



Can we afford to save nature?

The economics of the Half-Earth scenario

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Bridging the biodiversity finance gap

Executive Summary



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- Climate goals are unattainable without a healthy planet. Yet natural capital and ecosystem services are deteriorating at an alarming pace. The Living Planet Index shows a -73% decline in wildlife populations over the past five decades. Without rapid action to halt and reverse biodiversity loss, the ecosystems that support food, water, climate stability and economic growth will continue to erode.
- Nature underpins more than half of global GDP. Continued biodiversity loss could slash global GDP by -2.3% by 2030, relative to a baseline in which biodiversity remains at 2020 levels, with far deeper impacts on developing economies (-7% to -10%). Drivers include deforestation, pollution, intensive agriculture and climate change. These risks flow through two channels: physical risks, as ecosystem services like pollination and water regulation fail, and transition risks, as policy, market and consumer shifts raise compliance costs, strand assets and reshape competitiveness. Ecological decline is now a direct macro-financial threat.
- The Half-Earth scenario, which proposes to protect 50% of land on the planet, offers a bold pathway to restore critical ecosystems. Large scale Protection of land would restore biodiversity to 2010 levels. Such a transition pathway brings adjustment costs: by 2050, global cropland could shrink -11%, raising food prices by +15% and global CPI by +24%, with developing economies seeing sharper GDP impacts (up to -19%) than advanced markets (around -4%). Our findings highlight that while biodiversity protection is vital, it must be accompanied by inclusive economic transition strategies to avoid widening global inequality. But these costs are far lower than losses from unchecked nature decline. For example, the loss of just one ecosystem service such as pollination would inflict greater damages than large-scale conservation in major economies, such as Europe, the UK and the US.
- Expanding protected areas alone cannot deliver recovery. On the supply side, sustainable intensification through regenerative agriculture, precision farming, soil restoration and crop diversification can raise yields without expanding farmland. Global trade in certified sustainable commodities can reduce pressure on biodiversity hotspots while maintaining market access for developing producers. On the demand side, dietary shifts toward plant-rich diets and reduced meat consumption, alongside food waste reduction, are crucial to free land for restoration and cut emissions. Simulation models show that isolated actions achieve limited gains, but when conservation, sustainable production and responsible consumption advance together, the Living Planet Index more than doubles by 2100, restoring biodiversity to levels above those of 1970.

We would like to express our gratitude to the BiROFin project team, in particular to Willem Jan van Zeist, for providing the HG dataset, valuable comments, and contributions to this paper. The BiROFin project operates in close collaboration with the Foundation for Sustainable Development and several private-sector partners, including Allianz Group, ING, APG, Commerzbank, Ortec Finance, Sail Investment, and KfW. The project receives financial support from the Top Sector Agri & Food, under the Knowledge and Innovation Agenda for Agriculture, Water, and Food (KIA) 2024–2027.

- Closing the USD700bn annual biodiversity finance gap is essential. Current flows total just USD143bn, though private investment has grown rapidly, from USD9.4bn in 2020 to over USD100bn in 2024, driven by new nature-focused funds, credit instruments and green bonds. The Kunming-Montreal Global Biodiversity Framework targets international financial flows of USD20bn per year by 2025 and USD30bn by 2030 but achieving this will require a major scale-up of blended finance, stronger policy incentives and standardized biodiversity taxonomies to guide capital.
- Finance will determine whether biodiversity recovery succeeds, and insurers are on the front line. They can underwrite restoration projects, offer ecosystem-based coverage and create transition products that reward sustainable practices. By valuing and protecting natural assets, insurers also shield themselves from the rising physical and liability risks of ecological decline, such as flood losses from wetland degradation or stranded assets as regulation tightens. Investors, too, are stepping up. Biodiversity-themed funds now exceed USD1.6bn, while portfolio managers increasingly use tools like the Global Biodiversity Score to align investments with nature goals. Public programs are amplifying these efforts: the EU's InvestEU aims to mobilise EUR10bn for natural capital, and France's SNCRR initiative is building biodiversity credit markets. To meet the Kunming–Montreal targets, including USD200bn a year in biodiversity finance by 2030, financial institutions must expand capital flows, strengthen safeguards and make biodiversity impact reporting as standard as carbon disclosure.



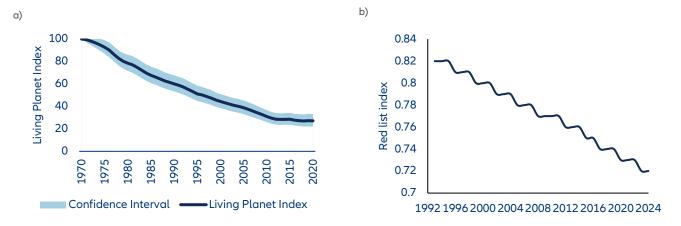
Recent shifts in the world's living systems

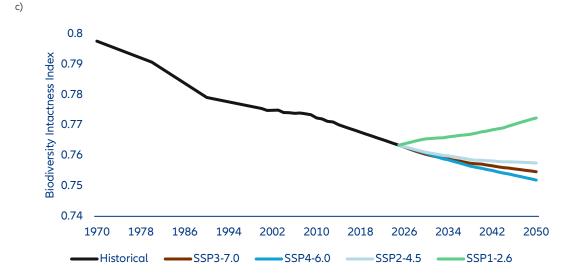
A range of scientific indicators consistently paint the same stark picture: nature is in rapid and dangerous decline (Figure 1). The Living Planet Index (LPI) is one of the most widely used measures of biodiversity health (Figure 1a). Tracking more than 35,000 populations across 5,500 species of mammals, birds, fish, amphibians and reptiles, it provides one of the most comprehensive global assessments of ecosystem change. The results are alarming. Since 1970, monitored wildlife populations have plummeted by -73%, meaning that, on average, nearly three-quarters of these populations have vanished in just five decades. This equates to an average decline of -2.6% per year, affecting both rare and oncecommon species, revealing that even those we assume to be secure are edging towards rarity or extinction. This erosion of biodiversity is mirrored by the Red List Index (RLI), which measures species' extinction risk over time (Figure 1b). From above 0.82 in the early 1990s, the RLI has fallen to around 0.72 in 2023, showing that species are, on average, moving closer to extinction. The unbroken downward slope reflects persistent pressures from habitat loss, overexploitation, invasive species,

pollution and the accelerating impacts of climate change. The Biodiversity Intactness Index (BII) further captures the degradation of ecosystem integrity (Figure 1c). It has steadily declined from almost 0.80 in 1970 to just above 0.76 today. Future projections show sharply contrasting outcomes depending on the development pathway described by the SSP-RCP scenarios¹. In high-emission and high-social development pressure scenarios (SSP3-7.0, SSP4-6.0, SSP2-4.5), the BII continues its historic decline, dipping below 0.75 by 2050, a sign of worsening habitat loss and insufficient conservation measures. Conversely, the sustainabilityfocused SSP1-2.6 pathway, aligned with ambitious climate mitigation and ecosystem restoration, could reverse the trend, enabling gradual recovery to around 0.78 by mid-century. This crisis extends with equal severity to the marine ecosystem (Box 1). Taken together, these indicators show that the trajectory of global biodiversity will be determined by the policy choices and collective action taken within this decade.

