SUN Institute
Environment & Sustainability
Initiated by Deutsche Post Foundation

SYSTEMIQ

Consultation Paper for Discussion and Improvement

INTEGRATING CLIMATE ADAPTATION AND NATURAL CAPITAL INTO MACROECONOMIC FRAMEWORKS AND DEBT SUSTAINABILITY

September 2024

ACKNOWLEDGMENTS

This consultation paper presents very initial ideas and proposals for discussion and improvement. We welcome comments and suggestions. Meanwhile, the views expressed in this paper are preliminary and subject to revision. The paper has been conducted by Systemiq with the support of the SUN Institute Environment & Sustainability.

The lead authors of this consultation paper are Guido Schmidt-Traub, Veerle Haagh and Rad Sappany, (Systemiq). The authors would like to thank all those who contributed their time, insight and expertise throughout the development of this paper. In particular, we extend special thanks to Kevin Bender, Director, Greening Sovereign Debt, The Nature Conservancy.

We are also grateful to the following stakeholders for their input and support: Vera Songwe, Brookings Institute, Co-Chair Expert Review on Debt, Nature & Climate; Ulrich Volz, Director, Centre for Sustainable Finance, SOAS University; Brett House, Professor of Professional Practice, Economics Division Columbia Business School; Ralph Chami, CEO, Blue Green Future; Arend Kulenkampff, Sovereign Financing Lead, NatureFinance; Rishikesh Bhandary, Assistant Director, Global Economic Governance Initiative, Boston University.

PURPOSE AND CONTEXT

Climate change and nature loss are taking an increasingly heavy toll on Emerging Markets and Developing Economies (EMDEs) in particular. Over the past two decades, climate-vulnerable EMDEs have lost $525 billion to extreme weather events, one-fifth of their collective GDP.[1] Nature loss threatens vital ecosystem services like agriculture, storm protection and carbon capture, which are critical for human wellbeing. This destruction undermines carbon sinks like oceans and forests and worsens the impact of climate disasters on communities.[2]

These changes are becoming macroeconomically significant in at least two ways. First, countries need to make macroeconomically significant investments in climate change adaptation and nature protection to strengthen resilience against the impacts of climate change. Second, under business as usual, countries may experience higher GDP volatility from climate change and nature loss (e.g. through the impacts of hurricanes or droughts) as well as downward pressure on secular GDP growth. Under business as usual, Small Island Developing States (SIDS) and low-income countries (LICs) stand to be most severely affected because of their geography and limited ability to invest. This is doubly unfair, because these countries and their populations have contributed the least to climate change.

The International Monetary Fund is paying greater attention to climate change, including in its baseline GDP growth forecasts and the Debt Sustainability Analysis (DSA).

This is welcome, but must be done well to benefit all EMDEs. It is of course correct and overdue that the world's premier macroeconomic institution incorporates climate change impacts and related investment needs into its work, because macroeconomics cannot ignore climate science. But exposing greater climate risks in poorer and geographically exposed EMDEs might worsen their debt carrying capacity and growth forecasts unless the macroeconomic analysis takes account of the specific needs and assets of these countries, supports greater investments in adaptation, and enables more financing on terms that do not add to unsustainable debt burdens.

This paper begins to lay out the technical elements of a comprehensive macroeconomic treatment of climate and nature risks by the Fund. These comprise: (i) systematic consideration of climate and nature risks for all countries the Fund works with, including market-access countries, using transparent assumptions; (ii) inclusion of investments in natural capital as an adaptation lever, which is particularly important for nature-rich EMDEs that can substitute nature-based solution as a complement or alternative to more costly physical infrastructure; (iii) clear guidance (in collaboration with the World Bank and others) on what types of investments countries may consider to adapt to climate change and build resilience, including technical support for programming and executing them; and (iv) a country-specific analysis of how to finance increased investments in climate change adaptation without adding to unsustainable debt burdens and how these investments enhance economic growth.

1 V20, Climate Vulnerable Economies Loss Report, 2022.
2 World Bank, The Economic Case for Nature, 2022.

Done well, a rigorous macroeconomic treatment of climate change, adaptation and natural capital will generate major benefits for EMDEs. This includes: (i) accelerating investments in adaptation as quickly as possible to ensure better future resilience at lower overall cost; (ii) raising political awareness and encouraging more adaptation investments by making this a topic for finance ministers as well as environment ministers; (iii) better technical support for countries wishing to design, program, and finance investments in climate change adaptation; and (iv) rewarding countries that take action on climate change adaptation.

As called for by the Bridgetown Initiative, EMDEs must not be punished for the higher climate risks that some bear – they need better technical and international support.

Since it is no longer possible for macroeconomists and finance ministers to ignore climate change, we believe the technical steps outlined in this paper – if validated during the consultation – should be taken up without delay. But they must be embedded in a political strategy that combines effective domestic implementation of adaptation programs with stronger international support for the countries that need access to concessional financing. In particular, climate vulnerable countries that present strong climate resilience investment plans must have access to financing for these plans that does not add to the capital stock. The technical nature of this discussion paper must not deflect from this fundamental political reality of climate justice and the need to bring down the cost of capital in EMDEs.

SUMMARY OF THE DISCUSSION PAPER

This paper lays out practical steps to reform the Fund's key macroeconomic frameworks – its baseline GDP growth forecasts and the DSA. Together, these tools form a leading assessment of a country's debt trajectory and growth prospects. But they are not informed by a robust understanding of EMDE's climate and nature investment needs, which leads to misalignment between the DSA, the Fund's GDP growth forecasts and the urgent need for countries to build resilience.

The Fund's GDP growth forecasts and the DSA do not adequately cover climate and nature risks and investments. On 5 August 2024, the Bank and the Fund updated the DSA framework for low-income countries to recognise the macroeconomic significance of climate change, acknowledging that climate risks impact baseline forecasts and their volatility, and that climate adaptation investments and policies can help mitigate these risks.[3] This update is an important step in the right direction, but deeper and more comprehensive changes are needed.

Today's DSA and its underlying growth forecasts still overlook five realities about climate adaptation, natural capital and debt sustainability:

1
Any baseline macroeconomic forecast that excludes climate change impacts is unrealistic.

2
Nature risks impact baseline macroeconomic forecasts and their expected volatility, just as climate risks do.[4]

3
In addition to physical ("hard") infrastructure, countries need to maintain and strengthen natural capital to build resilience against climate change and nature loss.

4
A country's natural capital is productive and contributes to its long-term economic growth.

5
Many market-access countries are just as climate vulnerable as low-income countries.

This paper sets out practical proposals to improve coverage of climate and nature risks. None of the five gaps raise fundamentally new issues or questions of principle for the Fund's GDP growth forecasts or the DSA. They can all be addressed in a straightforward manner by recognising the macroeconomic significance of climate change for all countries the Fund engages with; by widening the aperture to include nature risks and natural capital; and by treating productive natural capital in the same way as physical capital.

3 IMF and World Bank, Supplement to 2018 Guidance Note on the Bank-Fund Debt Sustainability Framework for Low Income Countries, 2024.
4 Kraemer and Volz, Integrating Nature into Debt Sustainability Analysis, Nature Finance, 2022.

DISCUSSION PAPER

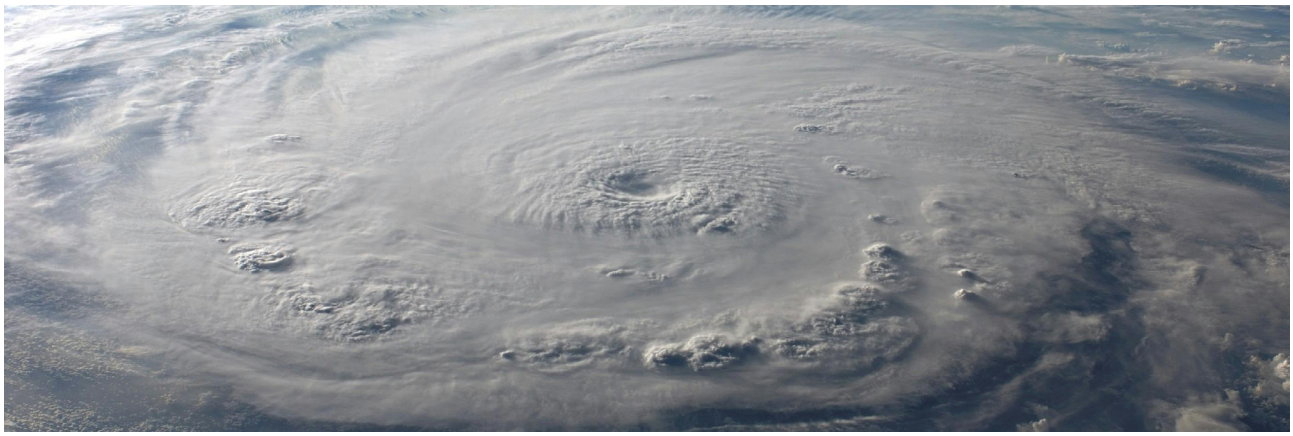
Hurricane Beryl was a stark reminder of the climate crisis – the strongest hurricane to form in June in the Atlantic Ocean, wreaking havoc throughout the Caribbean, Yucatan Peninsula and the Gulf Coast. Climate change is taking a heavy toll on Emerging Markets and Developing Economies (EMDEs). Over the past two decades, climate-vulnerable EMDEs have lost $525 billion to extreme weather events, one-fifth of their collective GDP.[5] Before the Covid pandemic, tourism-dependent lower middle-income countries lost 7.5% of GDP each year due to climate disasters. For small-island developing states, the loss was a staggering 8.2%.[6]
And the future holds more frequent and severe storms, floods, droughts and other extreme weather events.

