The Economics of Biodiversity Loss and Climate Change: Implications for Asia and the Pacific

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1 Introduction

There is growing recognition that planetary health underpins economic stability and growth (European Central Bank 2024; Financial Stability Board 2024). Biodiversity, one of the planetary boundaries at high risk of degradation from human activity, supports essential ecosystem services such as agriculture, fisheries, flood control, and pest regulation, all of which are fundamental inputs into the broader economic production process. As a result, losses in biodiversity can have severe consequences for human welfare. Countries in Asia and the Pacific have already experienced episodes where biodiversity losses negatively affected human societies. For example, the collapse of vulture populations in the Indian subcontinent has been shown to increase mortality rates, with estimated damages of $69.4 billion annually (Frank and Sudarshan 2024). Similarly, coral bleaching and habitat degradation in Southeast Asia's Coral Triangle threaten the livelihoods of over 100 million people (ADB 2016). Additionally, the desiccation of the Aral Sea has triggered widespread local extinctions and devastated industries such as fishing (NASA Earth Observatory 2014).

Climate change—another key planetary boundary—exacerbates these declines in biodiversity and is worsened by losses in carbon sequestration services provided by nature. Together, the joint dynamics of climate change and biodiversity loss contribute to a "twin-crises multiplier," which amplifies the individual effects of each process on economic productivity (Giglio et al. 2025). At the same time, the link between climate change and biodiversity presents opportunities for a positive feedback cycle. Increased biodiversity conservation efforts are crucial in mitigating this twin crisis, as they enhance carbon absorption, boost ecosystem resilience, support climate adaptation, and safeguard the natural capital essential for long-term economic growth and stability; this, in turn, raises overall economic benefits from conservation efforts. Likewise, interventions aimed at mitigating and adapting to climate change can have virtuous spillover effects on biodiversity and nature.

This chapter is divided into three sections that develop our argument. The first section reviews the economic importance of biodiversity loss, both in general and for Asia and the Pacific specifically. The second section describes the interaction between biodiversity loss and climate change, which lies at the core of the "twin-crises multiplier" dynamics. The final section proposes potential policies and financial solutions focused on protecting nature, highlighting the key difference between policies aimed at addressing climate change and those targeting biodiversity loss: while climate change is ultimately driven by one factor (greenhouse gas emissions), the value of biodiversity is context-dependent (e.g., the same species may have different values in different ecosystems).

2 Biodiversity Loss and Economic Activity.

The current state of biodiversity in Asia and the Pacific. Home to many richly biodiverse ecosystems, Asia and the Pacific is among the regions most vulnerable to biodiversity loss. Using data from the Environmental Performance Index (EPI) published by the Yale Center for Environmental Law and Policy, Giglio et al. (2024) developed a biodiversity destruction score that tracks biodiversity loss across countries.[1] Figure 1 shows biodiversity destruction scores for countries within and near Asia, where data is available. This set includes ADB developing member countries (DMCs), Asian economies that have graduated from ADB assistance (e.g., Singapore, the Republic of Korea), as well as geographically proximate countries in West Asia and territories associated with other continents. This approach ensures consistent comparisons across neighboring economies.

Figure 1: Biodiversity Destruction Scores in Asia

Note: The figure shows country-level Biodiversity Destruction Scores for ADB developing member countries and other Asian and neighboring regional economies, as constructed in Giglio et al. (2024) using the 2022 Environmental Performance Index (EPI) from the Yale Center for Environmental Law & Policy. The measure aggregates relevant biodiversity indicators from the EPI, including the Species Habitat Index, Biodiversity Habitat Index, Ecosystem Services, and Fisheries. Scores are rescaled from 0 to 100, with higher values indicating greater biodiversity destruction.
Source: Giglio et al. (2024)

