UN environment programme | finance initiative

TCFD training for MENA

Part 3: Conducting climate risk analysis

29 March 2021

SESSION OVERVIEW

Participants

- Senior-level sustainability managers
- On-ground implementing colleagues

Key topics

1. Introduction to IAMs
2. Physical risk analysis- data required
3. Transition risk analysis- UNEP FI methodology
4. Landscape review of climate risk tools

Learning objectives

- Gain an overview of the landscape of tools and methodologies used to assess physical and transition risks
- Understand how climate scenarios can be converted into decision useful financial information

DISCUSSION QUESTIONS

- Is there anything additional you would like to know about climate scenarios or climate data?
- What are the next steps for your institution in assessing physical risks?
- What are the next steps for your institution in assessing transition risks?

1

INTRODUCTION TO IAMS

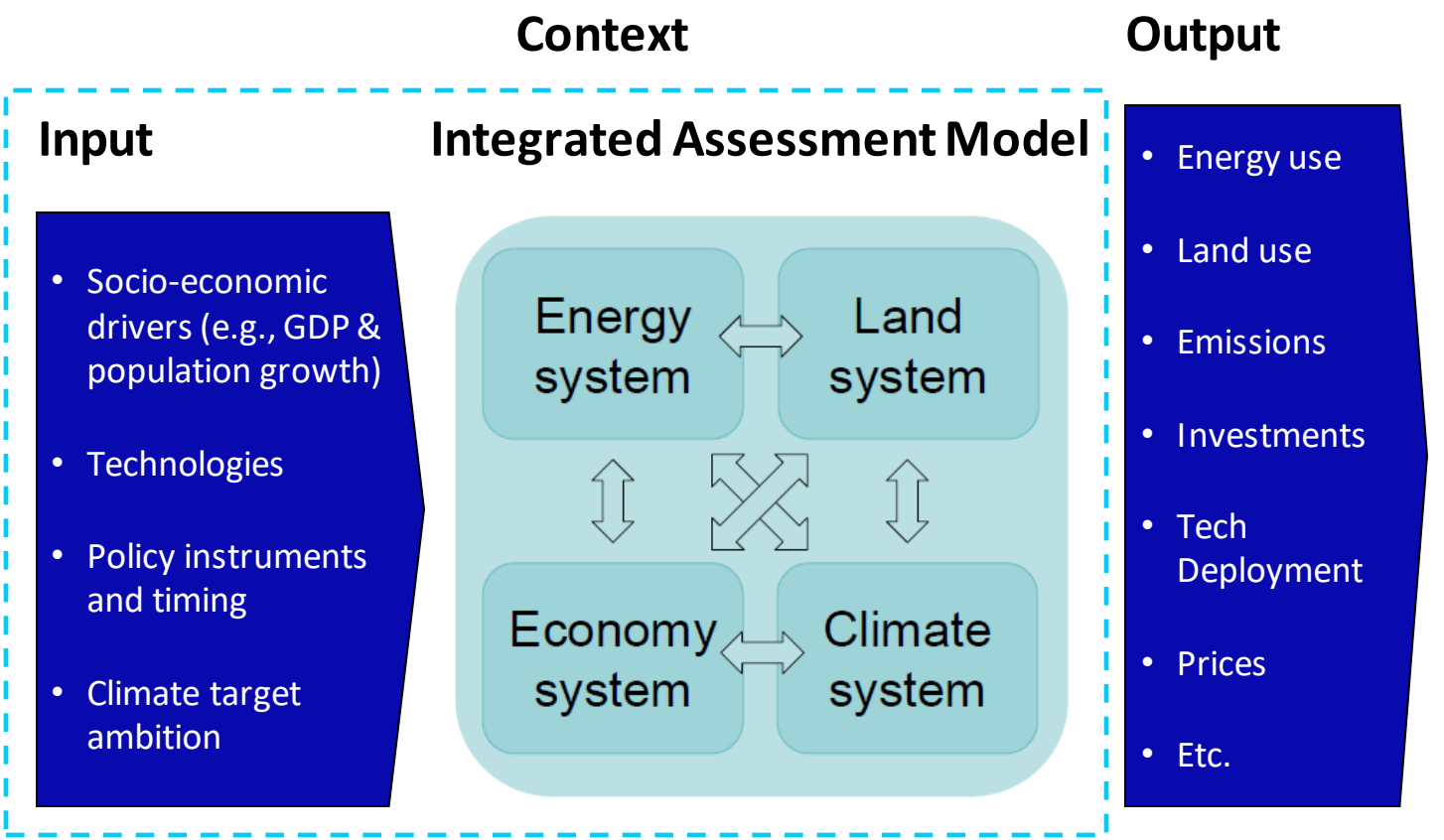
SCENARIOS ARE DERIVED FROM INTEGRATED ASSESSMENT MODELS (IAMS)

