APPROACHES TO NATURE-RELATED RISK ASSESSMENT: CURRENT STATE AND PERSISTING CHALLENGES

NGFS-WWF webinars on how to approach and assess nature-related financial risks

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Key Messages

1. The degradation of nature, and actions aimed at preserving and restoring it, will affect our economies and financial systems.

2. Climate and nature are deeply interconnected and should be considered in an integrated manner.

3. Although we are making progress, there is still work to do on specific nature-related risk assessment tools.

4. Short term action to start addressing those risks is possible and needed.
Growing Awareness regarding Nature-related risks

Global risks ranked by severity over the long-term (10 years)

1. Extreme weather events
2. Critical change to Earth systems
3. Biodiversity loss and ecosystem collapse
4. Natural resource shortages
5. Misinformation and disinformation
6. Adverse outcomes of AI technologies
7. Involuntary migration
8. Cyber insecurity
9. Societal polarization
10. Pollution


Source: Richardson et al. (2023)
How much impact does NATURE have on the economy?

The world cannot afford the collapse of ecosystem services, as such a collapse would cost 2.3% of global GDP (≈$2.7 trillion) annually by 2030 and some of the poorer countries would be hit hardest.

World Bank 2021
Nature and climate are closely interconnected

Nature loss reduces resilience to climate change

Climate change is a driver of nature loss

Source: IPCC, IPBES
The depletion of these ecosystem services exposes the financial sector to risks

- Exposure analysis can already provide a higher-level picture on overall materiality of nature dependence of financial systems
- Banks in emerging markets allocate around **half of their credit portfolio** to firms with highly or very highly dependency on one or more ecosystem services

Source: Calice et al. 2023
Malaysia Case: How Central Banks can address nature-related risks

Malaysia is ranked 12th in the world according to the National Biodiversity Index

Report Conclusions

- Nature and the financial system impact each other through economic activities

- Malaysian banks are potentially exposed to a variety of nature-related risks related to the deterioration of natural assets and ecosystems

- Additional analysis is needed to build on this exploratory study, which could also be improved with better data

Malaysia Case: How Central Banks can address nature-related risks: PHYSICAL RISK

Of the commercial sector loans analyzed 54 percent (RM 398 Billion) is exposed to sectors that depend to a high or very high extent on Ecosystem services.

Malaysian banks lend most to sectors that are highly or very highly dependent on surface water (29 percent), climate regulation such as carbon storage (26 percent) and flood and storm protection (16 percent).

Source: ENCORE, BNM, WB calculations
Malaysia Case: How Central Banks can address nature-related risks:
TRANSITION RISK

Of the commercial loans portfolio analyzed, 87 percent (RM 639 billion) is exposed to sectors which highly or very highly impact ecosystem services.

Malaysian banks end most to sectors that drive ecosystem deterioration due to **GHG emissions** (61 percent), **water use** (56 percent), and **terrestrial ecosystem use** (43 percent).

Source: ENCORE, BNM, WB calculations
Moving from exposure towards risk assessment – the need for scenarios

Source: NGFS (2023a)
Towards nature-related risk scenarios: The work of the NGFS

NGFS’ Agenda for nature financial risk scenario development

- Identify the foreseeable hazards linked to nature loss (sources of physical and transition risks)
- Identify the methods and tools through which the impacts of these hazards can be assessed, both existing and to be developed.

NGFS’ recent actions:

- The NGFS recently published a conceptual framework for nature-related financial risks and provided recommendations toward the development of nature-risk scenarios.
Challenges related to the development of nature narratives and scenarios

Major challenges in generating narratives for nature-related hazards:
- Ecosystem functions and processes at stake are more **numerous and complex** compared to climate change alone.
  - **No single metric** or policy/measure that can adequately capture the complexity of nature-related hazards.
  - **Multiple policies and ways of valuing nature** need to be considered.
  - **Feedback loops and nonlinearities** (e.g. lack of substitutability) play a significant role.

Trade-off between local granularity and macrofinancial relevance.
- Local approaches may lack global relevance, while global approaches may lack the necessary level of detail.

Source: NGFS 2023b, adapted from Lade et al. (2019)
Starting with a typology of potential nature-related risk impacts

Illustration of the types of nature-related impacts arising and their characteristic geographical scale and temporal distribution (chronic, acute or regime change)

Source: Ranger et al. 2023
Initial approaches for identifying nature scenario narratives – but further development needed

Two complementary avenues for identifying relevant physical hazards:

• **ESGAP-SESi** (Usubiaga-Liano & Ekins 2021): Measures the distance between the current state and a "healthy" operating state for ecosystems, providing observable trends at the national level and proxy for hazard occurrence likelihood.

• **INCAF-Oxford** (Ranger et al. 2023): Focuses on potential hazards occurrences (e.g. droughts) and maps them backwards and forwards to ecosystem services, natural assets, drivers of degradation, and economic impacts.

