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Resource mobilization and financial Mechanism: resource mobilization

Study on the relationship between debt sustainability and the implementation of the Convention**

Note by the Secretariat

Introduction

1. In decision 16/34 the Executive Secretary was requested, subject to the availability of resources, to commission, or undertake, alongside relevant international institutions, studies on: (a) the relationship between debt sustainability and the implementation of the Convention; (b) how the guidance on safeguards in biodiversity finance mechanisms adopted in decisions XII/3 and 14/15 has been implemented, identifying good practices and lessons learned, as well as opportunities for improving implementation of the guidance; and (c) the relationship between biodiversity and climate finance (para. 26 (b)).

2. Accordingly, a draft of the first of the listed studies on the relationship between debt sustainability and the implementation of the Convention, has been prepared and is provided in the present document.

3. The study has been prepared by an independent consultant who was commissioned by the Secretariat. Its development has been informed by the discussions held on the topic during the sixteenth meeting of the Conference of the Parties, the experience and expertise of the consultant, the selected expert interviews that the consultant conducted, and inputs from key staff at the Secretariat.

4. Notification No. 2026-013was issued on 2 February 2026 to request the voluntary peer review of the present document. The deadline for the submission of comments for the peer review is 13 March 2026.

* CBD/SBI/6/1.
** The present document is being issued without formal editing.

5. Following any inputs received on the present document at the sixth meeting of the Subsidiary Body on Implementation and the peer review, a final version of the study will be completed for presentation at the seventh meeting of the Subsidiary Body on Implementation.

6. The document is issued in the form and language in which it was received.

CONVENTION ON BIOLOGICAL DIVERSITY

STUDY ON THE RELATIONSHIP BETWEEN DEBT SUSTAINABILITY AND IMPLEMENTATION OF THE CONVENTION

Prepared in response to Decision 16/34, paragraph 26(b)(i)

Prepared by Diana Amoa

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EXECUTIVE SUMMARY

This study was prepared in response to Decision 16/34, which requested an examination of the relationship between debt sustainability and implementation of the Convention on Biological Diversity. Its purpose is to clarify where and how debt–biodiversity interactions become macro-relevant, and where they do not. The study is diagnostic in nature. It does not propose policy responses, evaluate financial instruments, rank countries, or advance negotiating positions.

The analysis establishes that the relationship between debt sustainability and biodiversity implementation is two-directional but asymmetric.

The transmission from debt sustainability to biodiversity implementation is more immediate and more widespread. Elevated interest burdens compress discretionary fiscal space, fiscal adjustment requirements disrupt multi-year planning, and revenue constraints limit what can be allocated to biodiversity regardless of policy intent. Because biodiversity expenditure is typically discretionary, institutionally fragmented, and lacking strong political protection, it is particularly exposed to these pressures. This forward channel operates across a broad range of country contexts where fiscal constraint binds.

The reverse transmission, from biodiversity outcomes to debt sustainability, is more indirect and conditional. It operates through three channels: nature-dependent revenues, where ecosystem degradation threatens government receipts and foreign exchange earnings in economies concentrated in ecosystem-dependent sectors; risk amplification, where loss of ecosystem protective services increases disaster costs and contingent liabilities; and long-term productivity effects, where natural capital depletion erodes sustainable growth potential. These channels become macro-relevant only under specific structural conditions and do not apply uniformly across countries. In diversified economies where no nature-dependent sector dominates output or revenues, biodiversity loss, however significant in ecological terms, does not materially affect sovereign debt dynamics.

A central contribution of the study is the development of a diagnostic framework that differentiates country contexts based on fiscal constraint and nature-linked economic exposure. This framework identifies four configurations: countries facing both elevated fiscal constraint and high nature exposure, where bidirectional dynamics are plausible; countries facing fiscal constraint without high nature exposure, where debt affects biodiversity primarily through general expenditure compression; countries with high nature exposure but lower fiscal constraint, where implementation gaps more likely reflect institutional or governance factors; and countries where neither dimension is elevated, where the debt–biodiversity relationship examined in this study is less directly relevant.

The framework highlights substantial heterogeneity across Parties and cautions against uniform interpretations. In some contexts, fiscal ceilings are the binding limitation on implementation. In others, institutional capacity, governance arrangements, or political prioritisation are more decisive, even where fiscal space exists. Accurate interpretation therefore depends on identifying which constraints bind in practice.

The study does not establish causal relationships between specific debt conditions and biodiversity outcomes. It does not assess the effectiveness of policy instruments, financing mechanisms, or institutional reforms. It does not evaluate country performance or identify cases

of success or failure. Its contribution lies in clarifying structural conditions, transmission channels, and boundary cases, thereby reducing the risk of misdiagnosis in discussions of debt sustainability and biodiversity implementation.

Within the CBD process, this study is intended as a clarifying analytical input to deliberations under the Convention. It does not represent a negotiating position, endorse particular proposals, or prejudge discussions on resource mobilisation or implementation support. By providing a common analytical foundation, the study seeks to support informed and disciplined consideration of how debt sustainability and biodiversity implementation interact across diverse country contexts.

The findings are intended to support analytical understanding under CBD Decision 16/34; they do not rank countries, assess national performance or ambition, or prescribe specific debt or financing instruments.

1. INTRODUCTION

1.1 Mandate and Purpose

At its sixteenth meeting, the Conference of the Parties to the Convention on Biological Diversity adopted Decision 16/34 on resource mobilisation. Paragraph 26(b)(i) of that Decision requests the Executive Secretary to commission a study on the relationship between debt sustainability and implementation of the Convention. This study responds to that mandate.

The request reflects increasing attention to the fiscal and macroeconomic conditions under which Parties are expected to implement the Convention and the Kunming-Montreal Global Biodiversity Framework, alongside concerns that debt dynamics may shape, or in some contexts be shaped by, biodiversity outcomes. This study seeks to clarify where and how debt sustainability conditions interact with biodiversity implementation, and where they do not.

The study is analytical and diagnostic in nature. It does not propose policy responses, evaluate financial instruments, assess debt restructuring options, or advance negotiating positions. Its purpose is to support informed consideration by the Subsidiary Body on Implementation and other relevant bodies by providing a structured basis for interpretation.

1.2 Why Debt Sustainability Matters for Biodiversity Implementation

Debt sustainability matters for biodiversity implementation because public biodiversity action depends, to varying degrees, on fiscal capacity and budgetary discretion. In many countries, biodiversity expenditure, enforcement, and institutional capacity are financed through discretionary budget lines that are sensitive to interest burdens, fiscal consolidation, and revenue volatility. Where fiscal space is constrained, biodiversity-related spending is often compressed, delayed, or fragmented alongside other discretionary priorities.

At the same time, biodiversity outcomes may, in certain contexts, have macro-fiscal relevance. In economies where government revenue, foreign exchange earnings, or exposure to fiscal shocks are closely linked to ecosystem services or nature-dependent sectors, biodiversity degradation can affect fiscal performance indirectly over time. These effects operate through channels such as revenue erosion, risk amplification, and long-term impacts on productivity and growth.

These relationships are neither uniform nor automatic. Debt conditions do not constrain biodiversity implementation in the same way across countries, and biodiversity outcomes do not systematically affect debt sustainability. Overgeneralising either direction risks mischaracterising implementation challenges and misidentifying the constraints that bind in practice.

1.3 A Two-Directional but Asymmetric Analytical Framework

The study adopts a two-directional analytical framework that recognises interactions running in both directions between debt sustainability and biodiversity implementation, while emphasising their asymmetry.

The transmission from debt sustainability to biodiversity implementation is more immediate and more widespread. Elevated interest burdens, fiscal adjustment requirements, and revenue constraints can directly shape implementation feasibility by compressing discretionary fiscal space and disrupting multi-year planning and execution.

The reverse transmission, from biodiversity outcomes to debt sustainability, is more indirect and conditional. It becomes macro-relevant only under specific structural conditions, particularly where economic structure creates substantial dependence on nature-derived revenues, where ecosystem services play a measurable role in mitigating fiscal risks, or where natural capital depletion affects long-term growth dynamics. In many countries, biodiversity loss, while ecologically and socially significant, does not materially affect sovereign debt dynamics.

Recognising this asymmetry is essential to avoid both overstating and understating the relevance of debt–biodiversity interactions.

1.4 A Diagnostic Approach and Its Rationale

Given data limitations and institutional realities, the study adopts a diagnostic rather than empirical or prescriptive approach. Comparable and consistent data on biodiversity expenditure remain limited across countries, and natural capital valuation involves methodological choices that affect cross-country comparability. Debt sustainability indicators capture important dimensions of fiscal risk but do not, on their own, determine implementation feasibility or macro-relevance.

Accordingly, the study focuses on identifying transmission channels, specifying the structural conditions under which they are likely to operate, and using screening indicators and qualitative judgment to characterise heterogeneity across countries. The objective is not to estimate causal effects, predict outcomes, rank countries, or assess performance, but to clarify where closer examination is warranted and where debt–biodiversity interactions are unlikely to be macro-relevant.

This diagnostic orientation reflects the study's intended role within the CBD process: to provide a common analytical foundation that supports disciplined interpretation and reduces the risk of misdiagnosis.

1.5 Scope and Structure of the Study

The study examines debt–biodiversity interactions at the sovereign and macro-fiscal level. It does not assess project-level finance, subnational dynamics, or the effectiveness of specific policy instruments or financing mechanisms. Country experiences are used selectively and illustratively to clarify analytical mechanisms rather than to generalise, compare performance, or identify success or failure.

The remainder of the study is structured as follows. Section 2 reviews relevant conceptual and institutional literature. Sections 3 and 4 examine the forward and reverse transmission channels, respectively. Section 5 presents a cross-country diagnostic framework based on fiscal constraint and nature-linked economic exposure. Section 6 translates this framework into interpretive implications for biodiversity implementation under the Convention. Section 7 concludes by situating the study within the CBD process as a clarifying analytical input.

2. EVIDENCE BASE AND ANALYTICAL FOUNDATIONS

The analytical framework developed in this study identifies distinct transmission channels through which debt sustainability and biodiversity implementation interact. It synthesizes three established strands of literature: (i) sovereign debt sustainability and fiscal space analysis; (ii) natural capital, ecosystem services, and nature-dependent economic activity; and (iii) climate- and nature-related macro-financial risk assessment. This section situates the analysis within that evidence base and clarifies the framework's specific contribution to understanding the relationship between sovereign debt dynamics and implementation of the Convention.

This integration responds directly to the Decision 16/34 mandate. While existing work has examined fiscal constraints on public spending, macroeconomic implications of nature-related risks, and biodiversity finance mechanisms in isolation, these insights have not previously been brought together in a structured way to assess how debt sustainability and Convention implementation interact. The framework developed here helps address that gap by providing a coherent analytical lens tailored to the CBD implementation context.

2.1 Fiscal and Debt Sustainability Literature

The relationship between debt sustainability and public expenditure allocation is well established in fiscal economics. The IMF and World Bank Debt Sustainability Framework (DSF) provides the institutional foundation for assessing whether sovereign debt trajectories are sustainable, classifying low-income countries into risk categories that inform lending decisions and policy surveillance. However, the DSF focuses primarily on aggregate fiscal sustainability rather than on the composition of expenditure or its environmental dimensions.[1]

Recent global and regional assessments provide important context for this analysis. For instance, the United Nations Conference on Trade and Development's *A World of Debt* reports have systematically documented the scale, composition, and distribution of sovereign debt burdens across developing economies, establishing the global macro-fiscal backdrop against which this study is situated.[2] At the regional level, studies such as the Economic and Social Commission for Asia and the Pacific's *Financing the SDGs to 2030 and Beyond* (2025) demonstrate how rising debt service obligations constrain development spending across multiple sectors, linking elevated interest burdens to the compression of discretionary fiscal space.[3] Together, this body of work establishes the macro-fiscal conditions underlying the transmission channels examined in Section 3, while leaving open the Convention-specific implementation questions that this study addresses.

The fiscal consolidation literature shows that the composition of adjustment is critical for fiscal and distributional outcomes. When governments reduce deficits primarily through expenditure restraint, budget lines that lack statutory protection or strong political constituencies are more likely to absorb disproportionate cuts. Biodiversity-related spending exhibits these characteristics in most jurisdictions. As a result, well-established findings from fiscal economics are directly

[1] IMF and World Bank, Debt Sustainability Framework for Low-Income Countries: Staff Guidance Note (Washington, DC: IMF, 2018); updated 2024.

[2] UNCTAD, A World of Debt 2024: A Growing Burden to Global Prosperity (Geneva: UNCTAD, 2024).

[3] ESCAP, Financing the SDGs to 2030 and Beyond: Asia and the Pacific SDG Progress Report 2025 (Bangkok: ESCAP, 2025).

relevant for understanding how consolidation pressures affect biodiversity implementation in the context examined in this study.[4]

2.2 Nature-Related Financial Risk Literature

A rapidly developing literature establishes that nature-related risks, including biodiversity loss, can have material implications for macroeconomic stability and financial systems. This body of work provides conceptual grounding for the reverse channel examined in Section 4, demonstrating that the mechanisms posited are not speculative but are recognised by central banks, financial regulators, and mainstream financial economics.

The IMF's 2024 Staff Climate Note *Embedded in Nature* provides one of the most comprehensive institutional treatments of this relationship to date. The note proposes a conceptual framework that maps transmission channels through which nature degradation affects macroeconomic aggregates and emphasises the concept of "double materiality", whereby nature affects the economy and economic activity affects nature. The framework distinguishes between physical risks, arising from ecosystem degradation that reduces productivity and amplifies disasters, and transition risks, arising from policy and market responses to nature loss. Importantly, the IMF analysis finds that 38 percent of global bank loans flow to sectors dependent on harmful subsidies, while 44 percent are exposed to operations in conservation areas under the Kunming–Montreal Global Biodiversity Framework, indicating significant financial system exposure to nature-related transitions.[5]

The Network for Greening the Financial System (NGFS), comprising over 130 central banks and financial supervisors, published a Conceptual Framework for Nature-Related Financial Risks in 2024. This framework outlines a three-phase risk assessment process: identifying nature-related exposures, assessing their economic risks, and evaluating implications for financial system stability. The NGFS framework validates at the highest institutional level that nature risks are macro-critical and warrant integration into financial supervision, a finding directly relevant to the debt-biodiversity relationship examined here.[6]

Academic work reinforces these institutional findings. Giglio, Kuchler, Stroebel, and Wang (2025), in a National Bureau of Economic Research working paper titled 'Nature and Biodiversity Loss: A Research Agenda for Financial Economics,' introduce the concept of a 'Twin-Crises Multiplier' whereby nature degradation and climate change reinforce each other, with ecosystem services entering economic production directly.[7] Their earlier work (2024) provides empirical evidence that credit default swap spreads increase when investors receive negative biodiversity news, particularly for countries with already-depleted ecosystems, demonstrating that markets are beginning to price nature-related sovereign risk.[8]

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[4]Isgut, A. et al., 'Fiscal Consolidation and Expenditure Composition in Developing Countries', Journal of Development Economics (2025).

[5]IMF, Embedded in Nature: Integrating Nature-Related Risks into Macroeconomic Policy, Staff Climate Note (Washington, DC: IMF, 2024).

[6]NGFS, Nature-related Financial Risks: A Conceptual Framework to Guide Action by Central Banks and Supervisors (Paris: NGFS, 2024).

[7]Giglio, S., Kuchler, T., Stroebel, J., and Wang, O., 'Nature and Biodiversity Loss: A Research Agenda for Financial Economics', NBER Working Paper 34286 (Cambridge, MA: NBER, 2025).

[8]Giglio, S., Kuchler, T., Stroebel, J., and Wang, O., 'The Economics of Biodiversity Loss', NBER Working Paper 32678 (Cambridge, MA: NBER, 2024).

Recent work in the sovereign risk literature has proposed structured approaches for incorporating environmental and climate-related factors into macro-financial analysis. For example, Volz and colleagues outline a set of transmission channels through which environmental risks may affect sovereign creditworthiness, including fiscal impacts through spending and revenue effects, macroeconomic growth and stability, financial sector exposure, external balance pressures, political and social stability, and policy response capacity.[9]

This study draws on that general channel-based logic, but applies it selectively and explicitly to the biodiversity–debt relationship within the Convention context. Rather than assessing sovereign credit risk per se, the framework here adapts these transmission concepts to examine how biodiversity-related pressures interact with debt sustainability and the capacity to implement the Convention, consistent with the scope of Decision 16/34.

2.3 Quantitative Modelling of Nature-Debt Linkages

Moving beyond conceptual frameworks, recent analytical work has begun to quantify the potential magnitude of nature-related risks for sovereign debt sustainability. While these estimates involve significant uncertainty and should be interpreted as indicative stress tests rather than forecasts, they provide an initial sense of scale and help clarify when nature-related effects could be material for debt dynamics.

At an aggregate level, scenario-based modelling exercises combine ecosystem service loss with country-level macro-fiscal data to examine how large-scale environmental degradation could interact with growth, fiscal balances, and financing conditions. Under partial ecosystem collapse scenarios, these studies estimate potential increases in public debt ratios in nature-dependent economies on the order of 7–15 percentage points of GDP. The purpose of these simulations is diagnostic rather than predictive: they are designed to test exposure under stress, not to forecast outcomes. Taken together, they suggest that, in countries with high ecosystem dependence, debt sustainability assessments that omit nature-related risks may understate underlying macro-fiscal vulnerabilities.[10]

More granular applications illustrate how these risks may translate into sovereign credit metrics. Researchers at the Bennett Institute for Public Policy, University of Cambridge, have developed scenario-based analyses integrating biodiversity risks into sovereign credit risk assessment. Applying ecosystem-degradation stress scenarios to sovereign risk models across a sample of 26 countries, the analysis finds that partial ecosystem collapse could materially increase sovereign default risk in a range of exposed economies. The study reports particularly large relative increases in modeled default risk in countries combining high ecosystem dependence with existing fiscal vulnerabilities, including Bangladesh, Ethiopia, and India. Under the stress scenarios examined, estimated default probabilities rise by approximately 41 percent, 38 percent, and 29 percent respectively. These estimates are illustrative and intended to assess exposure, not to anticipate rating actions.[11]

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[9] Volz, U. et al., Climate Change and Sovereign Risk (London: SOAS, 2020).

[10] See Kraemer, R. and Volz, U. Integrating Nature into Sovereign Debt Sustainability Analysis. (NatureFinance, 2022). The study applies ecosystem service loss scenarios derived from World Bank modelling to country-specific macro-fiscal data to estimate potential impacts on debt-to-GDP ratios under partial ecosystem collapse. The authors emphasise that these estimates are illustrative stress scenarios rather than forecasts.

[11] Agarwala, M. et al., 'Nature Loss and Sovereign Credit Ratings', Cambridge Bennett Institute Working Paper (Cambridge: University of Cambridge, 2022).

In parallel, international financial institutions have begun to explore operational integration of nature into macroeconomic modelling. The World Bank has piloted approaches linking biophysical ecosystem service models to macro-fiscal projections in countries such as India, Uganda, and Sri Lanka. These pilots assess how ecosystem change may affect GDP, employment, and fiscal stability, and while results remain preliminary, they establish institutional precedent for incorporating nature-related considerations into the quantitative frameworks that inform development policy and lending.[12]

Taken together, this emerging body of work indicates that integrating nature-related risks into debt sustainability analysis is technically feasible and increasingly recognised as relevant where ecosystem dependence is high. It provides an empirical foundation for the reverse transmission channels examined in Section 4, while underscoring the need for caution in interpretation given data and modelling limitations.

2.4 Biodiversity Finance Literature

A substantial body of work examines how biodiversity conservation is financed and the scale of resources required to halt or reverse nature loss. This literature provides essential context for the implementation challenges examined in later sections, but it is analytically distinct from the debt sustainability and macro-fiscal transmission channels that are the focus of this study. Its primary contribution lies in establishing the magnitude, composition, and structure of biodiversity finance flows, rather than their interaction with sovereign debt dynamics.

Global assessments consistently show a large and persistent gap between current biodiversity finance and estimated needs. OECD and partner analyses estimate that global biodiversity finance flows remain well below the levels required to meet internationally agreed biodiversity targets, with public finance accounting for most of the identifiable spending and private finance playing a comparatively limited role.[13] Comprehensive gap assessments, including those led by the Paulson Institute, The Nature Conservancy, and academic partners, estimate annual biodiversity financing needs on the order of several hundred billion US dollars, far exceeding current flows.[14]These estimates are subject to methodological uncertainty but establish the scale of the implementation challenge facing Parties.

A parallel strand of work focuses on how biodiversity-related expenditures are tracked within public finance systems. The BIOFIN programme, implemented by UNDP in more than 40 countries, has developed standardised methodologies for biodiversity expenditure reviews and finance needs assessments. These exercises provide the most systematic empirical evidence currently available on how biodiversity spending is distributed across government budgets and on the size of estimated financing gaps at the national level.[15] However, coverage remains incomplete, and methodologies are not fully harmonised across countries, limiting comparability. Related statistical frameworks, including Environmental Protection Expenditure Accounts and the

[12] World Bank, Mainstreaming Nature into Macroeconomic Models (Washington, DC: World Bank, 2025).
[13] OECD, *A Comprehensive Overview of Global Biodiversity Finance* (Paris: OECD Publishing, 2020); OECD, *Biodiversity Finance and the Economic Transition* (Paris: OECD Publishing, 2024).
[14] Paulson Institute, The Nature Conservancy, and Cornell Atkinson Center for Sustainability, *Financing Nature: Closing the Global Biodiversity Financing Gap* (Chicago: Paulson Institute, 2020).

[15] UNDP, *BIOFIN Methodology: Biodiversity Expenditure Review and Finance Needs Assessment* (New York: UNDP, 2018); UNDP, *The State of Biodiversity Finance* (New York: UNDP BIOFIN, 2023).

System of Environmental-Economic Accounting, highlight persistent challenges in consistently identifying biodiversity-related spending within national accounts.[16]

This literature underscores an important point for the present analysis: biodiversity finance is predominantly a public finance issue. While innovative instruments and private capital mobilisation are frequently emphasised in policy discussions, the bulk of biodiversity expenditure continues to flow through public budgets, development finance institutions, and concessional funding channels. As a result, biodiversity implementation remains directly exposed to fiscal conditions, budgetary prioritisation, and debt service pressures, rather than insulated from them.

Critical assessments of specific biodiversity finance instruments further reinforce this conclusion. Recent evaluations of debt-for-nature swaps find that, while such instruments can generate conservation funding and institutional commitments, their impact on headline debt stocks and debt service burdens has typically been modest relative to comprehensive debt restructurings.[17] Other analyses highlight scalability constraints, including transaction complexity, governance requirements, and the limited stock of eligible debt, particularly in low-income and high-debt countries with high biodiversity value.[18] These findings suggest that biodiversity finance instruments can complement, but not substitute for, broader fiscal and debt sustainability considerations.

Taken together, the biodiversity finance literature establishes several points that are directly relevant for this study. First, the scale of estimated biodiversity financing needs relative to existing public budgets indicates that implementation is structurally constrained by fiscal capacity in many countries. Second, the predominance of public finance in current biodiversity spending implies that implementation is closely tied to national budget processes. As shown in Sections 3 and 4, this linkage makes biodiversity expenditure vulnerable to the same debt service pressures and fiscal consolidation dynamics that affect other discretionary spending categories. Third, while innovative financing mechanisms can play an important role in specific contexts, the literature suggests that they do not substitute for underlying macro-fiscal conditions in shaping countries' overall capacity to implement biodiversity commitments.

Accordingly, this study does not evaluate biodiversity finance instruments as solutions in themselves. Instead, it uses the finance literature to contextualise why debt sustainability conditions matter for biodiversity implementation, and why understanding the interaction between fiscal constraints, debt dynamics, and nature-related economic exposure is essential for interpreting Parties' capacity to implement the Convention. These implications are taken up explicitly in the policy discussion in Section 6.

2.5 Synthesis: The Framework's Contribution

The transmission channel framework developed in Sections 3 and 4 synthesises across these literature streams to address a specific gap: understanding how debt sustainability conditions

[16] United Nations Statistical Commission, *System of Environmental-Economic Accounting—Ecosystem Accounting (SEEA-EA)* (New York: United Nations, 2021); Eurostat, *Environmental Protection Expenditure Accounts: Practical Guidance* (Luxembourg: Publications Office of the European Union, 2017).

[17] Debt Justice, *Debt-for-Nature Swaps: A Critical Assessment of Fiscal Impact and Development Effectiveness* (London: Debt Justice, 2025).