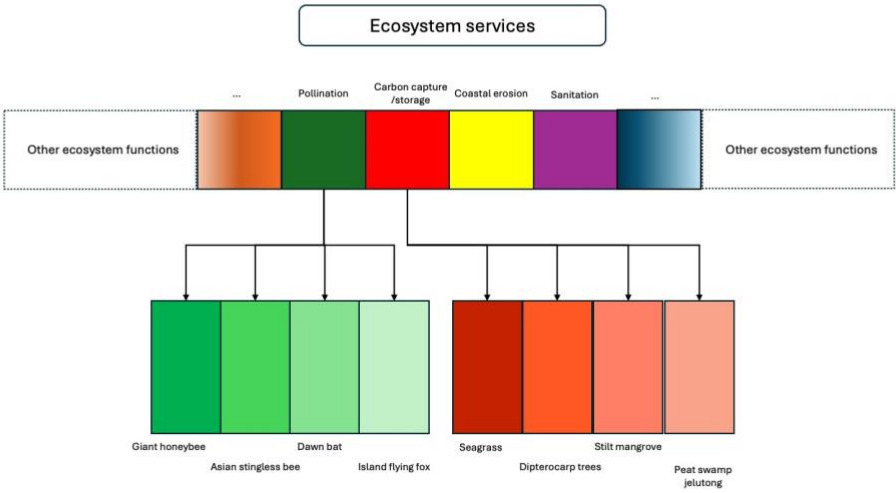
Southeast Asia, in particular, faces high levels of biodiversity loss, as the region's rapid economic growth in recent decades has come at the expense of natural resources. Climate

[1] The biodiversity destruction score constructed in Giglio et al. (2024) measures biodiversity destruction relative to a baseline in a given country. The score is rescaled from 0 to 100, with higher values indicating greater biodiversity destruction.

change and unsustainable fishing practices have also driven the decline of the region's marine biodiversity, with the Coral Triangle being a key example.

The impact of biodiversity loss on economic activity. Tracking (and mitigating) biodiversity loss is crucial because biodiversity plays an important role in the economic production process. Specifically, biodiversity contributes to providing *ecosystem services*, which are essential factors of production that perform a variety of *functions.* These include "provisioning services," such as food, fuel, timber, and raw materials for pharmaceutical research and development (R&D), as well as "regulating services," such as pollination, the provision of clean air and water, carbon sequestration, and pest and natural hazard regulation (Daily, 1997; Daily et al. 2000; Chichilnisky and Heal 1998; Heal 2000; Dasgupta 2021). Importantly, ecosystem services are generally complementary to other factors of production typically studied in economics, such as capital and labor. In other words, the effects of declines in ecosystem services on output are generally hard to offset with increases in these other factors (Cohen et al. 2019; Dasgupta 2021). To explain how biodiversity enters the production of ecosystem services and how biodiversity loss affects economic activity, we follow the framework introduced in Giglio et al. (2023).

Figure 2: Ecosystem Functions and Species



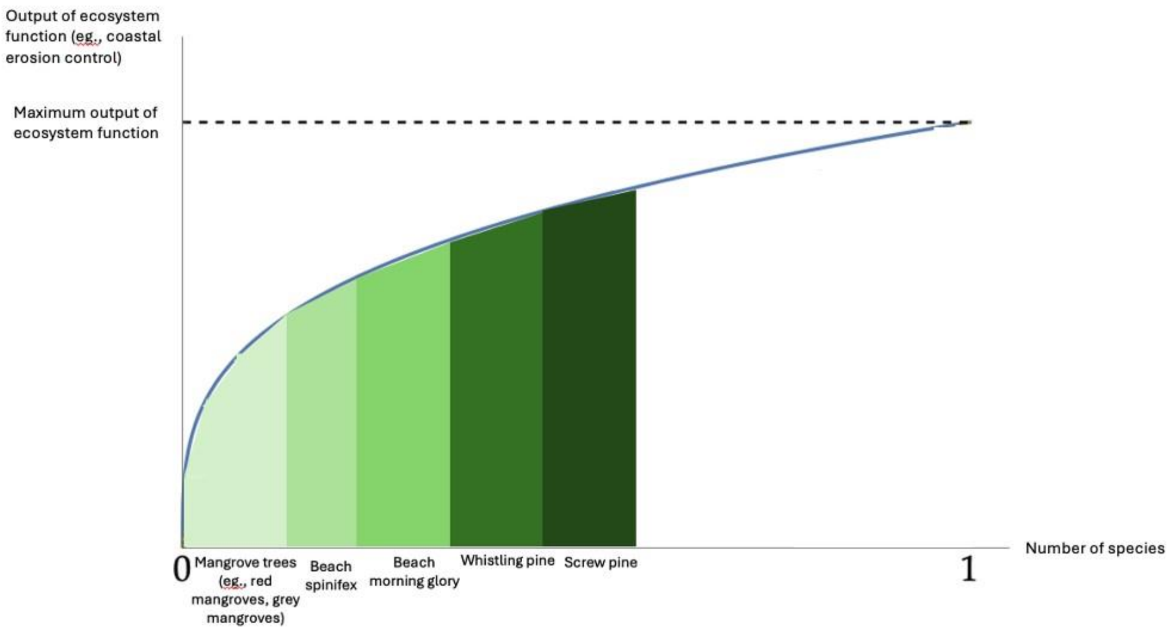
Source: Giglio et al. (2024)