Source: NGFS (2023b)
Nature-economy models reviewed only cover a subset of physical and transition hazards

Impact of ecosystem service loss (physical risks):
- Models cover mostly provisioning services (e.g. fisheries)
- Models capture maintenance and regulation services only to a limited extent
- None of the models capture dependencies on cultural services.

Drivers of nature loss (transition risk):
- Land use change and climate change and respective policies typically represented
- Other drivers of nature loss and related policies (e.g., overexploitation of resources, pollution) are partially represented by a few models.
- Invasive species not represented in any of the reviewed models.
- Technical change most sophisticated for energy technologies

Source: Kedward et al. forthcoming
Gaps in nature-related financial risk assessment need to be addressed

- Nature-economy modeling currently less developed compared to climate-economy modeling due to complex interactions between nature and the economy.

- Reviewed models likely to provide conservative estimates of the economic consequences of nature-related hazards due to high model adaptability and substitutability, exogenous growth assumptions, and limited impact channels.

- Important to manage uncertainty through sensitivity analyses of key parameters, ensure clear communication of modeling uncertainty to end-users, being transparent of coverage of ES, and complement analysis with different modeling approaches.

Source: Kedward et al. forthcoming
Alternative approaches: Using input-output tables and models to understand the propagation of nature-related hazards throughout value chains

- **Multi-regional input-output (MRIO)** tables and models are useful for representing how nature-related hazards generate direct shocks in different sectors and how these shocks **propagate** through value chains.

- **Short-run scenarios** can be developed using MRIO tables and models to assess the potential impacts of specific physical or transition hazards.

- MRIOs have **limitations**, including fixed technical coefficients of production, limited behavioral assumptions, and the inability to provide intra-sectoral information crucial for assessing nature-related hazards and their impacts.

Source: NGFS (2023b)
Options exist to develop nature scenarios, also in the short run

<table>
<thead>
<tr>
<th>Short-term program for central banks and supervisors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Static analysis</strong></td>
</tr>
<tr>
<td><em>Building scenarios with short-term horizon</em></td>
</tr>
<tr>
<td>&amp; <em>Conducting exposure analysis</em></td>
</tr>
<tr>
<td>- Using IO models to obtain sectorial exposures to hazards (Chapter 3.2)</td>
</tr>
<tr>
<td>- Using biophysical models to obtain static maps of physical hazards (Chapter 3.3)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dynamic analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Building scenarios with longer-term horizons, but with great caution</em></td>
</tr>
<tr>
<td>- Using a carefully chosen nature-economy modelling framework (reviewed in Chapter 3.2)</td>
</tr>
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<td>- Taking the following precautions:</td>
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<td>- Designing ad hoc shocks in multiple sectors (narratives developed in Chapter 2)</td>
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<td>- Using assumptions of various SSPs for calibration (not SSP2 only) and co-develop or build on new existing frameworks to go beyond SSP (e.g., IPBES)</td>
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<td>- Conducting sensitivity analyses, in particular on elasticities of substitution</td>
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<tr>
<td>- Better transparency of underlying assumptions and communication of implications on results</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Longer-term program for central banks and supervisors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Improvement of dynamic scenarios</strong></td>
</tr>
<tr>
<td>By supporting an improvement of nature-economy models (reviewed in Chapter 3.1)</td>
</tr>
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<td>- Including more nature-economy transmission channels (building on biophysical models reviewed in Chapter 3.2):</td>
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<td>- Representing more numerous ecosystem services and economic dependencies to those services</td>
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<td>- Representing more policies, technological options and socioeconomic developments (e.g., changes in diet)</td>
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<td>- Representing some missing economic transmission channels, such as food security and productivity losses</td>
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<td>- Better informing the elasticities of substitution, considering making them dynamic (e.g., lower in the short run)</td>
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<tr>
<td>- Developing nature-economy models with alternative macroeconomic modelling assumptions (e.g., regarding equilibrium)</td>
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<td>- Better transparency of underlying assumptions and communication of implications on results</td>
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Source: NGFS 2023b
Despite gaps in approaches and nature complexity – “Wait and see” no option and multiple starting points exist.

World Bank data and technical assistance

Sovereign ESG Data Portal

Data

Research

An Exploration of Nature Related Financial Risks in Malaysia

Regulatory Tools

Financial Instruments

TNFD

Scientific foundations and definitions

Existing disclosure frameworks & standards

Target setting

Dependency, impact, risk & opportunity analysis

Data standards & sources

Source of metrics

Sector & biome classification

Definitions of risk & approach to scenarios

Guidance on stakeholder engagement

Recommendations toward the development of scenarios for assessing nature-related economic and financial risks

TNFD Nature-related Data Catalyst community


WORLD BANK GROUP

Equitable Growth, Finance & Institutions
Questions and answers

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100% of the economy is 100% dependent on nature

• The biosphere refers to the **sum of all the ecosystems** of the world.