[18] Christoph Nedopil Wang, Mengdi Yue, and Alice Hughes, *Debt-for-Nature Swaps: Opportunities, Limitations, and Scalability* (Oxford: Oxford Sustainable Finance Programme, 2023).

affect, and are affected by, implementation of the Convention on Biological Diversity. This synthesis makes several contributions.

1. It adapts general fiscal and debt relationships to the biodiversity context, clarifying why biodiversity expenditure is particularly vulnerable to fiscal compression and how different country contexts give rise to distinct constraint profiles (Section 3.1 and Section 5).

2. It applies the nature-related macro-financial risk literature to CBD implementation, tracing how mechanisms identified in IMF, NGFS, and academic work may manifest through revenue exposure, risk amplification, and long-term productivity effects (Section 4).

3. It presents a structured cross-country empirical screening, using a 40-country sample to identify configurations in which the debt–biodiversity relationship is most likely to be macro-relevant (Section 5).

4. It derives policy-relevant implications with appropriate caution, distinguishing between analytically grounded mechanisms, illustrative country experiences, and areas where evidence remains incomplete (Section 6).

The framework does not claim to introduce new transmission channels. Rather, it synthesises and applies existing knowledge to a specific policy question linked to the Decision 16/34 mandate, drawing on the literature reviewed in this section while making explicit the limitations and uncertainties that condition interpretation. The following section turns from this evidence base to a structured analysis of how debt sustainability conditions affect the capacity of Parties to implement the Convention.

3. DEBT SUSTAINABILITY AND CAPACITY TO IMPLEMENT THE CONVENTION

How debt conditions shape fiscal space, institutions, and delivery

The transmission channels examined in this section are well established in the macro-fiscal literature on debt service burdens, revenue constraints, and fiscal adjustment dynamics. A substantial body of work by the IMF, World Bank, and related institutions shows how rising debt service, weak revenue mobilisation, and adjustment pressures compress discretionary fiscal space and shape the composition of public expenditure. The contribution here lies not in identifying new channels, but in applying these established fiscal dynamics to biodiversity implementation under the Convention, where expenditures are typically discretionary, weakly protected within budget processes, and institutionally fragmented across sectors.

Whether debt sustainability constrains biodiversity implementation depends on how these fiscal dynamics operate in a given context, rather than on debt levels alone.[19] In settings where interest burdens remain low, revenue capacity is strong, or fiscal institutions provide insulation for environmental spending, debt pressures may not bind. Where these conditions are absent, debt dynamics can operate as a structural constraint, limiting the feasibility, durability, and scale of biodiversity action even where policy ambition and planning frameworks are strong. The analysis therefore examines four transmission channels that capture the principal macro-fiscal mechanisms through which debt sustainability can plausibly affect biodiversity implementation: fiscal space compression from interest burdens; adjustment dynamics during consolidation and restructuring; revenue constraints that bind regardless of debt ratios; and institutional capacity erosion that compounds fiscal effects.

These transmission channels are not abstract. They operate against a global fiscal backdrop characterised by historically elevated debt burdens and tightening fiscal space, particularly in developing economies where biodiversity implementation demands are greatest.

Global public debt reached a record USD 102 trillion in 2024, with developing countries accounting for approximately USD 31 trillion, or around one-third of the total.[20] Since 2010, public debt in developing economies has grown at roughly twice the pace observed in advanced economies, reflecting a combination of development financing needs, exposure to commodity price and exchange-rate shocks, and, in some cases, unsustainable borrowing dynamics. Rising debt stocks have been accompanied by sharply higher debt servicing costs: in 2024, developing countries paid an estimated USD 921 billion in net interest on public debt, a 10 percent increase from the previous year, diverting fiscal resources from other development priorities, including biodiversity-relevant public investment. [21]

The human and fiscal dimensions of this debt burden are substantial. A record 61 developing economies now spend at least 10 percent of government revenues on interest payments alone. Today, 3.4 billion people live in countries that allocate more resources to debt interest than to

[19] This reflects standard macro-fiscal analysis, in which the expenditure impact of public debt is determined primarily by flow variables such as interest payments, revenue mobilisation, and fiscal institutions rather than by debt stocks in isolation. Empirical variation across country contexts is examined in Section 5.

[20] UNCTAD, A World of Debt 2025: It Is Time for Reform (Geneva: United Nations Conference on Trade and Development, 2025).

[21] Ibid.

either health or education.[22] These statistics illustrate the scale of fiscal pressure that debt service obligations impose on developing country budgets, pressure that inevitably affects the resources available for all discretionary spending categories including environmental protection and biodiversity conservation.

These macro-fiscal pressures have direct implications for biodiversity implementation. As of early 2025, the IMF and World Bank Debt Sustainability Framework classifies approximately 13 percent of low-income countries as being in debt distress, with another 39 percent at high risk. This means over half of LIC-DSF countries face serious debt sustainability concerns.[23] However, formal classifications understate the extent of fiscal constraint experienced by developing countries. Countries that retain market access and avoid crisis classification may nonetheless face chronic compression of discretionary fiscal space that systematically disadvantages environmental spending relative to sectors with stronger political constituencies or statutory protections.

Drawing on established macro-fiscal analysis, the transmission from debt sustainability to biodiversity implementation can be understood as operating through multiple channels whose relevance depends on country-specific fiscal and institutional conditions. This section analyses four such channels:

- **Fiscal space compression** arising from rising debt service burdens that crowd out discretionary expenditure;
- **Adjustment pressure and planning uncertainty** associated with fiscal consolidation, debt distress, and restructuring episodes;
- **Revenue constraints** that render even moderate debt burdens binding in low-revenue contexts; and
- **Institutional and non-fiscal constraints** that limit implementation capacity even where fiscal resources formally exist.

Together, these channels provide a structured basis for understanding how debt dynamics shape biodiversity implementation in different country contexts.

3.1 Fiscal Space, Debt Service, and Discretionary Spending

A primary and immediate channel through which debt sustainability affects biodiversity implementation is the compression of fiscal space available for discretionary public spending. Debt service obligations, particularly interest payments, constitute non-discretionary claims on government revenue that must be met to avoid default and preserve financial stability. As these obligations rise, the resources available for other purposes contract, intensifying competition among spending categories within a fixed fiscal envelope. Biodiversity-related expenditures, like many climate and environmental spending categories, are especially exposed in this context due to their discretionary status and limited institutional protection within budget processes.

Comparative fiscal evidence from international financial institutions shows that high interest burdens are associated with sharper expenditure trade-offs and tighter constraints on discretionary spending. Countries in which interest payments absorb a large share of government revenue, often at levels of around 20 percent or more, operate under qualitatively different fiscal

[22] Ibid.

[23] IMF-World Bank LIC-DSF Database (March 2025). Of 67 countries assessed under the Low-Income Country Debt Sustainability Framework, 9 are classified as in debt distress and 26 at high risk—together representing over half of LIC-DSF countries.

conditions than those where debt service pressures are more manageable. [24] In such settings, debt service obligations crowd out a broad range of public investments, including health, education, infrastructure, and environmental protection, forcing governments to arbitrate among competing development priorities.

Importantly, the distribution of interest burdens across developing countries is highly skewed, with significant implications for understanding where fiscal constraints on biodiversity implementation are most acute. While median interest burdens remain below 8 percent of revenue, a substantial tail of countries exceeds 20 percent, and in several cases interest payments absorb 30–40 percent of government revenue.[25] This skewed distribution implies that acute fiscal constraint is concentrated in a subset of countries, while others retain meaningful fiscal space despite elevated debt levels.

For biodiversity spending specifically, these constraints are often pronounced because such expenditures share several characteristics that disadvantage them in fiscal competition:

- **Non-entitlement status:** Biodiversity spending is not protected by statutory obligations in most jurisdictions, unlike debt service, pensions, civil service wages, or statutory social transfers. This means biodiversity budgets can be reduced or eliminated through annual budget processes without legal constraint, making them vulnerable to reallocation when fiscal pressure intensifies.
- **Low political salience:** Environmental spending rarely commands the electoral attention of health, education, infrastructure, or security spending. Politicians facing difficult fiscal choices typically prioritise sectors with more immediate and visible constituent benefits, particularly in contexts where electoral cycles are short and voters discount future environmental benefits heavily.
- **Institutional and budgetary fragmentation**: Biodiversity objectives are typically implemented across multiple ministries, agencies, and levels of government rather than through a single, consolidated budget line. This dispersion weakens budget ownership and political defense, making biodiversity expenditures more vulnerable to incremental cuts during fiscal consolidation without triggering explicit policy reversals.
- **Recurrent cost structure:** Biodiversity management requires continuous operational funding for protected area management, monitoring, enforcement, and staff salaries. These recurrent costs are particularly vulnerable to consolidation strategies that prioritise capital expenditure over operational spending, as governments often find it politically easier to defer maintenance and operations than to cancel visible capital projects.
- **Long time horizons:** Benefits of biodiversity investment materialise over decades, poorly matching political and budget cycles that typically operate on annual or electoral timeframes.

[24] There is no formal interest-to-revenue threshold in IMF or World Bank debt sustainability frameworks. Ratios in the range of 15–25 percent are nonetheless commonly treated in fiscal surveillance and debt diagnostics as indicative of severe fiscal stress, reflecting the point at which debt service materially constrains budgetary discretion (see, inter alia, IMF Article IV consultations and UNCTAD, *A World of Debt*, 2025). Illustrative cases from countries examined in this study underscore the fiscal relevance of such burdens: Bangladesh allocates approximately 30 percent of government revenue to interest payments, Brazil and South Africa each around 21 percent, and Ghana faced acute debt service pressures prior to its 2022 restructuring. These figures are provided for context only; cross-country patterns are examined systematically in Section 5.

[25] See Section 5 for detailed distribution analysis. Extreme cases include Sri Lanka (~80%), Egypt (~49%), Ghana (~48%), Nigeria (~41%).

This temporal mismatch reduces the political returns to biodiversity investment relative to spending categories with more immediate payoffs.

Importantly, this fiscal space compression channel operates not only in crisis contexts but also as a constraint affecting countries across the debt sustainability spectrum. Countries that retain market access and avoid formal debt distress classifications may nonetheless experience sustained compression of discretionary fiscal space over time. In such cases, biodiversity implementation is constrained not by acute retrenchment but by the cumulative effect of years or decades of marginalisation in budget allocation processes. This constraint may be less visible than crisis-driven cuts but can be equally damaging to long-term conservation outcomes.

This chronic pattern is reinforced by the way fiscal consolidation is typically implemented. Where governments pursue deficit reduction through expenditure restraint rather than revenue enhancement, the composition of adjustment matters significantly for biodiversity outcomes. Consolidation frameworks that protect capital expenditure while constraining recurrent expenditure systematically disadvantage biodiversity, given its predominantly recurrent cost structure. Similarly, across-the-board percentage cuts affect smaller budget lines disproportionately, as fixed costs absorb a larger share of reduced allocations in smaller agencies. Environmental ministries and protected area authorities, typically among the smallest budget entities, are particularly exposed to these effects.

Empirical research supports this pattern of disproportionate vulnerability. Cross-country studies of fiscal adjustment episodes find that environmental expenditure is consistently among the first categories reduced during fiscal tightening, with environmental budgets facing deeper percentage cuts than most other sectors.[26] Analysis of debt crisis episodes in developing countries finds that debt distress correlates with weakened environmental oversight, reduced protected-area funding, and increased recourse to environmentally harmful subsidies as governments seek short-term revenue or expenditure relief.[27] These findings reinforce the analytical basis for treating biodiversity budgets as structurally exposed to fiscal pressure, rather than assuming neutral treatment across expenditure categories during consolidation.

Beyond immediate budget allocations, sustained fiscal compression erodes institutional capacity over time. Staff attrition accelerates as qualified personnel leave underfunded agencies, conservation infrastructure falls into disrepair through deferred maintenance, training cuts reduce technical capacity, and backlogs accumulate in enforcement actions, monitoring activities, and management interventions. These compounding effects mean that even when fiscal conditions eventually improve, rebuilding depleted institutional capacity requires years of sustained investment.

[26] Baek, J. and Kim, H. (2013). Is economic growth good or bad for the environment? Empirical evidence from Korea. *Energy Economics*.

[27] Mahmoud, M. and Sessa, V. (2022). Debt Crises and Environmental Governance in Developing Countries. *Ecological Economics*; ODI (2023). Debt Relief, Fiscal Space, and Environmental Expenditure in Developing Countries.

Box 3.1 — When Interest Burdens Bind: Brazil and South Africa

Brazil and South Africa illustrate how high interest burdens can act as a binding constraint on biodiversity implementation in upper-middle-income economies that retain market access and avoid formal debt distress, not through sharp expenditure cuts but through persistent compression of discretionary fiscal space over time.

Brazil – General government gross debt stands at approximately 88 percent of GDP and is projected to rise toward 99 percent by 2030. Interest payments absorb roughly 21 percent of government revenue, among the highest interest burdens for upper-middle-income economies. Net interest payments of approximately 6 percent of GDP are comparable to total public education spending and exceed many other expenditure categories. The International Monetary Fund's 2025 Article IV consultation finds that elevated public debt and spending rigidities crowd out priority investments, a diagnosis that applies directly to biodiversity, which falls squarely within the discretionary envelope that bears the burden of fiscal adjustment. Brazil's experience during 2019–2022, when environmental governance weakened and enforcement capacity declined, occurred in a context of fiscal constraint alongside deliberate policy choices. The post-2023 reversal, including submission of Brazil's most comprehensive biodiversity strategy to date, the EPANB 2025–2030 spanning some 20 ministries and 30 federal entities, demonstrates that political commitment can shift within broadly unchanged fiscal parameters. However, the pace of implementation recovery remains constrained by the underlying interest burden, as biodiversity-relevant spending continues to be exposed to annual budget negotiations and consolidation pressures.

South Africa – A similar fiscal pattern is evident, with general government gross debt at approximately 78 percent of GDP and interest payments absorbing roughly 21 percent of main budget revenue. The November 2025 Medium-Term Budget Policy Statement marks a potential inflection point, with debt projected to stabilise for the first time since 2008. The IMF's December 2025 staff concluding statement nonetheless notes that, absent additional fiscal reforms, the projected primary surplus may be insufficient to stabilise public debt over the medium term. The fiscal framework does not protect expenditure composition, and biodiversity budgets, representing less than 1 percent of consolidated government expenditure, face near-zero real growth over the medium term. South Africa has adapted by shifting implementation toward regulatory instruments, biodiversity stewardship on private land, and offset mechanisms that preserve commitment while moving costs off-budget. SANParks generates over half its revenue from own sources, demonstrating institutional resilience, though this model depends on high-value tourism assets that most agencies lack. These adaptations represent genuine institutional innovation under constraint, but they introduce distinct risks related to long-term management funding and geographic coverage.

Brazil and South Africa demonstrate that strong biodiversity strategies and institutions are necessary but insufficient in the absence of fiscal anchoring mechanisms. The interest-burden channel operates continuously through gradual erosion rather than acute crisis, affecting implementation capacity even where political commitment is genuine. Full case studies appear in Annex B.

Sources: IMF Article IV (Brazil 2025; South Africa 2025); Ministério da Fazenda debt reports; South Africa National Treasury MTBPS (November 2025); BIOFIN expenditure reviews. See References for full country case citations.

3.2 Adjustment Pressure, Uncertainty, and Medium-Term Planning

A distinct transmission channel operates in countries experiencing acute debt distress and formal restructuring processes. Beyond the fiscal compression discussed in Section 3.1, these contexts generate additional constraints through adjustment conditionality, planning uncertainty, and foreign exchange scarcity that can severely disrupt biodiversity implementation even where nominal fiscal resources might appear adequate. The distinguishing feature of this channel is its acute, time-bound character, in contrast to the chronic pressure described above.

Debt restructuring under the G20 Common Framework or comparable mechanisms typically involves extended negotiation periods during which fiscal baselines remain uncertain and forward planning becomes challenging.[28] As of late 2025, four countries have applied to the Common Framework: Chad, Zambia, Ghana, and Ethiopia. While each case is unique in its specific circumstances, common features include multi-year negotiation timelines extending well beyond initial expectations, complex coordination challenges between official bilateral creditors and private bondholders, and conditionality requirements attached to IMF-supported programmes that constrain fiscal policy choices.

For biodiversity implementation, the restructuring process creates several specific challenges that compound the general fiscal pressure:

- **Planning horizon collapse:** Multi-year conservation and restoration programmes require sustained funding commitments across planning periods that typically span five to ten years or longer. Under Common Framework restructuring processes, prolonged negotiations, uncertain debt treatment timelines, and conditional fiscal targets associated with IMF-supported programmes make medium-term budget planning highly unreliable. Line ministries and implementing agencies are therefore unable to project available resources beyond the annual budget cycle with confidence. In response, environmental agencies operate defensively, prioritising short-term institutional continuity and compliance with annual ceilings over longer-term ecosystem management objectives. As a result, protected area management plans and restoration strategies cannot be financed consistently across the planning horizons required for ecological effectiveness.
- **IMF programme constraints:** Countries under Extended Credit Facility or Extended Fund Facility arrangements typically face limits on non-concessional external borrowing as part of programme conditionality. These constraints significantly restrict access to market-rate instruments, including sovereign green or blue bonds, unless such instruments are credit-enhanced or structured to meet concessionality requirements. As a result, the range of feasible financing options for biodiversity is narrowed precisely during periods when fiscal pressures are most acute and implementation challenges are greatest.
- **Foreign exchange scarcity:** In debt-distressed low-income countries, binding constraints on biodiversity implementation often arise not from domestic currency fiscal space but from foreign exchange availability. Conservation operations frequently depend on imported inputs, including vehicles, fuel, monitoring equipment, veterinary supplies, communications technology, and specialised technical services. Foreign exchange rationing or prioritisation can therefore undermine operational capacity even where domestic budget allocations exist on paper. This foreign exchange–environment nexus is often underappreciated in analyses that focus primarily on headline fiscal aggregates denominated in domestic currency.

[28] G20 Common Framework for Debt Treatments beyond the DSSI, established November 2020.

- **Pro-cyclical degradation dynamics:** In certain contexts, particularly in lower-income and resource-dependent economies, periods of economic stress are associated with behavioural and market responses that can accelerate biodiversity loss independently of formal budgetary decisions. Heightened pressure to expand export agriculture, intensify charcoal and fuelwood production, increase timber extraction, or relax controls on resource extraction may emerge during foreign exchange shortages and broader economic distress, as governments, firms, and households seek alternative income sources. These responses are frequently driven by private actors reacting to price signals, livelihood pressures, and survival needs rather than by explicit fiscal allocations, placing them partially outside conventional public expenditure control mechanisms. The strength and direction of these dynamics vary across regions and crisis episodes, reflecting differences in institutional capacity, enforcement strength, and economic structure.

Box 3.2 — Economic Crises and Environmental Degradation—What Does the Evidence Show?

The relationship between economic crises and environmental degradation is empirically heterogeneous. A recent global panel study covering more than 150 countries finds that, on average, financial crises are associated with reductions in deforestation, largely reflecting demand contraction for timber and agricultural commodities, while also identifying substantial regional and income-group variation (Antonarakis et al. 2022).

Country-level evidence nonetheless documents pro-cyclical degradation under specific conditions. The Asian financial crisis of 1997–98 provides the most extensively studied case. In Indonesia, currency collapse and enforcement budget cuts coincided with sharp increases in deforestation, attributed to weakened law enforcement and expansion of forest-based livelihoods and export agriculture (Dauvergne 1999; Pagiola 2001; Gaveau et al. 2009). Earlier studies similarly linked debt and adjustment pressures in parts of Latin America to increased deforestation through incentives to expand agricultural exports for foreign exchange.

More recent evidence from the COVID-19 pandemic reinforces the importance of institutional and enforcement capacity. In several countries, temporary collapse or re-prioritisation of monitoring and enforcement during lockdowns coincided with spikes in illegal logging, mining, and land conversion, particularly where governance gaps and informal resource dependence were already present (Brancalion et al. 2020; Singhal et al. 2023; Montoya-Zumaeta et al. 2025). In other contexts, however, reduced economic activity dampened deforestation pressures, underscoring the non-uniform nature of crisis effects.

Taken together, the evidence suggests that pro-cyclical degradation is most likely where enforcement capacity is fiscally vulnerable, natural resource dependence is high, foreign exchange pressures are acute, and households rely on ecosystems as safety nets. These conditions overlap with the fiscal vulnerability profiles examined in this study, indicating that pro-cyclical degradation should be understood as a context-dependent amplification mechanism, rather than a universal outcome of economic crisis.

See References for full citations

The extended timelines of Common Framework restructurings compound these effects significantly. Zambia's restructuring process extended over approximately four years from initial

application to substantial completion.[29] Ghana's process, while faster than initially anticipated, still required over two years of intensive negotiation and uncertainty.[30] Ethiopia's restructuring remains incomplete more than four years after initial application, with resolution complicated by conflict and governance challenges.[31] Throughout these extended periods, biodiversity implementation is conducted under conditions of sustained uncertainty, with ecological degradation incurred during restructuring potentially costly and slow to reverse once fiscal conditions eventually stabilise.

Ghana's 2022–2024 restructuring provides a clear illustration of these dynamics in practice. As one of the most comprehensive applications of the G20 Common Framework to date, Ghana's experience demonstrates that even restructurings judged successful by conventional debt sustainability metrics can coincide with accelerating biodiversity loss when environmental safeguards are absent from the restructuring process and when crisis political economy incentives favour short-term resource extraction.

Box 3.3 — Ghana: Restructuring Without Biodiversity Safeguards

Ghana's debt crisis and restructuring (2022-2025) illustrates how fiscal stabilisation and environmental collapse can proceed simultaneously, driven by crisis political economy that prioritises immediate fiscal relief over long-term sustainability. Public debt peaked at approximately 88% of GDP in late 2022, triggering loss of market access, currency depreciation exceeding 50%, and eventual default on external obligations. By March 2025, headline debt had declined to approximately 55% of GDP, reaching IMF programme targets three years ahead of schedule. Yet this 'successful' restructuring coincided with severe deterioration in environmental governance and biodiversity outcomes.

Crisis political economy: As Ghana entered debt default and announced restructuring negotiations in November 2022, the government adopted Legislative Instrument 2462, creating a legal pathway for mining in forest reserves subject to presidential approval.

The timing is consistent with heightened incentives to pursue immediate revenue and foreign exchange sources even at significant environmental cost. The subsequent acceleration of illegal small-scale mining (galamsey) has contaminated an estimated 60% of water bodies according to the Water Research Institute, affecting drinking water supplies for millions, reducing agricultural productivity, and contributing to a 25-30% decline in cocoa production from the 2021/22 peak.

Bidirectional dynamics: Ghana demonstrates both directions of the debt-biodiversity relationship operating simultaneously. Fiscal pressure contributed to regulatory rollback and enforcement collapse (forward channel). Environmental degradation now threatens cocoa export revenues and COCOBOD's USD 1.3 billion syndicated loan facility, potentially worsening debt dynamics (reverse channel, discussed in Section 4).

[29] IMF, Zambia: ECF Arrangement Review (Washington, DC: IMF, 2024). Restructuring substantially completed after approximately four years.

[30] IMF, Ghana: ECF Arrangement Review (Washington, DC: IMF, 2024). Programme targets achieved ahead of schedule.

[31] IMF, Ethiopia: Article IV Consultation and Programme Update (Washington, DC: IMF, 2024). Restructuring ongoing.

Implications: Ghana's experience highlights the potential for crisis-driven regulatory rollback during debt restructuring processes. The current Common Framework architecture does not explicitly incorporate biodiversity-related safeguards, which is analytically relevant for understanding debt–biodiversity interactions under Decision 16/34.

Sources: IMF ECF Review[32]; Legislative Instrument 2462[33]; Water Research Institute data[34]; COCOBOD Annual Report[35]See References for full country case citations

Whereas Ghana's restructuring, despite its environmental costs, progressed through a defined negotiation process, Ethiopia illustrates a different pathway in which prolonged and unresolved debt distress constrains biodiversity implementation. More than four years into its Common Framework application, Ethiopia faces not crisis-driven regulatory rollback but rather planning paralysis, operational breakdown from foreign exchange scarcity, and the compounding effects of sustained economic uncertainty on conservation institutions and ecosystems alike.

Box 3.4 — Debt Distress and Multi-Year Planning Breakdown: Ethiopia

Ethiopia's prolonged debt distress and restructuring illustrates how sustained fiscal uncertainty and foreign-exchange scarcity can undermine biodiversity implementation even in the absence of crisis-driven regulatory rollback.