¹ Intergovernmental Panel on Climate Change SSP-RCP scenarios | Ministry for the Environment

Figure 1: Development of biodiversity indicators: a) Historical development of the Living Planet Index (1970 – 2019); b) Historical development of the Red List Index (1992 – 2024); c) Historical and future developments of the Biodiversity Intactness Index (1970 – 2025 / 2025 – 2050 along different SSP-RCP scenarios)





Sources: Our World in Data, Natural Historical Museum, Allianz Research

Deforestation and agricultural expansion are among the most powerful forces driving the decline of ecosystem services, reshaping landscapes in ways that undermine nature capital. Over the past century, agriculture has expanded relentlessly. Cropland has grown from 0.9bn hectares in 1900 to over 1.6bn hectares in 2023, while grazing land increased to more than 3.3bn hectares before levelling off. This expansion has come at the direct expense of natural capital (forests, wetlands, grasslands and nursery habitats), transforming them into fields and pastures and eroding the ecological foundations that sustain food, water and climate stability. This has been accelerated though tropical deforestation in recent decades. Since 2001, global tree cover loss has surged, peaking at nearly 30mn hectares in 2016. In Brazil, a biodiversity hotspot, millions of hectares have been cleared for

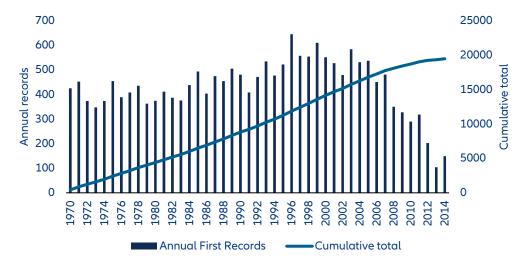
soy production, cattle ranching and other agricultural uses. Similar patterns are seen in Canada and Russia, where industrial logging and wildfires destroy carbonrich forests. Such losses weaken nature's ability to store carbon, regulate the climate (Box 2) and water cycles and support diverse species. Deforestation is also making wildfires even more dangerous, creating a devastating feedback loop for the whole ecosystem. Clearing forests exposes land to drying, increases flammability and removes natural firebreaks and moisture-rich vegetation. These fires release vast amounts of CO₂, turning forests from carbon sinks into carbon sources. The 2023 wildfires in Canada alone emitted nearly 480 Mt CO₂-eq, compared with the country's total annual emissions (excluding land use) of 694 Mt CO₂-eq².

² Copernicus: Canada produced 23% of the global wildfire carbon emissions for 2023 | Copernicus

Invasive alien species are another major and growing driver of biodiversity loss, disrupting ecosystems, threatening native species and undermining ecosystem services. Figure 2 shows the global rise in recorded alien species introductions since 1970, with annual first records peaking in the late 1990s and early 2000s before declining in recent years, likely reflecting reporting lags rather than a genuine slowdown³. The cumulative number of alien species has increased steadily, almost reaching 20,000 in 2014 globally. Once established, alien species can outcompete, prey upon or transmit diseases to native species, often leading to severe population declines. They also alter habitat structure and ecosystem functioning, with significant economic and social costs, particularly in agriculture, fisheries and forestry. Globalization, trade and climate change continue to facilitate their spread, making prevention, early detection and rapid response critical.



Figure 2: Global development of the number of alien species



Sources: Global Alien Species First Record Database, GFW, Allianz Research

³ The apparent decline in recent annual first records is largely due to the time lag between a species' actual introduction, its detection in the field, formal scientific identification, publication of the record and eventual inclusion in global databases. This process can take several years or even decades, meaning recent years are systematically underreported.

Box 1: Rising availability, rising waste

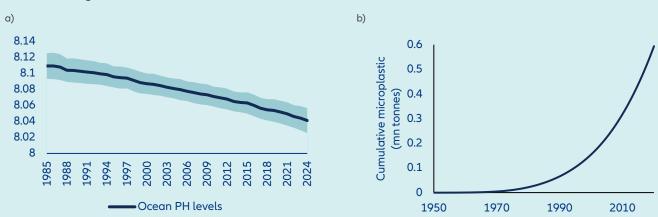
Climate change and rapid, unprecedented human development are placing marine ecosystems under immense and escalating pressure. The consequences are visible across multiple dimensions, from chemical changes in ocean water to the proliferation of pollutants and the overexploitation of fish stocks.

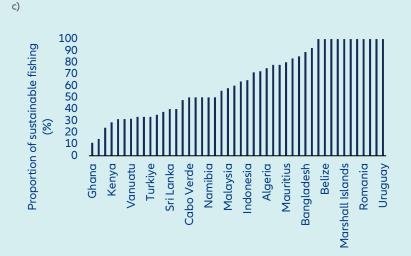
One of the most critical threats is ocean acidification, directly linked to rising carbon dioxide concentrations in the atmosphere. As shown in Figure 3a, average surface ocean pH has declined steadily since the late 1980s, dropping from above 8.11 to near 8.05 today. While these changes may appear numerically small, they represent a major shift in ocean chemistry, reducing the ability of corals, mollusks and plankton to build shells and skeletons. This weakens the foundation of marine food webs and undermines the resilience of ecosystems that support fisheries and coastal protection.

Equally concerning is the rapid accumulation of plastic pollution, which represents the physical footprint of unsustainable consumption and waste management. Figure 3b highlights the exponential rise in cumulative microplastic pollution since the 1950s. Today, millions of tons of microplastics permeate the oceans, entering the food chain and threatening marine species, from plankton to large mammals. In addition, microplastics carry toxic chemicals, posing risks to human health through seafood consumption.

Overfishing further compounds these pressures. Figure 3c illustrates the stark disparities in the proportion of sustainable fishing across countries. In many coastal nations, particularly in the Global South, less than 50% of fishing is conducted sustainably. This undermines fish stock recovery, disrupts reproduction cycles and erodes the livelihoods and food security of millions of people who depend on fisheries for survival.

Figure 3: Major pressures on marine ecosystems: a) Ocean PH levels (1985 – 2024); b) Cumulative microplastics in million ton (19850 – 2020); c) Sustainable fishing across countries

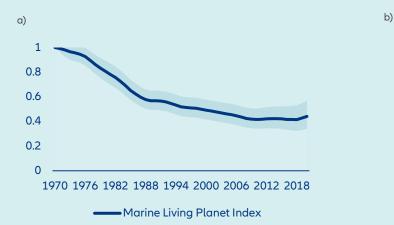


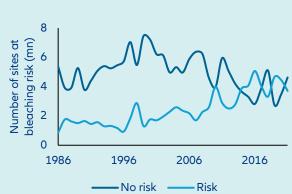


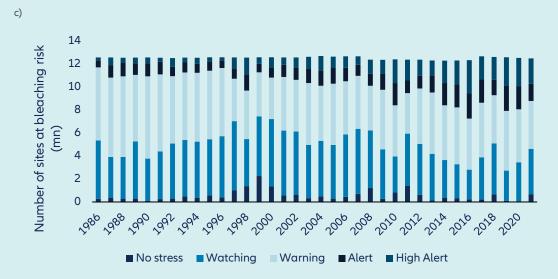
Sources: Copernicus, Our World in Data, World Bank, Allianz Research

The cumulative pressures on oceans are already translating into severe consequences for marine biodiversity and the services it provides to people (Figure 4). The Living Planet Index for marine species (Figure 4a) shows a dramatic decline since 1970, with populations shrinking by more than half and stabilizing at historically low levels in recent years. This trend reflects the compounded impact of climate change, overfishing, pollution, and habitat destruction, which together erode the resilience of marine ecosystems. Coral reefs, among the most biodiverse and economically valuable marine habitats, are particularly vulnerable. Data from NOAA (Figures 4b and 4c) demonstrate a clear increase in the number of reef sites exposed to bleaching risk as rising sea temperatures and ocean acidification push corals beyond their tolerance limits. Sites at "no risk" have steadily declined, while those facing "risk" or entering bleaching alert categories have risen significantly since the 1990s. Episodes of mass bleaching now occur with increasing frequency, leaving insufficient time for ecosystems to recover between events.

