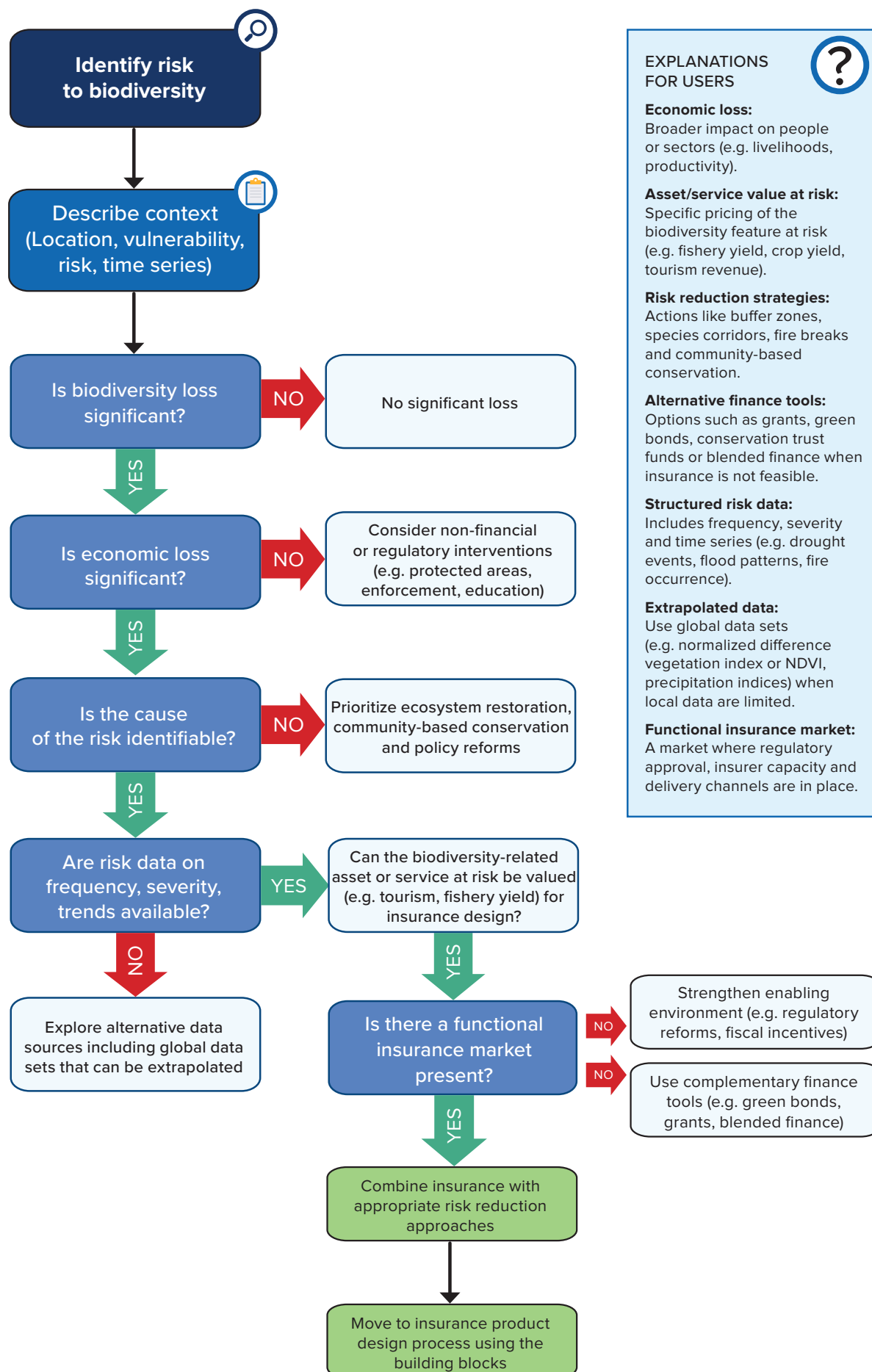
In Nepal, UNDP is supporting the implementation of the national agricultural insurance scheme by integrating human–wildlife coexistence principles that protect the country’s valuable wildlife while simultaneously strengthening financial resilience in the agricultural sector. Water fund insurance in Colombia, developed by Suramericana and WWF Colombia, is a parametric insurance solution aimed at safeguarding critical aquatic ecosystems, such as páramos and mangroves, that play a key role in water supply and regulation, biodiversity preservation and climate resilience. In Argentina and Indonesia, UNDP is supporting innovative insurance solutions, including jaguar-protection insurance to reduce human–wildlife conflict and parametric coral reef insurance to safeguard marine ecosystems that underpin coastal resilience and livelihoods.

3.1 Preliminary considerations: Is insurance the right tool?

Interest in using insurance to address biodiversity risks is growing rapidly, yet many countries are unsure where to begin. While early adopters testing innovative insurance models are inspiring others to follow, some countries are also being approached directly by insurance providers seeking to pilot new products. In this context, a structured feasibility assessment is essential. The first consideration is whether insurance is an appropriate tool for addressing the identified biodiversity risk.

