

Incorporating Adaptation and Resilience into Macroeconomic Assessments

RECOMMENDATIONS FOR THE IMF AND WORLD BANK'S DEBT SUSTAINABILITY ANALYSIS

In collaboration with:





Executive Summary

Climate and nature have become a major source of shocks and potential debt stress for developing countries. Disasters destroy infrastructure and reduce revenue. Degraded ecosystems, like mangroves, coral reefs, and soil, make those losses larger – pushing up debt burdens and borrowing costs at the moment countries most need fiscal space to invest in resilience.

Good borrowing, lending and policy decisions depend on finance ministries, debt management offices, the IMF and the World Bank understanding these risks and interventions and agreeing on how to measure them.

The IMF–World Bank Debt Sustainability Analysis (DSA) is a critical tool for building that shared understanding. As a central pillar of the international financial architecture, the DSA shapes how risk is defined, priced, and managed across the entire system – informing concessional borrowing limits, debt restructuring, costs of capital, and fiscal policy advice.

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In September 2026, the IMF and World Bank Boards approved the first major reform of the Low-Income Country Debt Sustainability Framework (LIC-DSF) in nearly a decade. The reform adds a new Long-Term module which will assess the debt-related impacts of physical climate risks as well as the benefits and costs of resilience policies and investments.

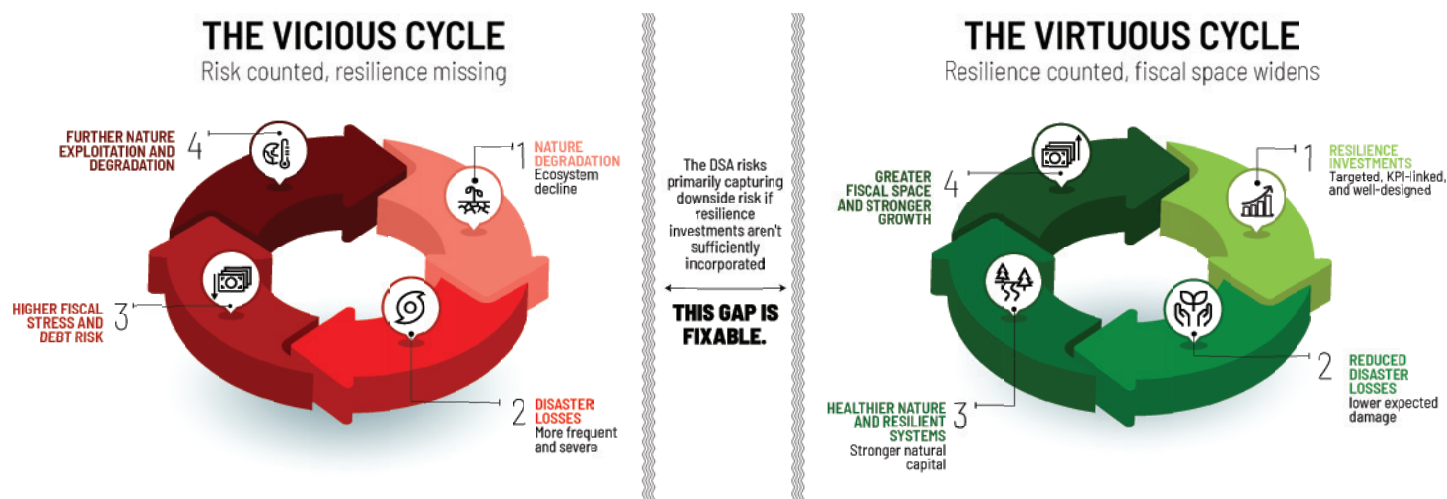
Supporting climate and resilience assessments in constructing a DSA will be a gradual process. Countries can get started with relatively simple scenarios and refine towards greater complexity, including:

- **Integrating earth-economy and hazard modelling**, to estimate how natural capital and resilience investments reduce disaster losses and support growth.
- **Converting government plans into KPI-linked investments**, such as National Development Plans, NDCs, NAPs and NBSAPs.
- **Incorporating innovative financial instruments**, such as debt conversions, outcome bonds, parametric insurance, and debt pause clauses whose terms can change a country's fiscal path.