IAMS ARE CLIMATE SCENARIO MODELS THAT COMBINE PHYSICAL, SOCIAL, AND ECONOMIC FACTORS TO MODEL FUTURE PATHWAYS FOR POLICYMAKERS

Integrated Assessment Models (IAMs):

- Provide an understanding of the interplay between society and the natural world
- Can be highly complex, exploring a variety of factors: energy, land-use, policy, among others
- Complex IAMs consist of a series of modules that are linked together
- While IAMs contain a climate module, computing limitations mean climate aspects are simplified

Illustrative IAM structure [1]



1. PIK

Note: The IEA also produces widely used climate scenarios based on an energy model. See appendix for more details.

INTEGRATED ASSESSMENT MODEL OVERVIEW (1/2)
IAMS CAN PROVIDE VALUABLE INSIGHTS INTO ECONOMIC AND SOCIAL DEVELOPMENTS, BUT ALSO HAVE LIMITATIONS

Advantages of IAMs[1]

- Enable a better understanding of the interrelated systems that are impacted by climate change
- Create a far more detailed vision of the future than any single module alone
- Allow an exploration of the "what if" questions for various temperature and emissions pathways (e.g. population growth, rising consumption)
- Provide policymakers with specific paths to attain climate goals and assessments of whether current actions and commitments are adequate
- Allow an assessment of various policy choices (e.g. carbon price, emissions standards)

Criticisms of IAMs and planned enhancements[2]

- Overreliance on negative emissions technologies- *studies to assess the importance of various CCS technologies*
- Lack of interaction with other policy goals- *studies increasingly exploring the interplay between emissions reductions and other objectives*
- Lack of assessment of feasibility- *increased focus on pathways that are technologically and economically feasible*
- Overreliance on mitigation costs in baseline scenarios- *additional analysis of SSPs provides greater transparency into cost assumptions*
- Lack of representation of economic and political behavior- *integration of more complex behavioral assumptions as well as the impacts from policy changes*

1. Earth Institute, Columbia University
2. Gambhir et al., 2019

INTEGRATED ASSESSMENT MODEL OVERVIEW (2/2)

SOME COMMON IAM MODELS ARE BEING USED IN REGULATORY AND INTERNAL CLIMATE RISK ASSESSMENTS

Popular complex IAMs[2]

- World Induced Technical Change Hybrid (WITCH)- *Fondazione Eni Enrico Mattei- Centro Euro-Mediterraneo sui Cambiamenti Climatici (FEEM-CEMCC)*
- Regional Model of Investments and Development (REMIND)- *Potsdam Institute for Climate Research (PIK)*
- Global Change Assessment Model (GCAM)- *Pacific Northwest National Laboratory (PNNL)*
- Integrated Model to Assess the Global Environment (IMAGE)- *Netherlands Environmental Assessment Agency (PBL)*
- Model for Energy Supply Strategy Alternatives and their General Environmental Impact (MESSAGE)- *International Institute for Applied Systems Analysis (IIASA)*
- Asia-Pacific Integrated Model (AIM)- *National Institute for Environmental Studies (NIES)*

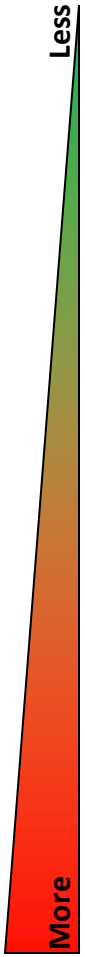
Models used directly in UNEP FI's Phase II Banking Program