The decision-support tool presented in **Figure 2** offers a practical framework for making this determination. It serves as a flexible template that can be adapted to a range of biodiversity contexts, including coastal resilience, human–wildlife coexistence and ecosystem restoration. **Box 3** provides further guidance on using the decision-support tool.

Figure 2. Decision-support tool for using insurance to address biodiversity risks



Box 3. Key considerations when using the decision-support tool

1

The flowchart in **Figure 2** is a simple decision-making tool to use in determining the appropriate use of insurance, since not all biodiversity risks can or should be transferred to an insurer. Once the risk has been assessed, the next questions in the tool relate to the significance of the biodiversity loss. This can draw from existing plans or targets from the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) or from National Biodiversity Strategies and Action Plans (NBSAPs). Cultural and religious factors also can help define what the “significance of biodiversity loss” might mean in a country context.

2

Economic and financial losses capture the value of production and ecosystem services at risk, including, for example, crops, livestock, land, coral reef or mangrove areas that may be threatened or damaged. The significance of these losses can be assessed relative to the total area of the ecosystem concerned and its corresponding economic value. Both financial and economic losses should be estimated to inform the decision-making process. Financial losses are actual losses of assets, while economic losses may include non-market products and services that are more difficult to estimate but still possess significant value characteristic of nature.

3

Data are essential in determining the design of insurance and the frequency and severity of the occurrence of the threat. In human–wildlife conflict cases, the correlation between wildlife deaths and incursions into farms is not always readily available, but a good triangulation of data from government and private insurers can be applied; otherwise, data transfers from similar situations based on the literature or actual data from similar contexts may be used. For parametric products, 10–15 years of data from independent third-party sources will be required.

4

Insurance should not replace risk reduction measures but rather should complement them as part of an integrated risk management strategy and can even be used to incentivize and reward risk reduction. In Nepal, for example, a holistic approach is being implemented to enhance the effectiveness of the national agricultural insurance scheme and promote coexistence between humans and wildlife. The country’s approach aligns well with the decision-support tool by demonstrating how insurance can be effectively integrated with complementary risk reduction strategies. Its structured focus on four pillars – literacy, access, capacity-building and collaboration – can be applied at various stages of the tool to strengthen both the enabling environment and the design of insurance solutions for biodiversity-related risks.

Where the screening indicates that insurance may be suitable, the feasibility assessment should be complemented by a vulnerability analysis. This involves identifying the biodiversity assets, ecosystems and communities at risk; mapping natural assets and their ecological, economic and cultural values; analysing exposure to hazards such as storms, floods, droughts, wildfires or human–wildlife conflict; and collecting baseline socioeconomic and ecological data. Together, these elements provide the foundation for determining whether and how an insurance solution can be designed effectively. The choice of insurance product, whether parametric or indemnity, will also depend on factors such as data availability, the purpose of coverage, operational considerations and cost efficiency.

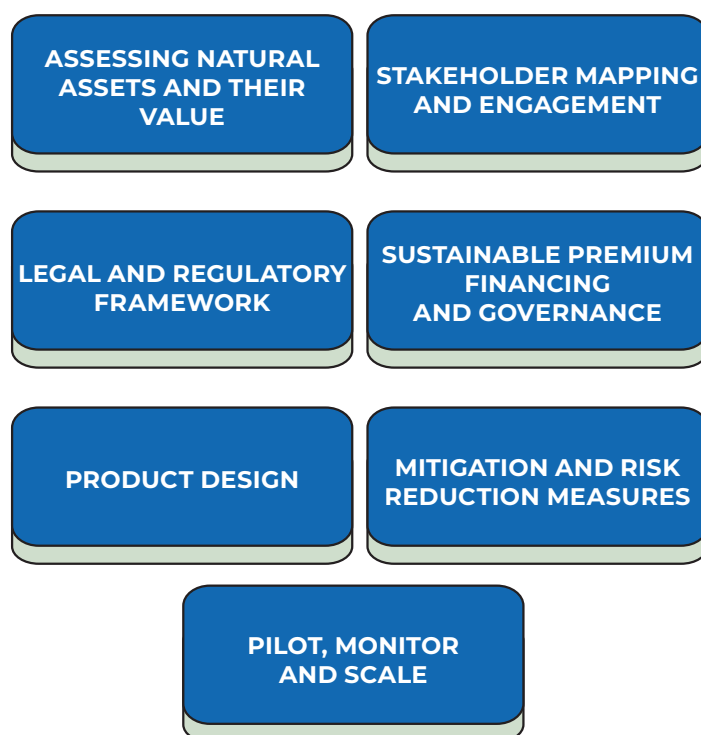
3.2 Building blocks for effective biodiversity insurance coverage

This section presents the core building blocks required to design effective biodiversity insurance solutions (**Figure 3**). These building blocks represent the key technical, institutional, financial and governance elements that must be addressed for insurance to function effectively in a biodiversity context. Rather than being applied sequentially, they are interlinked and inform multiple stages of the product development process.

PRACTITIONER SUGGESTION NO. 1

Start with a rapid screening to determine whether insurance is appropriate before investing in detailed studies. Engaging regulators and local insurers early can help identify data requirements, policy and regulatory frameworks and market readiness.