In this model, ecosystem services are a key factor of production, alongside other factors such as capital and labor. They are produced by combining various ecosystem *functions,* including various provisioning and regulating services. Insights from the ecology literature indicate that these functions are complementary: each contributes most effectively when the others are also working well, and the decline of one function cannot be easily compensated for by increases in the others (Ekins et al. 2003; Dietz and Neumayer 2007; Cohen et al. 2019; Dasgupta, 2021). For example, the negative effects of declines in pollination on overall ecosystem functioning cannot be easily offset by increasing pest control, and vice versa. Figure 2 presents a few illustrative examples of functions (each represented by a different color in the upper part of the figure): pollination, carbon capture/storage, and coastal erosion, among others.

Each function arises from the interplay among potentially many species; within any given ecosystem, multiple species often share highly, though not perfectly, substitutable primary functions. For example, different algae and aquatic plants contribute to the food supply for fish and larger marine animals. The interaction of species that contribute to each function is depicted in the bottom layer of Figure 2, with varying shades of the same color. For example, pollination (in green) is provided by different species that are partially substitutable with one another, such as honeybees and bats.

The ecology literature has consistently documented a positive but concave relationship between the biodiversity within a function and the function's productivity (Diaz and Cabido 2001; Hooper et al. 2005; Oliver et al. 2015). When a new species is added, it typically does not compete fully for resources with existing species due to "niche differentiation in resource extraction," allowing a greater number of members or organisms to be sustained within a function. In addition, "niche differentiation in services provision" means that more biodiverse functions are often more productive, even holding the number of organisms fixed. For example, when different pollinators operate at different temperatures or times of the day, 100 members of one species are less productive than 50 members each of two species. Together, these two types of niche differentiation indicate that total production usually increases with the number of distinct species (see Naeem et al. 1995; Tilman et al. 2014; Hector et al. 1999). However, the marginal value of adding a somewhat redundant species is decreasing in the existing level of biodiversity, which induces concavity in the overall biodiversity-productivity relationship (Liang et al. 2016). Figure 3 illustrates this increasing and concave relationship between biodiversity (horizontal axis) and the production of ecosystem services (vertical axis), using coastal erosion control as an example of an ecosystem function.

Figure 3: Biodiversity-Productivity and Biodiversity-Stability



Source: Giglio et al. (2024)

How, then, does biodiversity loss affect economic output? We can use this model to track the mechanism. The loss of a species that performs a key function—such as bees providing pollination—reduces the output of that function. This impact may be limited in ecosystems where biodiversity remains high, as other pollinators can substitute for the lost species. However, in already degraded systems, the remaining species may be insufficient to maintain the same level of function, leading to more severe consequences. This is clearly illustrated in Figure 3: starting from the right (a more intact ecosystem), the initial losses in biodiversity have milder effects on function-level productivity than later losses. Beyond the concavity at the function level, there is an additional effect due to the complementarity among functions: biodiversity losses in functions that are already degraded, whose output is a constraint on overall ecosystem productivity, will have larger effects on the overall health of the ecosystem. Finally, there is another layer of potential complementarity if ecosystem services themselves are complementary with other factors like capital. This additional complementarity suggests that nature loss might have the largest effects on countries where ecosystem services—and not physical capital or labor—are relatively scarce, thus becoming the key constraint on aggregate production.