The climate crisis is also exacerbating the depletion of natural capital in EMDEs with severe implications for human wellbeing. Nature's ecosystem services produce market goods and services for economies – including for agriculture, fishing, storm protection through mangroves, and carbon capture through oceans and forests – that underpin inclusive wealth and can ensure climate stability.

But climate change and the destruction of nature threaten these ecosystem services, which in turn undermines large carbon sinks and worsens the impact of climate disasters on communities.[7]

To mitigate these growing risks, EMDEs need to invest in climate adaptation and natural capital. The Independent High-Level Expert Group on Climate Finance (IHLEG) estimates that by 2030, EMDEs will need to invest $225 billion each year for adaptation alone—ten times the current expenditure.[8]

However, macroeconomic policymaking and the financial system discourage EMDEs from investing in climate adaptation and natural capital. Standard macroeconomic frameworks, like those used by the International Monetary Fund (the Fund), do not fully account for the additional and specific positive impact of these investments on growth and resilience.[9] As a result, countries are in effect advised against prioritising these public and private investments, including by taking on debt for climate adaptation and natural capital. EMDEs that follow standard macroeconomic guidance risk increasing their vulnerability to climate change and nature loss, while missing out on growth opportunities.



5 V20, Climate Vulnerable Economies Loss Report, 2022.
6 Coalition for Disaster Resilience Infrastructure, Global Infrastructure Resilience, 2020.
7 World Bank, The Economic Case for Nature, 2022.
8 IHLEG, Finance for climate action: scaling up investment for climate and development, 2022.
9 A macroeconomic framework is a structured approach used by economists and financial institutions to analyse the overall performance of an economy. It includes key indicators and models that help assess economic growth, inflation, fiscal policy, monetary policy, trade balance, employment and external stability. These frameworks aim to understand how various factors interact within an economy and inform decisions on achieving stable, sustainable growth, controlling inflation, managing public debt and maintaining fiscal stability.

This paper lays out practical steps to reform macroeconomic frameworks to incentivise EMDEs to invest in climate adaptation and natural capital. This starts with reforming both the Debt Sustainability Analysis (DSA) and the Fund's approach to its GDP growth forecasts, a key input into the DSA and the basis for macroeconomic policy advice to EMDEs. Together, these tools form a leading assessment of a country's debt trajectory and growth prospects.

They are not informed by a robust understanding of EMDE's investment needs to enhance climate resilience and protect natural capital, which leads to misalignment between the DSA, macroeconomic frameworks, and the urgent need for countries to build resilience. Their methodologies influence other key macroeconomic frameworks, including those of private rating agencies, and their results influence investors' perceptions of sovereign risk.

Box 1: The influence of the Fund GDP growth forecasts

The Fund produces GDP growth forecasts for its member countries and other economies. These forecasts shape the Fund's evaluation of a country's economic prospects and guide its policy recommendations. They equally guide the thinking of finance ministries in many EMDEs, particularly those that depend on regular Fund advice and support. If investments in climate change adaptation and natural capital are not considered in the growth forecasts, then Fund policy advice and finance ministry strategies are similarly likely to exclude them from their considerations.

These growth forecasts shape findings of the DSA – a critical tool for Fund surveillance and lending functions.[10] In surveillance, it helps the Fund to detect debt-related risks and to identify policy recommendations to prevent potential stress from materialising. In lending, it helps assess public debt sustainability to guide decisions about a country's access to Fund resources and to identify whether a country may need exceptional financing, including in the form of levels of debt restructuring and highly concessional finance. The Fund's GDP growth forecasts are crucial to this assessment, as a country's ability to repay a given level of debt depends heavily on its growth prospects.

In response to earlier criticism that Fund macroeconomic programming did not consider social and infrastructure investments needed for the Sustainable Development Goals, the Fund's Fiscal Affairs Department has issued comprehensive guidance for how the Fund and EMDE finance ministries can consider the investment needs and their public-private as well as domestic-international financing in a structured way that enhances growth and resilience.[11] The learnings and principles from this work must now be applied to investments in climate change adaptation and natural capital.

10 IMF, Staff Guidance Note on the Sovereign Risk and Debt Sustainability Framework for Market Access Countries, 2022.
11 Gaspar et al., Fiscal Policy and Development: Human, Social and Physical Investments for the SDGS, IMF Staff Discussion Note, 2019.

There are two DSA frameworks – the Fund framework for market-access countries, the Sovereign Risk and Debt Sustainability Framework (SRDSF), and the joint Bank-Fund framework for low-income countries, the Low-Income Countries Debt Sustainability Framework (LIC-DSF).[12] Both frameworks are built around the Fund's GDP growth forecasts, including GDP volatility and uncertainty. Countries can sustain more debt if such debt raises GDP growth and reduces GDP volatility. This interplay of projected economic growth and debt levels is central to determining countries' sovereign risk and cost of capital. (See Appendix B for more detail on framework methodology.)

But the DSA and its underlying GDP growth forecasts do not adequately cover climate and nature risks as well as investments in mitigating these risks.

Until recently, these tools did not consider risks or investment needs in a structured way, except for some ex-post adjustments based on ad-hoc assumptions. On 5 August 2024, the Fund and the Bank published the *Supplement to 2018 Guidance Note on the Bank-Fund Debt Sustainability Framework for Low Income Countries* (the "Supplement"), which updates the LIC-DSF to better account for the impact of climate change risks and climate investments and policies on debt sustainability. As described below, this Supplement is an important step in the right direction, but deeper and more comprehensive changes are needed to incorporate investments in climate adaptation and natural capital in macroeconomic strategies, as advised and supported by the Fund.

In the Supplement, the Fund for the first time recognises the macroeconomic significance of climate change and investments in adaptation in the context of the DSA and its supporting GDP growth forecasts:

Climate change risks – both long-term shifts in climate and sudden, extreme weather events induced by climate change – impact baseline macroeconomic forecasts and their expected volatility.

- The slow rise in temperature and associated changes in weather patterns affect the baseline of the debt sustainability assessment through their impact on productivity and the growth potential of the economy.
- An increase in the frequency and intensity of extreme weather events can increase the volatility around the baseline growth and debt sustainability scenarios, driven by large disruptions of economic activities.

Investments to increase resilience to climate change and climate policies more broadly can partially mitigate these climate change risks.

The Supplement focuses on how financial insurance instruments and physical infrastructure can strengthen resilience to climate change. For example, if a country invests to construct sea walls, it can reduce the likelihood and impact of severe floods that become more likely due to rising sea levels, as well as the higher frequency and greater severity of storms and other extreme weather events.

12 The SRDSF applies to market access countries, i.e. countries with significant access to international capital markets. This refers to countries that are not eligible for the IMF's Poverty Reduction and Growth Trust (PRGT) facility. This encompasses all advanced economies and most emerging market economies. Additionally, in special cases, some PRGT-eligible countries that have substantial and durable access to markets may also use the SRDSF. The LIC-DSF applies to low-income countries that have substantially long-maturity debt with terms that are below market terms, or to countries that are eligible for the Word Bank's International Development Association (IDA) grants.

When Fund staff implement the Supplement's guidance across all LIC-DSF countries, they will help countries to better align their investments and macroeconomic policies with the reality of climate change.

This work will also strengthen the case for investments in climate adaptation, as recommended by the IHLEG and many others. The need for these investments and greater international support for the most vulnerable countries aligns with the COP28 decision to enhance global efforts on adaptation.

Yet, as welcome as the Supplement is, today's DSA and its underlying GDP growth forecasts overlook five realities about climate adaptation, natural capital and debt sustainability:

1

Any baseline macroeconomic forecast that excludes climate change impacts is unrealistic.

The world is already experiencing the impacts of climate change. The Supplement encourages Fund staff to apply ex-post adjustments to baseline growth forecasts to include these impacts, particularly for climate-vulnerable LIC-DSF countries.[13] But the LIC-DSF and the Fund's growth forecasts still produce baseline scenarios in which the economy evolves under a stable climate, rather than a changing one. The experience of climate-vulnerable countries clearly shows that this approach does not reflect reality.