Figure 3. Building blocks for effective biodiversity insurance coverage



ASSESS NATURAL ASSETS AND INSURABLE VALUE

The foundation of biodiversity insurance lies in accurately assessing natural assets and understanding their value. To frame biodiversity in a way relevant to insurance, it is essential to clearly define biodiversity's value, including both its ecological functions and economic benefits. Identifying who owns or holds rights over this asset value, whether it be governments, local communities, private entities or conservation organizations, is equally critical. Establishing ownership and value attribution enables insurers to design appropriate coverage models and ensure equitable distribution of financial benefits. This process includes:

- **Mapping ecosystems:** Creating detailed inventories of natural assets such as coral reefs, mangroves, forests, wetlands and biodiversity hotspots. Geographic information systems (GIS) and remote-sensing technologies can be used to gather comprehensive data.
- **Valuing ecosystem services:** Estimating the economic, social and environmental benefits provided by ecosystems. This includes provisioning services (e.g. food and raw materials), regulating services (e.g. carbon sequestration and flood control), cultural services (e.g. tourism and recreation) and supporting services (e.g. nutrient cycling and habitat provision). It is important to build socially inclusive and gender-responsive valuation processes, recognizing that different people and groups may place significantly different valuation on different species, products or ecosystem services.
- **Quantifying vulnerabilities:** Identifying which ecosystems are most susceptible to risks such as climate change, habitat destruction, invasive species, pollution and overexploitation. It also is essential to apply a gender lens and actively engage local communities, including women's groups, using socioculturally appropriate approaches to ensure that vulnerabilities, impacts and coping capacities within these stakeholders are accurately understood.
- **Applying valuation frameworks:** Using methods such as the total economic value (TEV) framework, gross ecosystem product (GEP) and natural capital accounting to quantify the value of ecosystem services. These frameworks aid in setting appropriate premiums and designing effective payout mechanisms.
- **Evaluating socioeconomic dependencies:** Understanding how communities and industries depend on biodiversity and how their livelihoods are impacted by ecosystem degradation. This should include participatory consultations with diverse local stakeholders, including community groups.

The focus should be on insurable interest rather than total ecosystem value. Given that the total economic value of ecosystems is often extremely high, using it as the basis for coverage can sometimes render insurance unaffordable; instead, it is often more practical to define insurable interest in terms of tangible financial exposures, such as restoration costs, business interruption losses or specific ecosystem service disruptions.

PRACTITIONER SUGGESTION NO. 2

Country teams may engage experts from academia, conservation organizations or consulting firms to collect and analyse relevant data. Increasingly, satellite imagery, remote sensing and open-access environmental data sets provide cost-effective inputs for assessing ecosystem condition, hazard exposure and trends over time.

ENGAGE STAKEHOLDERS AND DEFINE ROLES

It is crucial to ensure inclusivity, legitimacy and effectiveness in designing biodiversity insurance products. Relevant stakeholders include:

- **Governments:** Environment, finance, agriculture and tourism ministries and regulatory agencies responsible for policymaking, funding and enforcement.
- **Conservation organizations:** NGOs, research institutions and advocacy groups working to protect ecosystems and promote sustainable practices.
- **Private-sector actors:** Insurance companies, reinsurance firms, agribusinesses, tourism operators, fisheries and forestry companies with business models that intersect with biodiversity.
- **Local communities and Indigenous Peoples:** Those directly affected by biodiversity loss, who often possess valuable traditional knowledge about ecosystem management.
- **Civil society groups:** Networks and coalitions advocating for environmental justice, equity and inclusive development, including women's groups, organizations and cooperatives. Nature-based insurance remains a relatively new concept in many contexts and insurance uptake among communities living closest to biodiversity-rich landscapes can be low due to limited awareness, trust gaps and financial literacy constraints. Awareness-raising and capacity development are therefore essential across all stakeholder groups and represent a cross-cutting priority throughout the building blocks of biodiversity insurance design and implementation.

In Nepal, for example, a the stakeholder analysis first ascertained the reasons behind the low uptake of agriculture insurance, despite an 80 percent subsidy on premium payments. All stakeholders, including community institutions, the private sector, local governments and the management authorities of protected areas, raised concerns about moral hazard issues, untimely and unfair payment, and poor administration of agricultural insurance. Although all stakeholders expressed willingness and interest to participate in the insurance scheme, they also demanded minimal administrative burdens, transparent valuation and limited transaction costs, together with fair and timely payment.

PRACTITIONER SUGGESTION NO. 3

A gender lens should be integrated at every stage, including:

- Engaging diverse women's groups during the initial design stages
- Analysing the legal and regulatory frameworks from the perspective of women's economic empowerment and gender equality
- Ensuring that women's biodiversity priorities are taken into account in valuation and product design
- Ensuring a gender-sensitive approach to community outreach and communications
- Embedding gender data in accountability frameworks
- Including women's groups and gender experts in governance structures
- Tailoring products to support nature-based resilience for those most commonly left behind and disenfranchised
- Targeting support for women's nature-based solutions.