Ethiopia requested treatment under the G20 Common Framework in February 2021 and remains in restructuring more than four years later. The country defaulted on its Eurobond coupon in December 2023 and is assessed by the IMF as being in debt distress. While headline public debt appears moderate at approximately 50 percent of GDP, debt sustainability is severely constrained by Ethiopia's exceptionally weak revenue base, with general government revenue declining from around 12–13 percent of GDP in the mid-2010s to approximately 6 percent by FY2023/24.

Prolonged restructuring dynamics: Unlike Ghana, Ethiopia's debt distress has not coincided with explicit regulatory rollback. Instead, the dominant constraint has been planning paralysis and operational breakdown. Extended restructuring negotiations, IMF programme conditionality under the Extended Credit Facility, and restrictions on non-concessional external borrowing have narrowed financing options precisely when fiscal pressures are most acute. Foreign exchange scarcity has further disabled conservation operations dependent on imported inputs, including vehicles, fuel, monitoring equipment, and technical services, even where domestic budget allocations exist on paper.

Pro-cyclical degradation pressures: Crisis conditions between 2020 and 2025 intensified charcoal production, marginal land cultivation, livestock encroachment into protected areas,

[33]Legislative Instrument 2462 (2022), Republic of Ghana. Permits mining in forest reserves subject to presidential approval.

[34]Water Research Institute, Ghana, cited in Ghana Cocoa Board Annual Report 2023-2024. Estimates 60% of water bodies affected.

[35]COCOBOD Annual Report 2023-2024. Production decline estimated at 25-30% from 2021/22 peak of approximately 1 million tonnes.

and wildlife poaching, while enforcement capacity weakened due to budget compression and personnel constraints. These dynamics raise the risk of hysteresis effects, where temporary economic shocks generate irreversible ecological damage.

Implications: Ethiopia demonstrates that prolonged debt restructuring can constrain biodiversity implementation through uncertainty, FX scarcity, and institutional erosion rather than regulatory rollback. Even with updated biodiversity strategies aligned to the Kunming–Montreal Global Biodiversity Framework, implementation remains tightly bound to debt sustainability and external liquidity conditions, underscoring the relevance of debt–biodiversity interactions.

Sources: International Monetary Fund (IMF), Ethiopia: Article IV Consultation and Extended Credit Facility Staff Reports (2021–2025); IMF, World Economic Outlook Database; World Bank, International Debt Statistics; Ministry of Finance of Ethiopia, fiscal and budget execution reports; Convention on Biological Diversity, Ethiopia Sixth National Report; UNDP BIOFIN Ethiopia diagnostics; FAO and UNEP forest and land-use assessments. See References for full country case citations

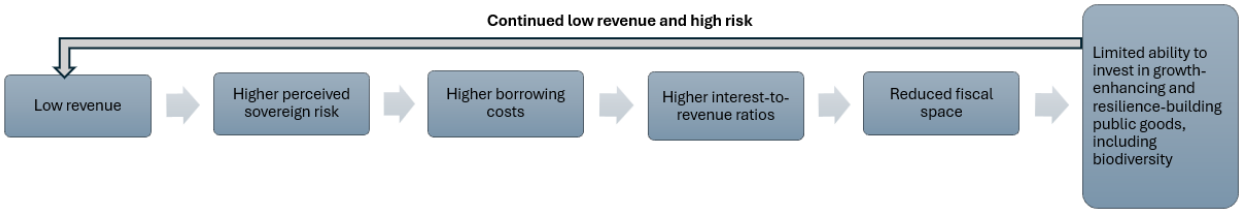
3.3 Revenue Constraints and When Moderate Debt Becomes Binding

A third transmission channel operates through the interaction between debt levels and revenue-raising capacity. Countries with weak domestic revenue mobilisation face qualitatively different constraints than those with stronger fiscal extraction capacity, even at comparable debt-to-GDP ratios. This mechanism is frequently overlooked in discussions that focus primarily on debt ratios, but it is essential for understanding why moderate debt can become binding for biodiversity implementation in countries with narrow revenue bases.

This mechanism is particularly important for understanding biodiversity implementation constraints in a substantial group of developing countries that appear moderately indebted by conventional metrics but face severe fiscal pressure in practice. Cross-country data reveal a strong negative correlation between revenue capacity (measured as revenue as a share of GDP) and interest burden (measured as interest payments as a share of revenue).[36] Countries with weaker revenue bases tend to face disproportionately higher interest burdens relative to their revenue, creating a structural trap that compounds fiscal pressure.

Fig 1. The Low-Revenue–High-Risk Fiscal Feedback Loop

How weak revenue mobilisation, elevated borrowing costs, and debt service pressures reinforce constrained fiscal space and underinvestment in growth- and resilience-enhancing public goods.



[36] Cross-country sample analysis based on 50-country dataset. See Section 5 for detailed discussion

This pattern has important implications for interpreting debt sustainability assessments in the context of biodiversity implementation. The IMF-World Bank Debt Sustainability Framework for low-income countries classifies countries by risk of debt distress based largely on ratios of debt and debt service to exports and GDP. However, these aggregate metrics may systematically understate the practical fiscal constraint faced by countries with very low revenue-to-GDP ratios, leading to underestimation of implementation challenges in such contexts.

For biodiversity implementation, the revenue constraint amplifies the general fiscal constraint through several specific mechanisms:

- **Crowding in narrow discretionary space:** When revenue is severely limited as a share of GDP, debt service, statutory obligations, and essential services such as civil service wages absorb most or all available resources. Biodiversity competes in a residual envelope that may be negligible or zero, regardless of debt-to-GDP ratios that might suggest adequate fiscal capacity.
- **Inability to counter-cyclically smooth:** Countries with narrow revenue bases lack the fiscal buffers and borrowing capacity to maintain spending during economic downturns or after external shocks. Biodiversity budgets are fully exposed to pro-cyclical adjustment, declining when economic conditions deteriorate precisely when pressures on ecosystems may intensify.
- **Dependence on external financing:** Low domestic revenue forces heavy reliance on external financing for environmental programmes, including both bilateral aid and multilateral lending. This creates volatility as external financing fluctuates with donor priorities, project fragmentation as multiple donors pursue different objectives, and potential misalignment between donor priorities and national conservation needs.
- **Climate-fiscal interaction:** Countries with narrow fiscal bases are also often highly exposed to climate impacts. Recurrent disaster costs create contingent liabilities that further compress discretionary space, while limiting capacity to invest in climate adaptation including ecosystem-based approaches. This creates a reinforcing loop between climate shocks, fiscal stress, and biodiversity under-investment that can be difficult to escape.
- **Debt composition and collateralisation effects:** Beyond debt levels, the *structure* of sovereign debt can create additional pressures on biodiversity outcomes. Resource-backed loans, in which debt repayment is secured against commodity export revenues or resource concessions, have been shown empirically to increase deforestation and accelerate natural resource depletion in borrowing countries.[37] These arrangements create direct incentive alignment between debt service obligations and extraction rates, potentially locking in unsustainable resource use patterns regardless of domestic policy preferences. While such instruments represent a small share of total developing country debt, their presence in commodity-exporting economies with high biodiversity value warrants attention to debt composition as well as debt levels when assessing implementation constraints.

Bangladesh clearly illustrates this pattern, demonstrating how a country that appears only moderately indebted by headline metrics can face severely constrained discretionary fiscal space due to exceptionally low revenue mobilisation.

[37] Coulibaly, Y. et al. (2025). The effects of resource-backed loans on deforestation. *World Development*; Bhattacharyya, S. and Hodler, R. (2015). Rent-seeking and resource-backed loans. *Journal of Development Economics*.

Box 3.5 — When Moderate Debt Becomes Binding: Bangladesh

With debt-to-GDP of approximately 38.5 percent, Bangladesh appears only moderately indebted by international standards and would not typically be considered fiscally constrained. However, with revenue-to-GDP of only approximately 8.9 percent, among the lowest globally, this moderate debt translates into an interest-to-revenue ratio of approximately 30 percent, a level that severely constrains discretionary fiscal space.

This is the defining insight of the Bangladesh case. Extremely low revenue mobilisation turns moderate debt service into a structural ceiling on discretionary spending. Bangladesh's apparent fiscal health when assessed through debt-to-GDP metrics masks binding constraints that affect all discretionary spending categories, including biodiversity.

The revenue constraint amplifies fiscal pressure through several mechanisms. First, debt service crowds into a very narrow discretionary envelope, intensifying competition among spending categories. Second, limited revenue capacity restricts the government's ability to smooth spending counter-cyclically during economic downturns. Third, environmental and biodiversity programmes rely heavily on external financing, increasing exposure to aid volatility and project fragmentation. Fourth, recurrent climate and disaster-related expenditures further compress discretionary space while simultaneously increasing the need for ecosystem-based adaptation and resilience investment.

Bangladesh illustrates that debt sustainability assessments based solely on headline debt ratios can understate implementation constraints where revenue mobilisation is exceptionally weak. In such contexts, biodiversity implementation is constrained not by crisis or institutional failure, but by persistent fiscal rigidity that limits the scale, predictability, and durability of public investment. The full Bangladesh country case, including institutional and implementation dynamics, is presented in Annex B.

Sources: IMF Article IV 2024; World Bank data; BIOFIN Bangladesh. See References for full country case citations

3.4 Institutional Capacity, Execution, and Non-Fiscal Constraints

A fourth consideration qualifies the fiscal channels discussed above: fiscal resources translate into biodiversity outcomes only to the extent that institutional capacity, governance quality, and execution effectiveness allow. Even where fiscal resources are nominally available, biodiversity implementation may be constrained by non-fiscal factors, including weak institutions, fragmented mandates, and limited delivery capacity. This qualification has important implications for interpreting the debt–biodiversity relationship.

Indeed, the academic literature on debt and natural resource management consistently identifies governance quality as a conditioning variable that mediates the relationship between fiscal pressure and environmental outcomes. Empirical studies find that the association between external debt and natural resource depletion is significantly stronger where governance is weak, suggesting that debt pressure operates *through* institutional channels rather than mechanistically.[38] Similarly, research on corruption and rent-seeking shows that fiscal pressure combined with weak governance increases illegal extraction and accelerates forest loss, as

[38] Cobbold, E.Y. et al. (2025). External debt and natural resource depletion. *Structural Change and Economic Dynamics*; González-Redín, J. et al. (2018). Exploring the role of debt in natural resource (un)sustainability. *PLOS ONE*.

enforcement capacity declines and short-term revenue imperatives override conservation mandates.[39] These findings imply that governance quality should be understood not merely as a parallel constraint alongside fiscal conditions, but as a variable that conditions how fiscal pressure transmits to biodiversity outcomes.

Fiscal constraints can be binding, but they do not operate mechanistically. Additional fiscal resources do not automatically translate into improved biodiversity outcomes where institutional bottlenecks, governance failures, or execution challenges intervene between allocation and impact. Conversely, some countries with limited fiscal resources achieve comparatively strong biodiversity outcomes through effective institutions, clear prioritisation, and efficient programme design.

Several recurring patterns in the cross-country evidence illustrate how institutional capacity mediates the relationship between fiscal resources and biodiversity outcomes:[40]

- **Resources without execution capacity:** In some countries, substantial resources have accumulated in dedicated environmental or compensatory funds but remain significantly underutilised due to administrative bottlenecks, weak project pipelines, inter-governmental coordination failures, or limited absorptive capacity. These cases demonstrate that the presence of fiscal resources alone does not guarantee implementation when institutional constraints bind.
- **Islands of effectiveness under fiscal constraint:** Even in fiscally constrained contexts, targeted conservation programmes, such as species-specific initiatives or geographically concentrated interventions, sometimes deliver measurable outcomes. Their success reflects strong institutional focus, clear accountability, political visibility, and ring-fenced management structures. However, such successes are often narrow in scope and difficult to scale across broader biodiversity portfolios.
- **Divergence under common fiscal rules:** In federal or decentralised systems, subnational jurisdictions operating under the same macro-fiscal constraints frequently exhibit wide variation in biodiversity outcomes. This divergence reflects differences in administrative capacity, political prioritisation, and governance effectiveness rather than differences in fiscal space, underscoring the importance of institutional factors at the subnational level.

The interaction between fiscal and institutional constraints is not merely additive; the two interact in complex and reinforcing ways. Fiscal pressure can erode institutional capacity over time through staff attrition as qualified personnel leave underfunded agencies, deferred maintenance of conservation infrastructure, training cuts that weaken technical capacity, and the accumulation of backlogs in enforcement, monitoring, and management activities. Conversely, weak institutions can limit absorptive capacity for additional resources, creating apparent fiscal space that cannot be effectively deployed because the administrative and technical machinery required to translate resources into outcomes is absent.

[39] Pellegrini, L. et al. (2021). Corruption, rent-seeking, and deforestation. *Ecological Economics*.

[40] These patterns are documented across a wide range of public expenditure reviews, biodiversity finance diagnostics, and institutional assessments. See, inter alia, UNDP BIOFIN Biodiversity Expenditure Reviews; IMF Article IV consultations and Selected Issues Papers on expenditure composition and fiscal institutions; World Bank Public Expenditure and Financial Accountability (PEFA) assessments; CBD Sixth National Reports; and independent evaluations of conservation finance and delivery mechanisms, including the Climate Investment Funds Forest Investment Program evaluations. Illustrative country examples are discussed in Annex B.

India exemplifies these dynamics at scale. As the world's most populous country and one of 17 megadiverse nations, India faces severe biodiversity loss with significant localised economic and human welfare effects. Yet India's debt sustainability picture is mixed: general government debt is elevated at approximately 83% of GDP[41], but India retains strong market access and has never approached debt distress. Interest payments absorb 25-37% of government revenue depending on level of government[42]—substantial but not at levels that would preclude meaningful conservation expenditure if institutional conditions supported effective deployment.

Box 3.6 — Fiscal Space Without Delivery: India's CAMPA Paradox

India illustrates that fiscal space is necessary but not sufficient for biodiversity implementation. The Compensatory Afforestation Fund Management and Planning Authority (CAMPA) has accumulated a corpus exceeding Rs. 54,000 crore (approximately USD 6.5 billion), making it one of the largest dedicated conservation funds globally. Yet utilisation rates remain well below potential, with substantial balances accumulating year after year while conservation needs go unmet.

Institutional bottlenecks: Fund utilisation has been constrained by administrative procedures, inter-governmental coordination challenges between central and state authorities, land availability constraints for compensatory afforestation, and absorptive capacity limitations in implementing agencies. These institutional factors, rather than fiscal constraint, represent the binding constraint on implementation.

Targeted programme success: Contrast CAMPA's challenges with Project Tiger, which demonstrates successful conservation outcomes under institutional conditions that enable effective resource deployment. Tiger populations have recovered from approximately 1,400 in 2006 to over 3,600 by 2023, attributed to dedicated institutional attention, clear metrics, strong political visibility, and ring-fenced funding that has been effectively utilised.

Implications for analysis: India demonstrates that biodiversity implementation challenges cannot be reduced to fiscal constraint alone. A comprehensive assessment of debt-biodiversity linkages must consider institutional dimensions that mediate the translation of fiscal resources into conservation outcomes. For countries like India, institutional reforms may be as important as fiscal measures.

Sources: CAMPA Annual Report 2022-23[43]; CAG Performance Audit[44]; Project Tiger evaluation reports[45] See References for full country case citations

Peru illustrates a complementary pattern that reinforces the importance of institutional factors in biodiversity implementation. With public debt well below regional peers at approximately 32

[41]IMF, India: Article IV Consultation Staff Report (Washington, DC: IMF, 2024). General government debt approximately 83% of GDP.

[42]Ministry of Finance, Government of India, Union Budget 2024-25. Interest payments 25-37% of revenue depending on government level.

[43]Compensatory Afforestation Fund Management and Planning Authority (CAMPA), Annual Report 2022-23. Corpus exceeds Rs. 54,000 crore (approximately USD 6.5 billion).

[44]CAG Performance Audit of CAMPA (2023); independent evaluations of fund utilisation rates.

[45]Project Tiger evaluation reports; National Tiger Conservation Authority data.

percent of GDP[46] ,substantial natural resource revenues from mining, and a diversified export base, Peru does not face binding macro-fiscal constraints on biodiversity spending under standard debt and fiscal sustainability metrics. Yet deforestation rates remain elevated, and protected area management is chronically underfunded relative to assessed needs. In Peru's case, constraints appear to be primarily institutional and political rather than fiscal, including limited governance capacity in remote forest areas, coordination challenges across ministries with competing mandates, enforcement gaps in addressing illegal activities, and political prioritisation of extractive development over conservation. Peru therefore demonstrates that the absence of binding fiscal constraints does not automatically translate into effective biodiversity outcomes where institutional and governance factors are decisive.

3.5 Summary: When and How Debt Sustainability Constrains Implementation

The preceding analysis identifies four distinct channels through which debt sustainability conditions can constrain biodiversity implementation under the Convention. Each channel operates with varying intensity across different country contexts, and understanding these differentiated pathways is essential for accurate diagnosis of implementation challenges and appropriate policy responses.

- **Chronic fiscal compression (Section 3.1):** High interest burdens reduce discretionary fiscal space over extended periods, systematically disadvantaging biodiversity expenditure that lacks statutory protection and political salience. This channel operates continuously in countries with elevated but sustainable debt, affecting implementation through gradual erosion of resources and institutional capacity rather than acute crisis.
- **Adjustment and planning disruption (Section 3.2):** Debt distress and restructuring create uncertainty, conditionality, and foreign exchange constraints that disrupt multi-year implementation even where nominal fiscal resources exist. Ghana's experience shows how restructuring can coincide with accelerating environmental degradation when safeguards are absent and crisis political economy incentivises resource extraction.
- **Revenue constraint amplification (Section 3.3):** Low revenue mobilisation transforms moderate debt ratios into binding fiscal constraints by producing high interest-to-revenue ratios that eliminate discretionary space. Bangladesh demonstrates how apparently moderate debt-to-GDP ratios can mask severe practical fiscal constraints when revenue bases are narrow.
- **Institutional mediation (Section 3.4):** The translation of fiscal resources into biodiversity outcomes depends on institutional capacity, governance quality, and execution effectiveness. India's CAMPA illustrates how substantial fiscal resources can remain underutilised when institutional constraints are binding, while Peru shows that relaxing fiscal constraints does not automatically resolve governance-driven implementation challenges.

These channels are not mutually exclusive. Countries may experience multiple channels simultaneously, and the relative importance of each varies by country context. The cross-country analysis in Section 5 maps these patterns systematically across a diverse sample of countries.

[46] IMF, Peru: Article IV Consultation (Washington, DC: IMF, 2025).

The evidence presented in this section establishes that debt sustainability conditions can materially affect the capacity of many Parties to implement the Convention, operating through multiple channels that vary by country context. The implications of these findings for national policy and international cooperation frameworks are explored further in Section 6.

4. BIODIVERSITY OUTCOMES AND DEBT SUSTAINABILITY

The reverse channel: when ecosystem health becomes macro-critical

Section 4 examines the reverse direction of the debt–biodiversity relationship, analysing how biodiversity outcomes associated with implementation, or non-implementation, of the Convention can become macro-relevant for fiscal stability and debt sustainability in specific country contexts. Unlike the forward relationship examined in Section 3, this reverse relationship does not operate through direct budgetary mechanisms. Biodiversity outcomes rarely affect debt sustainability through identifiable fiscal line items in the way that interest payments mechanically constrain fiscal space. Instead, their relevance is indirect and contingent, operating through three distinct transmission channels: effects on government revenue and foreign exchange generation in nature-dependent economies; amplification of fiscal risk through shocks and contingent liabilities where ecosystems provide protective services; and longer-term effects on productivity and growth arising from natural capital depletion. These channels operate over different time horizons, vary in strength across economic structures, and become macro-critical only where specific structural conditions are present. Accordingly, the analysis in this section is scenario-based and diagnostic, rather than predictive or estimative, and is explicitly concerned with identifying where these transmission channels plausibly bind, rather than asserting that they operate universally.

These indirect effects are highly context-specific and become material for debt sustainability only where particular structural conditions are present in the economy. A tourism-dependent island economy faces fundamentally different biodiversity–debt dynamics than a manufacturing-oriented continental economy, even where headline biodiversity indicators appear similar. Understanding these structural conditions, and their absence, is essential for accurate analysis of where the reverse channel operates and where it does not.

The World Bank's *Changing Wealth of Nations* programme (CWON) provides the most comprehensive methodological framework for understanding these relationships and quantifying their potential significance.[47] By measuring comprehensive wealth, including natural capital alongside produced capital, human capital, and net foreign assets, CWON enables systematic assessment of whether economic growth is achieved by genuinely expanding a country's productive base or by depleting it, a distinction that is fundamental for sustainability analysis and directly relevant for debt sustainability assessments that project growth into the future.

The World Bank estimates that the global economy could lose USD 2.7 trillion annually by 2030 if certain critical ecosystem services collapse, with low-income countries potentially experiencing GDP declines averaging 10 percent annually under such scenarios.[48] While these estimates involve significant uncertainty and depend on specific assumptions about ecosystem tipping points and economic linkages, they illustrate the potential scale of macroeconomic effects associated with severe biodiversity loss in the most affected economies. These estimates are not predictions of likely outcomes but rather indications of exposure under adverse scenarios, the type of risk analysis that is increasingly relevant for financial and fiscal planning.

4.1 Nature-Dependent Revenues and Fiscal Stability

The first reverse channel operates through nature-dependent revenues and fiscal balances. When ecosystems that support these activities degrade, the economic activities they enable

[47] World Bank, The Changing Wealth of Nations 2024 (Washington, DC: World Bank, 2024).

[48] Ibid. GDP loss estimates based on partial ecosystem collapse scenarios in nature-dependent economies.

decline, and fiscal revenues follow. This channel is most relevant in economies where nature-dependent sectors constitute a significant share of GDP, government revenue, or export earnings.

Tourism is the clearest and most frequently cited example of this mechanism. In economies where natural attractions such as coral reefs, wildlife, forests, beaches, and landscapes underpin visitor arrivals and spending, ecosystem degradation can directly threaten the tourism industry's viability. This affects tax receipts from tourism businesses and workers, employment and social stability in tourism-dependent communities, and foreign exchange earnings that are essential for servicing external debt and importing necessary goods.

The economic significance of nature-based tourism can be substantial in affected economies, particularly Small Island Developing States. In tourism-dependent SIDS, nature-based tourism may account for a very large share of GDP, often in the range of 30–50 percent, and may represent the primary or sole significant source of foreign exchange earnings.[49] In such contexts, ecosystem degradation that reduces tourism attractiveness, such as coral bleaching that diminishes reef appeal, coastal erosion that damages beaches, or wildlife decline that reduces safari viability, translates directly into reduced government revenue, reduced foreign exchange availability, and reduced capacity to service external debt denominated in foreign currency.

Ecosystem service valuations reinforce the economic significance of this relationship beyond tourism alone. Comprehensive studies have estimated that coral reefs and mangroves provide services equivalent to 15–22 percent of GDP in reef-dependent economies, aggregating tourism value, fisheries productivity, coastal protection services, and other measurable benefits.[50] Healthy reefs also provide non-revenue benefits with fiscal implications. By reducing wave energy by up to 97 percent, they deliver infrastructure-equivalent coastal protection that avoids government expenditure on built infrastructure, disaster response, and post-disaster reconstruction.[51][52]

Fisheries present a parallel dynamic in economies where fishing contributes significantly to livelihoods, nutrition, food security, and export earnings. Overfishing, destructive fishing practices, and habitat destruction that reduce fish stocks affect both government revenue from fishing licenses and export earnings from fish products. In coastal developing countries where fishing is a major economic activity and dietary protein source, unsustainable fisheries management has direct implications for fiscal stability and social welfare that may generate additional fiscal costs.

Box 4.1 — Ecosystems as Revenue Infrastructure: Belize

Belize exemplifies the revenue-based reverse channel, where reef health directly affects tourism arrivals, government revenue, and debt sustainability.

The Belize Barrier Reef, the second-largest in the world, underpins a tourism sector contributing approximately 40–46 percent of GDP and around 37 percent of national employment. An estimated 25 percent of tourism is directly reef-dependent through activities

[49] UNWTO, Tourism and Small Island Developing States (Madrid: UNWTO, 2023). Nature-based tourism accounts for 30-50% of GDP in tourism-dependent SIDS.

[50] Burke, L. et al., Reefs at Risk Revisited (Washington, DC: World Resources Institute, 2011).

[51] Spalding, M. et al., 'The role of ecosystems in coastal protection', Ocean & Coastal Management 90 (2014).