Figure 4: Degradation of marine ecosystems: a) Marine Living Planet Index; b and c) Evolution of number of coral sites at bleaching risk







Sources: LPI, NOAA, Allianz Research



Nature's role in building

economic stability

The degradation of natural capital, driven by deforestation, pollution, intensive agriculture and climate change, generates profound and cascading effects across the economy. As illustrated in Figure 5, two main channels transmit biodiversity loss into economic and financial risks: the dependence (physical) channel and the transition channel.

The first mechanism, the physical or dependence channel, reflects the deep interlinkages between economic activity and the health of ecosystems. Many sectors rely directly on ecosystem services, including pollination, soil fertility, water purification, air quality and climate regulation. The decline of these services leads to measurable economic disruptions (see Box 2 for a discussion on air pollution). Reduced pollination lowers crop yields; the destruction of natural storm or flood barriers increases disaster damages and the loss of carbon-sequestration capacity amplifies climate-related impacts. Beyond sectoral losses, degraded ecosystem services also affect labor productivity through poorer air quality and increased health burdens, particularly in urban and industrial regions. These shocks ripple across supply chains, eroding profitability, altering price

structures and ultimately manifesting as financial risks through higher credit defaults, asset devaluation or insurance losses.

The second mechanism, the transition channel, emerges from the societal and policy response to biodiversity loss. As governments tighten environmental regulations, adopt nature-positive standards and implement biodiversity-related disclosure frameworks, firms face growing compliance costs and potential revaluation of assets. Companies operating in biodiversity-intensive sectors may experience stranded assets, especially where business models rely on unsustainable resource extraction or land conversion. At the same time, rapid shifts in consumer preferences toward sustainable products and the diffusion of green technologies introduce additional transition costs and competitiveness pressures. While such changes are essential for reverting the biodiversity decline, they can temporarily heighten financial volatility and create winners and losers across industries.

Degradation of natural Financial risks capital driven by: Land-use / Strategic risk Decline of ecosystem Increased uncertainty Deforestation services Change of business model Climate change Less pollinators Pollution Destroyed natural Physical risk · Intensive agriculture Dependence Economic costs associated storm/flood barriers Economic risks Credit risk • Etc. ases in defaults with the dependence on channel Reduced carbon Damages to assets Collateral depreciation ecosystems services sequestration capacity (e.g., lack of flood of oceans and forests protection) Stranded assets (e.g., Etc. Market risk agri. Land dependina Repricing of assets on pollinators). Disruption of process (Chemical factories Underwriting risk depending on water) Increased insured losses Misalignment with Increased insurance gap Shift in prices nature actions Productivity loss / Transition risk Policy and regulation Impact channel Human health issues **Liquidity risk** Shortage of liquid assets Economic costs associated Technological Etc. with the **impact** on nature development capital Refinancingrisk Consumers and investors preferences Operational risk Disruption of financial institution's processes

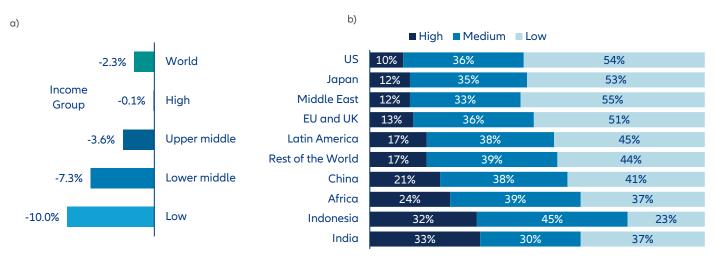
Figure 5: The economic ripple effects of the biodiversity crisis

Sources: Our World in Data, Trase, Allianz Research

According to the World Economic Forum, more than USD44trn of global economic value generation, over half of the world's GDP, is moderately or highly dependent on nature and its ecosystem services.

This deep interdependence implies that continued biodiversity loss could trigger substantial economic disruptions by 2030 if current trends persist. Modelbased projections indicate that, under a business-asusual scenario, global GDP could decline by about -2.3% by 2030 relative to a baseline in which biodiversity remains at 2020 levels (Figure 6a). However, the economic burden would be unevenly distributed across income groups: while high-income economies would face relatively modest losses (-0.1%), GDP is projected to fall by -3.6% in upper-middle-income economies, -7.3% in lower-middle-income economies and -10.0% in low-income economies. These disparities highlight the heightened vulnerability of developing regions, whose economies are both more dependent on natural capital and less equipped to absorb biodiversity-related shocks. The degree of economic dependence on nature varies significantly across regions (Figure 6b). While all economies rely on ecosystem services to some extent, developing regions tend to show a higher share of sectors with strong or moderate dependence. In countries such as India and Indonesia, and across Africa, over 60% of economic value generation is at least moderately dependent on natural capital, reflecting the dominance of agriculture, forestry and resource-based industries. By contrast, high-income economies such as the US, Japan and the EU display lower direct dependence, though they remain indirectly exposed through global supply chains and imported environmental risks.

Figure 6: Global economic dependence on nature: a) Economic costs resulting from biodiversity loss; b) Distribution of nature dependency by country



Sources: BloombergNEF, Allianz Research

To explore the structure of nature dependence in more detail, we developed an input–output model based on the Leontief inverse to map sectoral dependencies across the EU-27. The approach captures both the direct exposure of each sector to ecosystem services and the indirect relationships embedded in upstream suppliers and downstream value chains (Figure 7). The results reveal a tightly interlinked economic system in which almost every sector is connected, in one way or another, to the functioning of natural capital.

As expected, primary sectors such as agriculture, forestry and fisheries show the highest direct dependency, reflecting their reliance on healthy soils, water, pollinators and stable climatic conditions. Yet, the analysis also exposes how deeply nature is woven into the fabric of the wider economy. The food and beverage industry, construction, mining and metals and water utilities exhibit substantial upstream and downstream links with nature-dependent inputs. Even highly service-oriented activities – such as finance, insurance, information technology and communications – display moderate dependence through their exposure to clients and supply chains operating in resource-intensive industries.

This systemic perspective suggests that biodiversity degradation would reverberate through production networks, altering cost structures, supply stability and investment performance. Sectors at the heart of the European Green Deal, including manufacturing and energy, are particularly sensitive to disruptions in natural systems and will face growing adaptation costs if these risks remain unmanaged. The results underline the need for European institutions and financial actors to integrate biodiversity metrics into economic planning, credit assessment and industrial policy. Strengthening natural capital accounting, supporting disclosure frameworks and aligning fiscal incentives with ecosystem restoration would help reduce vulnerability and ensure that the EU's transition to a green economy is not only climatecompatible but also ecologically grounded.