The overall effect of biodiversity loss on economic production percolates through these layers of substitutability (at the function level) and complementarity (across functions and potentially across factors of production), yielding a highly nonlinear relationship between biodiversity and economic output. Each species loss makes the ecosystem more *fragile*—that is, more vulnerable to further losses. When biodiversity losses affect particularly non-replaceable species (so-called keystone species), especially in critical (i.e., highly necessary) functions, the loss of even one species could have significant effects on human welfare. The cases mentioned above (e.g., the loss of the vulture population in India) are an example of this mechanism in action.

It is important to note that biodiversity loss does not always lead to large short-run economic losses. Particularly when ecosystems' biodiversity is still relatively intact, some loss of species may not have large immediate economic effects, but it will always make ecosystems—and therefore the economy—more exposed to further losses. This is why it is crucial to not only track current economic losses due to biodiversity but also to measure the *risks* that future biodiversity losses pose to the economy.

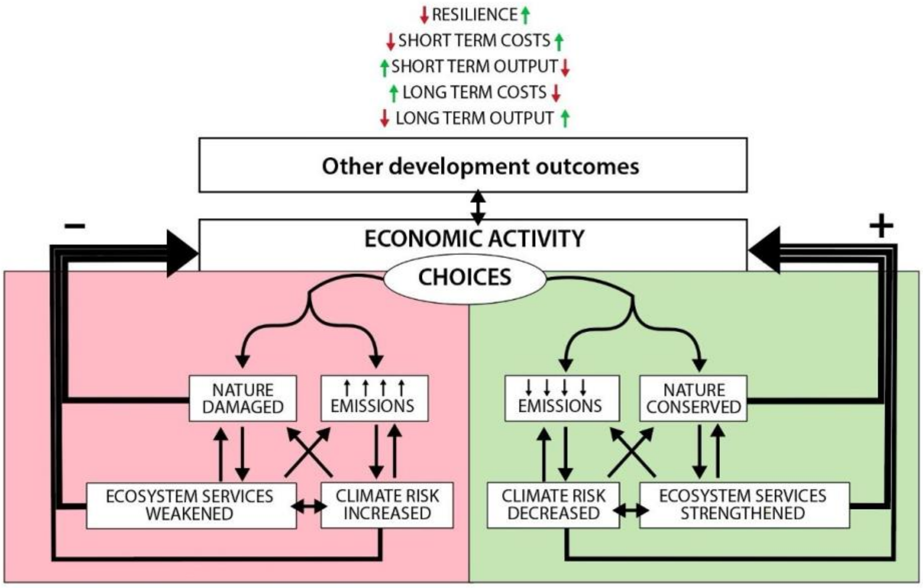
Biodiversity loss also has implications for long-term growth: any complementarity between ecosystem services and other factors of production means that degrading the ecosystem today increases the likelihood that nature will become a constraining factor of production in the future, thus limiting potential for long-term growth and increasing the likelihood of fiscal stress. This is a particularly important consideration for developing countries aiming for sustainable growth, given that nature, once lost, is hard to reaccumulate in the future (unlike physical capital and labor, which are easier to build over time).

These mechanisms underscore the importance of biodiversity conservation. In ecosystems with greater fragility, the conservation of keystone species is crucial for preventing significant negative effects of further biodiversity losses on economic output and human welfare. There are also tangible benefits to conserving species in less fragile ecosystems: such actions preserve ecological stability, buffering against future economic risks from biodiversity loss, while also ensuring the continued provision of ecosystem services and functions as the economy grows.