1. Carbon Brief,
2. Earth Institute, Columbia University

STORYLINES FOR PIK AND IIASA SCENARIOS USED BY UNEP FI AND NGFS

EACH SCENARIO REFLECTS A POTENTIAL FUTURE WITH THE COMPLEX SET OF SOCIAL, POLITICAL, AND ECONOMIC DECISIONS THAT ENTAILS

Degree of Transition Risk



Scenario	Model	NGFS Category	Storyline
Current policies (over 3°C)	**MESSAGE**, REMIND, GCAM	**Hot house world**	**Current climate policies are followed for all regions; similar to IEA's current policy scenario**
NDCs (~3°C)	MESSAGE, REMIND	Hot house world	Nations follow their unconditional nationally determined contributions (NDCs) based on the Paris Agreement but take no further action
Immediate 2°C with CDR	MESSAGE, REMIND, **GCAM**	**Orderly**	**Collective action is taken now to reduce emissions towards a 2°C target; full CDR technology is available**
Immediate 1.5°C with CDR	MESSAGE, REMIND	Orderly	Collective action is taken now to reduce emissions towards a 1.5°C target; full CDR technology is available
Immediate 2°C with limited CDR	MESSAGE, REMIND	Orderly	Aggressive collective action begins now on 2°C pathway; limited use of negative emissions
Delayed 2°C with CDR	MESSAGE, REMIND	Disorderly	Disruptive, aggressive collective action only begins after 2030 to align with a 2°C target; full CDR technology is available
Delayed 2°C with limited CDR	**REMIND**	**Disorderly**	**Disruptive, aggressive collective action only begins after 2030 to align with a 2°C target; limited use of negative emissions**
Immediate 1.5°C with limited CDR	MESSAGE, REMIND	Disorderly	Disruptive, aggressive collective action begins now on 1.5°C pathway, limited use of negative emissions