13 Under the Supplement, coverage of climate change risks and climate investments and policies is required in DSAs accompanying requests for RSF arrangements or World Bank Catastrophic Deferred Drawdown Options (CAT DDOs). It is encouraged in all other cases, with a presumption for inclusion in the DSAs accompanying or issued following the publication of World Bank or IMF in-depth topical climate change analyses, and for countries for which climate change and climate adaptation or transition management policies are assessed as macro critical in Article IV consultations.

2

Nature risks impact baseline macroeconomic forecasts and their expected volatility, just as climate risks do.[14]

Both the business-as-usual degradation of nature and the growing risk of large-scale, abrupt nature collapse can have major impacts on livelihoods and economic development, particularly in EMDEs.[15] They are partly driven by climate change:

- Business-as-usual nature degradation (e.g. conversion of natural land to pasture and cropland, pollution of water and air, excessive water use) reduces the availability of ecosystem services, such as pollination and water purification, which in turn impacts the growth potential of the economy, undermines livelihoods, and exacerbates inequalities.
- Climate change and nature degradation can push an ecosystem to a tipping point beyond which it will shift to a new state or collapse entirely, leading to a large-scale, abrupt decline in ecosystem services, such as the sudden loss of pollinators or the collapse of major fisheries. Such abrupt change is difficult to predict and can impact both GDP volatility and a country's growth potential.

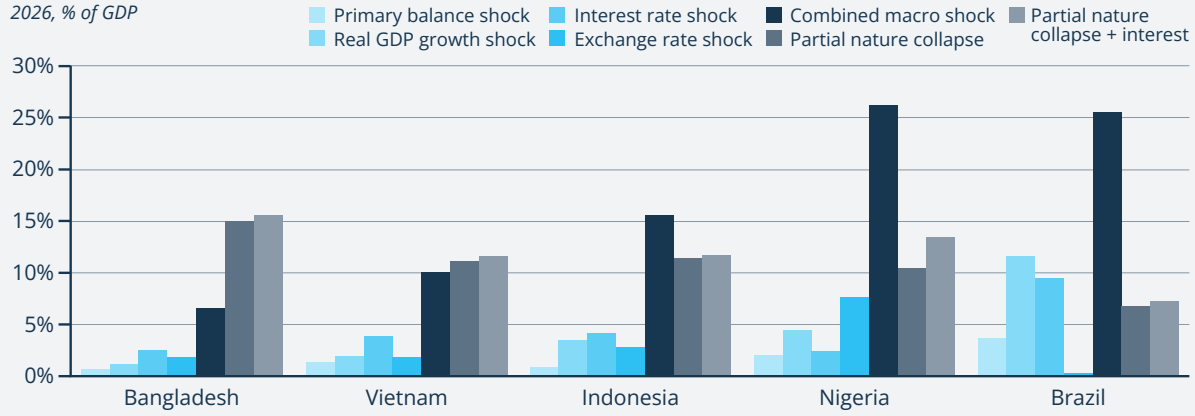
As Kraemer and Volz identify, the DSA ignores that nature-risks increase GDP volatility and undermine long-term trend growth.[16] This is a major shortcoming as nature shocks will become more frequent and severe under climate change.

Box 2: Nature loss matters for debt sustainability

In their report *Integrating Nature into Debt Sustainability Analysis*, Kraemer and Volz demonstrate the impact of integrating nature-related risks into DSAs and show that nature loss matters for debt sustainability. As shown in Figure 1,[17] for Bangladesh and Vietnam, the partial collapse of ecosystem services is the most severe stress scenario, including scenarios in which there is a shock to the primary balance, real GDP growth, interest rates, exchange rates and the Fund's combined macro-fiscal stress scenario, in which multiple shocks are bundled together.

Simulated change in general government debt ratio compared to baseline

2026, % of GDP



14 Kraemer and Volz, Integrating Nature into Debt Sustainability Analysis, Nature Finance, 2022.
15 World Bank, The Economic Case for Nature, 2022.
16 Kraemer and Volz, Integrating Nature into Debt Sustainability Analysis, Nature Finance, 2022.
17 Kraemer and Volz, Integrating Nature into Debt Sustainability Analysis, Nature Finance, 2022.

3

In addition to physical ("hard") infrastructure, countries need to maintain and strengthen natural capital to build resilience against climate change and nature risks.

Investments in natural capital, such as mangrove restoration or watershed restoration to reduce the risk of flooding, are often more cost effective than physical infrastructure and generate many other benefits, but the Supplement and its supporting tools do not give them sufficient attention. Since the same principles apply to the macroeconomic treatment of physical infrastructure and natural capital that mitigates climate and nature risks, the Fund should equally recognise the value of natural capital. This will incentivise and encourage governments to pursue such investments and to protect remaining natural capital.

Box 3: Natural capital can build resilience against climate change and nature risks

The World Bank finds that if current mangroves in the Philippines were lost, damages to residential and industrial property would increase by 28% to more than $1 billion annually, and 766 km of roads would be flooded.[18] But the Philippines' investment in mangrove conservation and restoration can reduce the likelihood and impact of storm events and floods. Studies show that mangroves create measurable resilience to tropical storms, improving long-term trend growth in economic activity by up to 0.3%.[19]

Of course, nature risks too can be mitigated through efforts to protect and restore natural capital, noting that nature risks are directly related to countries' decisions to exploit natural assets. For example, a country which invests in reforestation in degraded farmland areas can improve water quality.[20]

18 World Bank WAVES Partnership, Valuing the protection services of mangroves in the Philippines, 2017.
19 Hochard, Barbier & Hamilton, Mangroves and coastal topography create economic "safe havens" from tropical storms, Nature 2021.
20 Zuo et al., Assessment of changes in water conservation capacity under land degradation neutrality effects in a typical watershed of Yellow River Basin, China, Ecological Indicators, 2023.

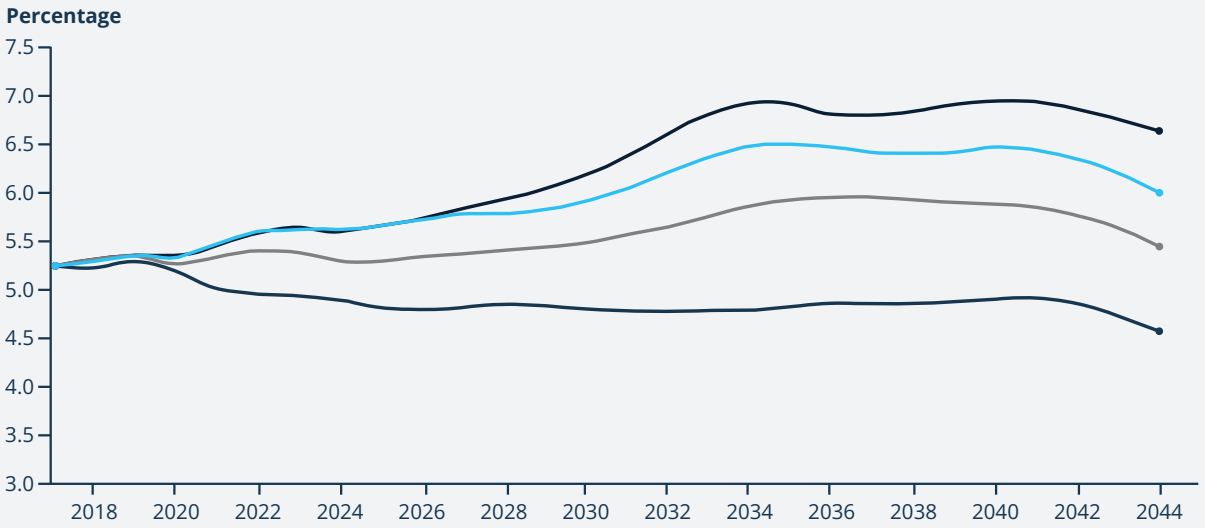
4

A country's natural capital is productive and contributes to its long-term economic growth.

Today's DSA and its underlying growth forecasts count short-term GDP gains from the destruction of natural capital (e.g. cutting down a forest to sell timber or depleting a country's fisheries to sell more fish) without considering the costs to livelihoods, resilience to nature-climate risks, or long-term GDP growth. This encourages economic policies that undermine nature, which all life and economic well-being depend on.

Box 4: Natural capital is productive capital – it is critical for economic growth

In Indonesia, scenario modelling demonstrates the positive impact of natural resource availability and ecosystem service provisioning on economic productivity.[21]



Ecosystem Services Plus
Relfects Ecosystem Services High for 2020-2024 and additional, more ambitious policy measures thereafter.

Ecosystem Services High
Includes more ambitious policy measures than Ecosystem Services, Moderate for 2020-2045, achieves the conditional NDC target.