[52] Ferrario, F. et al., 'The effectiveness of coral reefs for coastal hazard risk reduction', Nature Communications 5: 3794 (2014).

such as diving, snorkeling, and marine wildlife viewing, while the broader ecosystem underpins virtually all tourist activity. Reef degradation would therefore reduce goods and services tax receipts from tourist spending, departure taxes and protected area entry fees, corporate taxes from tourism operators, and income taxes from tourism employees.

The transmission mechanism is unusually direct and measurable. Belize welcomed a record 562,405 overnight visitors in 2024, a 21 percent increase over 2023, directly supporting the fiscal improvement that reduced public debt from 103 percent of GDP in 2020 to approximately 61 percent in 2024. The World Wide Fund for Nature estimates that four marine protected areas alone provide USD 19 million in annual tourism benefits, while total reef-related tourism value exceeds USD 100 million annually.

Critically, tourism revenues are earned in foreign currency, which is essential for servicing external debt and maintaining Belize's fixed exchange rate peg to the US dollar. Reef degradation that reduces tourism inflows would weaken the balance of payments, increase vulnerability to exchange rate pressure, and complicate external debt management.

The 2021 Blue Bond transaction, which restructured USD 553 million in Eurobonds, explicitly recognised this connection by creating legally binding marine conservation commitments alongside debt relief. The structure demonstrates policy recognition of the reef–tourism–fiscal nexus, even if precise causal attribution remains methodologically challenging.

Sources: IMF Article IV 2024; Belize Tourism Board; TNC Blue Bonds analysis; WWF reef valuation studies. See References for full country case citations

The same revenue-based reverse channel can operate in commodity-producing economies where ecosystem services underpin export production rather than tourism. In Ghana, cocoa accounts for a substantial share of export revenues and depends on forest-based ecosystem services. .[53] Environmental degradation in cocoa-growing regions has contributed to recent production declines, with fiscal implications through export earnings and the financial position of the state cocoa marketing board. This mechanism, and its interaction with Ghana's debt restructuring, is examined in detail in Box 4.2

Box 4.2 — Ghana's Cocoa Sector: The Reverse Channel in Action

Ghana's cocoa sector provides a real-time illustration of how environmental degradation can generate fiscal pressure through the reverse channel, demonstrating that this mechanism extends beyond tourism-dependent economies to commodity-producing countries where ecosystem services underpin export production.

Ecosystem service dependence: Cocoa accounts for approximately 20–25 percent of Ghana's export revenues and supports livelihoods for an estimated 800,000 farming households concentrated in the forest zone of southern Ghana. The sector's productivity depends fundamentally on ecosystem services that are largely invisible in national accounts but essential for production, including pollination by forest-dependent insects, soil fertility

[53]Ghana Cocoa Board (COCOBOD) Annual Report 2023-2024.

maintained through natural nutrient cycling, stable water availability from forested watersheds, and natural pest regulation.

Environmental degradation pressures: These ecosystem services have been progressively undermined by environmental degradation in cocoa-growing regions. Deforestation has reduced shade cover and pollinator habitat, while soil degradation from intensive cultivation without adequate restoration has diminished land productivity. In parallel, illegal small-scale gold mining (galamsey) has contaminated surface water used for irrigation and cocoa processing, further degrading production conditions. While weather variability and disease pressures have also played a role, environmental degradation has been identified as a significant compounding factor.

Production decline and fiscal implications: Between 2021/22 and 2024/25, cocoa production declined by an estimated 25–30 percent from its recent peak of approximately one million tonnes. This decline has had direct fiscal implications. The Ghana Cocoa Board (COCOBOD), the state-owned entity responsible for purchasing and exporting cocoa, has faced mounting financial stress, including difficulties servicing a USD 1.3 billion syndicated loan facility that was structured on the basis of higher production projections. Reduced export earnings have also constrained foreign exchange availability during Ghana's debt restructuring period, creating contingent fiscal liabilities for the sovereign through potential support to COCOBOD.

Bidirectional dynamics: Ghana's experience illustrates bidirectional dynamics. Debt distress and restructuring pressures contributed to weakened environmental enforcement and regulatory rollback, while environmental degradation is now undermining export revenues and generating fiscal risks. The two channels reinforce each other, highlighting how ecosystem degradation can become macro-fiscally relevant in commodity-dependent economies even when biodiversity does not appear directly as a budget line item.

Sources: IMF Article IV Consultation (2024); UNDP BIOFIN Ghana Biodiversity Expenditure Review; Government of Ghana cocoa sector statistics; COCOBOD financial disclosures; Water Research Institute of Ghana; CBD Sixth National Report; World Bank World Development Indicators. See References for full country case citations

From Biodiversity Outcomes to Debt Dynamics: Transmission Mechanics

The country cases above illustrate that biodiversity outcomes can affect macro-fiscal conditions through several pathways. Standard debt sustainability analysis centers on the relationship between the real interest rate, real economic growth, and the primary fiscal balance, the fundamental debt dynamics equation that determines whether the debt-to-GDP ratio rises, falls, or stabilises over time. [54] Understanding how biodiversity outcomes enter this framework requires mapping ecosystem effects to each component of debt dynamics.

[54] In standard debt sustainability analysis, public debt stabilises when economic growth exceeds the effective interest rate on public debt and when primary fiscal balances are sufficient to cover remaining financing needs. Debt dynamics are therefore shaped by the interaction between growth, borrowing costs, and the primary balance.

Biodiversity outcomes can affect all three components of debt dynamics—primary balance, growth, and interest rates—but through different mechanisms, over different time horizons, and with varying materiality depending on country structural conditions.

1. **Primary balance effects:**

- *Revenue impacts:* Revenue shocks from ecosystem degradation, such as reduced tourism receipts following reef bleaching, fisheries collapse from overharvesting, agricultural productivity decline from soil degradation, or commodity production losses from water contamination, widen the primary deficit if expenditure does not adjust commensurately. For countries with limited capacity to cut expenditure due to statutory obligations, political constraints, or minimum service delivery requirements, and limited ability to raise alternative revenues because of narrow tax bases or administrative constraints, nature-related revenue shocks translate relatively directly into fiscal deterioration.

- *Expenditure impacts:* Simultaneously, ecosystem degradation can increase expenditure requirements through several mechanisms. These include disaster response costs when natural protection fails, emergency social transfers to populations whose livelihoods depend on degraded ecosystems, public health costs from environmental contamination, and remediation investments attempting to restore degraded systems. These expenditure pressures compound revenue effects, potentially widening the primary deficit from both sides.

2. **Growth effects through the GDP denominator:** Ecosystem degradation that reduces economic output directly depresses GDP growth, affecting the debt-to-GDP ratio even without additional borrowing. The numerator, the debt stock, remains unchanged while the denominator, GDP, grows more slowly or potentially declines. In economies where nature-dependent sectors constitute a large share of GDP, including agriculture, tourism, fisheries, or forestry, biodiversity outcomes have direct mechanical effects on debt sustainability metrics through this growth channel. The effect is particularly significant for countries near debt sustainability thresholds, where relatively small changes in growth projections can shift assessments from sustainable to unsustainable.

3. **Interest rate effects through sovereign risk premia:** If investors perceive that ecosystem degradation increases fiscal risks through the revenue and growth channels described above, they may demand higher yields on sovereign debt to compensate for increased default probability. This raises the effective interest rate in the debt dynamics equation, making debt stabilisation more difficult by increasing the interest burden relative to growth. The Network for Greening the Financial System has developed analytical frameworks identifying nature-related financial risks as potentially material for financial stability and sovereign creditworthiness.[55]

The relative importance of these three mechanisms varies systematically by country context. In highly nature-dependent small economies, the primary balance impact through revenue effects may be dominant and relatively immediate. In countries with growth models built substantially on natural resource extraction, the growth effect may matter most over medium-term horizons. The interest rate effect is likely most relevant for countries already near market-access thresholds, where marginal changes in perceived risk can significantly affect borrowing costs and rollover capacity.

[55]NGFS, Nature-related Financial Risks: A Conceptual Framework (Paris: NGFS, 2023).

Box 4.3 – Emerging Quantitative Evidence on Nature-Debt Linkages

A small but growing body of academic and institutional work has begun to explore how biodiversity loss could affect macroeconomic performance and sovereign debt sustainability under adverse scenarios. This literature remains exploratory and should be interpreted as indicative rather than predictive, but it provides insight into the potential scale and pathways of the reverse channel discussed in this section.

Recent academic work at the University of Cambridge has produced experimental biodiversity-adjusted sovereign credit risk assessments. Using scenario-based approaches that model partial ecosystem degradation, these studies estimate how nature-related shocks could affect sovereign default probabilities through impacts on growth, fiscal balances, and long-term productive capacity. Results suggest that in highly nature-dependent economies, ecosystem degradation could materially increase perceived sovereign risk under adverse conditions. These exercises are explicitly framed as stress tests rather than forecasts and are not intended for direct operational use in credit rating or debt sustainability assessments.

In parallel, the World Bank has begun piloting nature-aware macroeconomic modelling approaches in selected countries, including India, Uganda, and Sri Lanka. Building on the *Changing Wealth of Nations* framework, these pilots link biophysical ecosystem service models to GDP, employment, and fiscal projections to assess whether economic growth trajectories are consistent with maintaining underlying natural capital. While still methodologically experimental, these efforts establish institutional precedent for integrating biodiversity considerations into macroeconomic analysis and long-term sustainability assessments.

Complementing these scenario-based approaches, recent econometric work has examined whether biodiversity indicators are already reflected in sovereign credit assessments. Using generalised method of moments estimation across a panel of countries, Şeker and İşgüven (2025) find that biodiversity indicators have a statistically significant negative effect on sovereign credit scores, suggesting that credit rating agencies may already be incorporating nature-related risk factors into their assessments, albeit implicitly.[56] Separately, event-study analysis by Giglio et al. (2024) finds that sovereign credit default swap spreads increase when investors receive negative biodiversity news, with larger effects observed for countries with already-depleted ecosystems.[57] These findings suggest that market participants may be beginning to price biodiversity-related risks into sovereign debt valuations, even in the absence of explicit nature-adjusted methodologies.

Taken together, these initiatives do not provide definitive quantitative estimates of biodiversity-related debt impacts. They rely on stylised scenarios, involve assumptions that are difficult to validate empirically, and cannot capture all relevant transmission mechanisms. Their significance lies instead in demonstrating that nature-related risks can be conceptually mapped into the analytical frameworks used for macro-fiscal and financial risk assessment, and that the potential magnitudes involved may be non-trivial for certain country contexts. This emerging work reinforces the analytical relevance of the reverse channel without supplanting the need for cautious interpretation and further methodological development.

[56] Şeker, A. and İşgüven, M.K. (2025). The Nexus Between Biodiversity and Sovereign Credit Ratings. *Sustainability*, 17(11), 4977.

[57] Giglio, S., Kuchler, T., Stroebel, J., and Wang, O. (2024). The Economics of Biodiversity Loss. NBER Working Paper 32678.

Sources : Agarwala, M. et al. (2022). Biodiversity-adjusted sovereign risk analysis for selected countries (University of Cambridge, Bennett Institute).

Kraemer, M. and Volz, U. (2022). Scenario-based assessments of nature-related macro-fiscal risk using World Bank ecosystem collapse scenarios.

World Bank (2025). Changing Wealth of Nations and pilot applications linking biophysical ecosystem models to macroeconomic and fiscal projections.

See References for full country case citations

4.2 Risk, Ecosystem Degradation, and Contingent Liabilities

A second reverse channel operates through the risk-reduction services that healthy ecosystems provide, particularly relevant for coastal and island economies. Ecosystems such as coral reefs, mangroves, seagrass beds, and coastal wetlands function as natural protective infrastructure, attenuating wave energy, reducing storm surge penetration, limiting flooding extent, and preventing coastal erosion. When these ecosystems degrade, the loss of protective services increases physical risk exposure for coastal populations and infrastructure, which in turn increases fiscal exposure through disaster response costs, reconstruction requirements, and economic disruption.

Scientific evidence quantifying ecosystem protective services has become increasingly robust and detailed. Healthy coral reefs can dissipate up to 97 percent of incoming wave energy before it reaches shore, providing measurable and significant reduction in coastal flooding, wave damage, and erosion rates.[58] This protective function is equivalent to substantial built infrastructure investment such as seawalls, breakwaters, and flood barriers that would require government expenditure to replicate artificially. The loss of reef protection through bleaching, acidification, or physical destruction therefore represents both the loss of an asset and the creation of an implicit infrastructure deficit.

Mangrove forests provide complementary protection through different mechanisms. A 100-metre-wide mangrove belt can reduce wave heights by 13-66 percent depending on forest density and wave conditions, with wider belts providing proportionally greater protection.[59] Mangroves also trap sediments that build coastlines, provide nursery habitat for commercially important fish species, and sequester carbon at rates exceeding most terrestrial forests. The economic value of these combined services has been estimated in the billions of dollars annually for the most extensive mangrove coastlines.[60]

When these protective ecosystems degrade through pollution, physical destruction for coastal development, climate-induced bleaching, or other pressures, the loss of protective services exposes coastal infrastructure and populations to greater physical risk from storms, flooding, and erosion. The fiscal implications operate through several mechanisms: direct disaster response costs when storms cause greater damage; reconstruction of damaged public infrastructure including roads, ports, utilities, and public buildings; economic disruption that reduces tax

[58] Ferrario et al. (2014), op. cit. Field measurements across Indo-Pacific reef systems.

[59] McIvor, A. et al., 'Reduction of Wind and Swell Waves by Mangroves', Natural Coastal Protection Series (2012).

[60] Beck, M. and Lange, G., 'Managing Coasts with Natural Solutions', World Bank Technical Report (2016).

revenues during recovery periods; and social support requirements for affected populations who lose homes, livelihoods, or both.

For countries with limited fiscal buffers or already-elevated debt levels, these disaster-related costs can materially affect debt sustainability trajectories. A major hurricane that might have caused moderate damage with intact reef and mangrove protection could cause catastrophic damage without that protection, potentially pushing a country from manageable post-disaster stress into debt distress requiring restructuring.

Repeated Shocks, Ecosystem Degradation, and Debt Dynamics

In highly disaster-exposed economies, repeated shocks can interact with ecosystem degradation to generate a *ratchet-like debt dynamic* that weakens fiscal sustainability over time, even where initial debt positions are not extreme. This dynamic arises not from a single event, but from the cumulative interaction of disasters, incomplete recovery, and declining natural protection.

When a major shock occurs, governments face immediate emergency spending and reconstruction needs, financed through borrowing, grants, or reallocation of scarce fiscal resources. Output and revenues typically recover only partially before the next shock occurs. If subsequent disasters strike before full recovery, additional fiscal pressure is created and public debt increases further. Over successive events, recovery capacity diminishes and debt trajectories fail to return to pre-shock baselines.

Ecosystem degradation can amplify this dynamic by increasing the severity of losses associated with each shock. As coral reefs, mangroves, wetlands, and other natural buffers deteriorate, disasters of similar meteorological intensity cause progressively greater damage to infrastructure, housing, and productive assets. This raises emergency costs, reconstruction needs, and contingent liabilities even if hazard frequency and intensity remain unchanged.

This type of ratchet dynamic is most relevant in economies with high disaster exposure, limited economic diversification, narrow fiscal buffers, and strong dependence on ecosystem services for protection or livelihoods. In such contexts, biodiversity outcomes become macro-relevant primarily through their influence on fiscal volatility and tail risks rather than through average growth or revenue effects.

Box 4.4 — Ecosystem Loss and Disaster Costs: Vanuatu

Vanuatu illustrates a distinct reverse transmission mechanism in which biodiversity outcomes affect debt sustainability primarily through fiscal risk and volatility rather than through average revenue or growth performance. As one of the world's most disaster-exposed countries, Vanuatu experiences frequent cyclones and climate-related shocks that impose large and recurrent fiscal costs. Average annual disaster losses are estimated to be very high relative to the size of the economy, with individual events regularly causing damages equivalent to a substantial share of GDP.

In this context, coastal and marine ecosystems such as coral reefs, mangroves, and seagrass beds function as protective infrastructure. Healthy reefs reduce wave energy and storm surge, while mangroves attenuate flooding, stabilise coastlines, and reduce erosion. These ecosystem services materially lower physical damage to public infrastructure, housing, and

productive assets during extreme weather events. When these natural protective systems degrade through pollution, physical destruction for coastal development, or climate-related stress, the severity of disaster impacts increases.

The macro-fiscal relevance of this degradation operates through several reinforcing effects. First, emergency response and recovery costs rise as storms cause greater damage, increasing immediate expenditure pressures. Second, reconstruction of damaged public infrastructure such as roads, ports, utilities, and public buildings requires additional borrowing or reallocation of scarce fiscal resources. Third, economic disruption following disasters reduces tax revenues during recovery periods, while social support requirements increase for populations that lose homes, livelihoods, or both. Together, these effects raise contingent liabilities and amplify fiscal volatility.

These dynamics are already partially reflected in debt sustainability analysis through lower baseline growth assumptions and the inclusion of disaster shocks in stress tests. However, the condition of natural protective ecosystems that shapes the magnitude of these losses is not explicitly incorporated. As a result, progressive ecosystem degradation can worsen debt trajectories even without changes in fiscal policy or borrowing behaviour. Over time, repeated shocks interact with weakened natural protection to create a ratchet effect, in which public debt rises after successive disasters without fully returning to pre-shock levels.

Vanuatu therefore demonstrates how biodiversity outcomes can become macro-relevant through tail risks and balance sheet effects rather than through average growth or revenue channels. This mechanism is analytically distinct from revenue-based pathways observed in tourism-dependent economies and underscores the importance of recognising biodiversity as a determinant of fiscal risk in highly shock-exposed country contexts.

Sources: IMF Article IV 2024; World Risk Index; MACBIO project valuations; Post-Disaster Needs Assessments. See References for full country case citations

4.3 Long-Term Productivity and Natural Capital Depletion

A third reverse transmission channel operates over longer time horizons through the effects of natural capital depletion on economic productivity and sustainable growth potential. This channel is less immediate than revenue shocks or disaster-related fiscal costs, but it can be significant for long-term debt sustainability in economies whose growth models depend substantially on natural resource extraction or nature-dependent production systems.

Evidence from the World Bank's Changing Wealth of Nations programme provides useful context for understanding this channel. Between 1995 and 2020, renewable natural capital, including forests, fisheries, agricultural land, and protected areas, declined by more than 20 percent in per capita terms globally.[61] This represents the sharpest decline among the major asset categories tracked in comprehensive wealth accounts and reflects a pattern in which renewable natural assets have been depleted faster than regeneration or deliberate investment can replenish them.

Over the same period, real GDP per capita increased by approximately 50 percent, while real comprehensive wealth per capita, which includes natural capital, produced capital, human capital,

[61] CWON 2024, op. cit. Renewable natural capital declined >20% per capita 1995-2020.

and net foreign assets, increased by only around 21 percent.[62] This divergence indicates that a meaningful share of measured economic growth over this period was achieved by drawing down natural capital stocks rather than by sustainably expanding productive capacity. In wealth accounting terms, this corresponds to consumption of capital recorded as income, a pattern that is not sustainable over sufficiently long horizons.

For debt sustainability analysis, this divergence has important analytical implications. Conventional assessments project future GDP paths largely on the basis of historical growth trends, then evaluate whether projected revenues can service accumulated debt. Where historical growth has been achieved partly through depletion of natural capital, projecting those growth rates forward implicitly assumes continued depletion at similar rates. As natural capital stocks approach exhaustion or ecological thresholds, growth rates may decline unless alternative sources of productivity and diversification emerge. Debt sustainability assessments that do not consider natural capital trajectories may therefore overestimate long-term growth potential and underestimate debt-related risks in resource- and nature-dependent economies.

These considerations do not imply that natural capital depletion will mechanically translate into debt distress. Rather, they highlight a conditional risk that becomes relevant over longer horizons in economies with high dependence on natural assets and limited scope for substitution. In such contexts, biodiversity outcomes influence debt sustainability primarily through their effects on long-term growth potential rather than through short-term fiscal flows. Complementing this analysis, the IPBES Global Assessment estimates that nature provides between USD 125 and 145 trillion annually in ecosystem services globally, most of which are unpriced and therefore invisible in conventional economic accounts, reinforcing the likelihood that standard growth and debt metrics understate long-term risks associated with natural capital depletion.[63]

Box 4.5 — Natural Capital Depletion and Growth: CWON Evidence

The World Bank's Changing Wealth of Nations programme documents global trends that are relevant for assessing long-term debt sustainability risks in nature-dependent economies. Between 1995 and 2020, renewable natural capital declined by more than 20 percent in per capita terms globally, the steepest decline among all major asset categories tracked. Over the same period, real GDP per capita increased by approximately 50 percent, while real comprehensive wealth per capita increased by only around 21 percent.

This divergence suggests that a portion of observed economic growth was achieved by drawing down natural capital stocks rather than by sustainably expanding productive capacity. In wealth accounting terms, this reflects consumption of capital recorded as income. While this pattern does not imply imminent fiscal stress, it raises questions about the durability of growth paths that rely heavily on continued natural capital depletion.

For debt sustainability analysis, these findings underscore the importance of interpreting historical growth trends with caution in resource- and nature-dependent economies. Where growth has been supported by asset depletion, forward projections based on historical performance may overstate long-term growth potential unless alternative sources of productivity are developed to replace declining natural capital contributions.

Sources: World Bank Changing Wealth of Nations; IPBES Global Assessment.

[62] Ibid. Real GDP per capita +50% vs. real wealth per capita +21% over same period globally.

[63] IPBES (2019), *Global Assessment Report on Biodiversity and Ecosystem Services*, Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.

4.4 Where Biodiversity Outcomes Are Not Macro-Critical: Limits and Non-Cases

The reverse transmission channels described in this section can be significant in affected economies, but they are not universal. Analytical discipline requires identifying where these channels do not bind as clearly as identifying where they do, in order to avoid overstating the macro-fiscal relevance of biodiversity outcomes in contexts where their effects remain limited to local, sectoral, or regional scales.

Biodiversity outcomes materially affect debt sustainability only where specific structural conditions are present. These include high economic dependence on nature-based activities for output, employment, or foreign exchange; significant disaster exposure in which ecosystems provide sovereign-scale protective services; or trajectories of natural capital depletion that materially affect medium-term growth potential. Where these conditions are absent, biodiversity loss may generate substantial environmental and social costs without transmitting meaningfully to aggregate fiscal balances or debt dynamics.

One class of non-cases consists of **large, diversified economies**. In such contexts, biodiversity degradation may affect specific regions or sectors but is diluted at the sovereign level by economic scale, sectoral diversification, and broad revenue bases. Aggregation across multiple growth engines limits the extent to which nature-related shocks can generate concentrated fiscal or debt effects, even where environmental degradation is extensive.

A second class of non-cases reflects **deep fiscal buffers and strong market access**, rather than economic structure alone. Countries with low debt burdens, ample reserves, diversified financing sources, and sustained access to capital markets can absorb sizeable nature-related shocks without triggering debt sustainability concerns. A disaster imposing fiscal costs equivalent to 10 percent of GDP may be manageable for a country with low debt, strong buffers, and recovery capacity, while the same shock could be destabilising for a highly indebted economy with limited market access. In this sense, the reverse channel interacts with existing fiscal conditions rather than operating independently of them.

Finally, a third boundary condition relates to **geography and disaster exposure**. Inland and low-disaster-exposure countries face reduced relevance of the disaster-risk amplification channel that operates through loss of coastal ecosystem protection. While landlocked economies may experience nature-related risks through other mechanisms, such as droughts affecting rain-fed agriculture, desertification, or freshwater ecosystem degradation, they do not experience the coastal protection dynamics that drive disaster-debt ratchets in island and coastal economies. The disaster amplification mechanism therefore requires both exposure to recurrent hazards and the presence of protective ecosystems, and is geographically concentrated.

The following box illustrates these boundary conditions in detail using India, a megadiverse economy with extensive environmental degradation but limited macro-fiscal transmission through the reverse channels identified in this section.

Box 4.6 — Biodiversity Loss Without Sovereign Debt Transmission

India provides a clear and instructive example of where biodiversity outcomes, while environmentally and socially significant, do not materially affect sovereign debt dynamics through the reverse channels identified in this section.

India is one of the world's recognised megadiverse countries and faces substantial biodiversity loss across multiple ecosystems. Forests in the Western Ghats, Himalayan

ecosystems, mangrove systems, grasslands, and freshwater systems are all subject to documented pressures, with significant implications for local livelihoods, food security, and ecosystem services. These impacts are real and consequential at sub-national and community levels.