Underlying these inputs is the need for the DSA itself to become more easy to use. The existing template is a behemoth with nearly 200,000 formula cells across 86 sheets with more than 500 links between tabs. Additional complexity will simply add the burden on country teams and governments to navigate the DSA. Open-source sovereign technology (SovTech) tools can make the analysis easier for finance ministries to run, test and own, so it is no longer a black box delivered to them.

As the revised framework becomes operational in the second half of 2027, we recommend that the IMF and World Bank:

1. **Set out a transparent and consistent method and calibration library for estimating the benefits of resilience investments.** A shared, open library of reference parameters and modelling guidance for specific interventions will function as a global benchmark for how other institutions conceptualise and structure resilience finance.
2. **Work with partners to develop guidance and SovTech tools to make this analysis practical for Ministries of Finance.** Translating existing or proposed national plans and innovative instruments into KPI-linked evidence that can feed into the Long-Term Module requires more policy analysis which can be supported by emerging [SovTech tools](#) to make this process more usable and scalable.



Why the Debt Sustainability Analysis?

The Debt Sustainability Analysis (DSA) is the IMF and World Bank's assessment of a country's fiscal stability.

Assessing debt “sustainability” is more an art than a precise science – but broadly the DSA seeks to diagnose a country's ability to meet its current and future debt payments without defaulting, requiring debt forgiveness, or making unrealistic cuts to public spending.

Every year the IMF and World Bank evaluate certain debt-burden indicators, such as public and external debt-to-GDP and debt service-to-revenue, against country-specific thresholds and probabilistic paths, rating a country's risk of debt stress as Low, Moderate, High, or In Debt Distress.

The DSA is a systemic coordinating device across the global financial architecture:

- Country debt managers use it directly to inform domestic financing strategy
- The World Bank ties concessional lending terms to it
- It anchors restructuring negotiations between governments, multilaterals and other creditors
- It can inform how credit rating agencies price sovereign risk
- It determines if a country can access loans from international financial institutions

There are two frameworks for the DSA: the Low-Income Country Debt Sustainability Framework (LIC-DSF) applies to [countries](#) eligible for IMF/World Bank concessional financing. The Sovereign Risk and Debt Sustainability Framework (SRDSF) is for market-access countries that finance themselves mainly through capital markets.

The LIC-DSF has just completed its first substantive review since 2017, including a new Long-Term Module which will enable country teams to model the implications of climate risks and adaptation and development investments.



This is a significant advancement but one that carries a risk of its own. Climate and nature degradation will increasingly appear as downside pressure on headline DSA indicators, and the tools for identifying and quantifying those risks have steadily improved. While the proposed framework allows analysts to incorporate the benefits of adaptation and resilience investments, doing so typically requires additional data, country-specific assumptions, and modelling choices.

By contrast, assessing exposure to climate and nature-related risks is often more straightforward and may therefore receive greater attention in practice. If left unaddressed, this dynamic could formalize a one-sided picture: countries would be penalized for their exposure, with no systematic mechanism to reflect the investments and policies that reduce that exposure over time.

This brief focuses on that gap – resilience investments, including nature-based solutions, which may often be the cheapest and most effective way to stem disaster losses yet remain the least visible input in the framework as currently approved.

Recommendation #1: Set out a transparent and consistent method and calibration library for estimating the benefits of resilience investments