• In this presentation the terms “nature” and “biosphere” are used interchangeably.

• **Benefits that people derive** from natural capital, measured as flows of goods and services, are called **ecosystem services**.

• **Ecosystem services cover a wide range**: from the provision of food, fresh water, and raw materials, regulation of climate and hazards, removal of pollution, soil formation, to the creation of a basis for personal enjoyment.

• **Ecosystem services** underpin economic activity in tangible, measurable ways.

• Already, **14 of the 18** assessed categories of ecosystem services, particularly regulating services, have **declined** since 1970.
The level of degradation of nature varies in different parts of the world

- The decline across Latin America and the Caribbean is far greater than any other region, with a 94% decrease between 1970 and 2018.

- Declines are seen across all the species groups studied but are most profound in freshwater fish, reptiles, and amphibians.
Biophysical models provide detailed information on biophysical aspects but do not include feedback to the economy.

- Biophysical models focus on understanding and simulating relationships within ecosystems, emphasizing material, energy, and species flow.
- These models prioritize ecological complexity and accuracy in representing natural systems.
- However, very few biophysical models are linked to economic aspects.
- Some well-captured phenomena include hydrological processes, vegetation dynamics, and climate change processes.
- Models related to biodiversity, health, fire, and fisheries are relatively new and still being refined and validated.
Nature and climate are closely interconnected - yet different

Nature-Climate Synergies

Ecosystems as Carbon Sinks:
- Terrestrial and marine ecosystems sequester 56% of annual anthropogenic GHG emissions.
- Mangroves’ flood protection is valued over $65 billion annually, highlighting the economic value of preserving ecosystems.

Climate Change Impacting Biodiversity:
- Climate change is a direct driver of biodiversity loss, alongside land use change, overexploitation, pollution, and invasive species.
- Mitigating climate change also reduces nature loss

Nature-Climate Differences

More localized Impact of Biodiversity and Ecosystem Loss:
- Highly dependent on local factors, with immediate local economic and financial effects.
- Example: Nutrient runoff from overuse of fertilizers leads to eutrophication, harming biodiversity, community health, and livestock.

Complexity in Assessing Nature-Related Risks:
- Biodiversity and ecosystem health assessments are multidimensional and less developed than climate change models.
- Lack of a unified high-level metric for economic activity’s impact on nature, unlike CO2 equivalent metrics for climate.
Malaysia Case: How Central Banks can address nature-related risks

There is a broad set of nature-related risk scenarios that could impact Malaysian Banks

Exposed share of commercial loans in top-15 scenarios

- Reduced ecosystem services due to resource overuse, pollution and urban sprawl
- Sudden and unexpected climate policy introduction
- Ecosystem services deterioration due to deforestation
- Sudden increase in the price of water
- Regulatory restriction of water pollution
- Changed ocean current and circulation
- Increase in sea surface temperature
- Severe reduction in available timber
- Severe flooding occurrence
- Severe storm occurrence
- Increased ocean acidification
- Extension of protected areas
- Lower clean water availability due to continuously high water pollution
- Regulatory restriction of non-sustainable fertilizers
- Regulatory restriction of non-sustainable pesticides

Source: ENCORE, BNM, interviews, WBS calculations.
Note: Dark blue scenarios are nature-related financial transition risk scenarios, light blue scenarios are nature-related financial physical risk scenarios. Exposure amounts are based on the share of corporate loans to economic sectors that could be directly affected in the scenario under consideration.
What kind of information was used to assess nature-related financial risks?

<table>
<thead>
<tr>
<th>Themes</th>
<th>Main analyses</th>
<th>Data sources</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure analysis</td>
<td>Loss of ecosystem services (physical risks)</td>
<td>• ENCORE (Natural Capital Finance Alliance 2021) • BNM sectoral data</td>
<td>ENCORE framework maps 86 production processes, representing 138 sub-industries and 11 sectors (GICS) onto 21 ecosystem services (physical risk exposures) and 11 drivers of ecosystem service losses</td>
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<td>Activities in biodiversity hotspots (transition risks)</td>
<td>• Key biodiversity areas (KBAs) (IBAT) • Protected areas (UN-WCMC) • BNM postal code level lending data</td>
<td>Mapping postal code level non-residential and residential property lending data onto KBAs</td>
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<td>Environmental controversies (reputational risks)</td>
<td>• MSCI controversies database</td>
<td>ESG controversies database records negative environmental impacts from a company’s products/operations</td>
</tr>
<tr>
<td>Expansion and deep dives</td>
<td>Deep dives on main issues in Malaysia</td>
<td>• Interviews</td>
<td>Banks, environmental ministries, environmental NGOs</td>
</tr>
</tbody>
</table>