Ecosystem Services Moderate
Includes new ecosystem services measures for 2020-2045, achoevs the unconditional NDC target.

Base Care
No new policies but reflects environmental degradation.

5

Many SRDSF countries (market-access countries) are just as climate vulnerable as low-income countries using the LIC-DSF.

The Supplement applies only to the LIC-DSF. It is critical that the SRDSF also acknowledge the need for investments in climate change adaptation and their implications on economic growth and volatility and debt sustainability. Similarly, the above four realities must also be acknowledged for SRDSF countries.

21 United Nations, World Economic Situation and Prospects, 2020.

None of these five gaps raise fundamentally new issues or questions of principle for GDP growth forecasts or the DSA. They can all be addressed in a straightforward manner by extending the principles of the Supplement to all countries the Fund engages with; by widening the aperture to include nature risks and natural capital; and by treating productive natural capital in the same way as physical capital. This can all be achieved by implementing three practical proposals, which in turn build on the principles of the Supplement:

PROPOSAL 1

Expand the Fund's GDP growth forecasts and macroeconomic programming to include climate and nature risks and investments:

As stated above, any GDP growth forecast and macroeconomic programming which excludes the impacts of climate change and nature loss and mitigating investments is unrealistic. In partnership with country governments, the Fund should expand its GDP growth forecasts and macroeconomic programming to include the country's (i) climate and nature risks, (ii) the mitigating impact of climate and nature investments and policies (i.e. financial insurance instruments, investments in physical and natural capital), and (iii) natural capital as productive capital for economic growth. The GDP growth forecasts should be updated for all countries, feeding into the DSA frameworks. As mentioned, the Fund has successfully expanded the scope of its GDP growth forecasts and macroeconomic programming in the past to include investment needs first in the Millennium Development Goals and now in the Sustainable Development Goals.[22] Lessons from these changes in theory and practice will help consider climate change adaptation and natural capital into macroeconomic programming and growth forecasts.

PROPOSAL 2

Expand the Supplement's guidance on alternative scenarios and volatility stress-tests to include nature risks and investments, and ensure consistent implementation across all LIC-DSF countries:

The LIC-DSF has two tools to assess uncertainty around its baseline forecast: alternative scenarios and stress tests. The Supplement provides guidance on how to use these tools to capture the uncertainty of climate change risk on a country's debt sustainability, considering the interplay between climate risks, investments and policies. It directs Fund staff to use alternative scenarios to explore different potential climate impacts, such as pessimistic warming scenarios or the effects of more ambitious set of adaptation investments than currently planned. Similarly, it directs Fund staff to use natural disaster stress tests to explore the impacts of an acute severe weather event, incorporating the mitigating role of adaptation investment (i.e. financial insurance instruments and physical infrastructure). This guidance must be broadened to treat nature risks analogously to climate risks and to consider natural capital's role in climate adaptation. The Supplement's guidance (in this expanded form and incorporating the changes set out in Proposal 1) should be implemented rapidly and consistently across all LIC-DSF countries' programming and policy advice.

22 Gaspar et al., Fiscal Policy and Development: Human, Social and Physical Investments for the SDGS, IMF Staff Discussion Note, 2019.

PROPOSAL 3

Revise the SRDSF principles and practice to align with the Fund's improved growth forecasts (Proposal 1) and changes to the LIC-DSF (both in the Supplement and in Proposal 2):

Many SRDSF countries have high vulnerability to climate change and nature loss,[23] and their current growth and investment policies do not adequately target these risks. Many of them will also need more technical and financial support to manage these risks. For these reasons, Proposals 1 and 2 need to be applied – with suitable adaptation – to the SRDSF, the constituent GDP growth forecasts, and Fund macroeconomic programming practice.[24] (See Appendix A for more detail on SRDSF-specific revisions.)

Table 1: Applying the proposals to the GDP growth forecasts and the DSA frameworks*

TOOL	CURRENT TREATMENT OF CLIMATE AND NATURE	PROPOSAL
Fund GDP growth forecasts	No explicit consideration	Expand growth forecasts to include: • Impact of climate and nature risks • Mitigating impact of climate adaptation and natural capital investments and policies (e.g. insurance, investments in physical and natural capital) • Natural capital as productive capital
LIC-DSF	• Baseline scenario – impact of climate risks and adaptation investments • Volatility assessments – impact of climate risks and adaptation investment e.g. insurance, physical capital (alternative scenarios and natural disaster stress test)	• Include impact of nature risks and mitigating natural capital investment in baseline forecasts and volatility assessments • Consider natural capital's role in climate adaptation • Include impact of climate risks and adaptation investment in all baseline scenarios • Include impact of climate risks and adaptation in volatility assessments (debt fanchart module and natural disaster stress test)
SRDSF	• Volatility assessments – impact of climate shock (natural disaster stress test) • Long-term, optional baseline forecast – fiscal costs of adaptation e.g. insurance, physical capital	• Align with LIC-DSF • Include nature risks and mitigating natural capital investment in baseline forecasts and volatility assessments • Consider natural capital's role in climate adaptation

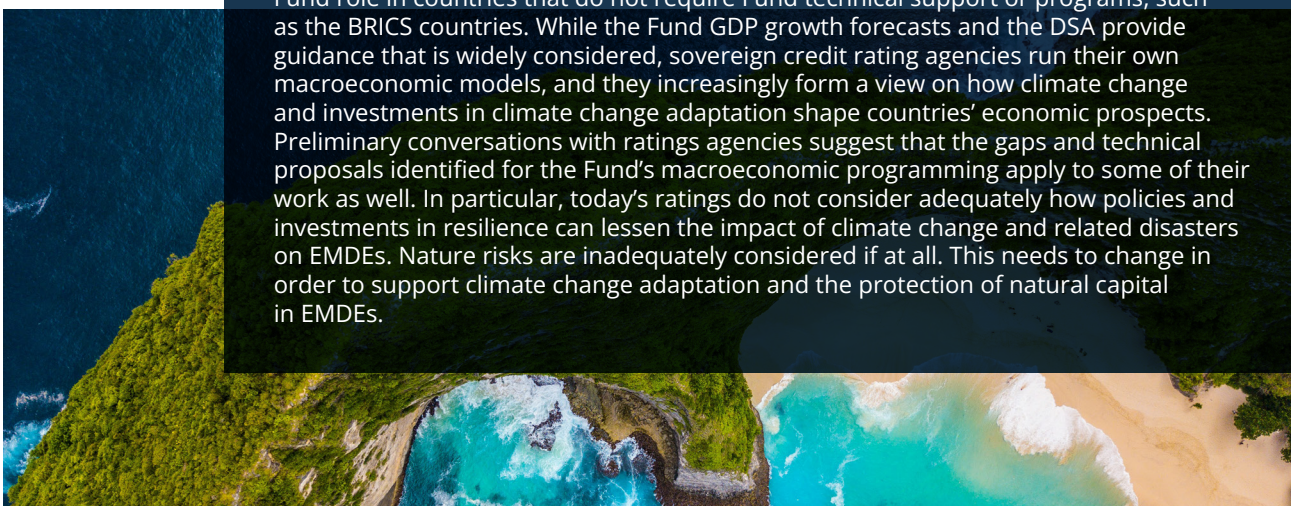
* *See Appendix B for more detail.*

23 For example, Gabon is an SRDSF country but ranks 126 on the Notre Dame Global Adaptation Initiative index (ND-GAIN), which assesses a country's vulnerability to climate change in combination with its readiness to improve resilience. Accessed September 2024: https://gain-new.crc.nd.edu/ranking.

24 The SRDSF was updated in 2022 to include climate risks through its natural disaster stress test and long-term climate change module. However, stress test calibration relies on historical data and overlooks adaptation measures, while the climate change module assumes climate risks can be fully offset by fiscal costs, underestimating the true risks to GDP growth from climate and nature.

Box 5: The link to sovereign credit ratings

We focus here on the role of the Fund as the leading macroeconomic institution for many EMDEs. Sovereign credit rating agencies also play a central role in determining the cost of capital in EMDEs and the rating of specific financing products, such as government or private sector bonds. Their role is of course far greater than the Fund role in countries that do not require Fund technical support or programs, such as the BRICS countries. While the Fund GDP growth forecasts and the DSA provide guidance that is widely considered, sovereign credit rating agencies run their own macroeconomic models, and they increasingly form a view on how climate change and investments in climate change adaptation shape countries' economic prospects. Preliminary conversations with ratings agencies suggest that the gaps and technical proposals identified for the Fund's macroeconomic programming apply to some of their work as well. In particular, today's ratings do not consider adequately how policies and investments in resilience can lessen the impact of climate change and related disasters on EMDEs. Nature risks are inadequately considered if at all. This needs to change in order to support climate change adaptation and the protection of natural capital in EMDEs.