REVIEW LEGAL AND REGULATORY FRAMEWORKS

Insurance solutions must operate within established legal and regulatory frameworks to ensure legitimacy, compliance and effectiveness. Key considerations include:

- **Understanding regulatory requirements:** Reviewing existing insurance, environmental and conservation laws relevant to biodiversity protection, including government budgeting rules, expenditure frameworks and financial planning practices that affect implementation and sustainability.

- **Navigating ownership rights:** Clarifying ownership of natural resources, especially where communal or customary rights might apply.
- **Aligning with international agreements:** Ensuring compliance with global frameworks such as the Convention on Biological Diversity and the Kunming-Montreal Global Biodiversity Framework.
- **Identifying gaps:** Recognizing regulatory barriers that may hinder the development or scaling of biodiversity insurance products.
- **Advocating for policy support:** Collaborating with policymakers to establish enabling environments for innovative insurance solutions. Regulatory frameworks should be aligned with national policies that recognize insurance and risk financing as integral components of development strategies and plans, whether focused on biodiversity or broader environmental protection agendas. They also should create the legal and institutional space necessary to enable the financing, implementation and scaling of such mechanisms.

In Colombia, three articles were approved in the country's National Development Plan (2022–2026) with UNDP support, enabling the issuance of non-agricultural parametric insurance. This created the necessary legal space for innovation in ecosystem-based insurance products. In Nepal, the policy and institutional environment support the implementation of insurance schemes in alignment with the sixteenth periodic development plan, which places high priority on rolling out insurance to cover wildlife-related losses of crops and livestock.

Moreover, the 2022 Agriculture, Livestock and Herbs Insurance Directive of Nepal, issued by the Insurance Board, requires that non-life insurance companies allocate at least 5 percent of their insurance portfolio to agriculture, livestock and herbs.

ESTABLISH SUSTAINABLE PREMIUM FINANCING AND GOVERNANCE

Premium financing mechanisms must be designed to ensure the long-term viability and scalability of biodiversity insurance products. Essential components include:

- **Blended finance:** Combining grants, community funds, premiums, investment returns and donor contributions to diversify funding sources.
- **Public–private partnerships:** Engaging insurers, governments, NGOs and investors to pool resources and share risks. In some countries, existing legal provisions may allow governments to finance insurance premiums directly, for example by repurposing human–wildlife conflict compensation funds to support insurance schemes.
- **Biodiversity-linked bonds and securities:** Developing financial instruments that attract capital for conservation and resilience-building projects.
- **Governance structures:** Establishing oversight bodies, advisory boards or steering committees made up of stakeholders to enhance transparency, accountability and coordination.

- **Monitoring and evaluation:** Implementing performance assessment frameworks to ensure financial sustainability and effectiveness in achieving biodiversity protection goals.

Many nature-related insurance schemes face challenges in securing sustainable premium financing. The conservation of natural assets is often viewed as a government responsibility, yet public budgets in many developing countries are limited and cannot consistently support long-term premium payments. This makes alternative financing models essential. For example, the Colombia Water Fund is designed to secure premium funding through a combination of private sector contributions, public capital investments and support from international donors. This diversified approach can ensure financial sustainability and shared ownership. Similar arrangements could be explored in other contexts, for example by engaging the tourism industry in funding coral reef insurance or involving private operators in human–wildlife conflict schemes, since these sectors directly benefit from healthy ecosystems and reduced ecological risks.

PRACTITIONER SUGGESTION NO. 4

Given limited public budgets, explore blended financing models that combine public funds, donor support and private-sector contributions. Ecosystem service users, such as water utilities or tourism operators, may be well positioned to contribute to premium financing.

DESIGN THE INSURANCE PRODUCT

Effective product design is essential to ensure that insurance solutions adequately address biodiversity risks and provide incentives for conservation. Key elements include:

- **Defining coverage:** Determining which biodiversity risks are insured, e.g. habitat destruction, climate-induced disasters, invasive species and human–wildlife conflict.
- **Establishing triggers:** Identifying objective criteria for payouts, which may be based on weather-based parameters (e.g. wind speed, rainfall, temperature) or physical indicators (e.g. population decline, habitat degradation).
- **Data sourcing:** Establishing reliable sources of data from governments and other stakeholders to facilitate the product design process. For parametric insurance, reliable third-party or satellite data are essential, with sufficient historical records to validate correlations with past losses and ensure the robustness of trigger design and modelling.
- **Pricing models:** Setting premiums that reflect the value of natural assets, the likelihood of adverse events and the cost of restoration or mitigation.
- **Incorporating incentives for conservation:** Designing policies that reward sustainable practices and penalize harmful activities.

- **Claims processes:** Creating efficient, cost-effective, gender-responsive and transparent systems for assessing losses and disbursing funds and harnessing technological advancements and innovations to further streamline claims reporting, verification and payment.

The structured use of the building blocks was key in the development in Colombia of water fund insurance, an innovative parametric insurance product tailored to local ecosystem risks (**Figure 4**).

The product design process in Nepal assessed the following insurance modalities:

- a. Community-based insurance
- b. Enhancement of existing insurance products (e.g. agricultural insurance)
- c. Creation of a new product focused solely on wildlife-related losses to crops and livestock.