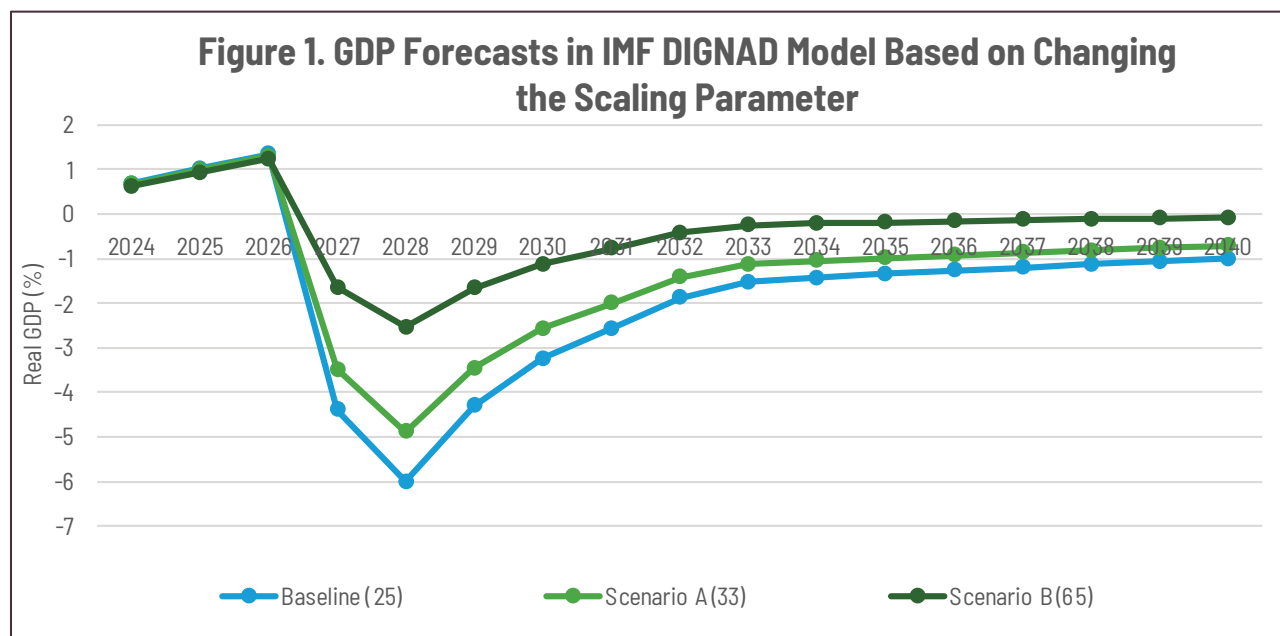
Existing quantification methods for resilience interventions span two analytically distinct variable types: avoided loss from disasters and growth-oriented variables like exports, productivity and tourism. Both are increasingly modelled, but neither has established reference intervals for calibration.

Right now, resilience modelling is a landscape of bespoke analyses where every institution is independently deriving parameters with no common anchor or benchmark for consistency. The calibration of these variables can significantly affect the GDP and debt forecasts, making their accuracy and transparency critical to credible surveillance, policy guidance, and reproducibility.

For example, the Debt, Investment, Growth, and Natural Disasters (DIGNAD) toolkit is considered the IMF's "workhorse model" to study the effects of climate

and disaster risk and how investments in adaptation infrastructure can mitigate them. DIGNAD's default assumption **is that the cost of adaptation infrastructure is 25 percent higher than standard infrastructure** because it requires more skilled workers or specialized parts and materials. This automatically disadvantages resilience investments from a planning standpoint and is an overly broad assumption that is inappropriate in many contexts.

As another example, **DIGNAD's "scaling parameter" for adaptation capital sets the dials** for a disaster shock's effect on the country's stock of public and private capital and total factor productivity. Figure 1 below represents different GDP paths in the event of a disaster shock based on how strong adaptation capital is calibrated to in the model. **The difference from the model's baseline calibration to a more robust calibration in Scenario B is nearly 4 percentage points of GDP in avoided loss.**



The critical issue is estimating the resilience dividend – the losses avoided relative to a “no-additional-adaptation” scenario – which determines whether adaptation spending ultimately stabilises debt rather than increasing it.