However, biodiversity outcomes do not materially affect India's sovereign debt dynamics through revenue, risk, or growth channels. The revenue channel is limited by economic structure and diversification. Agriculture contributes approximately 15 to 17 percent of GDP and continues to decline as the economy shifts toward services and manufacturing. Tourism contributes roughly 5 to 7 percent of GDP and is not predominantly ecosystem-dependent in the sense observed in small island economies, with demand driven largely by cultural heritage, religious pilgrimage, urban centers, and business activity. Fisheries contribute less than 1 percent of GDP. Even substantial biodiversity-driven declines in these sectors would not generate concentrated fiscal shocks at the national level.

India's aggregate natural capital share, estimated at approximately 33 percent of total national wealth under Changing Wealth of Nations metrics, might suggest significant nature dependence in screening exercises. However, this aggregate measure obscures composition. India's natural capital is dominated by agricultural land and subsoil assets rather than ecosystems that generate large foreign exchange flows or provide sovereign-scale disaster protection. As a result, the mechanisms through which biodiversity outcomes could transmit to debt dynamics remain weak.

Finally, the scale and diversification of India's economy provide a further buffer. With an economy exceeding USD 3.5 trillion and diversified across information technology services, manufacturing, pharmaceuticals, agriculture, and other sectors, no plausible biodiversity scenario operates at a scale sufficient to materially alter sovereign debt trajectories. While biodiversity loss can generate severe localised economic and social impacts, aggregation across India's continental scale dilutes these effects to fiscal insignificance at the sovereign level.

India therefore illustrates a critical boundary condition for the reverse channel. Severe biodiversity degradation can coexist with limited macro-fiscal transmission where economic diversification, scale, and revenue structure prevent environmental shocks from becoming sovereign debt risks.

Sources: Government of India, Sixth National Report to the Convention on Biological Diversity; World Bank, World Development Indicators and Changing Wealth of Nations 2021; FAO FishStat; IMF, India Article IV Consultation. See References for full country case citations

4.5 Summary: When Biodiversity Outcomes Become Macro-Critical

The analysis in this section identifies three distinct channels through which biodiversity outcomes can affect macroeconomic conditions and debt sustainability, while also establishing important boundary conditions that appropriately limit claims about where these channels are relevant.

- **Nature-dependent revenues:** In economies concentrated in tourism, fisheries, or ecosystem-dependent agriculture and commodity production, including Ghana's cocoa sector as a commodity example extending beyond typical SIDS cases, ecosystem degradation directly threatens government revenue and foreign exchange earnings, with potential implications for debt service capacity and fiscal stability.

- **Risk and contingent liabilities:** Ecosystem degradation that reduces natural protective services amplifies disaster costs in geographically exposed economies, creating fiscal shocks and potential debt ratchets that progressively undermine sustainability. This channel is most relevant for coastal and island economies in disaster-prone regions.
- **Long-term productivity**: Natural capital depletion erodes sustainable growth potential over extended horizons, potentially affecting debt sustainability through the growth component of debt dynamics. This channel operates over longer timeframes than typical debt sustainability assessments but may become relevant in countries with rapid depletion trajectories.

The macro-relevance of each channel depends critically on country context. Structural conditions that increase the likelihood of transmission include high concentration of GDP and government revenue in nature-dependent sectors; significant exposure to climate and disaster risks where ecosystems provide measurable protection; limited economic diversification that constrains alternative growth and revenue sources; narrow fiscal buffers that limit shock-absorption capacity; and natural capital endowments with demonstrable links to economic flows and rapid depletion dynamics.

Many countries experience multiple channels simultaneously, creating compound exposure that may be greater than the sum of individual effects. Small Island Developing States typically face all three channels, combining nature-dependent tourism revenues, coastal disaster exposure with ecosystem protection, and limited diversification options, resulting in exceptional vulnerability to biodiversity-debt dynamics. Other countries, including large diversified economies such as India, illustrate non-cases where none of the channels operate at a macro-relevant scale, despite severe biodiversity loss with significant localised welfare impacts. Recognition of this heterogeneity is essential for accurate analysis and proportional interpretation of the debt–biodiversity relationship.

Section 5 draws on the analytical framework established in Sections 2 and 3 to examine cross-country patterns in fiscal constraint and nature exposure, identifying configurations where bidirectional mechanisms are structurally most plausible and providing empirical context for the transmission channels examined conceptually in this section.

5. CROSS-COUNTRY DIAGNOSTIC ANALYSIS

Sections 3 and 4 established the transmission channels through which debt sustainability and biodiversity implementation interact. This section presents a cross-country diagnostic analysis designed to identify where and under what structural conditions these transmission channels are most likely to be relevant. The analysis draws on a 50-country sample spanning income levels, regions, and ecological characteristics.[64]

Box 5.1: Scope and Purpose

This analysis characterises cross-country patterns in fiscal constraint and nature-linked exposure. It provides empirical descriptive context for the transmission mechanisms discussed in Sections 3 and 4 and identifies country configurations where those mechanisms are structurally plausible.

The analysis aims to describe distributions, identify countries where both dimensions are elevated, and classify countries into configurations based on indicator profiles. It does not establish causal relationships, make predictions, or substitute for country-specific analysis of institutional conditions.

The framework is a screening tool. Countries identified in particular configurations are not thereby assessed as performing well or poorly; the framework identifies structural conditions, not policy outcomes.

5.1 Indicators

The primary fiscal constraint indicator is interest payments as a percentage of government revenue. As established in Section 3.1, this captures how much of the government's revenue envelope is absorbed by debt servicing, which is the non-discretionary claim that most directly compresses fiscal space for biodiversity and other discretionary expenditures. Supplementary indicators include debt-to-GDP ratios, external debt ratios, and IMF–World Bank DSA risk classifications

Nature-linked exposure is measured through flow indicators (tourism and agriculture, forestry and fisheries as percentages of GDP) and stock indicators (renewable natural capital as a share of total national wealth).[65] Flow indicators capture near-term revenue exposure; stock indicators capture longer-term wealth composition and the productivity channel examined in Section 4.4.

An important interpretive distinction applies between renewable natural capital (such as cropland, forests, fisheries, and protected areas) and total natural capital, which also includes non-renewable extractive assets. In several resource-rich economies, high natural capital shares are driven predominantly by oil, gas, or mineral wealth rather than by ecosystems that generate biodiversity-relevant economic flows or risk-mitigating services. Kazakhstan illustrates this pattern: renewable natural capital accounts for only 3.8 per cent of national wealth, while total natural capital reaches 48.8 per cent, reflecting the dominance of hydrocarbon and mineral reserves. Such countries face commodity-price and terms-of-trade fiscal exposure but do not exhibit the biodiversity-related transmission channels relevant to this study.

[64] See Annex C for country selection rationale and full sample composition.

[65] Renewable natural capital is constructed from the World Bank's *Changing Wealth of Nations* database (2024) as the sum of cropland, pastureland, forest, fisheries, and protected area ecosystem service values for 2020, expressed as a share of total comprehensive wealth. See Annex C for methodological details and coverage notes.

5.2 Observed Patterns

Fiscal constraint is unevenly distributed. Most countries retain meaningful fiscal space, but a significant minority face severe constraint where interest payments absorb 20 per cent or more of government revenue.[66] For this constrained group, discretionary compression likely affects biodiversity spending regardless of political prioritisation. For the majority, implementation challenges more plausibly reflect institutional or political factors.

Revenue capacity strongly mediates the practical burden of debt. Countries with low revenue-to-GDP ratios can experience binding fiscal constraints even at moderate debt levels, as interest payments absorb a disproportionate share of available revenue. The practical constraint is debt relative to revenue capacity, not headline debt ratios alone.[67]

Nature-linked economic exposure also varies widely. Tourism dependence concentrates among Small Island Developing States, where natural attractions often underpin the primary economic sector. Agriculture dependence concentrates among low-income countries, where ecosystem-dependent production accounts for substantial shares of output, employment, and foreign exchange. In more diversified economies, these sectors represent a much smaller share of economic activity, limiting the macro-fiscal relevance of ecosystem degradation despite potentially severe local impacts.[68]

Renewable natural capital stocks show even greater dispersion, reflecting differences in long-term development trajectories rather than immediate fiscal exposure. High stock values indicate that long-run prosperity is closely tied to natural asset management, but they do not by themselves imply near-term debt vulnerability.

Importantly, stock and flow measures do not consistently coincide. Some countries exhibit high operational dependence on nature-linked sectors despite more diversified wealth structures, while others hold substantial natural capital stocks without equivalent reliance on nature-dependent economic flows. Both dimensions are required for comprehensive screening, as they illuminate different transmission channels.[69]

5.3 Screening Framework

Combining fiscal constraint and nature-linked exposure produces a screening framework identifying configurations where the transmission channels are most likely to be relevant. The framework uses approximate upper-quartile thresholds: interest payments above 15–20 per cent of revenue for fiscal constraint, and either renewable natural capital above 30 per cent or combined flow above 22 per cent for nature exposure. Based on these thresholds, countries can be assigned to four illustrative configurations.[70]

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[66] At the extreme, one country (Sri Lanka, following its 2022 default) allocates approximately 80 per cent of revenue to interest payments. Several others exceed 40 per cent. See Annex C for data sources and coverage.

[67] Bangladesh illustrates this pattern: at 38.5 per cent debt-to-GDP it appears moderately indebted, but with revenue-to-GDP of only 8.9 per cent, interest payments absorb 30 per cent of revenue.

[68] Brazil exemplifies this boundary condition: globally significant biodiversity but nature-linked sectors contribute modestly to GDP, limiting reverse-channel transmission at the sovereign scale. See Section 5.5 on boundary conditions.

[69] Kenya illustrates high flow exposure (37 per cent combined GDP) with moderate stock exposure (18 per cent renewable natural capital); Vietnam shows the reverse pattern. See Annex C for methodological discussion.

[70] These thresholds are illustrative rather than definitive. The logic follows from Section 3.1: as interest payments rise, non-discretionary claims crowd out lower-priority expenditures first. Countries in the 15–25 per cent range face meaningful but manageable constraint; above 25 per cent, constraint becomes severe.

Table 5.1: Screening Framework

	Higher Nature-Linked Exposure	Lower Nature-Linked Exposure
Higher Fiscal Constraint	**A: Structural Nexus** Both forward and reverse channels plausible. Bidirectional relationship most relevant. *Examples: Egypt, Ghana, India, Kenya, Malawi, Nigeria, Uganda*	**B: Fiscal Stress** Forward channels dominate. Fiscal constraint binds; nature exposure lower at sovereign scale. *Examples: Bangladesh, Brazil, Colombia, Indonesia, Mexico, South Africa, Sri Lanka*
Lower Fiscal Constraint	**C: Nature Exposed** Reverse channels relevant; fiscal constraint lower. Implementation gaps likely institutional. *Examples: Belize, Cambodia, Ethiopia, Fiji, Madagascar, Nepal, Rwanda, Vanuatu, Vietnam*	**D: Lower Dual Exposure** Neither channel at upper-quartile intensity. Other factors dominate. *Examples: Australia, Canada, Chile, France, Germany, Japan, Kazakhstan, Peru, Thailand*

Note: Country assignments are illustrative based on approximate thresholds. The framework is diagnostic, not classificatory and the quadrants describe structural exposure profiles based on selected indicators. They do not represent performance rankings, policy effort, or implementation quality.

Configuration A (Structural Nexus) identifies countries where the debt–biodiversity relationship may operate bidirectionally. High fiscal constraint limits implementation capacity and may trigger crisis-driven regulatory rollback (forward channels); high nature exposure means biodiversity outcomes can materially affect fiscal stability through revenue loss, disaster costs, or productivity effects (reverse channels). Ghana (Boxes 3.3, 4.2) illustrates bidirectional dynamics in real time: fiscal pressure contributed to regulatory changes during restructuring while environmental degradation now threatens cocoa revenues.

Configuration B (Fiscal Stress) identifies countries where fiscal constraint binds but nature-linked exposure is lower at the sovereign scale. The forward channels are most relevant; the reverse channel is limited because biodiversity loss, however severe locally, does not materially affect aggregate fiscal indicators in diversified economies. Brazil and South Africa (Box 3.1) exemplify chronic fiscal compression without nature-linked macro-fiscal feedback. Bangladesh (Box 3.4) illustrates how moderate debt becomes binding when revenue extraction is exceptionally weak.

Configuration C (Nature Exposed) identifies countries with high nature-linked exposure but lower current interest burdens. This configuration includes two distinct subgroups: countries with genuine fiscal space where implementation gaps are primarily institutional, and countries where concessional debt composition or restructuring masks underlying fragility.[71] Ethiopia (Box 3.3) exemplifies the latter, classified as In Debt Distress despite moderate interest burden.

Configuration D (Lower Dual Exposure) includes countries where neither dimension reaches upper-quartile levels. The debt–biodiversity relationship as examined in this study is less relevant for these contexts; implementation challenges more plausibly stem from institutional capacity, governance, or political prioritisation. This configuration also includes countries with high total

[71] Ethiopia's low interest-to-revenue ratio despite In Debt Distress classification reflects heavily concessional debt composition. Vanuatu's low ratio despite High Risk classification reflects projected trajectories and contingent disaster exposure rather than current debt service flows. See Annex C for discussion of indicator limitations.

natural capital shares driven by extractives, which face commodity-related exposure but not biodiversity-relevant transmission channels.[72]

These framework classifications are consistent with the country experiences examined in Sections 3 and 4. Countries discussed in the context of fiscal space compression (Box 3.1), debt distress and adjustment (Box 3.3), revenue constraints (Box 3.4), and reverse-channel transmission (Boxes 4.1–4.4) fall into configurations that align with their qualitative profiles. This consistency suggests the indicators capture relevant structural conditions, though as Box 5.2 illustrates, mechanical application of thresholds cannot substitute for judgment about which transmission channels actually operate in specific contexts.

Box 5.2: When Indicators Require Judgment—India

India meets both thresholds (approximately 33 per cent renewable natural capital, approximately 25 per cent interest-to-revenue), placing it in Configuration A by the indicators. However, the transmission channels operate differently than in other Configuration A countries.'India's CWON share reflects primarily agricultural land values rather than ecosystems generating foreign exchange through tourism or buffering sovereign-scale disasters. The forward channel does operate: fiscal constraint affects implementation capacity, and the CAMPA paradox (Box 3.5) demonstrates how fiscal and institutional constraints interact. The reverse channel is more limited. India's diversified economy means that no plausible biodiversity scenario materially affects sovereign debt dynamics at the national scale.

The implication is that indicators flag countries for closer examination but do not determine classifications mechanically. Country-specific assessment of which transmission channels actually operate remains essential.

See References for full country case citations

The framework in this section requires interpretation. As the configuration descriptions and Box 5.2 illustrate, indicators identify structural conditions but cannot determine which transmission channels actually operate in specific contexts. Ecological significance does not guarantee macro-fiscal relevance; debt metrics can mislead depending on composition; and institutional factors may bind even where aggregate fiscal indicators suggest capacity. These boundary conditions reinforce that the framework is a screening tool, not a substitute for country-specific assessment.

5.4 Summary

This diagnostic analysis maps the structural conditions under which the transmission channels identified in Sections 3 and 4 are most likely to be relevant. Key findings include:

- Fiscal constraint is highly skewed: Most countries retain meaningful fiscal space, but a non-trivial subset exceed the 15 per cent interest-to-revenue threshold where forward channels are likely to bind.
- Revenue capacity mediates debt burden: Moderate debt-to-GDP ratios can mask severe practical constraint where revenue extraction is weak.
- Stock and flow measures diverge: Both are required for comprehensive screening, as reliance on either alone risks misclassifying important cases.

[72] Kazakhstan, for example, shows total natural capital of 49 per cent of wealth but renewable natural capital of only 3.8 per cent with the difference reflecting oil and mineral reserves.

- A small group of countries exhibit structural nexus conditions where both forward and reverse channels are plausible, indicating heightened exposure to debt–biodiversity interactions.
- Framework classifications align with the country cases examined in Sections 3 and 4, reinforcing that the indicators capture relevant structural conditions when applied with appropriate judgment.

The heterogeneity documented here implies that uniform policy prescriptions are unlikely to be appropriate. Countries in different configurations face different binding constraints and require differentiated responses. Section 6 examines implications for policy and financing mechanisms, recognising that approaches must be tailored to the structural conditions identified through this framework.

6. Interpretive Implications for CBD Implementation

The diagnostic framework developed in Sections 3 through 5 yields interpretive implications for how Parties, finance ministries, and international institutions may understand the relationship between debt sustainability and implementation of the Convention in different country contexts. This section translates the analytical framework into guidance for interpretation. It does not propose policy measures, financial instruments, or institutional reforms.

The implications set out below concern how to read structural conditions and what they suggest about likely binding constraints. They are intended to inform analytical judgment and dialogue within the CBD process, rather than to direct policy choices, which remain the prerogative of Parties.

A central implication of the analysis is that the debt–biodiversity relationship is context-dependent. Uniform interpretations, whether asserting that debt invariably constrains implementation or that biodiversity loss systematically undermines debt sustainability, misrepresent the heterogeneity documented in the preceding sections. The implications are therefore differentiated by country configuration.

6.1 Interpretive Implications by Structural Configuration

The four-quadrant framework presented in Section 5 provides the organising structure for differentiated interpretation. Each configuration signals which transmission channels are likely to be relevant, which constraints are plausibly binding, and where conventional assumptions warrant caution.

Configuration A: Structural nexus (fiscal constraint and high nature-linked exposure)

Countries exhibiting both elevated fiscal constraint and high nature-linked exposure face structural conditions in which the debt–biodiversity relationship operates in both directions. The forward channels identified in Section 3 are likely to bind. Debt service pressures compress discretionary fiscal space, adjustment dynamics disrupt multi-year planning, and implementation capacity is constrained by revenue limitations and institutional strain. At the same time, the reverse channels examined in Section 4 may be macro-relevant. Nature-dependent revenues, ecosystem-mediated risk reduction, and long-term productivity effects link biodiversity outcomes to fiscal stability.

Several interpretive implications follow. First, biodiversity implementation challenges in these contexts cannot be attributed solely to insufficient financing. Even where external biodiversity finance is available, binding fiscal constraints may limit its effective translation into sustained implementation if debt service continues to absorb fiscal space. The binding constraint may lie in the fiscal envelope rather than in sectoral allocation.

Second, biodiversity outcomes may warrant consideration as macro-relevant variables, not only as environmental indicators. Where economic structure creates dependence on ecosystem services at sovereign scale, biodiversity degradation may carry fiscal implications that extend beyond environmental ministries. This suggests that macro-fiscal dialogue may be analytically relevant for understanding implementation feasibility in these contexts, without implying changes to fiscal mandates or frameworks.

Third, the coexistence of forward and reverse channels creates the possibility of feedback dynamics over medium-term horizons. Fiscal pressure that constrains biodiversity implementation

may contribute, over time, to biodiversity outcomes that further weaken fiscal positions. The operation of such feedback is not automatic and requires country-specific assessment, but its plausibility cautions against short-term interpretations that treat biodiversity and debt dynamics as independent.

Configuration B: Fiscal constraint without high nature exposure

Countries with elevated fiscal constraint but lower nature-linked exposure face a more circumscribed relationship. The forward channel is likely to operate. Debt service burdens constrain discretionary spending, and biodiversity expenditure is affected as part of broader fiscal compression. By contrast, the reverse channel is limited. Biodiversity loss, however significant in ecological or welfare terms, does not materially affect aggregate fiscal indicators in diversified economies where no nature-dependent sector dominates revenues or output.

In these contexts, implementation challenges are most appropriately interpreted as consequences of general fiscal constraint rather than as manifestations of a distinctive debt–biodiversity nexus. Biodiversity is not uniquely affected; it is affected alongside other discretionary priorities. Arguments linking biodiversity investment to macro-fiscal stability through the reverse channel are correspondingly weaker.

Institutional factors may therefore be as important as fiscal factors in explaining observed outcomes. Where fiscal resources exist but biodiversity outcomes remain limited, the binding constraints may lie in institutional capacity, governance arrangements, or political prioritisation rather than in debt sustainability per se. Interpretation that assumes fiscal relaxation would automatically improve outcomes risks misdiagnosis.

Configuration C: Nature exposure without binding fiscal stress

Countries with high nature-linked exposure but lower current fiscal constraint present a different interpretive challenge. The forward channel is less binding because fiscal space is comparatively available. However, the reverse channel may be macro-relevant because economic structure creates exposure to biodiversity outcomes through revenues, risk, or productivity.

In these contexts, implementation gaps are more plausibly explained by institutional, governance, or political factors than by fiscal constraint. Where interest burdens are moderate and revenue capacity is adequate, persistent under-implementation suggests that fiscal space is not the binding limitation.

At the same time, the absence of current fiscal stress does not imply that biodiversity is macro-irrelevant. Nature exposure may constitute a latent vulnerability that is not reflected in headline debt indicators. The appropriate interpretation is therefore prospective rather than immediate. Biodiversity outcomes may become fiscally relevant under plausible future trajectories even where they do not currently constrain implementation.

Interpretation must also attend to debt composition and sustainability assessments. Countries with concessional debt structures or recent restructuring may exhibit low interest-to-revenue ratios while remaining vulnerable on a forward-looking basis. In such cases, screening indicators may understate fragility, and judgment is required.

Configuration D: Lower dual exposure

Countries where neither fiscal constraint nor nature-linked exposure is elevated face structural conditions in which the debt–biodiversity relationship examined in this study is less directly relevant. Implementation challenges in these contexts are more plausibly explained by factors

outside the scope of this framework, including institutional capacity, governance, or political economy dynamics.

This represents a boundary condition rather than a limitation. The framework is designed to identify where debt sustainability and biodiversity implementation interact in macro-relevant ways. Where neither dimension is elevated, other diagnostic approaches are likely to be more informative.

6.2 Implications for CBD Implementation Planning

Across configurations, a common implication is the importance of diagnosing what binds. Implementation plans that do not distinguish between fiscal ceilings, institutional capacity, and political prioritisation risk setting expectations that are analytically inconsistent with country conditions.

Where fiscal constraint binds, implementation planning that assumes stable multi-year financing may be unrealistic, given adjustment dynamics and revenue volatility. Where institutional capacity binds, resource mobilisation alone is unlikely to improve outcomes. Where nature exposure is high, planning that ignores prospective macro-fiscal relevance may understate longer-term risks.

This differentiation does not imply differentiated ambition. All Parties have committed to the Kunming-Montreal Global Biodiversity Framework. It does imply that feasible implementation pathways, sequencing, and risk profiles differ across structural contexts.

Box 6.1. Why Debt Relief Is Not a Universal Explanation

A common interpretation holds that relaxing debt constraints would systematically improve biodiversity implementation. The diagnostic analysis suggests a more qualified reading.

Debt relief can expand fiscal space where debt service is the binding constraint. However, fiscal space is a necessary but not sufficient condition for effective implementation. Institutional bottlenecks, governance constraints, and execution capacity may continue to bind even where resources increase. Moreover, fiscal space created through relief is not automatically allocated to biodiversity, and revenue constraints may persist independently of debt service levels.

The appropriate interpretation is that debt relief may be relevant in specific structural configurations, but it does not constitute a general explanation for biodiversity implementation gaps across Parties.

6.3 Implications for Engagement with Finance Ministries and IFIs

The debt–biodiversity relationship operates in part through macro-fiscal channels that lie outside the traditional remit of environmental authorities. In countries where the relationship is structurally relevant, interpretation of implementation constraints may therefore benefit from engagement with finance ministries and international financial institutions, within existing mandates and analytical frameworks.

The analysis does not imply that biodiversity objectives should be incorporated into debt sustainability analysis as a general rule, nor that fiscal frameworks should be redesigned. Rather,

it clarifies where existing fiscal and debt analysis is informative for understanding implementation feasibility, and where it is not. In contexts where reverse channels are plausible, sustainability assessments that hold nature-related risks constant may understate longer-term vulnerabilities. In other contexts, macro-fiscal framing adds little explanatory power.

Box 6.2. Illustrative Context on Debt-Related Instruments

Recent experience with debt-for-nature and related transactions illustrates the highly conditional nature of debt instruments in practice.[73] Such operations have typically involved extensive structuring, external guarantees, and dedicated trust arrangements, and have been pursued selectively in countries where debt trajectories are assessed as sustainable.[74]

Even in these cases, institutional capacity within environmental agencies has emerged as a binding constraint, with concerns about assuming large performance-linked obligations under conditions of prolonged fiscal compression. Critical assessments have noted that debt reduction achieved through such transactions has typically been modest relative to comprehensive restructurings, and that transaction complexity and costs can absorb a meaningful share of savings.[75]

A related but distinct category of instrument—state-contingent debt clauses that allow payment suspension following natural disasters—has recently demonstrated operational viability. In 2024, Grenada became the first sovereign to activate a hurricane clause embedded in its debt instruments, triggering automatic payment suspension following a major storm without requiring creditor negotiation or triggering default.[76] This activation provides proof-of-concept that contingent clauses can function as designed, freeing short-term fiscal space for disaster response and recovery without increasing net present value losses to creditors. While such clauses do not directly generate conservation finance, they may protect biodiversity budgets from post-disaster reallocation by reducing the fiscal pressure that typically follows major climate events in disaster-exposed economies.