*** Bold denotes Representative Scenario**

2

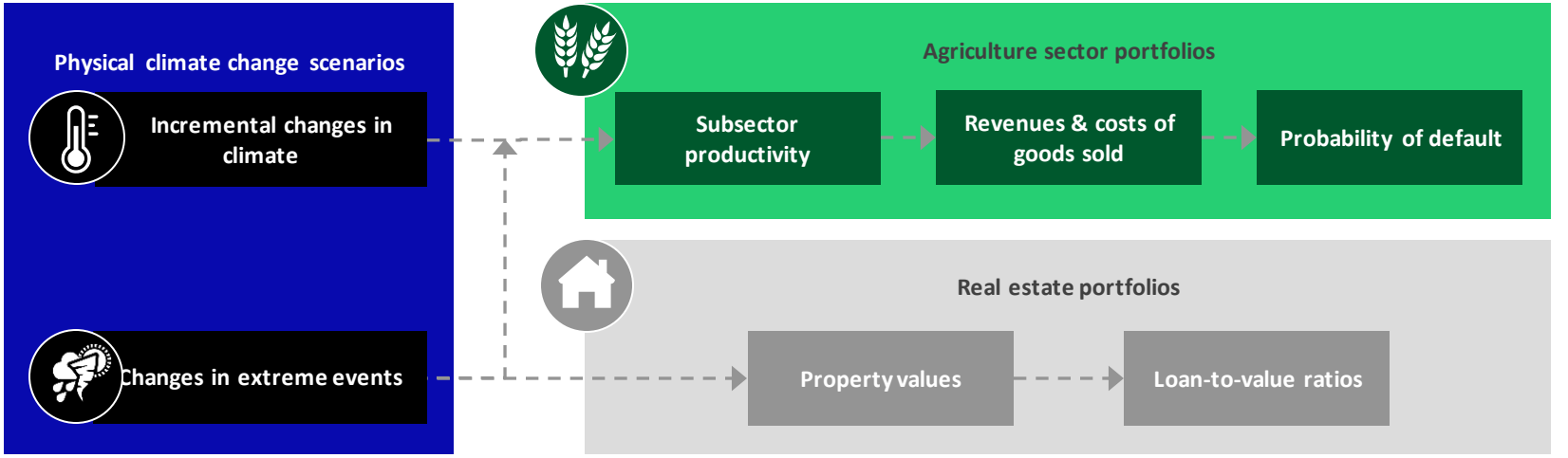
PHYSICAL RISKS ANALYSIS – DATA REQUIRED

TCFD BANKING PROGRAM: PHYSICAL RISK FRAMEWORK

THE PHYSICAL RISK METHODOLOGY EXPLORED BOTH EXTREME EVENTS AND INCREMENTAL CHANGES

ACCLIMATISE
building climate resilience

Overview of the physical risk framework



Agriculture

1. Select representative sample of borrowers to assess
2. Identify climate change impacts on subsector productivity, price, downtime
3. Assess implications for borrowers' finances: changes in revenue & costs of goods sold
4. Estimate changes in probability of default: stress the factors/ratios in banks' internal credit rating models that have revenue and cost components
5. Extrapolate findings to whole portfolio subsector

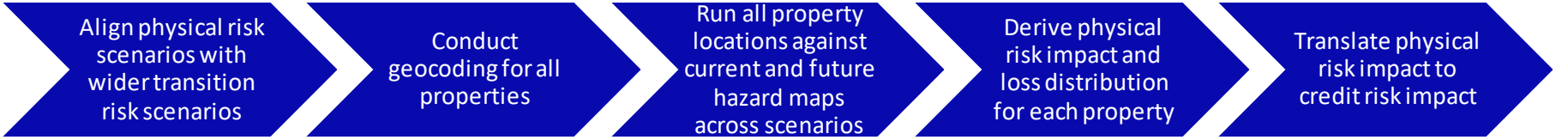
Real estate

1. Identify properties facing risk of extreme events using existing online risk assessment platforms
2. Estimate probabilities of properties encountering extreme events in future
3. Assess potential changes in property values for 'at risk' properties
4. Calculate revised loan-to-value ratios

PHYSICAL RISK DATA REQUIREMENTS- REAL ESTATE EXAMPLE
TAKING THE INITIAL STEPS STEPS IN RISK AND OPPORTUNITY IDENTIFICATION

Physical risk identification for financial institutions

- The physical risk analysis typically follows the below steps:



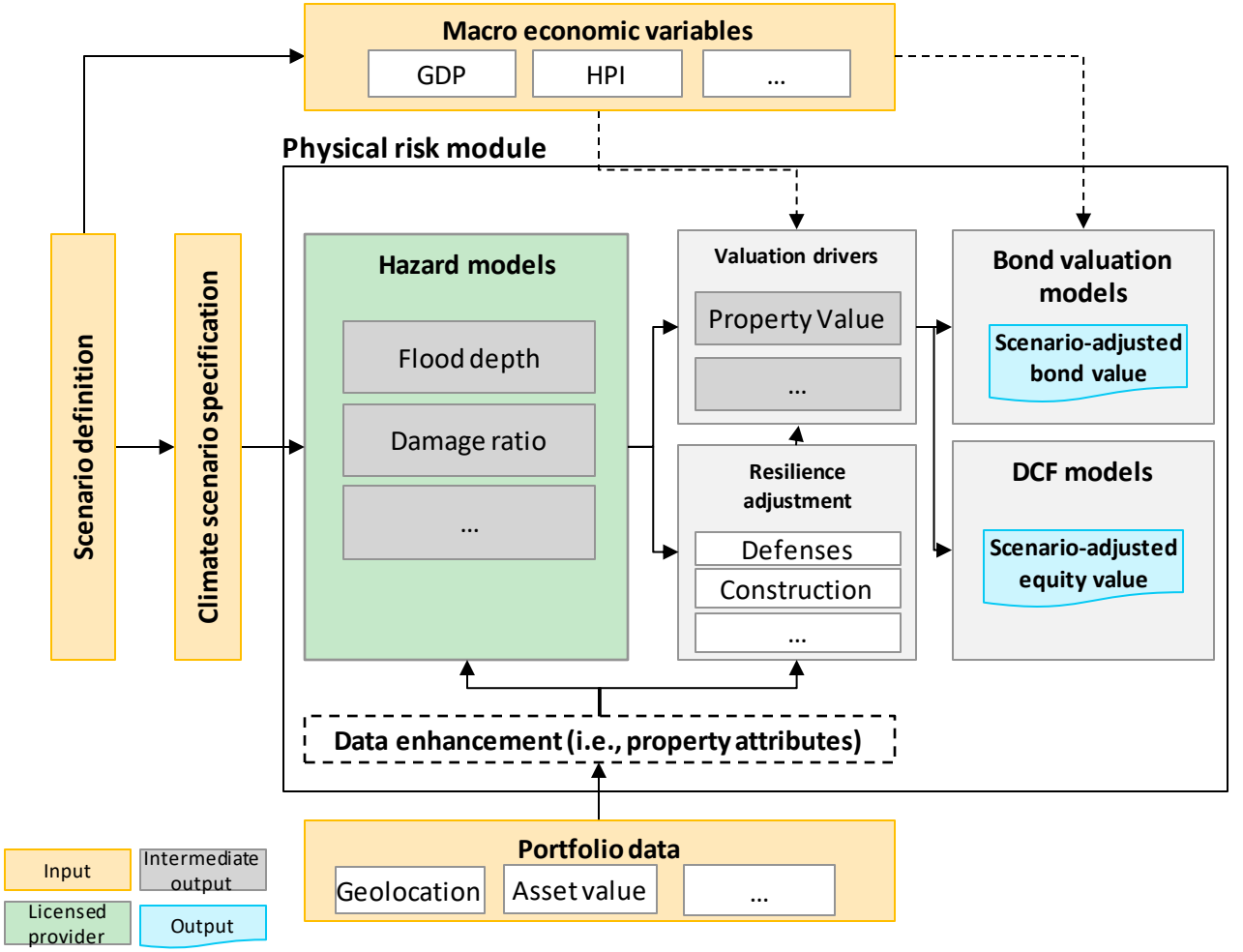
- Physical risks are typically captured via two components:
  - Direct impact of natural catastrophes (extreme events)
  - Changing expectations of future physical risks (incremental risks)