3 The Climate-Biodiversity Nexus

Studying the economic effects of biodiversity loss in isolation overlooks an important interaction with another fundamental nature-related source of economic damage: climate change. The joint dynamics of biodiversity and climate change are discussed in depth in Giglio et al. (2025), which formalizes the concept of the "twin-crises multiplier."

Figure 4: Illustration of the Twin-Crises Multiplier



Source: Giglio et al. (2024)

Climate change interacts with the economy and biodiversity in several ways. Figure 4 provides a graphical representation based on Giglio et al. (2025). The left side of the figure shows the negative cycle induced by economic activity on climate change and biodiversity, along with their interactions. The right side of the figure shows the virtuous cycle induced by conservation, which can minimize biodiversity loss and, indirectly, climate change.

Consider the left panel first. As is well known from the extensive climate economics literature, climate change is generally made more severe by economic activity, largely because of carbon emissions. In turn, climate change is expected to negatively affect output (Nordhaus 1991; Nordhaus and Boyer 2003). At the same time, economic activity also contributes to biodiversity loss and nature degradation, for example, through land use (Marques et al. 2019); this reduction in nature's ability to provide ecosystem services subsequently decreases economic activity. Furthermore, biodiversity and climate also interact, with increased climate change leading to further nature degradation and increased nature degradation resulting in higher net carbon emissions. The amplification channel that arises from these feedback effects between climate change and biodiversity loss is referred to as the "twin-crises multiplier."

An example of the economic impacts of the twin-crises multiplier can be found in the Coral Triangle, a marine region spanning six Southeast Asian countries that is home to 76% of the world's coral species (Coral Reef Alliance 2025). Coral reefs have important adaptive and mitigative mechanisms for climate change: they protect coastlines from storms and erosion while also acting as a carbon sink to absorb atmospheric carbon dioxide. The ecosystem services provided by the Coral Triangle are essential to economic activity; they support the livelihoods of over 120 million people through fisheries and tourism and contribute an estimated $2.3 billion annually to local economies (Coral Reef Alliance 2025). However, rising temperatures driven by climate change have led to coral bleaching. Consequently, the damage to coral reefs has resulted in widespread reductions in marine biodiversity and the provision of ecosystem services. In particular, the degradation of coral habitats means that many species lose critical shelter and breeding grounds, disrupting the entire marine food web. Due to the ramifications of biodiversity loss and climate change, the Asian Development Bank (ADB) estimates that the losses linked to climate change across the Coral Triangle region amount to $38.3 billion (ADB 2016).

In short, the spiral of biodiversity loss and climate change intensifies each threat. Although nature-based adaptation solutions remain one of the most cost-effective means of mitigating climate hazards (see Vicarelli et al. 2024 for a review), their effectiveness wanes if biodiversity continues to decline. Addressing these twin crises therefore requires a fully integrated approach, recognizing that preserving ecosystems not only sustains biodiversity but also reinforces the natural climate defenses upon which economies and societies depend. This "virtuous cycle" promoted by conservation is represented on the right side of Figure 4. Conservation directly improves biodiversity and ecosystem services (and, consequently, economic resilience and growth) while also interacting with climate change by improving resilience to its damages and reducing carbon emissions. Biodiversity conservation, therefore, results in direct and indirect economic benefits.

4 Economic Risks and Policy Implications

As discussed above, both climate change and biodiversity have the potential to severely damage the economy. Even if the economic damages are expected to materialize and worsen slowly over the coming decades, asset markets are already anticipating these risks today, as current losses make the system more fragile and, therefore, more exposed to future shocks. While the effect of climate change on financial markets has been studied in the literature (see Giglio et al. 2021 for a review), evidence on the pricing of biodiversity risk is much more limited. Here, we review the existing evidence across asset classes.