These modalities were evaluated against 10 predefined criteria, revealing that three (community-based insurance, upscaling existing products and the development of innovative models) were considered feasible. The findings were validated at both the study sites and the national level with key stakeholders. The country's insurance product design incorporated the valuation of risk (sum insured) based on either production costs or the value of agricultural output. Where data were available, claim ratios for crops and livestock were analysed in correlation with wildlife predation.

Figure 4: Building blocks in action:
Water Fund Insurance in Colombia

 Assessing natural assets and their value	 Stakeholder mapping and engagement	 Legal and regulatory framework	 Sustainable premium financing and governance	 Product design and mitigation activities
 8,313 hectares protected with more than 100 properties, 344 families and 36 water system suppliers linked in the Fund	 Private sector companies	 Regulatory framework enabling insurance companies to issue non-agricultural parametric insurance. Three Articles approved in the National Development Plan 2022–2026 with IRFF support.	 Private sector contribution	 The prototype parametric scheme has been structured with a precipitation index
 Investment: \$4 billion pesos initial in investment in the Fund	 Public–private sector: Bogota Water and Sewerage Company		 Public capital investments	 Negative anomalies correlate with the issuance of forest fire alerts allowing for immediate disbursement to the fund to implement mitigation actions before the event materializes
 Definition of parameter (NDVI)	 Development banks		 International donors	 Compensation is defined based on detailed costing of fire prevention activities in páramo areas
	 Donors: The Nature Conservancy, UNDP			 Fire mitigation and prevention with payments

A key feature of the approach of Nepal is the emphasis on achieving a minimum threshold of participation to enhance the scheme's viability. The government currently allocates \$11.6 million annually as an agriculture insurance subsidy, which could benefit farmers near protected areas, provided that challenges such as moral hazard and implementation hurdles are addressed. Given that more than 30 commodity-specific insurance policies already exist, promoting these products at the group level could lower transaction costs for both farmers and insurers. Consequently, upscaling and improving the effectiveness of existing products was identified as the most viable financial solution for addressing wildlife-related losses.

INTEGRATE MITIGATION AND RISK REDUCTION MEASURES

Insurance is most effective when combined with actions that reduce the likelihood or severity of loss. For example, health insurers often encourage policyholders to adopt healthy behaviours, such as exercising regularly or undergoing preventive health check-ups, by offering rewards or premium discounts. Similarly, risk reduction and mitigation measures should be an essential complement to biodiversity insurance, helping strengthen ecosystem resilience and financial sustainability. When coverage is linked to conservation and management interventions, insurers and policymakers can reduce claims, lower premiums and improve the long-term insurability of biodiversity assets. In this way, risk reduction and insurance become two sides of the same coin: prevention ensures that ecosystems remain resilient, while insurance provides the financial protection needed for recovery. In California, a wildfire resilience insurance product developed by The Nature

Conservancy and WTW (a multinational risk advisory, insurance and reinsurance broking firm) integrates forest management practices into insurance design, demonstrating that nature-based risk reduction can help improve insurability. By accounting for ecological forest interventions that reduce fire risk, the model aims to enable coverage in high-risk areas from which insurers have been withdrawing while also significantly lowering premiums and deductibles.

Mitigation measures should be embedded across the design process, from risk assessment and product development to claims payout and recovery planning. These measures can target the underlying drivers of ecosystem degradation, strengthen early warning systems and improve community preparedness for natural hazards. For example, wildlife-friendly farming practices in Nepal and the use of crop protection fences have helped reduce human–wildlife conflicts and limit losses.

PRACTITIONER SUGGESTION NO. 5

Engage local insurers and international reinsurers early to test technical feasibility and pricing assumptions. Workshops with local insurance associations can help build market interest and identify practical design options. Co-designing products with biodiversity stakeholders is important to ensure relevance, usability and alignment with conservation objectives.