- Direct physical risks arise from property damage caused by increasing severity and frequency of severe weather events (e.g. flooding, windstorms, subsidence, wildfires etc.).
  - Uninsured properties can see a severe reduction in asset values, while insured properties can experience increased premia.

PHYSICAL RISK COMPONENTS (1/2)

A RISK QUANTIFICATION FRAMEWORK SHOULD INCORPORATE CLIMATE SCIENCE INSIGHTS AND FINANCIAL RISK DRIVERS

Overview of physical risk approach



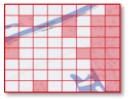
Notes

- Physical risk approach models each key hazard (e.g., flood, hurricane, wildfire, subsidence) to achieve a leading approach
  - Each model is based on suitability for accurate representation of specific hazard in region of interest.
  - It is possible to augment or replace components as science and provider capabilities improve or new hazards emerge
- Portfolio data quality is a critical point of failure. Sensitivity testing informs data gaps that need to be filled
  - Users can address gaps and enhance attribute data as needed (e.g., accurate geocoding, key features)
  - Users can develop a methodology blueprint for each hazard and produce repeatable analyses using a tested approach

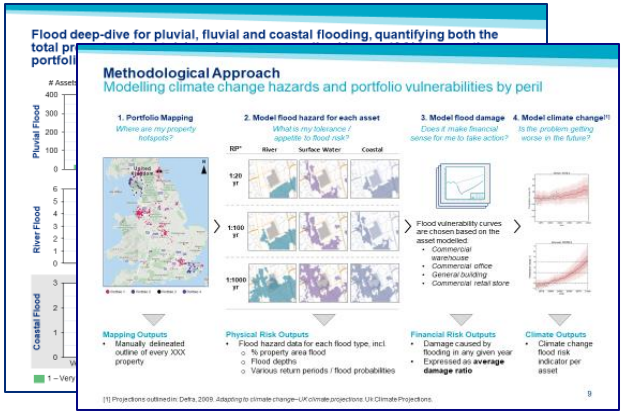
PHYSICAL RISK COMPONENTS (2/2)

A COMPREHENSIVE APPROACH TO PHYSICAL RISKS SHOULD ENABLE THE FIRM TO ASSESS MATERIAL PORTFOLIOS AND FOCUS ON DECISION-USEFUL OUTPUTS