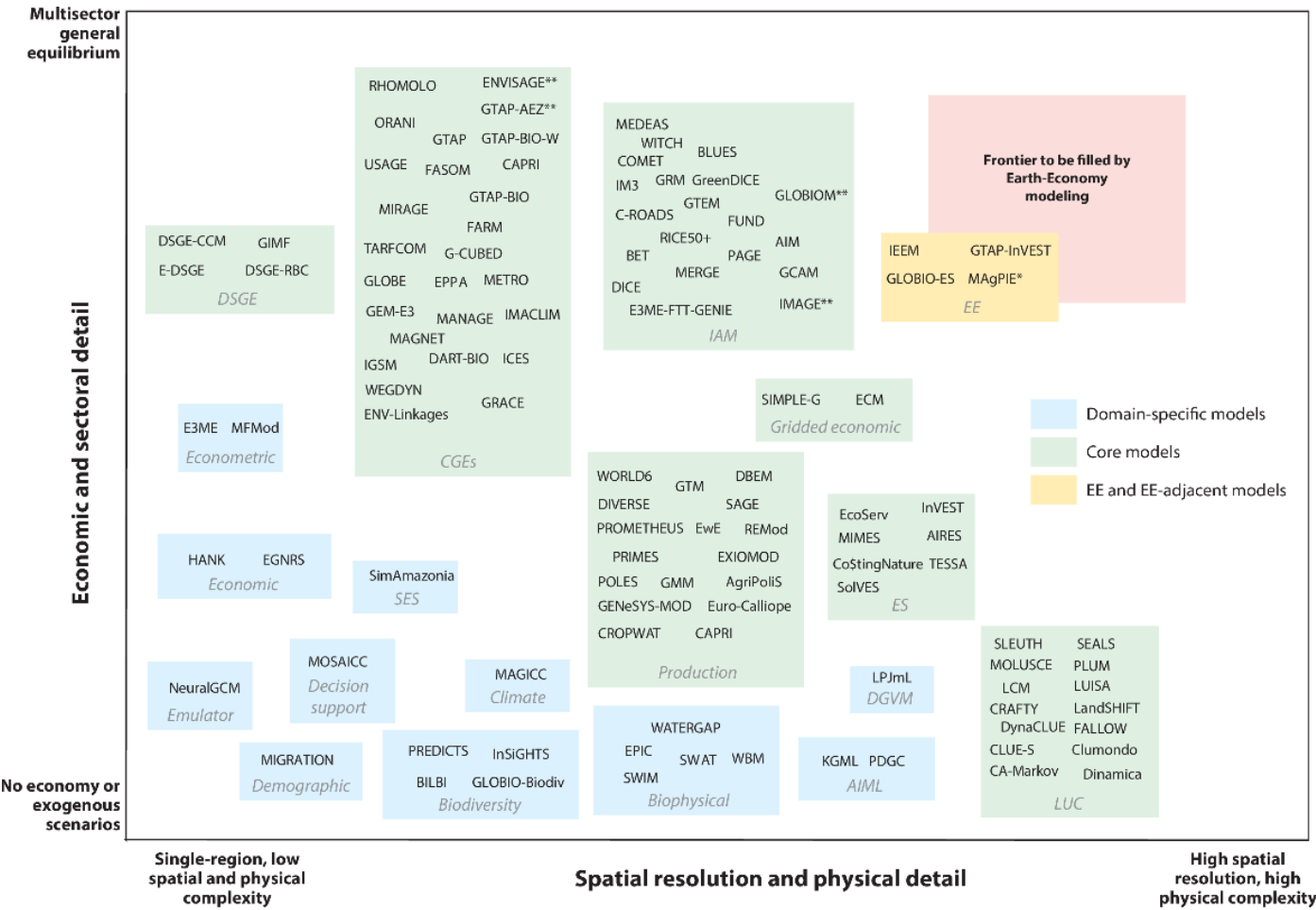
This analysis must remain country-specific because climate exposure, economic structure and the effectiveness of resilience investments vary significantly across countries. While the framework itself can be standardised, the relevant transmission channels and their magnitude cannot.

Much of the necessary country-level analysis already exists in World Bank Country Climate and Development Reports (CCDRs), which use tools like MF-Mod and MANAGE. However, CCDRs were not designed for direct application within the LIC-DSF. Their outputs are generally not expressed using debt burden indicators or organised around the transmission channels required by the framework.

A valuable step for the CCDRs would be creating a concise DSA-oriented annex that identifies and ranks the climate transmission channels most relevant for macro-fiscal outcomes and reports their estimated effects on the variables used in the LIC-DSF, including real GDP growth, exports-to-GDP, revenue-to-GDP, gross financing needs and the public debt-to-GDP ratio.