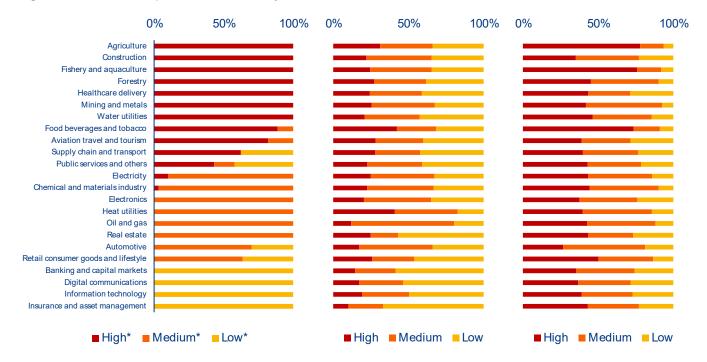


Figure 7: Economic sector dependencies on biodiversity in the EU-27

Sources: EXIOBASE 2022, ENCORE 2024, Hirschbuehl et al. 2025, Allianz Research

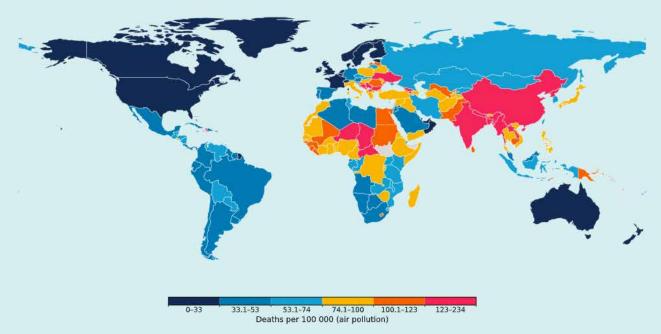
Box 2: Health and economic toll of air pollution

Air pollution remains one of the most pressing global public health threats, responsible for a significant share of premature mortality worldwide. According to the State of Global Air 2024, an estimated 8.1mn deaths in 2021 were attributable to exposure to ambient and household air pollution, making it a leading environmental risk factor for human health. The geographical distribution of deaths (Figure 8a) highlights the sharp regional disparities: the highest burdens are concentrated in South and East Asia, particularly India and China, where dense populations, urban smog and reliance on solid fuels exacerbate exposure.

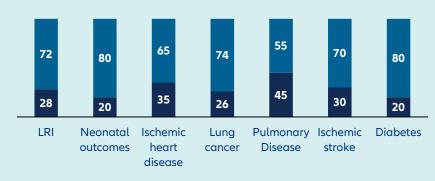
The cause-specific analysis (Figures 8b–c) shows that air pollution contributes substantially to a wide range of chronic diseases. About 45% of global deaths from chronic obstructive pulmonary disease (COPD) and 35% from ischemic heart disease are linked to polluted air, followed by significant shares of ischemic stroke (30%), lung cancer (26%) and lower respiratory infections (28%). Even non-communicable diseases such as diabetes (20%) and neonatal complications (20%) are increasingly recognized as pollution-related. In China and India – the two most affected countries – the health impact profile differs slightly but remains severe, with a particularly high proportion of stroke, COPD and heart disease deaths attributable to pollution. These findings underscore that air pollution is not merely an environmental issue but a major health and economic challenge, driving hospitalizations, productivity losses and premature deaths. Reducing emissions from fossil fuels, transport and biomass burning would therefore yield immense co-benefits for both public health and climate mitigation.

Figure 8: Premature air-pollution-related deaths: a) Global air-pollution-related deaths (2021); b and c) Cause-specific disease burden (China & India)





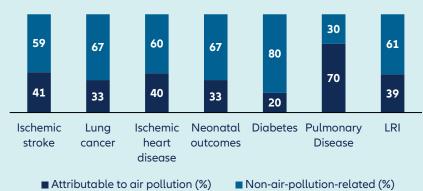




■ Attributable to air pollution (%)

■ Non-air-pollution-related (%)

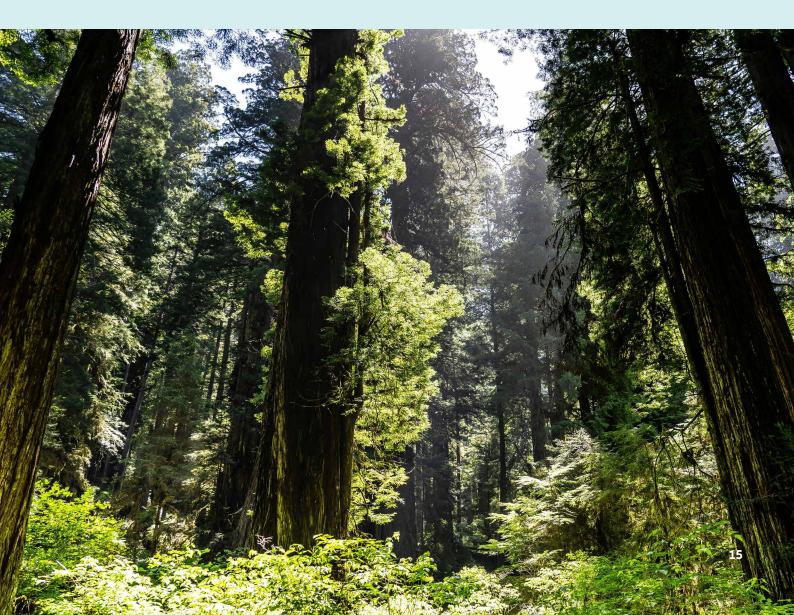




Sources: Health Effects Institute, Global Burden of Disease, Allianz Research

Recent evidence confirms that air pollution exerts a measurable drag on economic productivity. Using firm-level data from over 2.5mn companies across Europe between 2000 and 2022, Dechezleprêtre and Vienne (2025) provide causal estimates of the short-run productivity impacts of particulate matter ($PM_{2.5}$) exposure. The study finds that a 1 μ g/m³ increase in $PM_{2.5}$ concentrations, equivalent to a +7% rise at the sample mean, leads to a -0.55% decline in labour productivity within the same year. The effect is particularly pronounced on days with $PM_{2.5}$ levels above 25 μ g/m³, and disproportionately affects sectors such as construction, knowledge-intensive industries and medium-sized firms with lower capital intensity. Simulations indicate that up to one-third of Europe's labour productivity growth between 2011 and 2022 could be attributed to improvements in air quality, underscoring the economic co-benefits of stringent air pollution control policies.

Similar results emerge from micro-level evidence linking air pollution to individual productivity and health outcomes in China. Using a 15-year panel of more than 19,000 adults from the China Health and Nutrition Survey (2000–2015) combined with satellite-based air quality data, He and Ji (2021) estimate that each 1 µg/m³ increase in PM_{2·5} concentrations reduces annual working hours by 26.6 hours and hourly wages by 0.34 yuan (approximately USD0.05). The effects are strongest among rural and outdoor workers, whose productivity declines as air pollution directly impairs physical performance and respiratory health. Among urban and higher-skilled workers, pollution primarily affects cognitive functions, diminishing focus and decision-making capacity. Chronic exposure further increases the likelihood of diabetes and asthma, and lowers overall well-being, amplifying long-term human capital losses.