PILOT, MONITOR AND SCALE

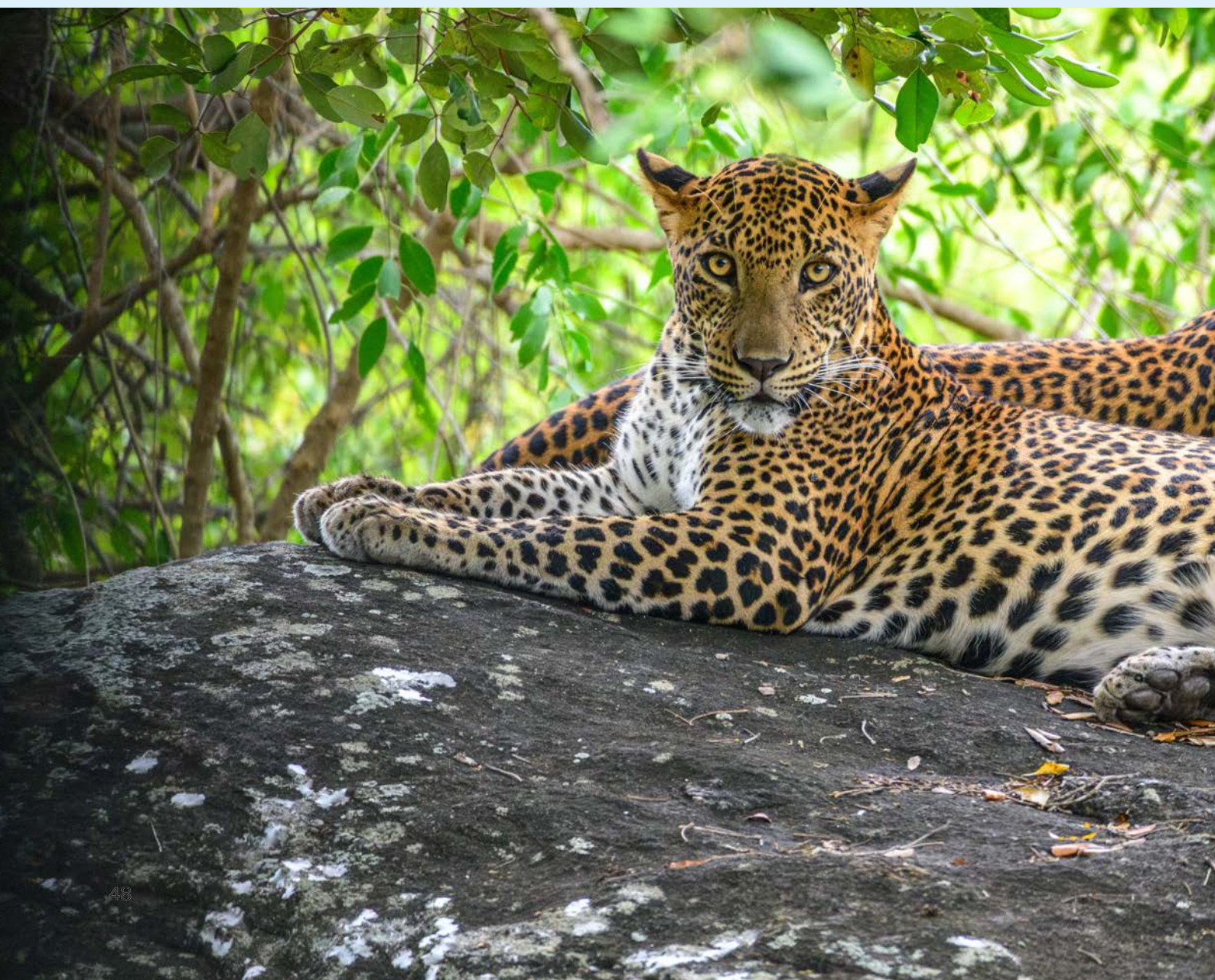
Piloting allows insurance solutions to be tested in real-world conditions before full-scale implementation. Pilots help validate product design, pricing assumptions, governance arrangements and operational processes while identifying data gaps and implementation challenges. Ongoing monitoring should track both financial performance and biodiversity outcomes, enabling continuous learning and adaptation. Lessons from pilot phases can then inform scale-up to additional ecosystems or regions, supporting the wider adoption of effective and resilient insurance solutions for biodiversity.

Table 6. Key activities for designing insurance for biodiversity

FOCUS AREA	KEY ACTIVITIES	KEY OUTPUTS
<i>Conduct screening and vulnerability assessment</i>	Apply the decision-support tool to assess whether insurance is appropriate. Identify biodiversity assets, ecosystems and communities at risk. Analyse exposure to hazards. Collect baseline ecological and socioeconomic data.	Decision on suitability of insurance; vulnerability profile; preliminary risk and data assessment
Assess natural assets and their value	Map ecosystems and biodiversity assets. Estimate ecological, economic and cultural values. Assess vulnerabilities and dependencies. Apply valuation frameworks such as TEV, GEP or natural capital accounting.	Natural asset inventory; ecosystem valuation; quantified risk and exposure estimates
Engage stakeholders and define roles	Identify relevant public, private and community stakeholders. Conduct consultations. Clarify roles in design, financing, implementation and monitoring. Establish participation and data-sharing mechanisms.	Stakeholder map; engagement plan; agreed roles and responsibilities
Review legal and regulatory frameworks	Assess ownership and insurable interest. Review insurance and environmental regulations. Identify policy gaps. Engage regulators to confirm compliance and approval pathways.	Legal and regulatory assessment; confirmed policyholder and beneficiary structure
Establish sustainable financing and governance	Identify premium financing needs. Explore blended finance options. Assess contributions from the government, donors, the private sector and ecosystem service users. Design governance and oversight arrangements.	Financing strategy; premium funding model; governance structure
Design the insurance product	Engage insurers and reinsurers. Select insurance mechanism. Define coverage, triggers, pricing and claims processes. Integrate conservation incentives and risk reduction measures. Co-design with stakeholders.	Product concept note; pricing and trigger model; claims and payout design
Integrate mitigation and risk reduction measures	Link insurance to preventive actions. Design premium incentives. Embed early-warning systems. Use insurance data to support risk reduction and ecosystem management.	Risk reduction plan; conservation-linked incentives; data feedback mechanisms
Pilot, monitor and scale	Implement pilot. Monitor financial and biodiversity outcomes. Refine product design. Develop scale-up strategy for additional ecosystems or regions.	Pilot results; monitoring framework; scale-up plan

Box 4. Stronger communities, safer leopards: risk reduction in the first livestock insurance scheme in Sri Lanka

In a groundbreaking move for wildlife conservation and support for rural livelihoods, Sri Lanka launched its first livestock insurance scheme to reduce human–leopard conflict and protect the endangered Sri Lankan leopard. Guided by the Department of Wildlife Conservation of Sri Lanka, UNDP (through its BIOFIN initiative), the Wildlife and Nature Protection Society and LOLC Insurance, this initiative offers swift compensation to livestock farmers who lose livestock to leopard predation.