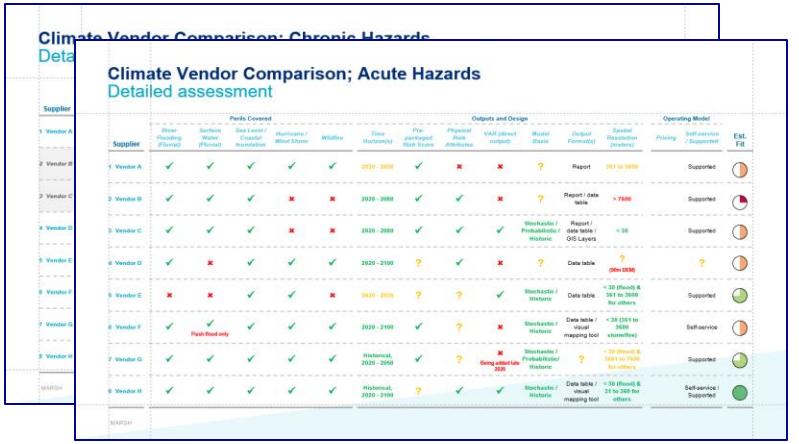
Geocoding methodologies

	Data run by model provider			*Data run on Marsh systems*
Method Design	**Option 1: Asset Boundary Method**	**Option 2: Asset Buffer Method**	**Option 3: Regional Grid Method**	**Option 4: Postcode-level Method**
Schematic				
Indicative accuracy	**5 / 5**	**4 / 5**	**3 / 5**	**~3 / 5 (depends on postcode scale)**
Output Summary	Method derives asset specific outputs calculated for individual property boundaries (best-in class)	Property specific outputs calculated for individual property using rooftop geocodes and an associated buffer to approximate asset boundary	User-defined grid allowing for aggregated outputs based on number of assets in grid. Grids are uniform across UK + HK portfolios	Outputs generated for property clusters within e.g. postcode boundaries (or District in HK)
Positives	• Can use asset specific attributes (e.g. resilience, # storeys etc.) • Shows hotspots most accurately • Level of exposure an exact reflection of the property	• Can use asset specific attributes (e.g. resilience, # storeys etc.) • Pinpoint property accuracy used • Every asset has unique outputs	• Asset attributes can be applied within grid (e.g. 5% a terraced etc.) • Uniform grid allows for comparable measure between countries/areas	• Simpler computation within models • More suitable for aligning with house price models
Negatives	• Expensive to purchase data • Computationally challenging • Granular data sharing required	• Asset exposure is approximated due to size of buffer • Computationally challenging	• High aggregation reduces granularity of analysis	• Higher aggregation reduces granularity • Boundaries vary in size
Sending data to 3rd parties required?	**Yes – 2+ providers per portfolio**	**Yes**	**Yes**	**No**