Economic implications of the Half-Earth scenario

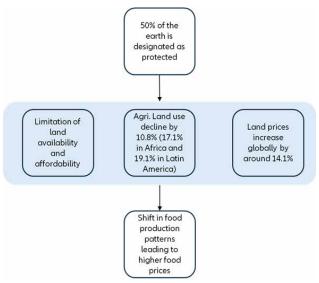
The Half-Earth scenario represents an ambitious conservation pathway in which half of the planet's surface is designated as a protected area to safeguard critical ecosystems and sustain the resilience of global biodiversity. It envisions a world where 50% of terrestrial and marine areas are conserved, prioritizing regions with the highest ecological value and species richness. This concept builds on Target 3 of the Kunming–Montreal Global Biodiversity Framework (GBF), adopted in December 2022, which calls for the protection of at least 30% of the Earth's land and oceans by 2030. The Half-Earth scenario extends this ambition, viewing the 30×30 target as an essential milestone toward the broader vision of conserving approximately half of the planet as a foundation for long-term ecological stability.

While the expansion of protected areas is essential to conserve biodiversity, it also constrains land availability and increases competition for remaining agricultural land, particularly in biodiversity-rich regions (Figure 9). Global projections indicate that agricultural land use could decline by -10.8%, with the sharpest reductions occurring in low- and lower-middle-income countries. The most pronounced impacts are expected in Africa, where agricultural land could shrink by -17.1%, and in Latin America, by -19.1%. In contrast, the effects appear more moderate in high-income regions such as the EU, where the projected decline is around -1.6%. These spatial redistributions of land use are accompanied by substantial price adjustments: global agricultural land prices are projected to rise

by an average of +14.1%. Within the EU, land values increase by +10.5%, with particularly strong pressures in the Netherlands (+23.5%), Germany (+14.9%) and Italy (+15.2%).

As biodiversity-rich regions allocate more land to conservation, agricultural production increasingly shifts toward biodiversity-poor countries to meet the growing global demand for food and biological resources. Model projections indicate that production volumes decline markedly in Africa, India and Latin America, while they increase in the EU by +5.4% (equivalent to 51.8mn tons), reflecting lower exposure to land constraints and a parallel rise in agrifood exports. The most pronounced global declines occur in oilseeds and sugar beet (-3.8%, or 191.2mn tons) and in horticultural products (-3.3%, or 130mn tons), with losses concentrated in Africa, Latin America and South and East Asia. Within the EU, output growth is driven primarily by cereals and horticulture, particularly in France, Germany and Italy. Trade patterns evolve accordingly: African countries experience a -11.1% reduction in export volumes, reflecting weaker production capacity, and a corresponding +16.5% increase in food imports by 2050. In contrast, European exports expand by +11.9%, supported by productivity gains and further intensification of agricultural practices. These shifts suggest that global conservation efforts could reshape agricultural geography, amplifying regional disparities in production capacity, trade balance and food security.

Figure 9: Description of the half-earth scenario and its consequences



Sources: Kok et al. (2023)⁴, BIROFIN, Allianz Research

These structural changes in production and trade also translate into higher agricultural commodity prices (Figure 10)⁵. By 2050, global prices are projected to increase by +15.2% compared with the baseline, reflecting tighter land availability and reduced output in biodiversity-rich regions. The strongest price effects are observed in cocoa-producing areas of Africa (+38.1%) and Central America (+34.2%), where the contraction in arable land and limited scope for intensification constrain supply. Broader price pressures are evident across Africa (+23.9%), driven by reduced export capacity and greater dependence on food imports. In contrast,

Europe and East Asia experience more moderate increases, ranging from +7% to +10%, supported by higher productivity and stronger trade positions. These results show the critical impact of large-scale conservation and protection policies, while critical for biodiversity, could generate asymmetric price and welfare impacts, underscoring the need for productivity-enhancing investments and inclusive trade mechanisms to mitigate food security risks in already vulnerable regions.

⁴ Assessing ambitious nature conservation strategies in a below 2-degree and food-secure world - ScienceDirect

⁵ These results are the simulation outcomes of the MAGNET model

38.1% 34.2% 23.9% 15.2% 11.3% 10.0% 8.8% 8.8% 7.8% 7.3% 7.2% 6.0% North Africa **EU27** Middle Rest of EU Rest of Cocoa Central World Rest Latin East Asia Stans producers America America Fast Europe Africa Africa

Figure 10: Change in agricultural commodity prices under the Half-Earth scenario relative to the baseline (2050)

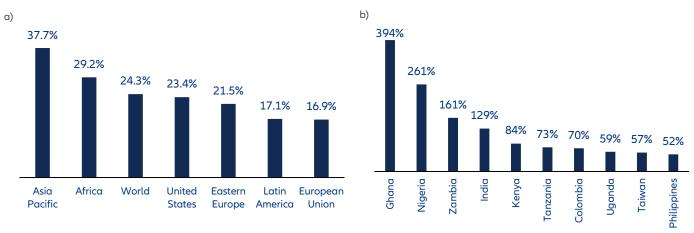
Sources: BIROFIN, Allianz Research

Food-price increases induced by the Half-Earth scenario are expected to feed through inflation channels and raise the global consumer price index (CPI). Using an econometric pass-through model combined with the Oxford Economics, we estimate the cumulative increase in CPI over the period 2025–2050 relative to the baseline (Figure 11). The results suggest that biodiversity-driven production constraints could have a significant and persistent impact on global inflation dynamics. By mid-century, the world average CPI rises by about +24% (cumulative 2025 – 2050), with pronounced regional disparities (Figure 11a). The Asia-Pacific region experiences the sharpest cumulative increase (+37.7%), reflecting its high exposure to climateand biodiversity-related shocks in agriculture and food supply chains (result discussed in our previous research⁶). Africa follows with an increase of +29.2%, driven by import dependency and limited fiscal buffers to absorb food price volatility. In contrast, price effects remain more contained in the EU (+16.9%) and Latin America (+17.1%), where higher productivity or stronger policy responses might help mitigate inflationary pressures.

At the country level, African economies – particularly those in cocoa-producing regions – are projected to face the most severe inflationary impacts as food systems are both biodiversity-dependent and highly exposed to climatic variability. Ghana (+394%), Nigeria (+261%), and Zambia (+161%) are among the hardest hit, where food represents a large share of household consumption baskets (Figure 11b). Asian economies such as India (+129%), Taiwan (+57%) and the Philippines (+52%) also face substantial inflationary effects due to production declines and import price shocks. These results highlight how large-scale conservation, while environmentally necessary, could amplify inflation differentials between advanced and developing economies, underscoring the need for inclusive biodiversity protection strategies.