Overall surfacing and clarifying the underlying methodologies and papers used by IMF and WB tools for calculating climate risk and cost-benefit calibrations for resilience interventions (e.g. Centorrino et. al. 2025, Ha Nguyen et. al. 2026, Marto et. al. 2018) is an important methodological step to create a shared parameter infrastructure to build on.

Looking down the horizon, closing these analytical gaps would benefit from sustained global investment in improved data, scenarios and the broader field of Earth-Economy modelling – working with environmental scientists, national statistics agencies, academics, and project implementers on how to estimate the risk reduction and economic co-benefits of nature-based solutions as a landscape scale resilience investment – including forest protection, mangrove and coral reef restoration, and agroforestry.



Johnson JA, et al. 2025
Annu. Rev. Resour. Econ. 17:209–39

Figure 2 - Landscape of Earth-Economy Modelling Tools. Source: Johnson et al. (2025), Annual Review of Resource Economics 17:209-39

Earth-Economy models link economy-wide general equilibrium models with spatially detailed models of land use, ecosystems and climate, so that changes in natural capital affect economic outcomes and vice versa. Their distinctive contribution is connecting local ecological and economic processes to national and global effects through markets, trade and prices, over both near-term shocks and long-term trajectories.

A number of promising tools are being developed in this domain area. Models like GTAP-InVEST can provide spatially explicit ecosystem-service and economic scenario analysis, while Nature Value at Risk (NVaR) can provide more 'off-the-shelf' spatially-disaggregated as well as country- and sector-level risk indicators to help countries get started in integrating adaptation and nature into the DSA.

Their outputs can feed into the calibration library and be translated through macroeconomic models into DSA-relevant baseline or scenario assumptions. Experience integrating [GTAP-InVEST into the MANAGE-WB model](#) shows that this is not a simple plug-and-play extension – it requires a separate, data and calibration intensive process. Initial case studies in [Uganda](#) and [Belize](#) demonstrate how more simple and complex approaches can be combined to generate flexible scenarios that can feed the DSA, allowing countries to test different pathways and adaptation options.

More work is needed on how these next generation models complement a growing menu of natural capital measurement tools, including the Coastal Resilience Explorer, Mapping Ocean Wealth, UN SEEA, Ecosystem Services Valuation Database, the Integrated Economic-Environmental Modelling Platform, etc. to help analysts discern which models are best to answer which questions.

Recommendation #2: Work with partners to develop guidance and SovTech tools to make this analysis practical for Ministries of Finance

A key component of the new Long-Term Module is to help country teams model alternative policy scenarios. This way discussions can focus on the policy and financing mix, including the share of public versus private investment and expected fiscal costs and payoffs of adaptation and domestic mitigation policies and investments.

Countries today have a menu of innovative nature finance policy tools and policy packages for which there is no roadmap on how they link to the relevant macro-fiscal indicators in the macroeconomic models that ultimately determine their cost of capital and borrowing limits.

Ministries of Finance need to be able to credibly incorporate NDCs, NBSAPs, country platforms, debt conversions, outcome bonds, parametric insurance, climate resilience debt clauses, etc. into their macro-fiscal analysis through KPI decomposition, transmission channel mapping, and model calibration. What might this look like?

Figure 3 offers a representative example of how one type of instrument – a debt conversion – could be incorporated into the DSA. **More user guidance is needed on the menu of policy packages that can be modelled.**

Figure 3. Considerations for Modelling Debt-for-Nature Conversions

- 1. The Debt Buyback:** An existing debt is bought back potentially at a discount with users setting the share retired and the price and removing the retired debt share's future interest and amortisation from the debt service path.
- 2. The New Facility:** A new loan is raised to fund the buyback – its size is the cash cost, and users set its interest rate, grace period and maturity. Its service replaces the retired instrument's service.
- 3. The Development Package:** All or a portion of funds unlocked is committed to a resilience investment which is broken into a set of infrastructure calibrations for avoided loss and co-benefits of economic growth.
- 4. Disaster Pause Clause:** Allows for deferral of up to two years of debt service payments after a qualified natural disaster or pandemic event.