The Sri Lankan leopard, the apex predator and a keystone species in its ecosystems, plays a vital role in supporting healthy habitats.

However, shrinking and fragmented forests, declining prey due to poaching and increasing human activity have forced leopards to look for prey in rural, human-dominated landscapes, where livestock predation can occur. These incidents often cause financial hardship for farmers, fuelling negative attitudes and leading to retaliatory leopard killings. Driven by the findings of the Multi-Regional Leopard Research and Conservation Project from the Wildlife and Nature Protection Society and LOLC Insurance, this intervention was developed to ease the economic burdens of livestock farmers while promoting long-term leopard conservation by minimizing retaliatory killings.



While facilitating financial compensation in its first phase, the initiative also introduces mitigatory measures to improve long-term sustainability. Proposed mitigatory measures include predator-proof enclosures, livestock bank and the “eye cow” technique:

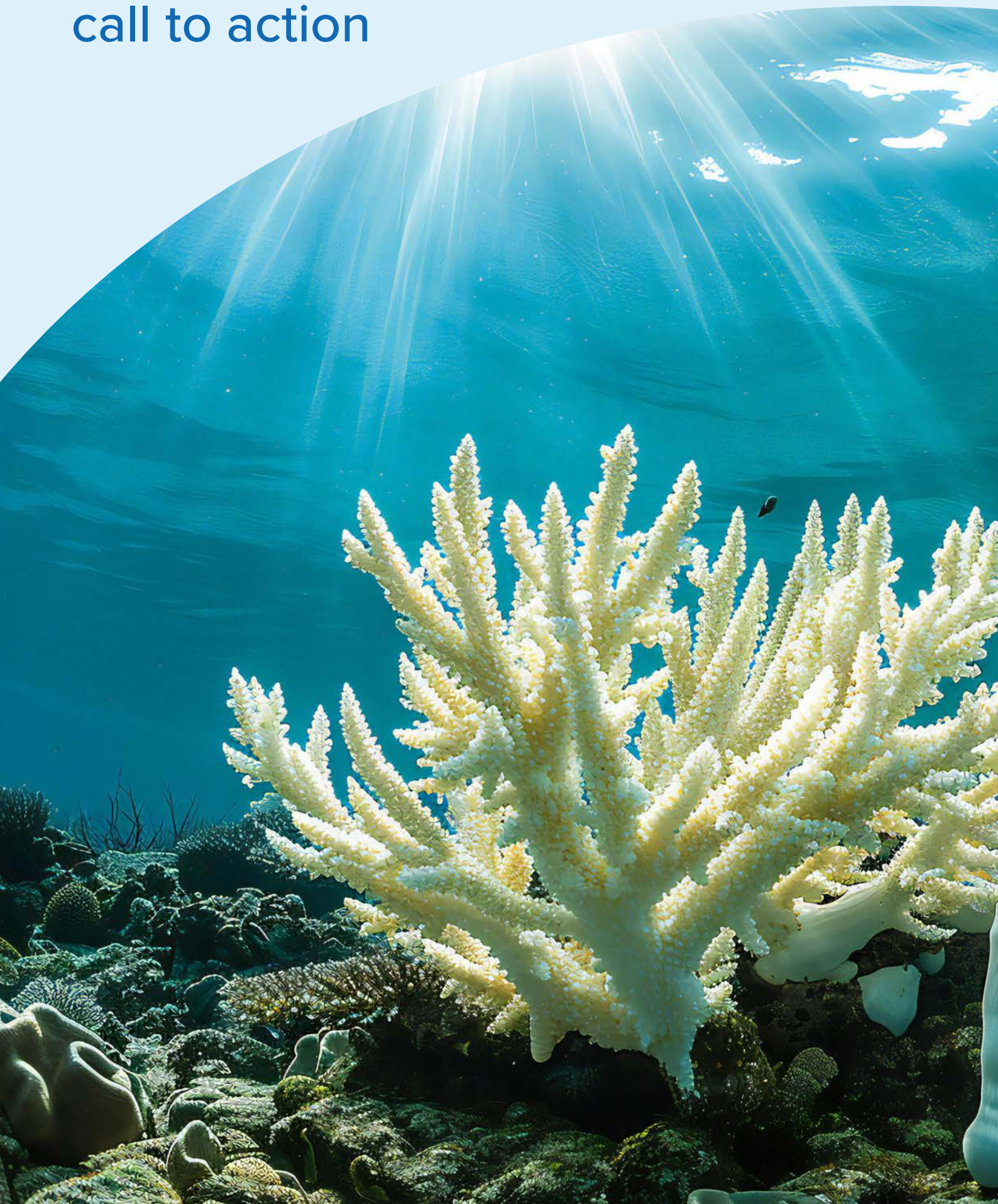
- Predator-proof enclosures are used as night-time livestock housing to deter leopards when predation risk is highest. Communal livestock pens are established in selected locations where farmers can share livestock holding facilities to safely house their animals overnight while reducing construction costs.
- Cattle bank initiatives look at livestock-to-livestock replacement systems, developed as a community-managed facility through which farmers receive replacement livestock of similar value and breed.