⁶ Feeding a warming world: Securing food and economic stability in a changing climate | Allianz

Figure 11: Cumulative increase in CPI for the period 2025 – 2050 compared to baseline: a) Regional cumulative CPI increase; b) Country level CPI increase (10 most affected countries)



Sources: Oxford Economics, Allianz Research

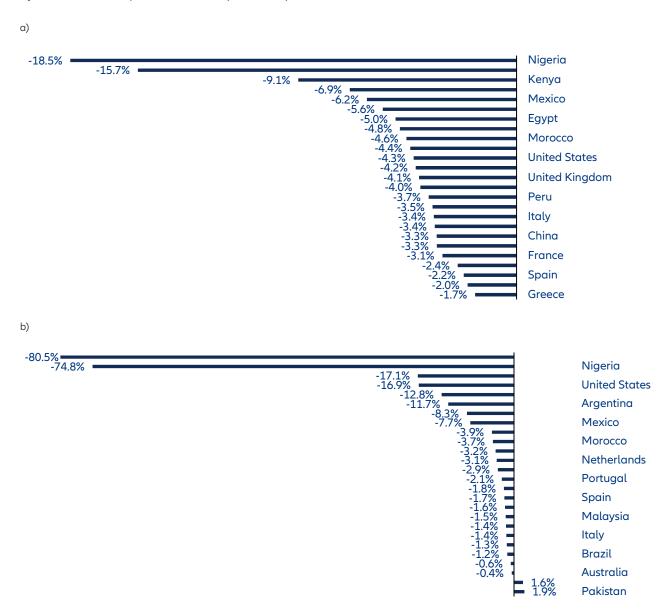
These inflationary pressures translate into tangible economic consequences, as reflected in the projected changes in real GDP per capita (Figure 12a). The results show a widespread cumulative (2025 – 2050) decline in per capita GDP across both emerging and advanced economies, underscoring the macroeconomic costs of the land-use adjustments required under the Half-Earth scenario. The largest contractions are observed in Nigeria (-18.5%) and Kenya (-15.7%), where high inflation, declining agricultural productivity and heavy reliance on food imports erode household purchasing power and slow economic growth. Other emerging economies such as Mexico (-6.2%), Egypt (-5.0%), and Morocco (-4.6%) also experience notable per capita GDP losses. Advanced economies are comparatively less affected, with moderate declines in the US (-4.3%), the UK (-4.2%), and EU members such as Italy (-3.4%) and France (-3.1%), reflecting stronger fiscal resilience and adaptive capacity.

The Half-Earth scenario also entails substantial implications for household disposable income, reflecting how protection policies translate into welfare losses (Figure 12b). Between 2025 and 2050, cumulative income losses are particularly severe in sub-Saharan Africa. Ghana (-80.5%) and Nigeria (-74.8%) record the steepest declines in household disposable

income, followed by Egypt (-17.1%) and Tunisia (-12.8%), as households face both falling real wages and rising food prices. Outside Africa, significant impacts are observed in the US (-16.9%), Argentina (-11.7%), India (-8.3%), and Mexico (-7.7%), which might be driven by reduced export revenues and slower economic growth. Advanced economies experience smaller but still nonnegligible reductions in disposable income – around -2% to -4% across European countries.

These results underline the uneven social cost of large-scale conservation, where without compensatory policies, biodiversity protection could deepen global income inequality and threaten social stability in already fragile regions. This reinforces the importance of integrating biodiversity protection with economic transition planning, ensuring that conservation pathways are accompanied by social safety nets, productivity-enhancing investments and international financial support mechanisms to prevent deepening global inequality.

Figure 12: Economic cost of the half-earth scenario: a) cumulative country-level per capita GDP (PPP, USD) decline (2025 – 2050); b) cumulative country-level households disposable income loss (2025 – 2050)



Sources: Oxford Economics, Allianz Research

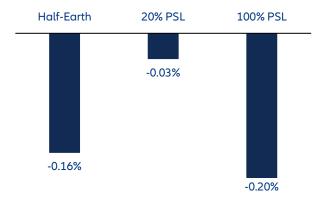
An ambitious pathway to protect nature and reverse biodiversity loss inevitably entails economic costs.

However, these costs are significantly lower than the losses societies would incur from the continued degradation of ecosystem services on which all economies depend. In a previous study⁷, we estimated that the loss of pollinators alone – just one of the 25 ecosystem services identified in the ENCORE database - could reduce global per capita GDP, in the EU, UK and the US, by -0.2% by 2050 relative to the baseline. This impact is 0.04pp higher than the projected cost of implementing the Half-Earth scenario in the same year (Figure 13a). When considering additional ecosystem services such as soil fertility, air and water quality and climate regulation, the cumulative economic toll of biodiversity decline would far exceed the cost of ambitious conservation, making economic and social stability under pressure.

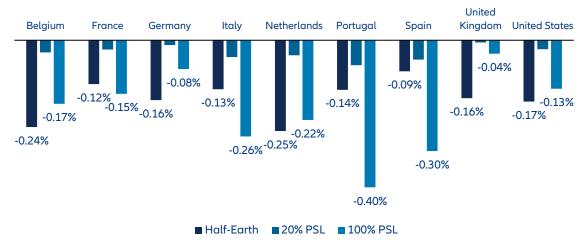
A closer look at the countries reveals a similar pattern as seen globally (Figure 13b). In fact, four out of nine countries – Spain, Italy, Portugal and France – are projected to experience greater economic losses under a pollinator loss scenario than under the Half-Earth scenario. Other advanced economies display comparable magnitudes of per capita GDP decline across both cases. For example, by 2050, the US would see losses of -0.17% under the Half-Earth scenario and -0.13% under pollinator loss, while the Netherlands would record declines of -0.25% and -0.22%, respectively. These results suggest that even in developed nations, the loss of a single ecosystem service can inflict macroeconomic damages comparable to those associated with large-scale conservation efforts.

Figure 13: Benefits of the Half-Earth scenario: a) Aggregated per capita GDP decline in the EU-UK-US; b) Per capita GDP decline by country (EU-UK-US)

a)







Sources: Oxford Economics, BIROFIN, Pamuk et al. (2023)8, Allianz Research

⁷ The new risk frontier in finance: biodiversity loss | Allianz

⁶ Bending the curve for biodiversity loss and economy: case study evidence from pollination services loss - Wageningen University & Research



Beyond the Half-Earth scenario

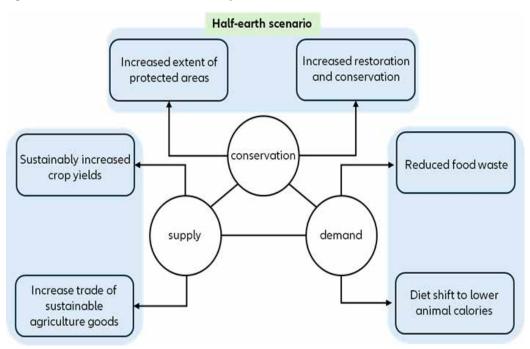
The Half-Earth scenario highlights the magnitude of the transformation required to halt biodiversity loss while maintaining global food security. Extending protected areas and restoring degraded ecosystems are necessary but insufficient on their own. Without complementary actions to rebalance supply and demand, conservation efforts risk being offset by landuse displacement and rebound effects (Figure 14). The success of such a pathway depends on how efficiently agricultural systems can produce more from less, how consumption patterns evolve and how international trade is governed.

On the supply side, productivity gains must come from sustainable intensification. Improving yields through better soil management, crop diversification and regenerative practices rather than chemical inputs or further land conversion. Expanding the trade of sustainably certified agricultural goods can help reduce the pressure on biodiversity-rich regions by aligning market incentives with environmental performance.

Equally, investments in technology, climate-resilient crops and nature-positive farming are critical to maintaining output while restoring ecosystem health.

On the demand side, shifting dietary habits and reducing food waste are decisive levers. Lowering the share of animal-based calories and halving food losses along the supply chain could free millions of hectares for nature restoration, while also cutting agricultural emissions and water use. Yet, behavioural change requires targeted public policies – pricing reforms, education campaigns and fiscal measures – to make sustainable consumption accessible and attractive.

Figure 14: Efforts to reverse trends in biodiversity



Sources: Leclère et al. (2020)9, Allianz Research

Simulation results clearly show that no single policy lever can reverse global biodiversity decline.