Emerging market standards for biodiversity-linked sovereign instruments—including the ICMA Sustainability-Linked Bond Principles (2024) and the ICMA Sustainable Bonds for Nature guidance (2025)—provide integrity frameworks that may reduce transaction costs and improve credibility over time.[77] Nevertheless, these developments do not alter the study's

[73] For a comprehensive IMF assessment of debt-for-climate and debt-for-nature swaps, including design trade-offs and macroeconomic considerations, see Chamon, M., et al., *Debt-for-Climate Swaps: Analysis, Design, and Implementation*, IMF Working Paper WP/22/162 (Washington, DC: IMF, 2022). The paper positions swaps as complements to restructurings and fiscal reforms, not substitutes, and emphasises that robust governance and verification are essential for environmental additionality.

[74] World Bank and NatureFinance, *Debt-for-Nature Swaps: Lessons from Belize, Barbados, Ecuador* (Washington, DC: World Bank, 2024). This synthesis examines transaction structures, credit enhancement requirements, and governance arrangements across recent high-profile conversions.

[75] For a critical assessment of DNS outcomes relative to comprehensive debt restructuring, see Debt Justice, *The Limitations of Debt-for-Nature Swaps* (London: Debt Justice, 2023); and Debt Justice, *Analysing the Debt-Related Outcomes of Debt-for-Nature Swaps* (London: Debt Justice, 2025). These analyses find average debt reduction of approximately 3 per cent for DNS transactions compared with 21 per cent for comprehensive restructurings.

[76] Reuters (2024). Grenada becomes first to trigger hurricane clause; World Bank Treasury (2024). Sovereign Resilient Debt Clauses: Market Uptake and Lessons.

[77] International Capital Market Association (2024). Sustainability-Linked Bond Principles; ICMA (2025). Sustainable Bonds for Nature: A Practitioner's Guide.

central diagnostic message. Debt-related instruments do not bypass underlying fiscal and institutional constraints. Their relevance and feasibility depend on structural conditions that vary across countries, and they are best understood as context-specific mechanisms rather than general solutions to biodiversity implementation challenges.

See References for full country citations

6.4 Use of Screening and Diagnostic Tools

The screening framework developed in Section 5 identifies structural conditions, not policy performance. Classification signals where the debt–biodiversity relationship is plausibly macro-relevant, not whether countries are performing well or poorly.

Indicators require interpretation. Aggregate natural capital shares may reflect extractive resources rather than biodiversity-relevant ecosystems. Moderate interest burdens may mask fragility where debt composition or restructuring history matters. Screening therefore serves to guide analytical attention rather than to determine conclusions mechanically.

Table 6.1. Diagnostic Interpretation of Debt–Biodiversity Constraints by Country Configuration

Configuration	Dominant Binding Constraint(s)	Debt–Biodiversity Relationship: How to Interpret	Interpretive Cautions
Dual Exposure	Fiscal constraint and nature-related macro-fiscal exposure	Both forward (debt constraining implementation) and reverse (biodiversity affecting fiscal stability) channels may be relevant. Implementation feasibility depends on interaction between fiscal ceilings and nature-dependent revenues or risks.	Do not assume that additional finance alone will translate into sustained implementation. Do not treat biodiversity solely as a sectoral issue detached from macro-fiscal conditions.
Fiscal Constraint Only	Fiscal space compression; limited reverse-channel relevance	Debt affects biodiversity implementation primarily through general expenditure compression. Biodiversity is constrained alongside other discretionary priorities. Reverse-channel effects are weak at sovereign scale.	Avoid framing biodiversity primarily as a fiscal-stability issue. Do not assume that biodiversity outcomes materially affect debt sustainability in diversified economies.
Nature Exposure Only	Institutional, governance, or prioritisation constraints; fiscal space exists	Biodiversity outcomes may become macro-relevant over time through revenue or risk channels, even where current fiscal indicators appear stable. Reverse-channel relevance is	Do not interpret implementation gaps as evidence of fiscal constraint. Do not assume current debt indicators

Configuration	Dominant Binding Constraint(s)	Debt–Biodiversity Relationship: How to Interpret	Interpretive Cautions
		prospective rather than immediate.	capture future nature-related vulnerability.
Lower Dual Exposure	Constraints not primarily debt-related	The debt–biodiversity relationship examined in this study is unlikely to be macro-relevant. Implementation outcomes are shaped by other institutional or political economy factors.	Applying debt-centred interpretations risks misdiagnosing constraints. Other diagnostic frameworks are likely to be more informative.

6.5 Summary

The interpretive implications developed in this section translate the diagnostic framework into guidance for understanding how debt sustainability and biodiversity implementation interact in different country contexts. The key messages are:

- The relationship is heterogeneous and conditional. Uniform interpretations misrepresent the diversity of structural conditions across Parties.
- Fiscal constraint is one possible binding limitation among several. Institutional capacity, governance, and political prioritisation often matter as much as, or more than, debt conditions.
- The bidirectional relationship operates selectively. Biodiversity outcomes are macro-relevant in some economic structures and not in others.
- Standard assumptions warrant caution. Debt relief is not a universal explanation, biodiversity finance gaps are not always fiscal, and macro-fiscal engagement is relevant in some contexts but not all.

These implications are offered as guidance for interpretation, not as policy prescriptions. The study's contribution lies in clarifying where debt sustainability conditions are likely to shape biodiversity implementation under the Convention, where they are not, and why careful diagnosis of structural conditions is essential. Decisions regarding policy responses appropriately remain with Parties.

7. CONCLUSION

This study was prepared in response to Decision 16/34, which requested an examination of the relationship between debt sustainability and implementation of the Convention on Biological Diversity. Its purpose has been to clarify where and how debt–biodiversity interactions become macro-relevant, and where they do not. The study does not propose policy responses, evaluate financial instruments, or advance negotiating positions.

The analysis demonstrates that the relationship between debt sustainability and biodiversity implementation is two-directional but asymmetric. Debt conditions more frequently and more immediately shape implementation feasibility through fiscal constraint, expenditure compression, and planning volatility. By contrast, biodiversity outcomes affect debt sustainability only under specific structural conditions and operate indirectly through revenue exposure, risk amplification, and long-term productivity effects. These reverse channels are conditional and do not apply uniformly across countries.

A central analytical contribution of the study is the development of a diagnostic framework that differentiates country contexts based on fiscal constraint and nature-linked economic exposure. This framework highlights the heterogeneity of structural conditions across Parties and cautions against uniform interpretations. In some contexts, fiscal ceilings are the binding limitation on implementation. In others, institutional capacity, governance arrangements, or political prioritisation are more decisive, even where fiscal space exists. Accurate interpretation therefore depends on identifying which constraints bind in practice rather than assuming a single dominant mechanism.

The study also underscores the importance of judgment in the use of fiscal and debt indicators. Common metrics provide valuable signals but do not, on their own, determine implementation feasibility or macro-fiscal relevance. Debt composition, revenue capacity, and the nature of economic exposure to biodiversity condition how these indicators should be read. The screening framework is intended to guide analytical attention to contexts where closer examination is warranted, not to classify performance or predict outcomes.

Consistent with its diagnostic mandate, the study does not establish causal relationships between specific debt conditions and biodiversity outcomes, nor does it assess the effectiveness of policy instruments, financing mechanisms, or institutional reforms. Its contribution lies in clarifying structural conditions, transmission channels, and boundary cases, thereby reducing the risk of misdiagnosis.

Within the CBD process, this study is intended as a clarifying analytical input to deliberations under the Convention. It does not represent a negotiating position, endorse particular proposals, or prejudge discussions on resource mobilisation or implementation support. By providing a common analytical foundation, the study seeks to support informed and disciplined consideration of how debt sustainability and biodiversity implementation interact across diverse country contexts.

References

CBD and Biodiversity Policy Frameworks

- Convention on Biological Diversity. 2022. Kunming-Montreal Global Biodiversity Framework. CBD COP-15, Montreal.
- Convention on Biological Diversity. 2024. Decision 16/34: Resource Mobilization Strategy and Monitoring. CBD COP-16, Cali.
- CBD Secretariat. 2024-2025. Sixth National Reports (6NR) and National Biodiversity Strategies and Action Plans (NBSAPs). Montreal: Secretariat of the Convention on Biological Diversity.

International Financial Institutions

IMF Publications

- International Monetary Fund. 2023. Guidance Note on the Sovereign Risk and Debt Sustainability Framework for Market Access Countries (MAC-DSA). Washington, DC: IMF.
- International Monetary Fund and World Bank. 2023. Guidance Note on the Bank-Fund Debt Sustainability Framework for Low-Income Countries. Washington, DC.
- International Monetary Fund. 2024. Embedded in Nature: Integrating Nature-Related Risks into Macroeconomic Policy. Staff Climate Note. Washington, DC: IMF.
- Network for Greening the Financial System. 2024. Nature-related Financial Risks: A Conceptual Framework to Guide Action by Central Banks and Supervisors. Paris: NGFS.

World Bank Publications

- World Bank. 2021. The Changing Wealth of Nations 2021: Managing Assets for the Future. Washington, DC: World Bank.
- World Bank. 2024. The Changing Wealth of Nations 2024: Managing Wealth for a Greener, More Resilient Future. Washington, DC: World Bank.
- World Bank. 2021. The Economic Case for Nature: A Global Earth-Economy Model to Assess Development Policy Pathways. Washington, DC: World Bank.
- World Bank. 2025. Mainstreaming Nature into World Bank Macroeconomic Models. Washington, DC: World Bank.

UN System

- United Nations Development Programme. 2018. BIOFIN Workbook: A Methodology for Biodiversity Finance. New York: UNDP.
- United Nations Development Programme. 2025. Biodiversity Finance Trends Dashboard 2025. New York: UNDP BIOFIN.
- United Nations Environment Programme. 2023. State of Finance for Nature. Nairobi: UNEP.
- UNCTAD. 2024. A World of Debt 2024: A Growing Burden to Global Prosperity. Geneva: UNCTAD.
- UNCTAD. 2025. A World of Debt 2025: It Is Time for Reform. Geneva: UNCTAD.
- ESCAP. 2025. Financing the SDGs to 2030 and Beyond: Asia and the Pacific SDG Progress Report 2025. Bangkok: UNESCAP.
- Isgut, A. 2025. Debt Challenges and Fiscal Space Constraints in Developing Countries. MPFD Working Paper No. WP/25/03. Bangkok: ESCAP.

- United Nations Statistical Commission. 2021. System of Environmental-Economic Accounting - Ecosystem Accounting (SEEA-EA). New York: United Nations.

Policy Reports and Expert Reviews

- Colombia, Kenya, France, and Germany. 2025. Healthy Debt on a Healthy Planet: Final Expert Review on Debt, Nature and Climate. April 2025.
- OECD. 2021. Biodiversity, Natural Capital and the Economy: A Policy Guide. Paris: OECD Publishing.
- Zabel, A., Nanhthavong, V., and Epprecht, M. 2025. Gaps Between Demand and Supply of Biodiversity Impact Finance in the Global South. Current Opinion in Environmental Sustainability, 76, Article 101568.
- Paulson Institute, The Nature Conservancy, and Cornell Atkinson Center for Sustainability. 2020. Financing Nature: Closing the Global Biodiversity Financing Gap. Chicago: Paulson Institute.

Academic Literature

- Giglio, S., Kuchler, T., Stroebel, J., and Wang, O. 2025. Nature and Biodiversity Loss: A Research Agenda for Financial Economics. NBER Working Paper 34286. Cambridge, MA: NBER.
- Giglio, S., Kuchler, T., Stroebel, J., and Wang, O. 2024. The Economics of Biodiversity Loss. NBER Working Paper 32678. Cambridge, MA: NBER.
- Volz, U. et al. 2020. Climate Change and Sovereign Risk. London: SOAS Centre for Sustainable Finance.
- Agarwala, M. et al. 2022. Nature Loss and Sovereign Credit Ratings. Cambridge Bennett Institute Working Paper. Cambridge: University of Cambridge.
- Kraemer, R. and Volz, U. 2022. Integrating Nature into Sovereign Debt Sustainability Analysis. NatureFinance.

Debt-for-Nature Instruments and Evaluations

- Chamon, M. et al. 2022. Debt-for-Climate Swaps: Analysis, Design, and Implementation. IMF Working Paper WP/22/162. Washington, DC: IMF.
- World Bank and NatureFinance. 2024. Debt-for-Nature Swaps: Lessons from Belize, Barbados, Ecuador. Washington, DC: World Bank.
- Debt Justice. 2023. The Limitations of Debt-for-Nature Swaps. London: Debt Justice.
- Debt Justice. 2025. Analysing the Debt-Related Outcomes of Debt-for-Nature Swaps. London: Debt Justice.
- Nedopil Wang, C., Yue, M., and Hughes, A. 2023. Debt-for-Nature Swaps: Opportunities, Limitations, and Scalability. Oxford: Oxford Sustainable Finance Programme.

Brazil Case Study

- International Monetary Fund. 2025. Brazil: 2025 Article IV Consultation - Staff Report. Washington, DC: IMF.
- Ministerio do Meio Ambiente e Mudanca do Clima. 2024. Estrategia e Plano de Acao Nacionais para a Biodiversidade (EPANB). Brasilia.

- Convention on Biological Diversity. Brazil: Sixth National Report to the Convention on Biological Diversity. Montreal.
- United Nations Development Programme. BIOFIN Brazil: Biodiversity Expenditure Review. Brasilia: UNDP.
- Brazil Restoration and Bioeconomy Finance Coalition. 2024/2025. Study on Restoration and Biodiversity Finance in Brazil. Brasilia.
- Climate Investment Funds. 2023. Midterm Evaluation of the Forest Investment Program. Washington, DC: CIF.
- Ministerio da Fazenda. 2025. Annual Debt Report 2025. Brasilia.
- Ministerio da Fazenda. 2025. Brazil Investors Presentation 2025. Brasilia.

South Africa Case Study

- International Monetary Fund. 2025. South Africa: Article IV Consultation - Staff Report. Washington, DC: IMF.
- International Monetary Fund. 2025. South Africa - Selected Issues: Strengthening the Fiscal Framework. Washington, DC: IMF.
- National Treasury, Republic of South Africa. 2025. Medium Term Budget Policy Statement. Pretoria.
- Convention on Biological Diversity. Republic of South Africa: National Biodiversity Strategy and Action Plan 2015-2025. Pretoria: Department of Environmental Affairs.
- United Nations Development Programme. 2016. BIOFIN South Africa: Biodiversity Expenditure Review. Pretoria: UNDP.
- United Nations Development Programme. 2018. BIOFIN South Africa: Biodiversity Finance Plan. Pretoria: UNDP.
- United Nations Development Programme and SANParks. 2025. A Model for Expanding Protected Areas through a Proactive Biodiversity Offset Bank. Pretoria.
- Department of Forestry, Fisheries and the Environment. 2024. First Biennial Transparency Report under the Paris Agreement. Pretoria.

Ghana Case Study

- International Monetary Fund. 2025. Ghana: Fourth Review Under the Extended Credit Facility Arrangement. Press Release PR/25/242. Washington, DC: IMF.
- Government of Ghana. 2024. National Targets Aligned with the Kunming-Montreal Global Biodiversity Framework. Accra.
- United Nations Development Programme. 2025. BIOFIN Ghana Launch. Accra: UNDP.
- Government of Ghana. 2022. Legislative Instrument 2462. Accra.
- Government of Ghana. 2025. Repeal of Legislative Instrument 2462. Accra.
- Ghana Cocoa Board (COCOBOD). 2024. Annual Report 2023-2024. Accra.
- Water Research Institute, Ghana. 2024. Water Quality Assessment Report. Accra.
- World Bank. 2022. Country Climate and Development Report: Ghana. Washington, DC: World Bank.

Ethiopia Case Study

- International Monetary Fund. 2024. Ethiopia: Debt Sustainability Analysis. Washington, DC: IMF.

- International Monetary Fund. 2025. Ethiopia: 2025 Article IV Consultation - Staff Report. Washington, DC: IMF.
- Federal Democratic Republic of Ethiopia. 2017. National Biodiversity Strategy and Action Plan. Addis Ababa.
- Federal Democratic Republic of Ethiopia. 2024/2025. Updated National Biodiversity Strategy and Action Plan 2025-2030. Addis Ababa.
- Climate Investment Funds. 2024. CIF Nature, People and Climate Investment Plan: Ethiopia. Washington, DC: CIF.
- United Nations Development Programme. 2020. Terminal Evaluation: Mainstreaming Biodiversity Incentives into Ethiopia's CRGE. Addis Ababa.
- United Nations Framework Convention on Climate Change. 2024. Ethiopia Nationally Determined Contribution (NDC 3.0). Addis Ababa.
- Scholte, P. et al. 2025. The Protected Area System of Ethiopia: Coverage, Governance, and Financing Implications for 30x30. PARKS, 31(1).
- Fashing, P.J. et al. 2022. Ecology, Evolution, and Conservation of Ethiopia's Biodiversity. Biological Conservation, 266.

Bangladesh Case Study

- International Monetary Fund. 2024-2025. Bangladesh: ECF/EFF Program Reviews. Washington, DC: IMF.
- International Monetary Fund. 2025. Bangladesh: Technical Assistance Report on Disaster Risk Financing. Washington, DC: IMF.
- Government of Bangladesh. 2016. National Biodiversity Strategy and Action Plan 2016-2021. Dhaka.
- Ministry of Finance, Bangladesh. 2024. Climate Financing for Sustainable Development: Budget Report 2024-25. Dhaka.
- United Nations Development Programme. 2025. BIOFIN Umbrella Programme Launch - Bangladesh. Dhaka: UNDP.
- Bangladesh Bureau of Statistics. 2025. Natural Resources Accounts - Forest and Ecosystem (2015-2023). Dhaka.
- World Bank. 2023. Bangladesh Country Climate and Development Report. Washington, DC: World Bank.

India Case Study

- International Monetary Fund. 2025. India: 2025 Article IV Consultation - Staff Report. IMF Country Report No. 25/314. Washington, DC: IMF.
- Ministry of Environment, Forest and Climate Change. 2024. Updated National Biodiversity Strategy and Action Plan. New Delhi.
- Finance Commission of India. Various years. Reports on Horizontal Devolution and Forest Cover Weighting. New Delhi.
- Ministry of Finance, India. 2025. Union Budget 2025-26: Expenditure Budget. New Delhi.
- Forest Survey of India. 2023. India State of Forest Report. Dehradun: Ministry of Environment, Forest and Climate Change.
- Comptroller and Auditor General of India. 2023. Report on Compensatory Afforestation Fund Management and Planning Authority (CAMPA). Report No. 12 of 2023.

Peru Case Study

- International Monetary Fund. 2025. Peru: Staff Report for the 2025 Article IV Consultation. IMF Country Report No. 25/125. Washington, DC: IMF.
- International Monetary Fund. 2025. Revamping Fiscal Decentralization to Secure Peru's Position as a Leading Critical Mineral Exporter. IMF Selected Issues Paper No. 25/126. Washington, DC: IMF.
- International Monetary Fund. 2024. Economic Benefits of Building Resilience to Natural Hazards and Climate Change. IMF Staff Country Report No. 2024/134. Washington, DC: IMF.
- OECD. 2025. Regional Development Policy in Peru. Paris: OECD Publishing.
- World Bank. 2023. Peru Public Finance Review: Strengthening Spending Efficiency and Resilience. Washington, DC: World Bank.
- World Bank. 2021. Advancing Policy Reforms in Peru to Reduce Risk from Natural Hazards. Washington, DC: World Bank.
- World Bank. 2010. Peru - The Decentralization Process and Its Links with Vertical Imbalance and Poverty. Report No. 52885-PE. Washington, DC: World Bank.
- Government of Peru. National Biodiversity Strategy and Action Plan (extended action plan). Lima.
- Sustainalytics. 2021. Peru Sustainable Bond Framework Second-Party Opinion. Morningstar Sustainalytics.
- United Nations Development Programme. BIOFIN Peru: Biodiversity Finance Diagnostics. Lima: UNDP.
- Critical Ecosystem Partnership Fund / UNEP-WCMC. Peru Biodiversity Profile. Interactive Country Fiches.

Belize Case Study

- International Monetary Fund. 2025. Belize: 2025 Article IV Consultation. IMF Country Report No. 25/262. Washington, DC: IMF.
- The Nature Conservancy. 2022. Belize Blue Bonds for Ocean Conservation: Case Study.
- Government of Belize. 2016. National Biodiversity Strategy and Action Plan 2016-2020. Belmopan.
- WWF. 2017. Valuing Belize's Barrier Reef.
- Belize Tourism Board. 2025. 2024 Tourism Performance Report. Belize City.
- Protected Areas Conservation Trust. 2024. Conservation Investment Strategy. Belmopan.
- Green Finance Institute. 2022. Government of Belize Debt Conversion for Marine Conservation: Case Study.

Vanuatu Case Study

- International Monetary Fund. 2025. Vanuatu: 2025 Article IV Consultation. IMF Country Report No. 25/277. Washington, DC: IMF.
- Government of Vanuatu. 2018. National Biodiversity Strategy and Action Plan 2018-2030. Port Vila.
- Government of Vanuatu. 2015. Post-Disaster Needs Assessment: Tropical Cyclone Pam. Port Vila.
- Government of Vanuatu. 2023. Tropical Cyclones Judy and Kevin Post Disaster Needs Assessment. Port Vila.

- Beck, M.W. et al. 2018. The Global Flood Protection Savings Provided by Coral Reefs. Nature Communications, 9, 2186.
- Pascal, N. and Seidl, A. 2015. National Marine Ecosystem Service Valuation Summary: Vanuatu. MACBIO Project.

Ecosystem Services and Coastal Protection

- Ferrario, F. et al. 2014. The Effectiveness of Coral Reefs for Coastal Hazard Risk Reduction and Adaptation. Nature Communications, 5, 3794.
- Menendez, P. et al. 2020. The Global Flood Protection Benefits of Mangroves. Scientific Reports, 10, 4404.
- McIvor, A. et al. 2012. Reduction of Wind and Swell Waves by Mangroves. Natural Coastal Protection Series.
- Beck, M. and Lange, G. 2016. Managing Coasts with Natural Solutions. World Bank Technical Report.

Data Sources

- World Bank. International Debt Statistics. Washington, DC: World Bank (ongoing).
- World Bank. World Development Indicators. Washington, DC: World Bank (ongoing).
- UNEP-WCMC. World Database on Protected Areas (WDPA). Cambridge: UNEP-WCMC (ongoing).
- Global Forest Watch. Country Dashboards. Washington, DC: World Resources Institute (ongoing).
- FAO. Global Forest Resources Assessment. Rome: FAO (various years).
- World Travel and Tourism Council. Country Economic Impact Reports. London: WTTC (various years).

Annex A. Empirical Framework, Data Sources, and Methodological Notes

This annex documents the country sample, indicator construction, data sources, and methodological considerations underlying the cross-country diagnostic analysis presented in Section 5. Its purpose is to ensure transparency regarding data provenance, comparability constraints, and interpretive limits, thereby supporting appropriate use of the screening framework developed in the study.

The annex is descriptive and diagnostic. It does not establish causal relationships, define policy benchmarks, or assess country performance.

A.1 Country Sample Selection

The country sample was selected to provide a diverse cross-section of income levels, regions, ecological profiles, and debt conditions. The objective was to ensure that the diagnostic framework is tested across varied national circumstances without implying global extrapolation or representativeness.

Four principles guided selection:

1. *Coverage across regions and income groups.*

The sample includes low-income, lower-middle-income, upper-middle-income, and high-income countries, with representation from Africa, Asia-Pacific, Latin America and the Caribbean, and other regions. Small Island Developing States, Least Developed Countries, megadiverse countries, and resource-dependent economies are included to capture structural diversity.

2. *Inclusion of biodiversity-relevant economic structures.*

Given the study's focus on biodiversity implementation, the sample intentionally includes countries with significant natural capital endowments, nature-dependent economic sectors, or exposure to ecosystem-mediated risks, alongside more diversified economies for contrast.