The Fund can operationalise these proposals using existing data and models to estimate climate and nature risks and investment needs, recognising that these estimates will have inherent uncertainties. Nonetheless, this will give the Fund and country governments a more accurate picture of countries' potential growth and debt trajectories.

Some of this data will come from the Bank, researchers and national governments who are increasingly focused on climate and nature risks. So, in terms of next steps, the Fund, Bank and broader research community can improve the coverage and quality of investment needs estimates through high-level analyses that aggregate needs across similar country groups, as well as the extent to which these investments mitigate climate and nature risks and drive growth. Over time, detailed bottom-up assessments of investment needs need to be developed at the country-level, both for use in macroeconomic forecasting and in national investment plans and budgeting processes.

Based on lessons from other SDG priorities and their inclusion in Fund macroeconomic programming,[25] we are confident that these gaps can be closed rapidly. (See Appendix A for more detail on this point.)

These eminently feasible changes will have important ramifications for macroeconomic practice:

- The Fund and, by extension, the Bank's policy advice to governments, along with the international financial community's discourse on climate and nature risks, will undergo significant changes. This will impact macroeconomic practice more broadly, including – indirectly – for private credit rating agencies whose sovereign credit ratings have profound influence on countries' cost of capital.
- In the same vein, finance ministries and other economic policymakers will be incentivised and supported to grapple seriously with the investments and policies needed to mitigate climate and nature risks.

25 Gaspar et al., Fiscal Policy and Development: Human, Social and Physical Investments for the SDGS, IMF Staff Discussion Note, 2019.

- There is a risk that a candid assessment of the economics of climate and nature risks in poorer and geographically exposed EMDEs will worsen their growth forecasts and debt carrying capacity, potentially limiting their access to finance in the short-term. EMDEs must not be punished for the higher climate risks that some bear. For this reason, the macroeconomic analysis must also support greater investments in adaptation and nature, consider the specific investment needs and assets of these countries (noting nature-rich EMDEs can substitute nature-based solutions for more costly physical infrastructure), and enable more financing on terms that do not add to unsustainable debt burdens.
- On a related point, it is likely that many EMDEs will require more international concessional financing for adaptation and nature investments. This candid assessment will support EMDEs to access such financing; better country-level policies, data, and investment proposals will strengthen their case, with strong backing from Fund staff assessments and Article IV consultations.

This paper is one small part of a broader effort to build a global financial system that drives action on climate and nature. Here, the focus is on the responsibilities of the Fund, as the globally leading macroeconomic institution. But of course, the Bank, regional development banks, private credit rating agencies, and – above all – national governments all have their role to play. If the Fund leads boldly in line with its mandate to support global and national macroeconomic stability and sustained growth, then other organisations will follow, and national governments will be empowered to tackle the climate and nature risks that endanger their wellbeing and long-term prosperity, and capture the benefits of decisive action on these fronts for their citizens and economies.

APPENDIX A: IMPLEMENTING THE PROPOSALS

QUANTIFYING CLIMATE AND NATURE RISKS AND INVESTMENTS

The proposals put forward in this consultation paper can largely be operationalised using existing data and models to estimate climate and nature risks and investment needs, recognising that these estimates will have inherent uncertainties. But the data coverage and quality need to be improved by the Fund, Bank and broader research community.

A starting point is the initial Fund staff estimates (including under the LIC-DSF and the SRDSF) of the effects of climate risks and climate adaptation investment needs on debt projections. These estimates need to be improved.

The LIC-DSF (via the Supplement) directs staff to derive assumptions from the Bank and the Fund's in-depth analyses of climate-change impact, such as the Bank's Country Climate and Development Reports (CCDRs) and the Fund's Climate Policy Diagnostics (CPDs), which are supported by stand-alone, climate change macroeconomic models and tools such as the Bank's MANAGE and the Fund's DIGNAD. However, these analyses and supporting models do not exist for all LIC-DSF countries (and certainly not for all SRDSF countries). Their coverage needs to be expanded.

These models also need to be expanded to cover natural capital. Today's models consider the way in which adaptation infrastructure mitigates climate change risk, but they only cover physical infrastructure. This ignores the fact that in many cases, nature-based solutions are just as effective as physical infrastructure in supporting a country to adapt to climate change, and are more cost-effective. For example, protecting and restoring a mangrove forest to act as a seawall can be more cost-effective than constructing a concrete seawall. The models should be expanded to consider nature-based solutions as adaptation capital.

In-depth analyses of climate change impacts, such as those in CCDRs and CPDs, are generally less available for SRDSF countries. For these countries, Fund staff must rely on adaptation cost estimates and develop an informed view about how these adaptation measures will mitigate climate change impacts on debt sustainability. The SRDSF refers staff to climate-related adaptation cost estimates from Aligishiev, Bellon and Massetti (2022),[26] which provides regional ranges. Additionally, it refers staff to countries' stated adaptation needs (as set out in Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs)) to the extent these are deemed reliable rather than aspirational. The SRDSF's adaptation cost estimates significantly underestimate the fiscal costs of adaptation, with adaptation investments limited to strengthening physical assets and investing in coastal protection. The Fund itself notes in the SRDSF that these assumptions should be reviewed as data availability and modelling techniques improve.

The Bank, working with the Fund and the broader research community, has a central role to play in improving the quality and coverage of estimates for country investment needs on climate change adaptation and nature protection or restoration. The Bank and the Fund can draw on lessons from needs assessments for the Sustainable Development Goals and how they now inform Fund country programming.[27] Drawing on this analogy, we propose the following steps: (i) develop a typology of public and private adaptation investment needs; (ii) quantify incremental adaptation needs across all SDGs using both top down global/regional approaches and more bottom-up country assessments; (iii) describe how these investment estimates feed into growth projections and macroeconomic programs, as already done for key physical and social infrastructure investments.

26 Aligishiev, Bellon and Massetti, Macro-Financial Implications of Adaptation to Climate Change, IMF Staff Climate Note, 2022.
27 Gaspar et al., Fiscal Policy and Development: Human, Social and Physical Investments for the SDGS, IMF Staff Discussion Note, 2019.

Thanks to the Bank and others, significant data on countries' natural capital, its depletion and its impact on trend growth is available for the LIC-DSF and SRDSF to begin considering nature risks and investments. However, the Fund, Bank and broader research community must improve coverage and quality of this data.

The Bank has made an important start in estimating the economic impacts of nature degradation and collapse. Its report, The Economic Case for Nature, projects the GDP impact of business-as-usual degradation and partial collapses of three ecosystem services – wild pollination, provision of food from marine fisheries and timber from native forests.[28] This data can already be used to improve the LIC-DSF and SRDSF, but its coverage and quality need to be improved to cover a broader range of ecosystem services and to better understand impacts for economies that are not highly dependent on nature. Additionally, assessing how investments in natural capital can mitigate these impacts will require the Fund and Bank to develop a standardised assessment framework.

The Fund's growth forecasts are supported by Dynamic Stochastic General Equilibrium (DSGE) models, which simulate how economies might react over time under various shocks and policy changes, incorporating randomness and theoretical economic behaviours. (See Appendix B). These models already incorporate the supply-side effects of physical capital. There are many calls for a better treatment of human capital in Fund models, so adding natural capital will constitute an extension of established macroeconomic programming methods to cover all three capital dimensions of inclusive wealth (physical, human and natural).[29]

Natural capital accounting has advanced sufficiently to allow for approximations of the value of a country's natural capital stock and flows in national accounts and economic growth models.[30]

CONSIDERATIONS FOR REVISION OF SRDSF

With Proposal 3, this paper calls for the SRDSF to be revised in line with the Supplement (as well as with the changes set out in Proposals 1 and 2). In particular, this applies to the need to recognise that climate change risk can impact baseline macroeconomic forecasts and their expected volatility, and how investments to increase resilience to climate change (and climate policies more broadly) can partially mitigate these risks.

In its current form, the SRDSF goes some way to consider the impact of climate change on macroeconomic forecasts and their expected volatility, but this is limited to:

- The impact of natural disasters on medium-term forecast volatility, with little consideration of how resilience investments can mitigate these risks
- The impact of mitigation and adaptation investments on long-term macroeconomic forecasts (30-year horizon).[31]

As the SRDSF is a more complex framework than the LIC-DSF, updating it to align with the principles set out in the Supplement will require SRDSF-specific revisions. These revisions are considered here, looking at the SRDF's tools.

28 Johnson et al., The Economic Case for Nature: A Global Earth-Economy Model to Assess Development Policy Pathways, World Bank, 2021.
29 For example, Jeffrey Sachs, The Crucial Role of Education Finance in Economic Development, The Crucial Africa's Prospects for Rapid Economic Growth (forthcoming).
30 Juhn and Portela, Natural Capital Accounting to Inform Climate, Biodiversity and Development Policies in Africa, World Bank, 2023.
31 This consideration only applies to a subset of climate-vulnerable countries.