Sovereign risk and credit default swap (CDS) spreads. Giglio et al. (2024) study the relationship between biodiversity risk exposure and CDS prices—measures of markets' perceived default risk—in the cross-section of countries. Key to the identification of these pricing effects is the construction of empirical proxies for the fragility of countries' ecosystems, motivated by the authors' theoretical model. The fragility of a country's ecosystem depends on two factors: the average destruction of biodiversity and the imbalance of biodiversity losses across functions. A country where some functions are particularly depleted (and thus critically endangered) becomes more sensitive to future shocks relative to a country where biodiversity loss has been more evenly distributed across functions. These predictions follow directly from the previously described non-linearity in the biodiversity-productivity relationship within a function, combined with the complementarities across ecosystem functions. Biodiversity risk exposure scores are constructed by combining the two measures above, weighted by the estimated coefficients from the baseline CDS pricing regression in Giglio et al. (2024), and standardized across countries—meaning that the resulting scores are transformed to have a mean of zero and a standard deviation of one across all countries. This ensures comparability by expressing each country's score relative to the cross-country distribution.

Figure 5: Biodiversity Risk Exposure Scores in Asia

Note: The figure shows biodiversity risk exposure scores for ADB developing member countries and other Asian and neighboring regional economies. Scores are computed as weighted averages of two factors from Giglio et al. (2024): the average level of biodiversity destruction and the imbalance of biodiversity losses across ecological functions. Weights are derived from the baseline regression estimates in the paper. Higher scores reflect greater exposure to biodiversity risk.
Source: Giglio et al. (2024)

Figure 5 presents biodiversity risk exposure scores for ADB developing member countries, as well as other Asian and neighboring regional economies. Countries like Malaysia and Indonesia, characterized by high average biodiversity destruction, generally exhibit higher exposure scores. However, the map also reveals risk in countries with relatively lower average destruction levels, such as Singapore, where risk is predominantly attributable to a high functional imbalance in biodiversity loss.

Equity market exposures. The stock market is another asset class already influenced by biodiversity risk, with industry-level heterogeneity in exposure (Garel et al. 2024; Coqueret et al. 2025). For example, firms in the agricultural sector, which use ecosystem services as a direct input, might be affected by physical biodiversity risk. In addition to the direct economic effects of nature loss, firms may also be exposed to biodiversity transition risks from the regulation of economic activities that negatively impact nature.

For instance, energy firms face transition risks from drilling and refining, which may be constrained by habitat regulations. Giglio et al. (2023) quantify these transition and physical risks using 10-K statements and news-based indicators of aggregate biodiversity risk. They find that biodiversity risk impacts equity prices and portfolio returns based on industry exposure, and that these risks are distinct from climate-related equity risks (see Engle et al. 2020; Alekseev et al. 2024 for examples of climate hedging portfolios).

Adequacy of pricing. Despite evidence that asset prices have begun to reflect biodiversity risk exposures, Giglio et al. (2023) show that most market participants believe that biodiversity risk remains underpriced in asset markets. This mispricing leaves markets vulnerable to abrupt corrections if ecosystem losses accelerate, tipping points are breached, or if investors suddenly become more aware of these risks (for example, in response to salient biodiversity-climate-related events). To prevent sudden repricing and financial instability, it is essential to integrate biodiversity risk assessments into investment decisions and regulatory frameworks.

4.1 Policy and Financial Solutions

The design of policy solutions and financial instruments to mitigate biodiversity loss parallels the interventions to mitigate climate risks. However, important differences make the work for biodiversity significantly more challenging.

A key driver of climate change is the externality associated with carbon emissions: the economic benefits from emitting activities are collected by a relatively small group of people, while the costs of climate change are global. The classic solution to this climate externality is a Pigouvian tax on carbon emissions (or an equivalent cap-and-trade system). Indeed, despite frequent lack of political will for such interventions, economists generally agree that they would be very effective at mitigating climate change.