3. *Availability of existing diagnostics.*

Priority was given to countries for which biodiversity expenditure diagnostics, fiscal and debt sustainability analyses, or relevant national reporting to the Convention are available, enabling triangulation of qualitative and quantitative information.

4. *Data availability and comparability.*

Countries were included where consistent macro-fiscal and natural capital data could be obtained from standardised international sources, allowing for systematic cross-country screening using common indicators.

The sample is designed for diagnostic illustration, not for statistical inference or global generalisation. Its function is to illuminate patterns, transmission channels, and boundary cases across diverse contexts.

A.2 Fiscal Constraint Indicators

A.2.1 Primary indicator: Interest payments as a share of government revenue

The primary indicator of fiscal constraint is interest payments expressed as a percentage of general government revenue. This measure captures the extent to which debt servicing absorbs the government's revenue envelope and constrains discretionary fiscal space available for biodiversity and other non-protected expenditures.

Data are drawn primarily from IMF World Economic Outlook databases and IMF Article IV consultation reports, supplemented where necessary by World Bank World Development Indicators and national budget documents. Where multiple sources report differing values, IMF estimates are used for consistency.

This indicator is widely used in fiscal surveillance as a practical gauge of budgetary pressure. While no formal threshold defines when interest burdens become binding, higher ratios are commonly interpreted as signalling increasing constraint on fiscal discretion. In this study, the indicator is used for relative screening, not for defining binding limits.

A.2.2 Supplementary fiscal indicators

To contextualise interest-to-revenue ratios, several supplementary indicators are reported:

- General government debt as a share of GDP, drawn from IMF sources. This stock measure provides background context but does not directly capture fiscal pressure.
- IMF–World Bank debt sustainability classifications, where applicable, reflecting forward-looking assessments of debt trajectories and shock sensitivity.
- Government revenue as a share of GDP, providing insight into revenue mobilisation capacity and helping interpret interest burdens.

These indicators are considered jointly. None is interpreted in isolation.

A.2.3 Interpretive limitations

Fiscal indicators capture only selected dimensions of constraint. Debt composition, revenue volatility, adjustment dynamics under fiscal consolidation or restructuring, and institutional features all affect how debt conditions translate into implementation constraints. As a result, fiscal indicators serve to guide analytical attention, not to determine conclusions mechanically.

A.3 Nature-Linked Economic Exposure Indicators

A.3.1 Stock indicator: Renewable natural capital as a share of total wealth

The primary stock-based indicator of nature exposure is renewable natural capital expressed as a share of total national wealth, drawn from the World Bank's Changing Wealth of Nations 2024 database.

Natural capital includes cropland, pastureland, forests, fisheries, and protected-area ecosystem service values. Non-renewable natural capital, such as fossil fuels and minerals, is reported separately and interpreted distinctly, as it reflects commodity-price exposure rather than biodiversity-relevant transmission channels.

In some countries, natural capital exceeds 100 per cent of total measured wealth. This reflects structural conditions where produced, human, or intangible capital stocks are small or negative,

rather than accounting anomalies. Such values indicate high structural dependence on ecosystems and should be interpreted accordingly.

A.3.2 Flow indicators: Nature-dependent sectors

Flow-based indicators capture near-term exposure through the contribution of nature-dependent sectors to economic output:

- Tourism as a share of GDP, using World Travel and Tourism Council data and national accounts.
- Agriculture, forestry, and fisheries as a share of GDP, using World Bank World Development Indicators.

Stock and flow indicators identify overlapping but not identical sets of countries. Both are required for comprehensive screening.

A.3.3 Coverage limitations

Some countries, particularly Small Island Developing States, lack complete natural capital or wealth data under standard parameters. These cases are treated cautiously in quantitative screening and addressed qualitatively where relevant information exists.

A.4 Biodiversity Finance Data

A.4.1 Source hierarchy

Where biodiversity expenditure data are referenced, the study adopts a tiered approach:

- Primary sources: UNDP BIOFIN Biodiversity Expenditure Reviews, which capture biodiversity-relevant spending across government functions using a standardised methodology.
- Secondary sources: Environment or biodiversity ministry budget allocations, used as conservative lower-bound proxies where BIOFIN data are unavailable.

A.4.2 Comparability limitations

Biodiversity expenditure data are not systematically tracked within national accounts. BIOFIN estimates and ministry proxy figures are not directly comparable, and cross-country comparisons should be interpreted with caution. Unlike fiscal indicators, biodiversity spending lacks a globally standardised accounting framework.

A.4.3 Structural data gaps

Available figures often exclude subnational spending in federal systems, spending by non-environment ministries, and private or non-governmental conservation finance. Budget allocations also do not equate to executed expenditure. These limitations reinforce the study’s reliance on qualitative interpretation alongside quantitative screening.

A.5 Data Sources Summary

Indicator	Primary Source
Interest payments / revenue	IMF World Economic Outlook; IMF Article IV reports
Debt-to-GDP	IMF World Economic Outlook
Debt sustainability classification	IMF–World Bank Debt Sustainability Framework
Natural capital wealth	World Bank Changing Wealth of Nations 2024
Tourism share of GDP	World Travel and Tourism Council; World Bank WDI
Agriculture, forestry, fisheries share	World Bank World Development Indicators
Biodiversity expenditure	UNDP BIOFIN; national budget documents

A.6 Guidance for Interpretation

Several principles govern interpretation of the screening results:

- *Indicators characterise structural conditions, not performance.*

  Country placement reflects exposure to fiscal constraint and nature-linked economic structure, not policy effectiveness or implementation quality.

- *Thresholds are heuristic.*

  Indicator ranges are used to organise cross-country variation, not to define precise boundaries or binding limits.

- *Judgment remains essential.*

  Aggregate metrics can misclassify countries where transmission channels operate differently than headline indicators suggest. Country-specific assessment remains necessary.

- *Data limitations counsel caution.*

  Screening results should be interpreted as approximate characterisations subject to revision as data improve, not as definitive classifications.

ANNEXE B1: BRAZIL

High Ambition, High Constraint: The Interest-Burden Channel

Upper-middle-income
Market access
Not debt-distressed

Fiscal Position	Biodiversity Profile	Implementation Status
Debt/GDP: **~88%**	Global species: **15–20%**	NBSAP: **EPANB 2025–2030**
Projected 2030: **~99%**	Protected areas: **~30%**	Targets/actions: 25 / 234
Interest/revenue: **~21%**	Biomes: Amazon, Cerrado, Atlantic Forest, Pantanal, Caatinga	Ministries involved: ~20
Net interest/GDP: **~6%**		ICMS Ecológico: **17 states**

1. Why Brazil Is a Critical Case Under Decision 16/34

Brazil combines globally significant biodiversity assets with persistent macro-fiscal constraint, despite continued market access and absence of formal debt distress. The country contains ecosystems of planetary importance while operating under a high and rising debt burden with elevated interest costs. Brazil illustrates how chronic fiscal pressure, rather than crisis dynamics, can constrain biodiversity implementation in upper-middle-income economies with substantial institutional capacity.

2. Macroeconomic and Fiscal Context

General government gross debt stood at approximately 88 per cent of GDP in 2024 and is projected to rise toward 99 per cent by 2030 under current policies. Interest payments absorb around 21 per cent of government revenue, placing Brazil among the highest interest-burdened upper-middle-income economies. Net interest payments of roughly 6 per cent of GDP exceed many major expenditure categories. The IMF's 2025 Article IV consultation notes that elevated debt and high interest costs crowd out priority investments and constrain fiscal flexibility. Adjustment has occurred primarily through compression of discretionary expenditure, leaving environment- and biodiversity-related spending exposed within annual budget processes.

3. Biodiversity Importance and Implementation Architecture

Brazil contains an estimated 15–20 per cent of global terrestrial biodiversity, with high endemism across multiple biomes. Biodiversity policy involves multiple federal ministries, autonomous agencies, subnational governments, and dedicated fiscal instruments including ecological fiscal transfers (ICMS Ecológico) operational in 17 states. BIOFIN expenditure reviews estimate biodiversity-related public spending at around 0.1 per cent of GDP, with financing gaps of three to six times current allocations. Biodiversity expenditure is largely discretionary, fragmented across budget lines, and weakly protected within the fiscal framework.

4. Debt Sustainability → Implementation Transmission Channel

Brazil illustrates the interest-burden transmission channel. High and persistent debt service obligations compress discretionary fiscal space and expose biodiversity implementation to competition within a fixed budget envelope. This constraint operates continuously and affects implementation capacity even without formal debt distress. Between 2019 and 2022, environmental governance weakened and enforcement capacity declined in a context of tight fiscal conditions where discretionary environmental budgets were particularly exposed. While interest burdens constitute the binding fiscal constraint, institutional design and political commitment shape how this constraint translates into outcomes.

5. Policy Ambition Under Fiscal Constraint

Since 2023, Brazil has demonstrated renewed political commitment to biodiversity. The updated EPANB, submitted in 2024, aligns with the Kunming–Montreal Global Biodiversity Framework and spans approximately 20 ministries. However, biodiversity-relevant spending remains within the discretionary budget envelope and exposed to annual negotiations and consolidation pressures. Complementary initiatives including ECO-INVEST Brasil illustrate efforts to mobilise private capital, but these supplement rather than replace required public expenditure

6. Implications for CBD Implementation

Brazil demonstrates that strong biodiversity strategies and capable institutions are necessary but insufficient without fiscal anchoring mechanisms. The interest-burden channel operates through gradual erosion rather than acute crisis, shaping implementation capacity over time even where political commitment is genuine. For Decision 16/34, Brazil illustrates how debt sustainability conditions can constrain biodiversity implementation in structurally important economies without triggering formal debt distress.

Full citations appear in Annex 1: Annotated Bibliography.

ANNEXE B2: SOUTH AFRICA

Chronic Constraint and Institutional Adaptation

Upper-middle-income
Market access
Not debt-distressed

Fiscal Position	Biodiversity Profile	Implementation Status
Debt/GDP: **~75–78%**	Hotspots: **3**	NBSAP: **2015–2025**
Trajectory: **Stabilising**	Known species: **>95,000**	Key agencies: SANBI, SANParks
Interest/revenue: **~21%**	Protected areas: **~8% terrestrial**	DFFE budget: ~0.45% govt spend
Primary balance: Surplus (first since 2008)	Biomes: 9 (incl. Cape Floristic, Succulent Karoo)	Innovations: Stewardship, offsets

1. Why South Africa Is a Critical Case Under Decision 16/34

South Africa combines globally significant biodiversity assets with persistent macro-fiscal constraint, despite continued market access and absence of formal debt distress. The country hosts three globally recognised biodiversity hotspots—the Cape Floristic Region, Succulent Karoo, and Maputaland-Pondoland-Albany—while operating under high debt and interest burdens. Its relevance lies in illustrating how chronic fiscal pressure can constrain biodiversity implementation in an upper-middle-income economy with sophisticated environmental governance, and how institutional adaptation occurs under sustained constraint.

2. Macroeconomic and Fiscal Context

South Africa retains market access, issues predominantly domestic debt in local currency, and is not subject to IMF programme conditionality. General government gross debt stands at approximately 75–78 per cent of GDP, while interest payments absorb around 21 per cent of main budget revenue—among the highest for upper-middle-income economies. The November 2025 Medium-Term Budget Policy Statement marks a potential inflection point with the first primary surplus since 2008, though the IMF's 2025 Article IV assessment notes this may be insufficient to stabilise debt without additional reforms. The fiscal framework does not protect expenditure composition; adjustment falls disproportionately on discretionary spending, including environment-related budgets.

3. Biodiversity Importance and Implementation Architecture

South Africa hosts exceptional biodiversity across nine biomes, with high endemism and globally significant ecosystems. Protected area coverage stands at approximately 8 per cent of terrestrial area, supplemented by biodiversity stewardship on private and communal land. Public biodiversity expenditure represents approximately 0.45 per cent of total government spending, with near-zero real growth projected. Implementation relies on dedicated institutions including SANBI, SANParks, and provincial agencies, alongside stewardship programmes and offset arrangements.

4. Debt Sustainability → Implementation Transmission Channels

South Africa exhibits multiple transmission channels. Budgetary compression constrains biodiversity spending through chronic pressure on discretionary space. Instrument substitution drives a shift from direct public expenditure toward offsets and stewardship arrangements, shifting costs off-budget while preserving nominal policy alignment. Governance load-shifting means implementation becomes more coordination-intensive and less spending-intensive, with objectives enforced procedurally rather than through dedicated fiscal expenditure. Budget volatility undermines enforcement capacity and long-term planning. These channels operate through gradual erosion rather than acute crisis.

5. Institutional Adaptation Under Fiscal Constraint

South Africa's biodiversity governance has adapted to fiscal constraint through functional substitution. Where direct public investment is constrained, biodiversity outcomes are pursued through regulatory instruments, private cost-bearing via offsets, and coordination-intensive approaches that economise on cash expenditure. This adaptation preserves nominal commitment while shifting implementation modalities. However, private finance and regulatory instruments cannot reliably fund core public goods including enforcement, monitoring, and landscape-scale coordination.

6. Implications for CBD Implementation

South Africa demonstrates that strong biodiversity institutions are necessary but insufficient without fiscal anchoring mechanisms. Debt sustainability affects biodiversity primarily through spending composition and volatility rather than crisis dynamics. For Decision 16/34, South Africa illustrates how even capable upper-middle-income countries require explicit fiscal protection mechanisms, and why CBD implementation cannot be assessed independently of macro-fiscal regimes.

Full citations appear in Annex 1: Annotated Bibliography.

ANNEXE B3: GHANA

Restructuring, Extractive Pressure, and Bidirectional Transmission

Lower-middle-income
G20 Common Framework
Post-restructuring

Fiscal Position	Biodiversity Profile	Implementation Status
Debt/GDP: ~88% (2022 peak)	Hotspot: Guinean Forests	NBSAP: Targets submitted 2024
Post-restructuring: ~55%	Historical forest loss: ~80%	BIOFIN: Launched April 2025
IMF ECF: USD 3 billion	Protected areas: ~14–15%	L.I. 2462: Passed 2022, repealed 2025
Eurobond haircut: ~37%	Water contamination: >60%	Cocoa decline: ~35%

1. Why Ghana Is a Critical Case Under Decision 16/34

Ghana provides the clearest real-time illustration of bidirectional debt–biodiversity dynamics. During the 2022–2025 crisis period, fiscal pressures coincided with rapid deterioration in environmental governance, while biodiversity-relevant shocks fed back into export earnings and fiscal stability. Ghana demonstrates that biodiversity underperformance cannot be attributed solely to weak institutions; the country has an established NBSAP, SDG-linked budget tagging, and launched BIOFIN during restructuring.

2. Macroeconomic and Fiscal Context

Ghana's recent debt crisis required treatment under the G20 Common Framework. Public debt peaked at approximately 88 per cent of GDP in 2022; market access was lost, and external debt service suspended. An IMF Extended Credit Facility of USD 3 billion was approved in May 2023, followed by a domestic debt exchange of approximately USD 20 billion and a Eurobond exchange involving a 37 per cent haircut on USD 13 billion. By March 2025, debt-to-GDP had declined to approximately 55 per cent. However, this improvement did not translate into restored fiscal space for discretionary spending; the post-restructuring path remains characterised by tight expenditure ceilings under IMF conditionality.

3. Biodiversity Importance and Implementation Architecture

Ghana lies within the Guinean Forests a biodiversity hotspot, spanning tropical forests, savannah woodlands, wetlands, and a significant coastal zone. Historical deforestation has been severe, with original forest cover reduced by an estimated 80 per cent. Protected area coverage stands at approximately 14–15 per cent of national territory, but the binding constraint is management effectiveness and enforcement capacity rather than spatial designation. Key pressures include illegal artisanal mining cocoa expansion, logging, and pollution. Ghana submitted national targets aligned with the KGBF in August 2024 and launched BIOFIN in April 2025, yet these advances have not insulated biodiversity from fiscal consolidation.

4. Transmission Channels

Ghana exhibits pronounced bidirectional transmission. The debt-to-biodiversity channel operated through fiscal compression, enforcement collapse, and regulatory relaxation. Legislative Instrument 2462, passed in November 2022, permitted mining in forest reserves; by September 2024, over 60 per cent of surface water bodies had been contaminated and 44 of 288 forest reserves faced active threats. The biodiversity-to-debt channel operated through cocoa production collapse (from approximately 1 million to 650,000 metric tonnes), COCOBOD losses of approximately USD 1.3 billion, increased water treatment costs, and emerging EU Deforestation Regulation market access risks.

5. Crisis-Driven Regulatory Reversal

The passage and repeal of L.I. 2462 illustrates a critical asymmetry. Regulatory weakening occurred rapidly under fiscal desperation; reversal required three years of sustained civil society pressure, with final repeal in December 2025. During this period, forest reserves were extensively degraded and watersheds contaminated. Ghana demonstrates that crisis-period governance failures impose costs extending far beyond the crisis itself, and that successful debt restructuring can coincide with accelerating environmental collapse.

6. Implications

Ghana provides evidence of bidirectional causation between debt dynamics and biodiversity outcomes. It demonstrates that debt restructuring alone does not restore fiscal space for biodiversity implementation, while biodiversity strategies lacking fiscal anchoring remain vulnerable during macroeconomic shocks. The Common Framework, as currently designed, lacks mechanisms to protect environmental governance during restructuring. For Decision 16/34, Ghana illustrates why the relationship between debt and Convention implementation is a structural determinant of feasible biodiversity commitments. Ghana is not exceptional; it is anticipatory of conditions facing many biodiversity-rich countries encountering debt stress.

Full citations appear in Annex 1: Annotated Bibliography.

ANNEXE B4: ETHIOPIA

Prolonged Restructuring, Revenue Crisis, and Pro-Cyclical Degradation

Low-income
G20 Common Framework
In debt distress

Fiscal Position	Biodiversity Profile	Implementation Status
Debt/GDP: ~49.5%	Hotspots: 2	NBSAP: 2025–2030 (GBF-aligned)
Revenue/GDP: ~6.2%	Protected areas: ~14%	Restructuring: 4+ years
IMF ECF: USD 3.4 billion	Plant species: ~6,000–7,000	AIP: March 2025 (USD 8.4bn)
Eurobond default: Dec 2023	Coffee centre of origin	Private creditor talks: collapsed

1. Why Ethiopia Is a Critical Case

Ethiopia anchors the debt-distressed, low-income end of the study's country spectrum. One of Africa's most biodiverse countries, hosting two global biodiversity hotspots, Ethiopia is simultaneously navigating acute debt distress and prolonged restructuring under the G20 Common Framework. Ethiopia requested treatment in February 2021 and remains in restructuring more than four years later. The case illustrates how severe fiscal compression, foreign exchange scarcity, and prolonged restructuring uncertainty constrain biodiversity implementation even in a policy-capable state with high environmental stakes.

2. Macroeconomic and Fiscal Context

Ethiopia is assessed by the IMF as being in debt distress. The country defaulted on its Eurobond coupon in 2023 and is undergoing restructuring under the G20 Common Framework. While headline debt of approximately 49.5 per cent of GDP appears moderate, debt sustainability is severely constrained by Ethiopia's weak revenue base. Government revenue stood at approximately 8.5 per cent of GDP in FY2024/25, among the lowest ratios globally. In this context, even moderate debt stocks become binding; debt service of 2–3 per cent of GDP can absorb 30–50 per cent of total revenue. An IMF Extended Credit Facility of USD 3.4 billion was approved in July 2024, but prohibits non-concessional external borrowing, sharply limiting biodiversity finance options.

3. Biodiversity Importance and Implementation Architecture

Ethiopia contains portions of the Eastern Afromontane and Horn of Africa biodiversity hotspots and is a centre of origin for globally significant crops including coffee. Protected area coverage stands at approximately 14 per cent of national territory, but the binding constraint is management effectiveness and financing adequacy rather than spatial designation. Ethiopia's updated NBSAP (2025–2030) is aligned with the KGBF, but lacks a fully costed implementation plan or protected fiscal envelope. In the absence of safeguarded budget lines, biodiversity remains vulnerable in annual negotiations.

4. Transmission Channels

Ethiopia exhibits multiple transmission channels. The debt-to-biodiversity channel operates through fiscal compression, foreign exchange scarcity, and restructuring uncertainty. Protected areas face chronic underfunding; staffing, patrol coverage, and monitoring are affected by budget compression and FX shortages. Ethiopia's debt crisis also includes a distinct FX dimension: export concentration and FX scarcity create incentives to liquidate natural assets for hard currency, driving accelerated deforestation for charcoal and expansion of agriculture into marginal lands. This pro-cyclical pattern—where economic crisis accelerates natural resource extraction while enforcement weakens—intensified during the 2020–2025 period of conflict, drought, and macro stress.

5. Prolonged Restructuring and Planning Uncertainty

Ethiopia's restructuring has been among the most prolonged under the Common Framework. An Agreement in Principle with official creditors was reached in March 2025 covering USD 8.4 billion; negotiations with private creditors collapsed in October 2025. This extended process has had significant opportunity costs: fiscal baselines remain uncertain, medium-term budget planning is constrained, and multi-year conservation programmes become difficult to commit to. Environmental agencies operate defensively, prioritising short-term survival over long-term ecosystem management.

6. Implications

Ethiopia demonstrates that biodiversity implementation under acute debt distress faces fundamentally different constraints than under chronic but stable fiscal pressure. Revenue collapse makes moderate debt ratios binding; prolonged restructuring paralyses planning and accelerates degradation; IMF programme constraints exclude market-rate instruments. For Decision 16/34, Ethiopia illustrates why debt-distressed countries require differentiated implementation pathways and

financing instruments compatible with adjustment contexts. Ecological degradation incurred during restructuring may be costly or impossible to reverse, underscoring that biodiversity cannot be an afterthought in debt restructuring processes.

Full citations appear in Annex 1: Annotated Bibliography

ANNEXE B5: BANGLADESH

Revenue Constraint, Climate Exposure, and Structural Strangulation

Lower-middle-income
IMF ECF/EFF + RSF
Moderate debt distress risk

Fiscal Position	Biodiversity Profile	Implementation Status
Debt/GDP: ~38.5%	Sundarbans: world's largest mangrove	NBSAP: 2016–2021 (update pending)
Revenue/GDP: ~8.9%	Natural capital: ~75% of wealth	BIOFIN: Launched May 2025
Interest/revenue: ~30%	Protected areas: ~4–5% (WDPA)	Climate budget tagging: operational
IMF RSF: USD 1.4 billion	Climate Risk Index: top 10	LDC graduation: 2026

1. Why Bangladesh Is a Critical Case

Bangladesh combines exceptionally high dependence on natural capital and ecosystem services with chronic fiscal constraint, rising debt service pressures, and extreme exposure to climate and disaster risk. The case illustrates how biodiversity implementation can be constrained not by crisis or institutional fragility, but by persistent fiscal rigidity, structurally low revenue mobilisation, and pro-cyclical exposure to climate shocks. The binding constraint is clearly fiscal: extremely low revenue mobilisation turns moderate debt service into a structural ceiling on discretionary spending, even without acute debt distress

2. Macroeconomic and Fiscal Context

Bangladesh is not in sovereign debt crisis, but its fiscal position is structurally constrained. Total public debt of approximately 38.5 per cent of GDP appears moderate by international standards; however, government revenue stands at approximately 8.9 per cent of GDP—among the lowest ratios outside fragile states. In this context, debt service equivalent to roughly the full annual revenue envelope severely limits discretionary spending. Interest payments alone absorb close to 30 per cent of government revenue. An IMF programme approved in January 2023 includes a Resilience and Sustainability Facility of USD 1.4 billion for climate, but prohibits non-concessional borrowing, limiting biodiversity finance options.

3. Biodiversity Importance and Implementation Architecture

Bangladesh hosts globally significant ecosystems including the Sundarbans—the world's largest contiguous mangrove forest and a UNESCO World Heritage Site—extensive wetlands and haor systems, and the Ganges-Brahmaputra-Meghna delta. Natural capital accounts for an estimated 75 per cent of national wealth. Terrestrial protected area coverage stands at approximately 4–5 per cent under WDPA-consistent definitions. The NBSAP (2016–2021) is under revision; BIOFIN was launched in May 2025. Bangladesh has mature climate public financial management tools including budget tagging, but biodiversity spending remains fragmented, untracked at aggregate level, and unprotected in annual negotiations.