BASELINE SCENARIO

As set out in the Annex, the baseline scenario used by Fund staff under the SRDSF is derived from the Fund's GDP growth forecasts. As discussed in the paper, these GDP growth forecasts do not factor in the impact of climate risks and climate investments and policies on growth, instead assuming the economy is evolving under stable environmental conditions.[32] These should be revised as set out in Proposal 1 to include climate and nature risks, the mitigating impact of climate and nature investments and policies, and natural capital as productive capital for economic growth.

DEBT FANCHART MODULE AND NATURAL DISASTER STRESS TEST

Under the SRDSF, the debt fanchart module is a core, mandatory assessment, used to illustrate volatility and uncertainty around debt projections in the medium-term. It has significant influence on the overall SRDSF outcome. Currently, it does not consider the impact of climate or nature risks on forecast volatility. However, the SRDSF has a separate tool – the natural disaster stress test – to assess the impact of natural disasters on forecast volatility. This tool is only mandatory for climate-vulnerable countries, which are identified based on historical exposure to natural disasters.

There is a strong case for including an assessment of climate and nature risks in the debt fanchart module. This paper proposes that baseline scenarios incorporate climate and nature risks, but these will be risks associated with the slow rise in temperature and associated changes in weather patterns and business-as-usual nature degradation. There are other, more extreme but plausible climate and nature risks that can drive volatility around baseline debt projections, including extreme weather events and partial ecosystem collapse – this is particularly true for climate-vulnerable and nature-rich countries.

The SRDSF's debt fanchart module should be revised to incorporate climate and nature risks. Normally, the debt fanchart module works by applying stochastic shocks to baseline GDP forecasts, based on historical data. But when it comes to climate and nature risks, historical data is not an accurate predictor. Incorporating climate and nature risks will require the Fund to design stochastic climate and nature shocks based on forward-looking, country specific projections. It is also critical that the design of these shocks consider how efforts to mitigate climate and nature risks can reduce GDP volatility.

If the debt fanchart module is updated in this way, the natural disaster stress test must also be revised to be more country-specific. Currently, the natural disaster stress test applies a generic shock to a macroeconomic forecast. The impact of generic shocks can be assessed through the debt fanchart module. The natural disaster stress test can provide useful additional insights for climate-vulnerable countries, though these should be assessed based on forward-looking projections of natural disaster exposure, as the frequency and severity of these events will increase. The natural disaster stress test can be used to assess the impact of natural disaster shocks that are tailored to the country, in recognition that countries face specific risks. For example, the impact of increasing risk of floods in highly developed areas will be different to the impact of prolonged heat stress in agriculture. Again, natural disaster shock design must be based on forward-looking, country specific projections, and critically, must factor in the mitigating impact of countries' adaptation investments and policies.

32 Under the LIC-DSF, Fund staff are encouraged to make ex-post adjustments to these GDP growth forecasts to incorporate the impact of climate change risks and mitigating climate investments and policies.

LONG-TERM CLIMATE CHANGE MODULE (ADAPTATION)

The optional long-term climate change module includes two sub-modules: an adaptation sub-module and a mitigation sub-module. The adaptation sub-module assesses the long-term impact of climate change on debt sustainability due to rising adaptation costs. In its current form, it compares the baseline scenario, in which the economy evolves as if the climate were stable, to a climate change scenario, in which the economy evolves in response to a changing climate. The climate change scenario assumes that countries invest to adapt to climate change and that adaptation investments fully offset the negative long-term impact of climate change on growth.[33] In short, the climate change scenario captures the fiscal costs of climate change and the impact of these fiscal costs on debt sustainability.

As in Proposal 1, we recommend that baseline scenarios include the impact of climate and nature risks, the mitigating impact of climate and nature investments and policies, and natural capital as productive capital for economic growth.

Nonetheless, the adaptation sub-module can be revised in line with the LIC-DSF to provide useful insights on a country's debt sustainability. Despite the assumptions in the adaptation sub-module's climate change scenario, it is clear that countries cannot fully adapt to climate change, particularly if global greenhouse gas concentrations continue to rise. The long-term impacts of climate change cannot be reduced to fiscal costs.

There are unavoidable risks to GDP growth posed by both climate and nature, but the nature of these risks is uncertain particularly over the long-term. The adaptation sub-module can be revised (and renamed) to capture this uncertainty by assessing alternative long-term scenarios, such as a more pessimistic warming or nature degradation scenarios than in the baseline or the effects of more ambitious adaptation and natural capital investments than currently planned. One potential way forward is to include: (i) a standardised, high-ambition scenario, which assumes countries invest heavily in adaptation and natural capital (e.g. 90% of estimated needs) and largely offsets the impacts of climate change and nature degradation on trend growth; and (ii) a customised scenario, which considers each country's actual intentions regarding adaptation and natural capital investment and the likely impacts of this investment on trend growth, as compared to the baseline. This approach follows current practice in the SRDSF. The standardised scenario is consistent across different countries, allowing for easier comparison and benchmarking, and the customised scenario accounts for unique risks and vulnerabilities that are specific to individual countries.

33 The current SRDSF significantly underestimates the fiscal costs of adaptation, with adaptation investments limited to strengthening physical assets and investing in coastal protection. The SRDSF notes that assumptions should be reviewed as data availability and modelling techniques improve. There is further discussion on this point in the "Quantifying climate and nature risks and investments" section.

APPENDIX B: KEY METHODOLOGIES

This appendix outlines the methodologies used by the Fund to prepare growth forecasts and DSAs.

FUND GDP GROWTH FORECASTS

The Fund produces GDP forecasts for a variety of purposes, most importantly for publication in the World Economic Outlook (WEO) and use in Article IV consultations, which also include the Debt Sustainability Analysis. Its forecasts are derived from Dynamic Stochastic General Equilibrium (DSGE) models, which simulate how economies might react over time under various shocks and policy changes, incorporating randomness and theoretical economic behaviours. In these models, a country's physical capital stock is a key driver of productivity and long-term economic growth, because capital stock is used as an input for further production of goods and services.

In the Fund's DSGE models, government spending is split into public investment (which increases a country's capital stock) and public consumption (which does not). In this way, each type of government spending is treated differently based on its presumed economic effects and transmission channels. For example, government spending on infrastructure, such as roads, is treated as public investment. It is assumed to increase capital stocks and boost productivity, leading to higher potential output and positive supply-side effects. On the other hand, government spending on welfare is public consumption and is assumed to primarily influence aggregate demand and household consumption behaviour.

The Fund's DSGE models only consider government spending on physical capital to be public investment, ignoring human capital and natural capital. It is broadly accepted that physical capital – tangible assets like roads, electricity infrastructure, and water and sanitation infrastructure – contribute to economic growth. But the Fund's DSGE models overlook the productive function of (i) human capital, i.e. the collective skills, education and health of a country's workforce;[34] and (ii) natural capital, i.e. a country's natural resources and ecosystems, including forest, water, minerals and biodiversity. Instead, the Fund's DSGE models consider government spending on human and natural capital to be public consumption, in part due to their historically complex valuation and the difficulty of quantifying their impact within the relatively short-term focus of the models. This means that the Fund's DSGE models – and in turn, the Fund's GDP forecasts – ignore nature's productive role in the economy, which underpins long-term growth.[35]

Additionally, the Fund's DSGE models do not factor in climate change and nature risks on GDP growth. These risks in turn include the impact of the long-term, secular rise in average temperatures and resulting changes in in productivity. They further include the impact of stochastic extreme weather events that will rise in frequency and severity under climate change.

34 Various IMF teams use a number of DSGE models for a wide variety of purposes. For example, the IMF's SDG Financing Tool (SDG-FiT), underpinned by a DSGE model, allows users to evaluate financing needs to achieve the five sectors of the SDGs and assess additional financing options to close the financing gap. SDG-FiT considers treats human capital as public investment, with the stock of human capital accumulating through schooling and improvements in health and diffusing gradually into the economy as new cohorts enter the labour force. However, this modelling is not applied universally, and is distinct from that conducted by the IMF teams responsible for the GDP forecasts in the WEO and Article IV consultations.

35 This paper is focused on climate and nature risks and investments, and so focuses on physical and natural capital. However, there are concurrent reform efforts to improve integration of human capital into the IMF's GDP growth forecasts c.f. Jeffrey Sachs, The Crucial Role of Education Finance in Economic Development, The Crucial Africa's Prospects for Rapid Economic Growth (forthcoming).

LIC-DSF METHODOLOGY

The Low-Income Country-Debt Sustainability Framework (LIC-DSF) is the Bank-Fund debt sustainability framework for low-income countries.[36]

It applies to all 58 countries which are eligible for the Fund's Poverty Reduction and Growth Trust (PGRT) facilities, its main vehicle for concessional financing.