Figure 15 illustrates the projected evolution of the Living Planet Index (LPI) relative to its 2010 level under different scenarios. Under a business-as-usual trajectory, where production and consumption patterns remain unsustainable and conservation efforts limited, biodiversity continues to collapse – with the LPI projected to fall by -39% by 2050 and by -54% by 2100 compared with 2010. When isolating either supply-side measures or demand-side measures, results improve only marginally. In these single-pillar pathways, the LPI still declines by -44% and -39% by 2100 relative to 2010, respectively, underscoring the limited impact of fragmented action. By contrast, a conservation-only strategy – akin to the Half-Earth scenario – would significantly slow biodiversity degradation but not reverse it. In this case, the global LPI stabilizes close to 2010 levels, showing only a -2% decline by 2100. These findings emphasize that biodiversity recovery requires simultaneous progress on three fronts: protecting and restoring ecosystems, transforming production systems and reshaping consumption patterns. Addressing all three pillars simultaneously – conservation, sustainable production and responsible consumption – is essential not just to halt biodiversity loss, but to achieve genuine recovery. Modelling results show that integrating either supply- or demand-side measures with ecosystem protection could raise the Living Planet Index (LPI) by +26% and +54%, respectively, in 2100 relative to its value in 2010. Yet, only the scenario of conservation with addressing demand will allow to revert biodiversity to level higher than in 1970 starting from 2060. When all three levers are implemented together, the impact becomes transformational: the LPI more than doubles (+109%) by 2100 compared to its 2010 level, surpassing even the biodiversity levels recorded in 1970 from 2040 (around +31% above 2010). This outcome demonstrates that a comprehensive, system-wide strategy – linking land-use protection, sustainable food production and consumption change - is stabilizing nature and allowing its restoration to a healthier and more resilient state.

⁹ Bending the curve of terrestrial biodiversity needs an integrated strategy | Nature

120% 100% 80% 2040 reverting point 2060 reverting point 60% 40% 20% 0% -20%¹⁹70 1990 2010 2050 2070 2090 2030 -40% -60% Integrated action Demand and conversation Only demand Supply and conservation Only supply Only conservation (e.g. half-earth) Current policies Historic **- - -** 1970 value

Figure 15: Estimated future trend in biodiversity for different scenarios: Deviation of the Living Planet Index (LPI) comparing to 2010

Sources: Leclère et al. (2020), Allianz Research

The Kunming-Montreal Global Biodiversity Framework (GBF) recognizes the central role of area-based conservation in achieving its overarching biodiversity goals. The commitment to protect at least 30% of global land and ocean by 2030 (the "30×30 target") has emerged as a key strategy to curb nature degradation, in line with the most recent scientific evidence (see Figure 15). However, while conservation areas are essential for maintaining natural habitats, the mere designation of large Protected and Conserved Areas (PCAs) does not automatically translate into positive biodiversity outcomes as their effectiveness depends critically on strategic spatial planning. PCAs must be established in regions of high biodiversity value and designed to maintain ecological connectivity with surrounding habitats¹⁰.

There is no consensus on the optimal size of PCAs, though several benchmarks have been proposed. To ensure the protection of functioning ecosystems, the IUCN developed a global Standard for Key Biodiversity Areas¹¹, suggesting a potential minimum threshold of 10,000 km². Other organizations have adopted smaller, context-specific criteria, particularly for tropical regions. For instance, the Wildlife Conservation Society (WCS) structures its conservation programs around areas of at least 5,000 km²; Germany's Legacy Landscapes program recommends a minimum of 2,000 km²; and African Parks identifies "core anchor areas" of exceptional biodiversity importance starting from 500 km².

¹⁰ <u>Scaling up area-based conservation to implement the Global Biodiversity Framework's 30x30 target: The role of Nature's Strongholds | PLOS Biology</u>

¹¹ 2016-048.pdf

Related studies have further highlighted the importance of spatial configuration and ecological contiguity in defining conservation strongholds.

Building on previous analyses, researchers identified groups of PCAs that were either physically or ecologically connected, forming large conservation complexes, as well as clusters of PCAs that, while not contiguous, shared management frameworks or ecological coherence across broader landscapes. In both Central Africa and Amazonia, these strongholds were found to be embedded within broader Key Landscapes for Conservation (KLCs) delineated through EU-supported initiatives. These consolidated landscapes were extensive, averaging about 62,000 km² in Central Africa and more than 217,000 km² in Amazonia, showing the scale required to maintain ecological integrity and long-term conservation outcomes.

Beyond spatial design and connectivity, the effectiveness of PCAs ultimately depends on how they are managed and governed. Robust governance structures and inclusive management systems are essential to ensure that conservation outcomes are durable, equitable and responsive to local realities. Systems of governance and management vary widely across regions, reflecting political, institutional and cultural contexts. In Central Africa, national government agencies typically retain primary authority over most PCAs, while more decentralized arrangements characterize community reserves, forest management units, and local community forest concessions. Collaborative management partnerships between governments and international or national NGOs have also become increasingly common, facilitating capacity building and co-management. In Amazonia, in addition to PCAs managed by national governments, state and municipal authorities play a significant role, and devolved governance models are prevalent in extractive reserves, Indigenous territories and sustainable development reserves.





Bridging the biodiversity finance gap

The global biodiversity finance gap is vast – roughly USD700bn per year according to the Kunming-Montreal Global Biodiversity Framework (GBF) – far exceeding current flows. For example, the UNEP and World Bank analysis highlights that achieving GBF targets requires mobilising an additional USD700bn annually, including phasing out about USD500bn of biodiversity-harmful subsidies and raising about USD200bn from all sources (public, private, ODA, innovative schemes). In contrast, total annual investment in biodiversity conservation is estimated around USD143bn, well below the USD824bn needed for transformational results¹².

This funding gap directly mirrors the implementation deficits and systemic inertia described in earlier chapters. Halting biodiversity loss requires not only a robust scientific and spatial strategy, but also a coherent enabling environment that includes adequate, predictable and equitable financing. While private finance for nature is expanding – from USD9.4bn in 2020 to USD102bn by May 2024¹³ – it still represents a fraction of what is needed to support integrated conservation, sustainable land use and equitable benefit-sharing at scale. The GBF itself calls for mobilising at least USD200bn per year by 2030 (with interim targets of USD20bn by 2025 and USD30bn by 2030 in international flows). Without closing the finance gap, the ambitious spatial and governance shifts discussed here - such as safeguarding high-integrity ecosystems, securing Indigenous land tenure and investing in ecological connectivity – will remain aspirational rather than actionable.

 $^{^{12}\ \}underline{\text{https://sdg.iisd.org/commentary/guest-articles/conservation-finance-investing-in-people-and-the-planet/}.$

https://www.unepfi.org/publications/from-kunming-montreal-to-cali-is-the-financial-system-on-track/

To close this gap, innovative financial instruments, such as blended finance and nature credit, are essential. The GBF strategy explicitly emphasizes mobilizing finance via public budgets, private-sector contributions (mentioned 19 times in the strategy text), philanthropy, multilateral development banks, blended finance and market mechanisms. For example, governments have committed to: (1) scale up biodiversity investments through impact funds, blended finance and public-private partnerships (PPPs); (2) integrate biodiversity into disclosure and risk frameworks (e.g. TNFD-aligned reporting); and (3) reform incentives by eliminating USD500bn of harmful subsidies by 2030. The OECD also calls for leveraging private finance via blended instruments: stimulating green bonds, payments-for-ecosystems services (PES), biodiversity offsets/credits and benefit-sharing mechanisms¹⁴. In practice, this means using public concessional capital (e.g. MDB guarantees under InvestEU) to attract private co-investment in restoration, conservation and naturebased infrastructure.