4. Transmission Channels

The transmission channel operates through chronic fiscal compression rather than acute crisis. Environmental spending competes in a discretionary space dominated by social protection, subsidies, and debt service. Without explicit insulation, biodiversity budgets are vulnerable to compression even in non-crisis years. An indirect channel runs through food systems: wetland degradation and fisheries decline increase food import dependence, placing pressure on foreign exchange reserves and tightening fiscal conditions. Climate systematically outcompetes biodiversity for fiscal resources; under extreme constraint, biodiversity is relegated to co-benefit status unless explicitly protected through tagging or ring-fencing.

5. Climate-Disaster Risk as Fiscal Amplifier

Bangladesh ranks among the world's most climate- and disaster-exposed countries. Floods, cyclones, salinity intrusion, and riverbank erosion impose recurrent fiscal costs through emergency response, reconstruction, and productivity losses. Post-disaster spending is frequently financed through budget reallocation or additional borrowing, further tightening medium-term fiscal space. This creates a reinforcing loop: climate shocks compress fiscal space, which weakens investment in ecosystem protection and nature-based resilience, increasing vulnerability to future shocks. Biodiversity loss and fiscal stress are linked through climate risk even without acute debt distress.

6. Implications

Bangladesh demonstrates that moderate debt ratios can be functionally binding when revenue is low. The case illustrates structural strangulation: moderate debt rendered binding by an exceptionally weak revenue base under climate stress. For Decision 16/34, Bangladesh shows why debt sustainability assessments should be interpreted through a revenue lens—the same debt ratio implies different biodiversity feasibility depending on revenue capacity and climate exposure.

Biodiversity underperformance reflects fiscal structure, not policy absence; comprehensive strategies and institutional capacity exist, yet outcomes lag because spending is fragmented, unprotected, and residual in budget prioritisation.

Full citations appear in Annex 1: Annotated Bibliography

ANNEXE B6: INDIA

Federal Complexity, Fiscal Consolidation, and Scale

Lower-middle-income
Market access
Not debt-distressed

Fiscal Position	Biodiversity Profile	Implementation Status
Debt/GDP: ~82–84%	Hotspots: 4 of 36 global	NBSAP: Updated 2024
Interest/expenditure: ~24%	Global species: 7–8%	MoEFCC: ~0.07% of expenditure
Interest/revenue: ~35%	Protected areas: ~5.3%	NBSAP need: Rs 81,665 cr/year
Consolidation target: 50% by 2031	Forest-dependent: 275 million	States/UTs: 28 + 8

1. Why India Is a Critical Case

India demonstrates how chronic fiscal pressure, federal governance complexity, and scale can constrain biodiversity outcomes even in a policy-capable, market-access economy. As the world's most populous country, one of 17 megadiverse nations, and the fifth-largest economy, India's biodiversity trajectory materially affects the feasibility of achieving the Kunming–Montreal Global Biodiversity Framework. Implementation challenges cannot be attributed to insolvency or macroeconomic instability; instead, India illustrates how high but sustainable debt, elevated interest burdens, and intergovernmental coordination costs interact to shape implementation capacity.

2. Macroeconomic and Fiscal Context

India retains market access, issues predominantly domestic local-currency debt, and is not subject to IMFconditionality. General government gross debt is approximately 82–84 per cent of GDP, assessed as sustainable. However, interest payments absorb approximately 24 per cent of central government expenditure and 35 per cent of revenue receipts. The binding issue is compression of discretionary fiscal space, not abrupt retrenchment. Fiscal consolidation policy reinforces this: the medium-term framework protects capital expenditure while constraining revenue expenditure. Because biodiversity management is overwhelmingly recurrent, it competes poorly within a strategy that prioritises infrastructure investment.

3. Biodiversity Importance and Implementation Architecture

India harbours approximately 7–8 per cent of recorded global species within 2.4 per cent of global land area, spanning four biodiversity hotspots. The protected area network covers approximately 5.3 per cent of national territory. Approximately 275 million people depend on forests for livelihoods, embedding biodiversity management within complex social trade-offs. The updated NBSAP is aligned with the KMGBF and involves 21 central ministries; implementation is estimated to require approximately Rs 81,665 crore annually through 2030. However, the NBSAP does not establish a protected fiscal envelope, and implementation depends on annual budget negotiations within multiple ministries.

4. Transmission Channels

The debt-to-biodiversity channel operates through interest-driven discretionary squeeze and revenue-biased consolidation that disadvantages recurrent conservation costs. The Ministry of Environment, Forest and Climate Change accounts for approximately 0.07 per cent of Union government expenditure. Capacity constraints compound fiscal pressure: state forest departments report significant staff vacancies affecting enforcement and monitoring. Federal coordination costs filter fiscal resources through varied subnational capacities; 28 states and 8 union territories share environmental jurisdiction, with wide variation in administrative effectiveness. Climate shocks trigger fiscal reallocation, amplifying biodiversity stress.

5. Federal Fiscal Architecture and Subnational Variation

India’s federal system is central to biodiversity outcomes. The Finance Commission’s inclusion of forest cover in horizontal devolution potentially channels substantial resources to forest-rich states; however, transfers are not earmarked for conservation, reward existing stock rather than outcomes, and exclude non-forest ecosystems. Observed variation in biodiversity outcomes across states reflects differences in administrative capacity, political prioritisation, and economic structure. Targeted institutional design can overcome fiscal pressure selectively. Species-focused programmes such as tiger conservation have delivered measurable outcomes but such models may not be scalable across all domains.

6. Implications

India demonstrates that biodiversity implementation challenges are not confined to debt-distressed or low-capacity states. Even in a large, policy-capable economy, debt sustainability conditions—through interest burdens, fiscal consolidation strategies, and intergovernmental dynamics—can materially constrain implementation of the Convention. Fiscal constraint

is a necessary but not sufficient explanation; debt sustainability conditions biodiversity implementation through interaction with institutional design and governance capacity. India underscores that scale and federal complexity amplify implementation risk, requiring analysis beyond aggregate fiscal indicators.

Full citations appear in Annex 1: Annotated Bibliography

ANNEXE B7: PERU

Low Debt, High Disaster Risk, and Decentralised Fragmentation

Upper-middle-income
Market access
Not debt-distressed

Fiscal Position	Biodiversity Profile	Implementation Status
Debt/GDP: ~32–34%	Megadiverse: ~10% global species	NBSAP: GBF update underway
Reserves: ~27% of GDP	Hotspot: Tropical Andes	Regions: 26 + 1,800 municipalities
Fiscal deficit: 3.5% (2024)	Protected areas: ~17.9%	Subnational spending: ~40%
El Niño losses: up to 11.6% GDP	Biosphere reserves: 7	Sov. Sustainable Bond: USD 3.25bn8

1. Why Peru Is a Critical Case

Peru demonstrates that low debt and strong macroeconomic buffers do not insulate biodiversity implementation from binding constraints. As a megadiverse country with relatively low public debt, sustained market access, and sizeable international reserves, Peru nonetheless faces persistent biodiversity underperformance. Implementation challenges cannot be attributed to debt distress or institutional collapse; instead, Peru illustrates how recurring climate and disaster shocks, extreme fiscal decentralisation without commensurate capacity, and an extractives-dependent development model can constrain biodiversity outcomes in fiscally strong, policy-capable states.

2. Macroeconomic and Fiscal Context

Peru's public debt of approximately 32–34 per cent of GDP remains well below upper-middle-income peers. The debt profile is largely domestic and local-currency denominated, and international reserves exceed 27 per cent of GDP. Yet fiscal strength coexists with persistent constraints. The 2024 fiscal deficit of 3.5 per cent of GDP exceeded the target under Peru's fiscal responsibility framework. Infrastructure gaps, social protection demands, subnational transfer obligations, disaster response costs, and quasi-fiscal support for Petroperu all compete within a crowded discretionary envelope. Biodiversity spending, lacking statutory protection, is systematically subordinated in annual budget negotiations.

3. Biodiversity Importance and Implementation Architecture

Peru ranks among the world's most biodiverse countries, hosting approximately 10 per cent of global species within the Tropical Andes hotspot. The protected area system covers approximately 17.9 per cent of terrestrial territory. Peru's NBSAP is currently being updated to align with the Kunming–Montreal Global Biodiversity Framework. However, the strategy lacks fiscal anchoring: there is no protected multi-year budget envelope, and financing commitments are indicative rather than binding. Peru has developed sophisticated sustainable finance instruments, including a Sovereign Sustainable Bond Framework, but bond proceeds flow into the general budget without earmarking for biodiversity.

4. Transmission Channels

The primary transmission channel is shock-driven fiscal compression. Major El Niño events have generated losses equivalent to 6–12 per cent of GDP, with the 2017 coastal event alone causing approximately USD 3 billion in damages. Emergency response and reconstruction trigger in-year reallocations that disproportionately affect discretionary environmental spending. Decentralisation-induced fragmentation compounds this: subnational governments account for approximately 40 per cent of total spending and 60 per cent of public investment, yet environmental mandates have been transferred without commensurate resources or capacity. Approximately 60 per cent of social conflicts in Peru are environmental, frequently linked to extractive activities.

5. Decentralisation and Institutional Fragmentation

Fiscal decentralisation is one of Peru's most analytically significant features. Since 2002 reforms, 26 regional governments and over 1,800 municipalities share environmental jurisdiction. The canon system distributes natural-resource revenues disproportionately to local governments, creating mismatches where entities receiving revenues lack capacity while those holding environmental mandates lack funding. Territorial fragmentation weakens coordination and scale. Management effectiveness across protected areas varies widely, reflecting uneven resourcing and enforcement capacity.

Implications

Peru demonstrates that fiscal strength measured by debt metrics can mask profound implementation constraints. Recurring shocks, decentralisation without capacity, extractives dependence, and innovation–execution gaps can bind as tightly as debt distress. For Decision 16/34, Peru shows that biodiversity implementation challenges are not confined to debt-

distressed or institutionally fragile states. Even fiscally strong countries require differentiated implementation pathways that address disaster risk, decentralisation effectiveness, fiscal anchoring, and execution capacity beyond aggregate debt indicators.

Full citations appear in Annex 1: Annotated Bibliography

ANNEXE B8: BELIZE AND VANUATU

Small Island Developing States and the Reverse Channel: Biodiversity as Macro-Fiscal Asset

	BELIZE	VANUATU
Income classification	Upper-middle-income	Lower-middle-income (LDC graduating)
Debt/GDP	~61% (down from 103% in 2020)	~40–44% (high risk of distress)
Primary transmission channel	Revenue-based: reef → tourism → fiscal receipts	Risk-mitigation: ecosystems → reduced disaster costs
Key ecosystem asset	Belize Barrier Reef (2nd largest globally)	Coral reefs and mangroves as protective infrastructure
Quantified economic link	Tourism: 40–46% of GDP; reef services: USD 395–559m/year	Avg. disaster loss: 42.8% of GDP/year; TC Pam (2015): 64% GDP
Innovative instrument	2021 Blue Bond: USD 364m debt conversion; 30% ocean protection	Community-based marine conservation; ecosystem-based adaptation

1. Purpose of This Paired Case Study

The main country case studies examine the forward channel: how debt constraints affect biodiversity implementation. This paired case study examines the reverse channel: how biodiversity outcomes affect fiscal performance. Belize and Vanuatu are selected because they represent the two primary reverse-channel mechanisms in particularly clear form. Belize illustrates biodiversity as a revenue-generating asset; Vanuatu illustrates biodiversity as fiscal risk infrastructure. Together, they demonstrate that biodiversity can be macro-relevant without being a budget line item.

2. Belize: The Revenue-Based Channel

Belize exemplifies biodiversity as a revenue-generating asset. The Barrier Reef underpins a tourism sector contributing approximately 40–46 per cent of GDP. Reef-dependent tourism accounts for 25 per cent of tourist activity; ecosystem services from coral reefs and mangroves are valued at USD 395–559 million annually. The transmission channel is direct: reef degradation reduces tourist arrivals, which reduces GST receipts, corporate taxes from tourism operators, and income taxes from tourism employees. Degradation threatens the foreign exchange earnings required to service external debt and maintain the fixed exchange rate.

The 2021 Blue Bond—the largest debt-for-nature transaction in history at USD 364 million—demonstrates policy recognition of this link. The transaction reduced public debt by 12 per cent of GDP while securing USD 180 million for marine conservation over 20 years and committing Belize to protect 30 per cent of its ocean by 2026. By explicitly linking debt service to conservation milestones, the transaction created observable dependencies between biodiversity outcomes and fiscal performance. Belize's debt has fallen from 103 per cent of GDP (2020) to approximately 61 per cent (2024), alongside record tourism arrivals of 562,405 overnight visitors in 2024.

3. Vanuatu: The Risk-Mitigation Channel

Vanuatu illustrates biodiversity as fiscal risk infrastructure. Ranked the world's most hazard-exposed country, it faces average annual disaster damages equivalent to 43 per cent of GDP. Cyclones in 2015, 2020, and 2023 each caused damages equivalent to 60–65 per cent of GDP or affected two-thirds of the population. Coastal ecosystems provide material protection against storm surge and wave damage. Estimates suggest mangroves can reduce flood damage costs by 5–30 per cent.

Ecosystem degradation creates a 'ratchet effect' on debt: each disaster shock increases borrowing for reconstruction, while degradation of protective ecosystems amplifies damage from subsequent shocks. Debt rises after each event without full recovery as protective capacity is progressively lost. Unlike Belize, where the mechanism operates through tourism revenue, Vanuatu illustrates biodiversity loss as a fiscal risk amplifier—increasing contingent liabilities and debt volatility

4. Implications for Decision 16/34

These cases demonstrate that the biodiversity-to-fiscal channel operates through multiple pathways that are analytically distinct but often mutually reinforcing. For SIDS, ecosystem health is not a peripheral environmental concern but a structural

determinant of fiscal sustainability. Debt sustainability assessments should incorporate both the revenue implications of nature-based economic activities and the risk-reduction services of healthy ecosystems. The cases illustrate the reverse causal channel; they underscore that biodiversity finance is not merely an expenditure category but an investment in the asset base that generates revenue and reduces fiscal risk.

Full citations appear in Annex 1: Annotated Bibliography

Annex C: Further Reading

Conceptual and Analytical Frameworks

- HM Treasury, UK. 2021. The Economics of Biodiversity: The Dasgupta Review. London.
- Campiglio, E. et al. 2022. Climate-Related Risks and Sovereign Debt. Nature Climate Change.
- Burke, M., Hsiang, S., and Miguel, E. 2015. Global Non-linear Effect of Temperature on Economic Production. Nature.
- NatureFinance. 2022. Integrating Nature into Sovereign Debt Sustainability Analysis.
- NatureFinance. 2023. Aligning Sovereign Debt Markets with Nature.
- Principles for Responsible Investment. 2023. Investor Case for Biodiversity-Linked Sovereign Debt.

Debt-Biodiversity Nexus: Academic Literature

- Flammer, C. 2025. Biodiversity Finance. Journal of Financial Economics.
- Gonzalez-Redin, J. et al. 2018. Exploring the Role of Debt in Natural Resource (Un)sustainability. PLOS ONE.
- Sommer, J.M. et al. 2020. The United States, Bilateral Debt-for-Nature Swaps, and Forest Loss. Journal of Development Studies.
- Seker, A. and Isguven, M.K. 2025. The Nexus Between Biodiversity and Sovereign Credit Ratings. Sustainability, 17(11), 4977.
- Cobbold, E.Y. et al. 2025. External Debt and Natural Resource Depletion. Structural Change and Economic Dynamics.
- Coulibaly, Y. et al. 2025. The Effects of Resource-Backed Loans on Deforestation. World Development.
- Bhattacharyya, S. and Hodler, R. 2015. Rent-Seeking and Resource-Backed Loans. Journal of Development Economics.
- Bulte, E. and Barbier, E. 2021. Natural Capital, Institutions, and Indebtedness. Environment and Development Economics.
- Pellegrini, L. et al. 2021. Corruption, Rent-Seeking, and Deforestation. Ecological Economics.
- Baek, J. and Kim, H. 2013. Is Economic Growth Good or Bad for the Environment? Empirical Evidence from Korea. Energy Economics.
- Mahmoud, M. and Sessa, V. 2022. Debt Crises and Environmental Governance in Developing Countries. Ecological Economics.

Nature-Economy Modelling

- Green Central Banking / NatureFinance. 2023. Integrating Nature Into Debt Sustainability Analysis: Four-Step Methodology.

- Banque de France. 2024. Assessing Integrated Assessment Models for Building Global Nature-Economy Scenarios. WP #959.
- Finance for Biodiversity Foundation. 2025. New Sovereign Debt Nature Assessment Model.
- Systemiq / CLEAN Helpdesk. 2025. Integrating Climate Adaptation and Natural Capital into Macroeconomic Frameworks.
- Natural Capital Project / Stanford University. 2022. InVEST Global Toolkit: Integrated Valuation of Ecosystem Services.
- OECD. 2023. Assessing Biodiversity-Related Financial Risks. Paris: OECD.

Debt-for-Nature Instruments and Cases

- World Bank. 2020. Seychelles Sovereign Blue Bond - Impact and Lessons. Washington, DC.
- IDB. 2023. Ecuador Debt Conversion for Galapagos Conservation. Washington, DC.
- Benzaken, D. et al. 2024. From Concept to Practice: Financing Sustainable Blue Economy in SIDS - Seychelles Experience. Marine Policy.
- Steele, P. and Patel, S. 2020. Tackling the Triple Crisis: Using Debt Swaps to Address Debt, Climate and Nature Loss Post-COVID-19. London: IIED.
- IMF. 2022. Debt-for-Climate Swaps: A Perspective (Chamon et al.). Washington, DC: IMF Working Paper.
- Green Finance Institute. 2022. Government of Belize Debt Conversion for Marine Conservation: Case Study.
- Center for Global Development. 2021. Belize's Big Blue Debt Deal: At Last, A Scalable Model?
- Center for Global Development. 2023. Debt-for-Nature Swaps: More Relief or More Hype?
- Nedopil, C. 2023. Are Debt-for-Nature Swaps Scalable? PMC.
- Nedopil, C. 2025. Current Perspectives on Debt-for-Nature Swaps: Moving from Niche to Mainstream. ScienceDirect.
- Grund, S. et al. 2023. Debt-for-Nature Swaps: The Belize 2021 Deal and Lessons for Future Operations. SSRN.
- Latindadd. 2024. Initial Assessment of Galapagos Debt-for-Nature Swap: A Look from Civil Society After One Year.

Market Standards and Instruments

- International Capital Market Association. 2024. Sustainability-Linked Bond Principles (SLBP). ICMA.
- International Capital Market Association. 2025. Sustainable Bonds for Nature: A Practitioner's Guide. ICMA.
- International Finance Corporation. 2022. Biodiversity Finance Reference Guide. IFC.
- International Finance Corporation. 2024. Biodiversity Finance Metrics for Impact Reporting. IFC.
- The Nature Conservancy. 2024. Nature Bonds Toolkit (v1). TNC.

- Taskforce on Nature-related Financial Disclosures. 2023. TNFD Final Recommendations.
- NatureFinance. 2024. Nature-Linked Sovereign Debt: A Guide for Public Finance.
- World Bank Treasury. 2024. Sovereign Resilient Debt Clauses: Market Uptake and Lessons.

Global Architecture and Policy Initiatives

- United Nations. 2015. Addis Ababa Action Agenda on Financing for Development. New York.
- UNFCCC. 2015. Paris Agreement. Bonn.
- G20/Paris Club. 2022. G20 Common Framework for Debt Treatments.
- Government of Barbados. 2023. Bridgetown Initiative - Concessionality, Liquidity, Resilience.
- V20 Finance Ministers. 2023. Debt Reform for Climate-Vulnerable Economies.
- World Economic Forum. 2024. Nature and Net-Zero Financing Framework.
- DRGR Project. 2023. Debt Relief for a Green and Inclusive Recovery. Heinrich Boll Foundation / SOAS / Boston University.

Fiscal Space and Public Finance

- Heller, P.S. 2005. Understanding Fiscal Space. IMF Policy Discussion Paper 05/4. Washington, DC: IMF.
- Roy, R. and Heuty, A. (Eds.) 2009. Fiscal Space: Policy Options for Financing Human Development. London: Earthscan.
- ODI. 2023. Debt Relief, Fiscal Space, and Environmental Expenditure in Developing Countries.
- Climate Policy Initiative. 2024. Global Landscape of Nature Finance.

Ecosystem Services and Coastal Protection

- Losada, I.J. et al. 2018. The Global Flood Protection Benefits of Mangroves. Scientific Reports.
- Spalding, M. et al. 2014. Mangroves for Coastal Defence: Guidelines for Coastal Managers and Policy Makers.
- Guannel, G. et al. 2016. The Power of Three: Coral Reefs, Seagrasses and Mangroves Protect Coastal Regions. PLOS One.
- The Nature Conservancy. 2016. Mapping Ocean Wealth: Coastal Protection.
- Narayan, S. et al. 2019. The Costs of Mangrove and Reef Restoration Compared to Coastal Structures. TNC.
- Storlazzi, C.D. et al. 2019. Rigorously Valuing the Role of U.S. Coral Reefs in Coastal Hazard Risk Reduction. USGS.

Regional Development Bank Reports

- African Development Bank. 2023. Debt Sustainability and Climate Finance in Africa. Abidjan.
- African Development Bank. 2024. Natural Capital and Green Growth in Africa Report. Abidjan.
- Inter-American Development Bank. 2022. Nature and Debt: The Emergence of the Nature Bond. Washington, DC.
- Inter-American Development Bank. 2023. Latin America and the Caribbean Macroeconomic Report: The Cost of Environmental Degradation.
- Asian Development Bank. 2022. Innovative Finance Mechanisms for Biodiversity. Manila.
- Asian Development Bank. 2024. Mainstreaming Natural Capital into Development Planning in Asia-Pacific.
- GEF Secretariat. 2023. Blended Finance for Biodiversity (GEF-8 Lessons). Washington, DC.
- Green Climate Fund. 2022. Debt Instruments in Climate Portfolios. Incheon.

CBD Technical Resources

- CBD Secretariat. 2022. Technical Series #108: Innovative Finance for Biodiversity. Montreal.
- CBD Secretariat. 2021. Options for Enhancing Debt Instruments for Biodiversity Finance. Montreal.
- CBD Secretariat. 2023. Financial Reporting and Monitoring (GBF) - Guidance Note. Montreal.
- CBD Secretariat. 2020. Mainstreaming of Biodiversity in the Energy and Mining, Infrastructure, Manufacturing and Processing Sectors. Technical Series No. 93. Montreal.

Ecological Fiscal Transfers

- Busch, J. and Mukherjee, A. 2018. Encouraging State Governments to Protect and Restore Forests Using Ecological Fiscal Transfers: India's Tax Revenue Distribution Reform. Conservation Letters, 11(2).
- Busch, J. et al. 2021. What Drives Success in National Ecological Fiscal Transfers? Environmental Research Letters, 16.
- Ring, I. 2008. Integrating Local Ecological Services into Intergovernmental Fiscal Transfers: The Case of the Ecological ICMS in Brazil. Land Use Policy, 25(4).
- Droste, N. et al. 2017. Ecological Fiscal Transfers in Brazil - Incentivizing or Compensating Conservation? In: Biodiversity Conservation and Poverty Alleviation. Routledge.

Vulnerability and Risk Assessment

- Germanwatch. Global Climate Risk Index (annual). Bonn: Germanwatch e.V.
- Bundnis Entwicklung Hilft & IFHV. WorldRiskReport (annual). Berlin.
- Notre Dame Global Adaptation Initiative (ND-GAIN). Country Index.
- Swiss Re. Biodiversity and Ecosystem Services (BES) Index.

- INFORM Risk Index. EU/JRC and UNDRR.

Additional Country-Specific Sources

- UNDP BIOFIN. Various years. Biodiversity Finance Plans and Expenditure Reviews: Costa Rica, Sri Lanka, Zambia, Ecuador. New York.
- International Budget Partnership and PSAM. 2022. South Africa: Budget Credibility and the Sustainable Development Goals.
- Climate Bonds Initiative. 2022. Peru Sustainable Finance State of the Market 2022 Report. London.
- World Bank. 2013. Peru: A Mega-Diverse Country Investing in National Protected Areas. Washington, DC.
- World Bank. 2021. Building Public Sector Management Capacity and Empowering Subnational Governments in Peru. Washington, DC.
- Critical Ecosystem Partnership Fund. 2015. Ecosystem Profile: Guinean Forests of West Africa Biodiversity Hotspot.
- Council on Energy, Environment and Water. 2021. Mapping India's Climate Vulnerability: A District-Level Assessment. New Delhi: CEEW.
- The Energy and Resources Institute. 2023. Biodiversity Finance in India: Gaps and Opportunities. TERI Discussion Paper. New Delhi.