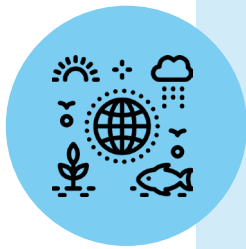
- The simple and low-cost “eye cow” deterrent technique has proven successful in Africa and India in reducing leopard predation. Eyespots painted on the hinds of cattle act as anti-predator signals to discourage and deter ambush predators such as leopards.

The latter two initiatives have not been implemented in Sri Lanka before and will be piloted alongside the newly introduced compensation scheme. In addition, campaigns have been organized to raise awareness via community meetings and radio broadcasts.



4. Conclusion and call to action





Biodiversity is declining at an alarming rate due to a combination of ecosystem-level and species-level threats. Ecosystems such as forests, wetlands, coral reefs and mangroves are being degraded or lost, while species face increasing pressure from habitat destruction, overexploitation, invasive species and climate change. This loss is creating physical, transition and systemic risks that threaten ecosystems, economies and long-term resilience, underscoring the urgent need for coordinated action.



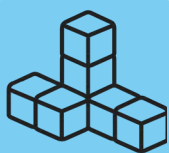
Insurance can serve as a critical enabler in biodiversity protection by transferring risk, incentivizing preventive action and enabling faster recovery. Innovative mechanisms such as the parametric water fund insurance in Colombia and the biodiversity-linked agricultural scheme in Nepal demonstrate the potential of insurance to support both conservation and community resilience. For governments, insurance also represents a tool for managing nature-related fiscal shocks and protecting public budgets from the growing costs of ecosystem degradation.



Insurance must be combined with other risk reduction measures. Integrated approaches that promote coexistence (as seen in Nepal), restore degraded ecosystems and reduce vulnerability are essential to maintain insurability and ecological integrity. By lowering the likelihood and severity of losses, effective risk reduction also supports the financial sustainability of insurance schemes and can help stabilize or reduce premium costs over time.



Intersectoral collaboration is essential. Governments, insurers, regulators, conservationists, communities and donors must work together to create enabling environments and innovative financial models that scale biodiversity insurance solutions.



The building blocks outlined in this guide offer a practical pathway for countries and partners to develop biodiversity insurance solutions supporting National Biodiversity Finance Plans as recommended by the Kunming-Montreal Global Biodiversity Framework. These include assessing ecosystem value, engaging stakeholders, navigating regulatory frameworks, securing sustainable financing and designing effective products. The selection and design of insurance instruments – such as parametric insurance, indemnity schemes, human–wildlife conflict insurance or sovereign risk financing mechanisms – should be guided by country-specific contexts, including the nature of biodiversity risks, data availability, institutional arrangements, regulatory frameworks and the maturity of domestic insurance markets.



Nature insurance needs catalytic support. The relationship between nature and insurance is multidimensional and often not well understood, requiring sustained awareness-raising and capacity development across governments, regulators, insurers and conservation stakeholders. At the same time, many nature-related insurance products remain novel and niche and will require targeted support, incentives and catalytic financing to test, pilot and scale effectively.



Negative impacts must be avoided. While insurance can promote biodiversity, it also can reinforce harmful practices if poorly designed, such as by underwriting environmentally destructive activities or excluding green solutions. Insurers must integrate safeguards and monitor the ecological impact of both products and investments to avoid unintended consequences. Impact measurement must be an essential element of any insurance scheme. After deploying insurance, effective risk avoidance must be measured, for example by asking whether the insurance scheme has helped reduce human–wildlife conflict.



The cost of inaction is high. For example, each hectare of wetland loss can cost up to \$8,000 annually in developed areas,⁷⁰ and the loss of a single jaguar in Argentina has been valued at \$1.8 million in environmental damage.⁷¹ These figures underscore the need for forward-looking financial tools that protect nature as a shared asset.

69 C. A. Taylor and H. Druckenmiller, “Wetlands, flooding, and the Clean Water Act”, *American Economic Review*, vol. 112, No. 4 (April 2022). Available at <https://www.aeaweb.org/articles?id=10.1257/aer.20210497>.

70 Argentina, National Parks Administration, *Cálculo de daño ambiental de yaguararé (Panthera onca) cazado en Formosa* [Estimate of environmental damage from jaguar hunting in Formosa] (Formosa, 2024). Available at <https://chacodiapordia.com/storage/2024/08/Informe-Yaguarete-APNAC.pdf>.

THIS IS THE MOMENT TO ACT

Biodiversity underpins more than half of global GDP and sustains economies, livelihoods and financial stability across sectors. By incorporating insurance into biodiversity finance plans and restoration efforts, we can secure vital ecosystems, support vulnerable communities and build a more resilient, nature-positive future.

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