Several EU and global initiatives exemplify these approaches. At the EU level, the InvestEU programme (2021–2027) has a dedicated natural capital window aiming to mobilise at least EUR10bn over ten years for nature-positive projects through public-private blending¹⁵. The EU has also committed to allocate 10% of its budget to biodiversity by 2026, and an EU study estimates a EUR19bn annual gap in financing the EU's own 2030 biodiversity strategy. New policy tools like France's Sites Naturels de Compensation, Restauration et Renaturation (SNCRR) are emerging: a hybrid financing vehicle enacted in 2023 to diversify revenue streams for ecosystem restoration and "compensation" sites (complementing traditional mitigation banking)¹⁶. Globally, the Global Environment Facility's (GEF) Global Biodiversity Framework Fund (GBFF) – launched in 2023 after COP15 – is channelling international funding to GBF implementation. At COP16, for instance, eight governments pledged an additional USD163mn to the GBFF, bringing total contributors to 12 countries. The GBFF's mandate is to support developing countries and mobilize further contributions (public, private and philanthropic) with streamlined procedures; its investments explicitly aim to leverage private finance via blended co-financing¹⁷.

Insurers have a dual role in managing nature-related risks and supporting nature-positive outcomes. On the risk side, ecosystem degradation is creating new liabilities and systemic threats. For example, biodiversity loss can increase the frequency or severity of extreme events (e.g. more severity of floods related to wetland degradation) and lead to stranded assets or legal risks as regulations tighten¹⁸. Proactively, insurers can protect natural assets to reduce these risks. Three classes of insurer interventions need to be highlighted in the context of nature-positive insurance:

- Insuring natural assets and solutions: Underwrite the protection and restoration of ecosystems. For example, insurers can offer coverage for forests, wetlands, mangroves or coral reefs (asset insurance) and for projects that build or maintain nature-based solutions (e.g. insurance on sediment retention basins, carbon-rich landscapes). This "insurance for nature" de-risks conservation investments and can make restoration credit transactions more bankable. Examples include parametric policies that pay out for reef restoration after storms or insurance pools for watershed rehabilitation.
- Transition insurance: Underwrite businesses adopting nature-positive practices. Insurers can provide coverage for firms moving to regenerative agriculture, sustainable forestry or other low-impact models, with premiums that reward those practices. They can also insure the risks of transition (e.g. financing new infrastructure or process changes). By incorporating biodiversity performance (KPIs) into product terms or pricing, insurers create market incentives for clients to reduce nature loss.
- Physical risk coverage: Offer products against new ecosystem-related hazards (e.g. crop failure from pollinator loss, water scarcity, invasive pests). These policies often encourage risk reduction through ecosystem management (e.g. lower premiums for farms using hedgerows or agroforestry to conserve soil health).

¹⁴ https://www.oecd.org/en/publications/biodiversity-and-development-finance-2015-2022_d26526ad-en.html

https://knowledge4policy.ec.europa.eu/biodiversity/eu-action-biodiversity-financing_en

¹⁶ https://www.cdc-biodiversite.fr/wp-content/uploads/2024/07/DOSSIER-MEB-55-SNCRR-MD.pdf

https://www.unep.org/gef/news-and-stories/press-release/boost-nature-governments-announce-163-million-new-pledges-global

¹⁸ https://www.unepfi.org/industries/insurance/insuring-a-resilient-nature-positive-future-global-guide-for-insurers-on-setting-priority-actions-for-nature/

Overall, insurers are in a unique position to innovate in this space. Priority actions include developing industry standards for biodiversity impact screening and disclosure (building on initiatives like the Insurance Sector Disclosure Project), and adopting risk-based underwriting that avoids financing nature-damaging activities. By expanding coverage to new areas (blue carbon, wildlife corridors, parametric triggers tied to ecological indicators), insurers can grow new markets while contributing to GBF targets on risk reduction and nature restoration.

Key actions for the investment sector: Asset managers and banks must align portfolios with biodiversity goals. Financial institutions should incorporate nature-related risks and dependencies into due diligence, alongside climate risks. Tools like the Taskforce on Nature-related Financial Disclosures (TNFD) are critical – over 400 companies and financial firms had joined TNFD by late 2024¹⁹, committing to report on nature impacts. Investors are also developing "nature-positive" products: as of September 2024, there were 24 dedicated biodiversity funds (totalling USD1.6bn) and emerging ETFs/indexes with nature-related screens. Debt-for-nature swaps and green bonds explicitly funding conservation are another avenue (an estimated USD100bn could be freed via debt swaps)²⁰.

Key steps for investors include: screening out activities harmful to biodiversity (e.g. deforestation-linked operations), raising new capital for nature (impact funds, sustainable infrastructure projects) and enhancing disclosures. The EU Sustainable Finance Taxonomy is evolving to include biodiversity; many countries are developing similar nature-inclusive taxonomies. Meanwhile, public–private investment platforms (like the World Bank's early Wildlife Conservation Bond) show how blended finance can attract institutional investors to nature projects. Overall, the sector must shift from "nature-blind" investing to integration of biodiversity into risk and opportunity assessment – consistent with GBF Target 15 on business disclosures and Target 14 on aligning financial flows.

To scale up finance effectively, strong policy frameworks and partnerships are needed. Regulatory mandates (e.g. requiring biodiversity disclosure, setting high environmental safeguard standards) will compel insurers and investors to align with the GBF. Public incentives – such as taxonomies, subsidies for nature-based enterprises and expanded use of public capital (e.g. InvestEU guarantees, MDB funds) – are essential to de-risk private investment. In Europe, the "do no net loss" principles and finance laws already bind public spending to biodiversity goals, and the EU's new GEF-like Global Biodiversity Finance Fund (GBFF) will coordinate multilateral funding.

Public-private partnerships are also crucial. The UNEP-FI-financial-sector roadmap – among others – urges financial institutions to support blended vehicles and PPPs for biodiversity. Insurers and investors can join partnerships (e.g. the Finance for Biodiversity Pledge) and co-financing schemes that pool climate and nature finance. Multi-stakeholder initiatives (such as the Coalition for Climate Resilient Investment) are broadening to include biodiversity risk, reflecting the nexus with climate. The insurance and investment sectors have both an opportunity and an obligation to pivot: by innovating nature-friendly financial products (blended risk pools, biodiversity bonds), adopting stringent risk management (TNFD disclosures, nature KPIs) and reorienting capital towards restoration and conservation, they can help close the USD700bn annual finance gap. At the same time, governments must continue to signal this priority through subsidy reform, and platform-building (e.g. InvestEU, GBFF, France's SNCRR) to ensure private flows are aligned with biodiversity goals.

¹⁹ https://www.unepfi.org/publications/from-kunming-montreal-to-cali-is-the-financial-system-on-track/

²⁰ https://www.msci.com/research-and-insights/blog-post/the-climate-nature-nexus-a-primer-on-the-way-to-cali and https://sdg.iisd.org/commentary/guest-articles/conservation-finance-investing-in-people-and-the-planet/



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