Biodiversity loss is similarly driven by a key externality. For example, developers are able to capture most of the economic benefits from land use changes that contribute to biodiversity loss, while the costs are borne by the general public. However, designing a Pigouvian taxation or cap-and-trade systems is much harder for addressing biodiversity loss than it is for addressing climate change. In the latter case, the entire policy revolves around a unique quantity—carbon emissions—which has the same effects on climate change independent of where they are emitted. This makes it possible to calculate a globally consistent "social cost of carbon" that quantifies the total social costs of a given carbon emission, and that can therefore serve as a basis for setting a carbon price. In contrast, as discussed above, the economic value of each species is highly dependent on the context (the state of biodiversity in its ecosystem, the presence of functionally similar species, the criticality of the function it provides, and so on). Therefore, the design of any policy solution that aims to align costs and benefits of biodiversity conservation must take a stand on the value of different species affected by the policy—a gargantuan task. Despite the challenges involved with precise quantification, a key insight from the framework in Giglio et al. (2024) is that, as a general rule, conservation policies should be prioritized in ecosystems with limited remaining redundancies and in functions that act as critical constraints on overall ecosystem productivity.

The fact that the same species may have different marginal ecological (and thus economic) values across ecosystems also complicates attempts to address the externality of biodiversity loss through the implementation of *biodiversity offsets,* conservation actions intended to compensate for the negative impacts on biodiversity caused by human activity to ensure a "no net loss" outcome. However, as Giglio et al. (2024) note, a "no net loss" of species does not generally translate into a "no net loss" for ecosystem functioning. In any given ecosystem, certain species may be more important at the margin than others. Again, the design of optimal offsets depends crucially on establishing the marginal value of each species involved.

Another important difference between the policy responses to climate change and biodiversity loss is worth noting. While climate change is fundamentally a global externality—since greenhouse gas emissions contribute to temperature rise and climate damages worldwide—biodiversity loss can also have a more localized dimension, with direct impacts on nearby ecosystems and economic activities such as agriculture. This means that incentives to conserve biodiversity in local ecosystems can be better internalized and are less affected by the externalities that affect climate change. Evidence for this is the presence of local efforts to preserve nature and biodiversity that are fundamentally justified by creating local economic value. One prominent example is the Riau Ecosystem Restoration Project in Indonesia. Backed by a $100 million pledge from the APRIL Group—a major fiber, pulp, and paper producer—the initiative aims to restore over 150,000 hectares of peatland in the Riau Province (World Business Council for Sustainable Development 2018). These considerations can play an important role in fostering conservation efforts.

Financial instruments. Several newly emerging financial instruments may also bring additional funds and incentives for biodiversity conservation. A notable example is the use of biodiversity and nature bonds. These are fixed-income instruments where investors provide upfront capital to an issuer, such as a multilateral development bank, which commits to using the proceeds for biodiversity-related projects. Because many of these issuers have high credit ratings, they can access funding at relatively low interest rates, enabling the financing of biodiversity conservation at scale. Additionally, some investors may be willing to lend to the issuers at a discount relative to the market, where the foregone coupon payments are instead allocated to further support reforestation and conservation projects. For instance, in October 2024, ADB issued its first biodiversity and nature bond to fund projects supporting biodiversity conservation and nature-positive initiatives, which was purchased by Japan's Dai-ichi Life Insurance Company (ADB 2024). In the Philippines, Ayala Land Inc., the country's leading property developer, issued its first sustainability-linked bond in July 2024, with total issuances now reaching ₱14 billion—approximately $246 million (Ayala Land 2024).

Another example of a biodiversity-linked financial instrument is a debt-for-nature swap, a type of debt restructuring that can either forgive or refinance a nation's foreign debt in exchange for local investments in environmental conservation measures. This enables the borrower to reduce its debt burden (either through lower principal or interest payments) while simultaneously reallocating a portion of those savings toward biodiversity conservation projects. For example, in July 2024, the United States and Indonesia signed a debt-for-nature swap deal in which the Indonesian government will redirect more than $35 million owed to the United States toward the conservation of its Coral Triangle region, one of the most diverse marine ecosystems on the planet (U.S. Department of the Treasury 2024). This exchange underscores the potential role of developed countries in addressing the twin crises by refinancing their foreign aid and using any interest savings for mitigation and adaptation efforts to combat biodiversity loss and climate change.