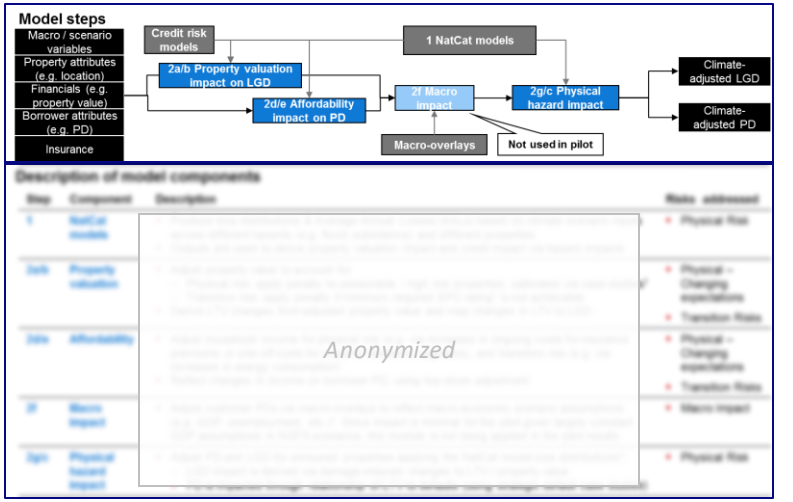
Result generation



Selection of physical risk vendor data



Sectoral assessment steps



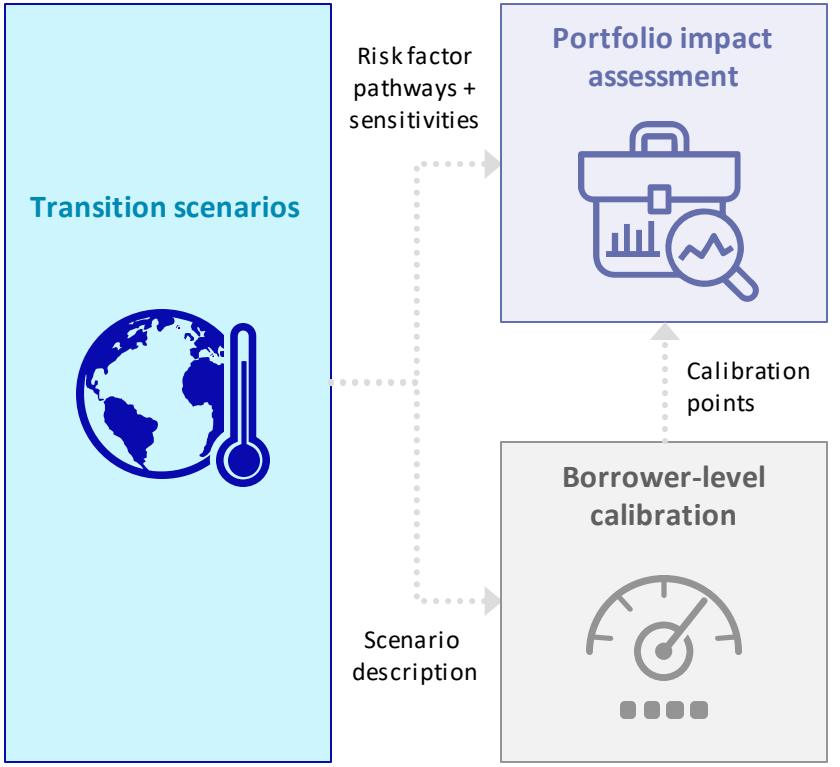
3

TRANSITION RISKS ANALYSIS – UNEP FI METHODOLOGY

TRANSITION RISK ASSESSMENT FRAMEWORK (1/2)

THE METHODOLOGY INTEGRATES CLIMATE SCIENCE WITH CREDIT RISK METRICS TO PRODUCE PORTFOLIO LOSS ESTIMATES

Overview of the transition risk framework



Transition scenarios describe an evolving economic environment in a consistent manner across time, sectors, and geographies. Scenarios provide detailed outputs to define sector-level exposure to transition impacts.

Borrower-level calibration addresses the lack of empirical data on corporate exposure to transition risk by using industry experts to estimate the scenario's impact on individual borrowers. Calibration specifies the relationship between economic scenarios and credit outcomes.

Portfolio impact assessment uses a systematic and repeatable approach to extrapolate the risk assessed by the other modules to the remainder of the portfolio.

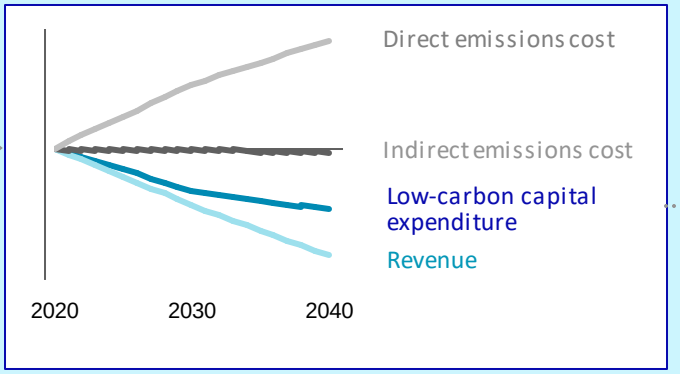
TRANSITION RISK ASSESSMENT FRAMEWORK (2/2)

SCENARIO PARAMETERS ARE COMBINED WITH BORROWER-LEVEL CALIBRATION POINTS TO INFORM THE SCENARIO'S IMPACT ON EXPECTED LOSS

Climate scenarios

Scenario models

Sector-level risk factor pathways



Segment sensitivities to risk factors

Risk factor pathway	Segment 1	Segment 2	...
Direct emissions cost			
Indirect emissions cost			
Low-carbon capital expenditure			
Revenue			