LOW INCOME COUNTRY – DEBT SUSTAINABILITY FRAMEWORK (LIC-DSF)

Classification

Composite Indicator (CI)
A country's debt carrying capacity is established based on a composite indicator: WorldBank's CPIA score, real GDP growth, remittances, international reserves and world growth.

The CI classifies countries as having weak, medium or strong debt carrying capacity.

Thresholds/benchmarks
Based on country classification, indicative (statistically determined) thresholds/ benchmarks are applied to analyse a country's risk of debt distress in years 1-10. The risk rating is assigned by comparing projected debt burden indicators to these respective thresholds.

Risk rating

Judgment
May be needed to arrive at final risk ratings – e.g. to assess gravity of threshold breaches and country-specific factors. In exceptional circumstances, threshold breaches in **long-term projections (years 11-20)** may result in a risk rating **downgrade**, i.e. if breach is large, persistent and highly probable. This situation could arise from **climate change impacts.**

Complementary risk analysis
If a country is assessed at moderate risk of external debt distress, there is further analysis of the debt position to determine how much space the country has to absorb shocks – i.e. limited space, some space, substantial space.

Points after external (PPG) debt
Low, moderate or high risk of debt distress, or in debt distress

Overall public debt
Low, moderate or high risk of debt distress, or in debt distress

Standardised stress tests
To help understand the potential volatility of projected debt burden indicators over years 1-10. It applies a series of stress tests to examine the impact of temporary shocks. There are six standardized stress tests: real GDP growth, primary balance, exports, other flows, depreciation, historical scenario. There is also a contingent liability stress test.

Triggered stress tests (Optional)
To help understand the potential volatility of projected debt burden indicators over years 1-10. These tailored stress tests apply to countries exposed to a set of specific risks: natural disasters, volatile commodity prices, and market financing pressures.

Natural disaster stress test (Optional)
If a country is vulnerable to natural disasters, a shock to debt-to-GDP ratio and real GDP and export growth is applied to the baseline to understand potential risks. Under the Supplement, IMF staff are expected to customise the standard calibration of the natural disaster shock where data allows to be country-specific, incorporating the mitigating impact of the country's climate adaptation investments and policies.

Baseline scenario (20 years ahead)
Key debt indicators include debt-to-GDP ratio, debt-to-exports ratio, debt service-to-exports ratio and debt service-to-revenue ratio. The realism of baseline assumptions is checked is checked through four tools: drivers of debt dynamics, realism of planned fiscal adjustment, fiscal adjustment-growth relationship and public investment-growth relationships.

Climate change and baseline/alternative scenarios
Under the Supplement, IMF staff are encouraged to incorporate the impact of climate change risks and climate investments on baseline macroeconomic forecasts.

IMF GDP growth forecasts
The Debt-to-GDP ratio and GFN-to-GDP ratio are determined by the IMF's GDP growth forecasts. This is calculated through DSGE models which simulate how economies might react over time under various shocks and policy changes. These models recognise the productive role of physical capital, but do not recognise the productive role of natural capital and its positive supply-side effects.

36 IMF and World Bank, Guidance Note on the Bank-Fund Debt Sustainability Framework for Low Income Countries, 2018. IMF and World Bank, Supplement to 2018 Guidance Note on the Bank-Fund Debt Sustainability Framework for Low Income Countries.

The LIC-DSF assesses a country's risk of debt distress for both Public and Publicly Guaranteed (PPG) debt (external and domestic) and overall debt (including private external debt). However, the LIC-DSF's principal focus is on external PPG debt. It has four categories for risk of debt distress for PPG debt and overall debt: low risk, moderate risk, high risk and in debt distress.

Under the LIC-DSF, Fund staff take a four-step approach to assess a country's risk of debt distress.

For the most part, risk of debt distress is assessed over the medium term (i.e. 1-10 years ahead):

First, Fund staff classify the country as having weak, medium or strong debt carrying capacity, based on a Composite Indicator which assesses the country's policy and institutional strengths, macroeconomic performance and buffers to absorb shocks. The Composite Indicator is a weighted average of the Bank's Country Policy and Institutional Assessment (CPIA) score, the country's real GDP growth, remittances, international reserves, and world product growth.

Second, Fund staff set debt burden indicator thresholds to analyse the country's risk of debt distress. These thresholds are linked to the country's debt-carrying capacity classification. For example, for PPG debt there are the following debt burden indicators and associated thresholds:

Table 1: LIC-DSF PPG external debt thresholds

DEBT CARRYING CAPACITY (CI CLASSIFICATION)	PV OF PPG EXTERNAL DEBT IN PERCENT OF		PPG EXTERNAL DEBT SERVICE IN PERCENT OF	
	GDP	Exports	Exports	Revenue
Weak	30	140	10	14
Medium	40	180	15	18
Strong	55	240	21	23

Third, Fund staff project these debt burden indicators under baseline and alternative scenarios. In the first instance, staff derive the baseline scenario from the Fund's GDP growth forecasts. As discussed in the paper, these GDP growth forecasts do not factor in the impact of climate risks on growth, instead assuming the economy is evolving under stable environmental conditions. However, the Supplement encourages Fund staff to make ex-post adjustments to these GDP growth forecasts to incorporate the impact of climate change risks and mitigating climate investments and policies.

These ex-post adjustments are made based on forward-looking macroeconomic climate assumptions, derived from country-specific climate models and in-depth analyses. These include the Bank's Country Climate and Development Reports (CCDRs) and the Fund's Climate Policy Diagnostics (CPDs), and supporting models such as the Bank's MANAGE and the Fund's DIGNAD. The Supplement also encourages Fund staff to use alternative scenarios to capture the uncertainty around long-term climate change impacts, such as a more pessimistic warming scenario or the effects of more ambitious adaptation investments than currently planned.[37]

37 The alternative scenarios are based on a different set of macroeconomic climate assumptions than in the baseline.

Then, Fund staff assess the expected volatility of these debt burden indicators under baseline forecasts, by applying various stress tests. There are six standardised stress tests that apply to all countries, which apply temporary shocks to real GDP, primary balance, exports, other flows (current transfers and foreign direct investment), depreciation and a combination of these individual shocks. Under the LIC-DSF, Fund staff also apply tailored stress tests to consider risks that are common to only some sets of countries. These include a natural disaster stress test for climate-vulnerable countries. The stress test applies a "standard" natural disaster shock, which comprises a direct impact to debt-to-GDP ratio and an interaction effect on real GDP growth and exports. The shock to these indicators is uniform across all LIC-DSF countries. Fund staff are also expected to produce a "customised" natural disaster shock, adjusting the parameters to design a scenario that is better tailored to the country's circumstance. Under the Supplement, Fund staff are encouraged to calibrate customised shock design using forward-looking projections of climate risks and mitigating investments and policies, drawing on the same models and in-depth analyses as used for baseline scenario adjustments.

Fourth, Fund staff classify a country as having low, moderate or high risk of debt distress, depending on the extent to which its debt burden indicators (as projected in step three) breach the relevant thresholds (as determined in step two). This may also involve the application of staff judgment. For example, in exceptional circumstances, threshold breaches in long-term projects (years 11-20) may result in a risk rating downgrade – particularly where the breach is large, persistent and highly probable. A breach due to climate change impacts is one situation where this could occur.

SRDSF METHODOLOGY

The Sovereign Risk and Debt Sustainability Framework (SRDSF) for Market Access Countries is the Fund's debt sustainability framework for market access countries.[38] It applies to countries with significant access to international capital markets that are therefore not eligible for the Fund's PGRT facilities. This includes all advanced economies and most emerging market economies. Some PRGT-eligible countries that have substantial and durable access to markets may also use the SRDSF, when they have graduated from being eligible to receive financial assistance exclusively from the International Development Association (IDA).

The SRDSF has two possible outputs. First, a sovereign risk assessment, which evaluates a country's vulnerability to "sovereign stress events" – situations where market or fiscal pressures related to public debt become critical. Second, a debt sustainability assessment, which determines whether a country can sustain its current level of debt without external assistance.

Under the SRDSF, the process begins with a sovereign risk assessment. If a sovereign stress event is identified, there is no presumption about how the pressures can be resolved. The solutions could involve (i) fiscal adjustment and economic reform; (ii) a combination of fiscal adjustment, economic reform and financing; or (iii) exceptional measures like debt relief and restructuring. Instead, identifying a sovereign stress event triggers the second step, a debt sustainability assessment. If this assessment concludes that debt has become unsustainable, it implies that exceptional measures like debt relief and restructuring are needed to resolve the pressures.

This discussion paper focuses on the methodology of the SRDSF's first output, the sovereign risk assessment. This is because the sovereign risk assessment is conducted for all SRDSF-countries, and the methodology for the debt sustainability assessment, the SRDSF's second output, is essentially a truncated version of the sovereign risk assessment with some modifications.[39]

38 IMF, Staff Guidance Note on the Sovereign Risk and Debt Sustainability Framework for Market Access Countries, 2022.
39 The near and medium-term tools in the sovereign risk assessment can be used to provide a debt sustainability assessment. (See below.)