Market incentives and regulatory integration. In addition to these financial instruments, recent efforts have turned to market-based solutions—such as nature credit systems—that aim to directly incentivize local stakeholders, including farmers and land managers, to engage in biodiversity conservation. For instance, in July 2025, the European Commission announced that to meet its €37 billion (approx. $43 billion) annual shortfall in biodiversity funding, the European Union will develop rules for ”nature credits” that pay farmers and foresters to protect their ecosystems (Abnett 2025). Although the European Union already provides significant subsidies to farmers (Abnett 2025), these nature credits offer more targeted incentives for biodiversity conservation.

Beyond these various policies and financial instruments, it is equally important for stakeholders to implement regulatory frameworks that mainstream biodiversity and climate risks into financial systems. Such regulatory integration can mobilize broader private-sector participation, scale up investments in conservation and adaptation, and enhance the resilience of financial markets. As an example of such activities, the Monetary Authority of Singapore has implemented robust environmental risk management guidelines that require financial institutions to incorporate climate and biodiversity risk assessments into their decision-making frameworks, thereby steering capital toward sustainable projects and reinforcing ecosystem protection (Monetary Authority of Singapore 2020).

5 Conclusion

Despite growing momentum to address climate change, robust efforts are also needed to confront the escalating crisis of biodiversity loss. To better understand the interplay between biodiversity and economic activity, Giglio et al. (2023) develop a model in which ecosystem services function as a factor of production. These services are produced by the interplay of distinct ecosystem functions, each relying on groups of species that are imperfect substitutes for one another—a form of functional redundancy that enhances ecosystem resilience. As biodiversity loss reduces redundancy within a function, the system becomes more fragile, both within that specific function (e.g., pollination) and across complementary functions. ecosystem services are critical to economic output, increased ecological fragility exposes the economy to potentially severe losses, although these effects may not always be immediate.

To fully capture the risks of biodiversity loss to economic activity, it is essential to consider how climate change interacts with both biodiversity loss and production, introducing its own shocks and compounding the effects of ecosystem fragility. In particular, Giglio et al. (2025) develop an economic model that highlights the “twin-crises multiplier” mechanism, showing that climate change and biodiversity loss are inextricably linked as a combined threat to economic output. Economic production directly contributes to both climate change and biodiversity loss. Simultaneously, climate change accelerates biodiversity loss by altering habitats and increasing extinction risk. This erosion of biodiversity reduces the supply of ecosystem services—many of which play a key role in mitigating climate change, such as carbon sequestration and coastal protection. The result is a self-reinforcing feedback loop in which ecological degradation and climate impacts amplify one another, deepening the resulting economic damages.

As this feedback loop intensifies, economic damages from both climate change and nature loss are expected to rise sharply in the coming decades—and asset markets are already beginning to reflect these growing risks. Giglio et al. (2024) show that biodiversity risk impacts sovereign CDS prices in countries with greater ecosystem fragility, while Giglio et al. (2023) highlight that equity prices and portfolio returns in certain industries are more sensitive to aggregate biodiversity risk than others. Despite the growing evidence that asset prices have started to reflect biodiversity risk exposures, Giglio et al. (2023) also find that most market participants believe aggregate biodiversity risk remains underpriced.

These mechanisms underscore the need for policy solutions and financial instruments that mitigate the "twin-crises multiplier" by promoting a virtuous cycle of conservation. Financial instruments such as biodiversity and nature bonds, as well as debt-for-nature swaps and regulatory interventions, are all important for biodiversity conservation, particularly if these policies can identify and target conservation efforts on species with the least amount of remaining functional redundancy.

Together, these insights highlight the urgent need to treat biodiversity loss as a first-order economic risk—one that demands not only targeted, forward-looking policy and market responses but also a fundamental rethinking of how ecological resilience is intertwined with economic output and climate dynamics.

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