Without that guidance, country teams cannot assess how innovative instruments change risk profiles or fiscal trajectories. Policy discussions risk defaulting to familiar financing mixes and underutilising instruments that could maximize alignment between finance, stability, and climate or nature objectives – ultimately limiting the effectiveness of IMF/MDB advice and the quality of country-level policy choices.

Open-source Sovereign Technology (SovTech) tools can help. Because this work requires complex analysis across multiple linked models, simpler, integrated tools are needed to **reduce the technical and operational burden on finance ministries and debt management offices.**

The Government of Uganda and its technical partners are laying the groundwork for a modular, open-source platform that connects existing analytical frameworks, allowing users to run scenarios, compare resilience investment pathways, and automate workflows that would otherwise require extensive manual effort. **Rather than building new debt sustainability models, the goal is to make established frameworks easier to use within routine government decision-making.**

ADVANCING THESE EFFORTS TOGETHER

This policy brief was developed by a network of NGOs, academic institutions, policy think tanks, and technical partners including The Nature Conservancy, London School of Economics and Political Science, NatureFinance, Teal Insights, Systemiq, the University of Minnesota, Finance for Development Lab, and the International Institute for Sustainable Development (IISD).

Together, these partners contribute distinct capabilities spanning country engagement and policy implementation, macroeconomic and Earth-economy modelling, sovereign debt and fiscal policy analysis, natural capital valuation, resilience measurement, and open-source tool development.

By combining technical expertise with in-country relationships and policy networks, the partnership seeks to create a harmonised and transparent approach for embedding nature and resilience into sovereign risk analysis.

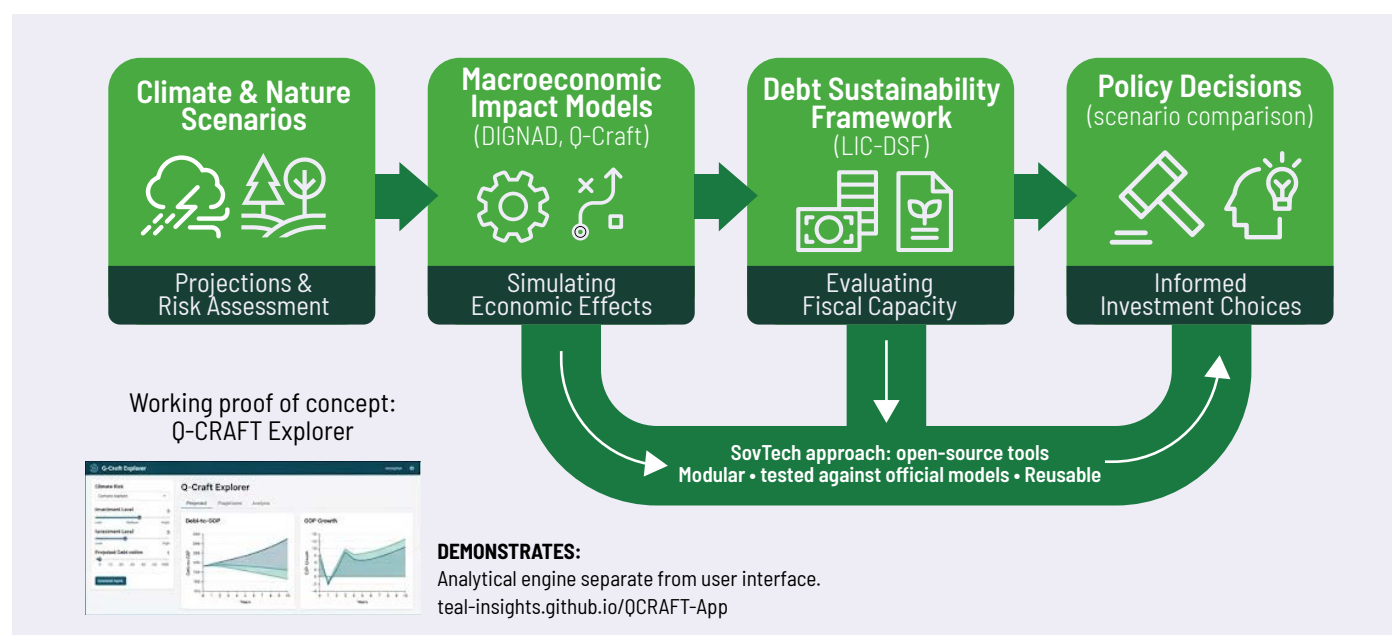


Figure 4: The SovTech approach to sovereign debt analysis, Uganda Ministry of Finance, 2026