SOVEREIGN RISK AND DEBT SUSTAINABILITY FRAMEWORK (SRDSF)[i]

Overall sovereign risk assessment

Risk of soverign stress: an event where market and/or fiscal pressures related to public debt becomes acute.
Three result categories: *low risk, moderate risk signals, high risk signals*

High — Strength of influence on overall risk assessment — Low

Near-term 1-2 years ahead	**Medium-term** up to 5 years ahead	**Long-term** >5 years ahead	**Debt stabilisation (Yes/No)** 10 years ahead
Sovereign stress logit model The chance of a stress event materialising within 1-2 years – e.g. sharp increase in borrowing costs, inability to access markets, significant decline in reserves The model is based on historical data rather than projections.	**Debt Fanchart and Gross Financing Needs (GFN) module** The country's solvency and liquidity risks over the medium-term.	**No specific tool** The country's risk of debt related stress over the long-term. Assessment may include extended debt fanchart, extrapolation of debt-to-GDP and debt-to-GFN under user-customised assumptions, and qualitative analysis.	
Key Compulsory – mechanical risk signal + judgment Compulsory – judgment only Climate element Optional	**Triggered stress tests**[ii] To help capture specific risks facing countries that are not fully covered by the fanchart and GFN tools. *i.e. banking sector instability, commodity price shocks, contingent liabilities due to narrow public debt coverage, corrections of misaligned exchange rates, and natural disasters.*	**Long-term modules** Optional standardised modules to help assessment of key issues that could drive debt risks well into the futureI.e. demographic change, natural resource wealth, large debt amortisations, climage change.	
	Natural disaster stress test If a country is at significant risk from natural disaster,[iii] a shock to debt-to-GDP and real GDP growth is applied to the base-line to understand potential risks. *In this way, a country's medi-um-term risk assessment can be downgraded due to climate impacts.*	**Adaptation and mitigation module** If the fiscal costs of adaptation and mitigation are likely to be large, the costs of adaptation and mitigation are added to a 30-year baseline to understand potential risks.[iv] *In this way, a country's long-term risk assessment can be down-graded due to the need to adapt to climate change.*	

The various tools in the medium-term and long-term risk assessments test the 5-year and 10-year baseline scenario respectively to determine the range of possible future debt paths and associated risks, as well as periods of potential liquidity stress.

Baseline scenario (10 years ahead)
The two key metrics are Debt-to-GDP ratio and GFN-to-GDP ratio.
The realism of baseline assumptions is checked through five tools e.g. forecast track record, fiscal adjustment and possible growth paths, real GDP growth.

IMF GDP growth forecasts
The Debt-to-GDP ratio and GFN-to-GDP ratio are determined by the IMF's GDP growth forecasts. This is calculated through DSGE models which simulate how economies might react over time under various shocks and policy changes. These models recognise the productive role of physical capital, but do not recognise the productive role of natural capital and its positive supply-side effects.

i When needed, a debt sustainability assessment can be added to the risk assessment. This is usually performed after the stress has materialised to help inform its resolution, including through the design of Fund-supported programs.
ii Activated when a country meets certain relevant criteria.
iii Two criteria: i. two natural disaster events in a three-year window, ii. cumulative economic loss of at least 5% of GDP caused by the natural disaster events in that window.
iv It assumes that adaptation investment exactly cancels any negative impact of climate change on growth, except for any impact that is already incorporated in the Year 5 growth projection (as this is extrapolated out to create the 30-year baseline).

The overall sovereign risk assessment groups risk into three categories: low risk signals, moderate risk signals and high risk signals. The assessment is based on Fund staff judgment, which in turn is based on the result of four supporting risk assessments:

- Near-term assessment (1-2 years ahead) – chance of a stress event materialising within 1-2 years, e.g. sharp increase in borrowing costs, inability to access markets, significant decline in reserves (not public)
- Medium-term assessment (up to 5 years ahead) – the country's solvency and liquidity risks over the medium-term, accounting for volatility and uncertainty in baseline growth projections.
- Long-term assessment (in most cases, 5-10 years ahead) – the country's risk of debt-related stress over the long-term
- Debt stabilisation (10 years ahead) – a yes/no assessment of whether the debt trajectory will stabilise in the 10 years ahead.

The results of the near-term and medium-term risk assessments have a stronger influence on the overall assessment result than the long-term risk assessment. This is because Fund staff can have a greater degree of confidence in their results, given greater uncertainty in longer-term time horizons. Additionally, there is greater scope to take feasible corrective actions to mitigate risks identified in the longer-term.

Because of this, Fund staff have less discretion to determine the results of the near-term and medium-term risk assessments than they have in determining the result of the long-term risk assessment. The result of the long-term risk assessment is entirely based on Fund staff judgment, supported by quantitative and qualitative analysis. But the results of the near-term and medium-term risk assessments are more constrained. The SRDSF reports two results for these assessments: (i) a mechanical risk signal; and (ii) a final assessment. The mechanical risk signal is an automatic indication of potential sovereign risk based on quantified thresholds and pre-defined criteria. In the near and medium-term assessments, there is scope for Fund staff to alter the mechanical signal in the judgment-based final assessment, if the mechanical signal is counterintuitive or does not account for specific country risks. This means that the inputs into the mechanical signal – that is the sovereign stress logit model and the debt fanchart and Gross Financing Needs (GFN) module – have particular weight on the overall sovereign risk assessment.

The critical indicators in the medium and long-term assessments are the debt-to-GDP and GFN-to-GDP ratios, both of which are driven by the Fund's GDP growth forecast. As above, the Fund's GDP growth forecasts are calculated through DSGE models, which simulate how economies might react over time under various shocks and policy changes, incorporating randomness and theoretical economic behaviours.

CLIMATE CHANGE IN THE SRDSF

In practice, the baseline scenario used by Fund staff under the SRDSF is derived from the Fund's GDP growth forecasts. As highlighted in the discussion paper, these GDP growth forecasts do not factor in the impact of climate risks on growth, instead assuming the economy is evolving under stable environmental conditions.

However, the SRDSF has two ex-post mechanisms to consider the impact of climate change – including increasing exposure to natural disaster – on countries' growth forecasts and their expected volatility:

1.

NATURAL DISASTER TRIGGERED STRESS TEST

In the medium-term analysis, the SRDSF provides standardised "triggered stress tests", mechanisms to capture specific country risks that are not fully covered by the debt fanchart or the GFN module, but which add volatility and uncertainty to medium-term projections.

These include a natural disaster triggered stress test for climate-vulnerable countries, which examines the impact of a natural disaster shock on a country's real GDP growth and debt-to-GDP ratio and the implications for sovereign risk in the medium term. The stress test applies a "standard" natural disaster shock, which comprises a direct impact to debt-to-GDP ratio and an interaction effect on real GDP growth. The shock to GDP is uniform across all SRDSF countries. Fund staff can also apply a "customised" natural disaster shock, adjusting the parameters of the shock to better reflect the country's characteristics, including the impact of adaptation policies such as catastrophe insurance.

The results of the triggered stress test have no impact on the mechanical risk signal, as the stress test is only triggered for climate-vulnerable countries. But, Fund staff can use judgment to incorporate the results into a country's medium-term final risk assessment, downgrading it from the mechanical signal due to climate impacts.

2.

LONG-TERM CLIMATE CHANGE MODULES (ADAPTATION AND MITIGATION)

In the long-term assessment, the SRDSF includes an optional climate change module for climate-vulnerable countries. This module is divided into two sub-modules: the adaptation model, which examines the impact of adaptation investments, and the mitigation sub-module, which looks at efforts to reduce greenhouse gas emissions.[40]

The adaptation sub-module assesses the impact of the fiscal costs of adaptation investments on a country's debt-to-GDP and GFN-to-GDP ratios over a 30-year horizon. It has two scenarios: (i) a standardised scenario, which applies the Fund's default climate adaptation costs, derived from the literature; and (ii) a customised scenario, which allows Fund staff to adjust adaptation costs based on country-specific characteristics.
In both scenarios, the adaptation investments are assumed to fully offset the negative impacts of climate change on GDP growth.

In this way, the adaptation sub-module produces scenarios which assess the impact of climate change on a country's long-term growth trajectory, with these impacts assumed to be the fiscal costs of adaptation. These are compared to a baseline scenario in which the economy is assumed to evolve under a stable climate.[41]
And so, the country's long-term risk assessment can be downgraded to its need to adapt to climate change.

40 We are focused here on the adaptation sub-module given the role adaptation plays in mitigating the impact of climate change on growth and volatility.
41 The IMF's GDP growth forecasts are extended over 30-years, assuming the same rate of growth.