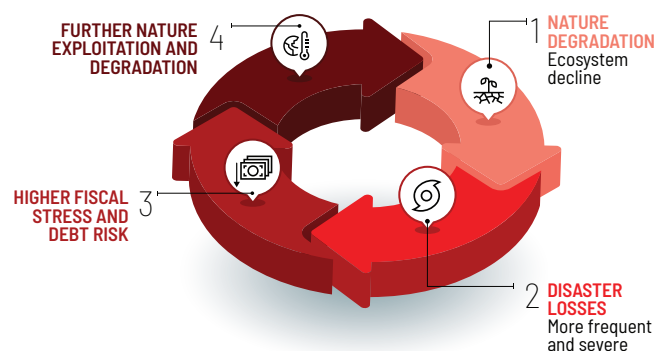
We are interested in working with additional governments, Debt Management Offices, Ministries of Finance, and Ministries of Environment that want to test, refine, and apply these approaches in real-world decision making. By enabling consistent application across multiple countries, we can generate the evidence base needed to influence IMF-World Bank methodologies, credit ratings, and capital allocation decisions.

Rethinking Debt Sustainability: Count Resilience, Not Just Risk

Integrating resilience into macroeconomic models leads to more accurate analysis, better decisions, and stronger fiscal outcomes.

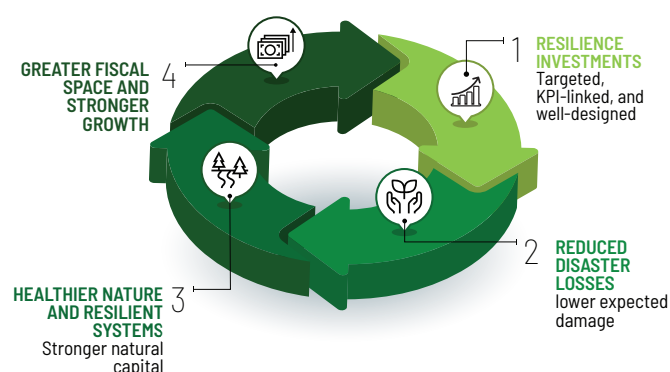
THE VICIOUS CYCLE

Risk counted, resilience missing



THE VIRTUOUS CYCLE

Resilience counted, fiscal space widens



RECOMMENDATIONS FOR THE IMF AND WORLD BANK



Set out a transparent and consistent method and calibration library for estimating the benefits of resilience investments

The calibration choices can significantly affect the GDP and debt forecasts of upstream models to the DSA, making their accuracy and transparency critical to credible surveillance, policy guidance, and reproducibility.



Work with partners to develop guidance and SovTech tools to make this analysis practical for Ministries of Finance

Without guidance, country teams cannot assess how innovative instruments and national plans change risk profiles or fiscal trajectories. Better tooling will allow users to run scenarios, compare investment pathways, and automate manual workflows.

Authors: Chetan Hebbale (TNC)

Contributors: Bharat Dhungana (TNC), Ian Luby (TNC), Nicola Ranger (LSE), Tom Taylor (LSE), Carlo Pasqua (LSE), Arend Kulenkampff (NatureFinance), Teal Emery (Teal Insights), Rad Sappany (Systemiq), Veerle Haagh (Systemiq), Guido Schmidt-Traub (Systemiq), Martin Kessler (FDL), Jules Devie (FDL), Justin Johnson (University of Minnesota), Matt Braaksma (University of Minnesota), Fernando Morra (IISD), Anahi Wiedenbrug (IISD)

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