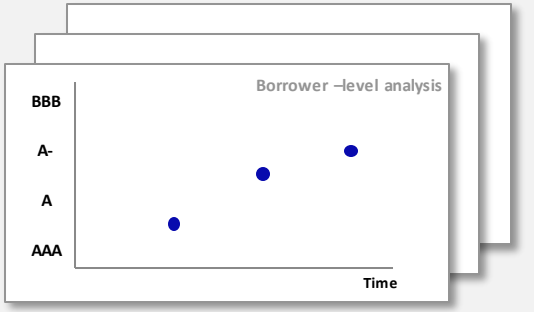
Portfolio impact assessment

Borrower characteristics (rating, business etc.)

Climate credit quality index (by segment/geography)

Impact on expected loss

Borrower-level calibration



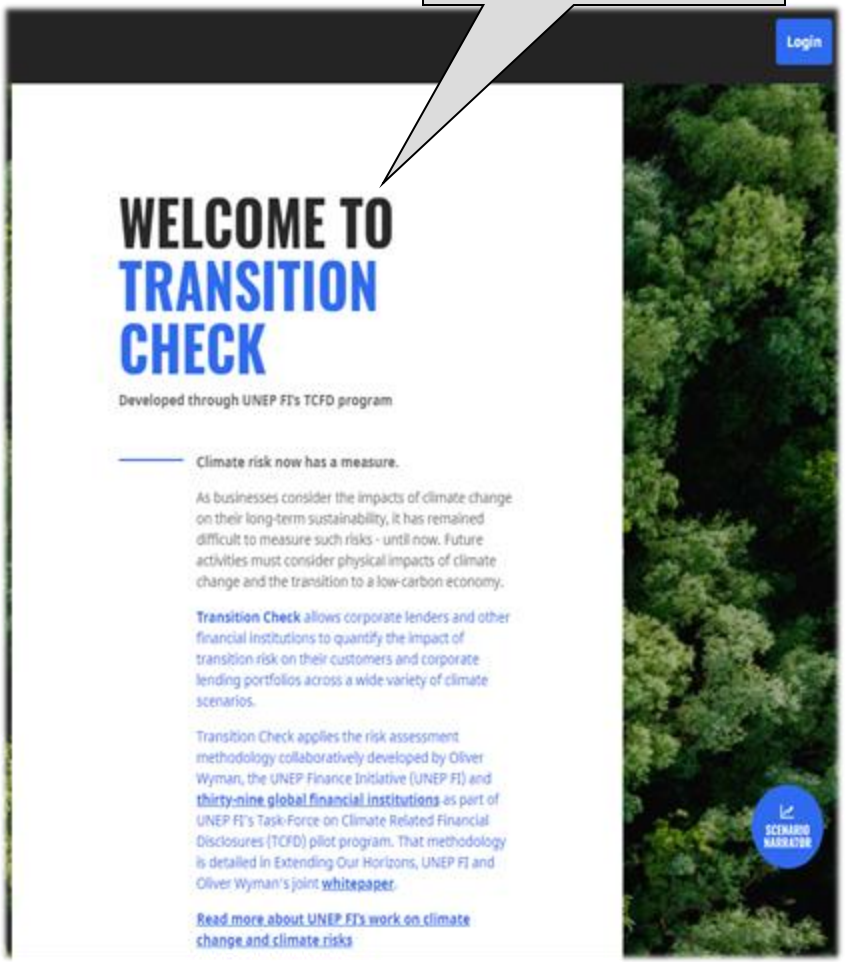
Input | Intermediary output | Output

TRANSITION RISK METHODOLOGY - RESOURCE DEVELOPED DURING PHASE II (1/2)

TRANSITION CHECK- ONLINE WEBTOOL FOR TRANSITION SCENARIO ANALYSIS

- Developed in conjunction with Oliver Wyman, a leading global management consultancy
- Includes a scenario visualizer for exploring the key variables across over a dozen NGFS reference scenarios
- Enables institutions to conduct transition scenario analysis across a variety of:
  - Geographies
  - Economic sectors
  - Temperature scenarios
- Produces loss estimates and default probabilities for sectors, segments, and borrowers standardized for TCFD reporting
- Free and open to all UNEP FI members

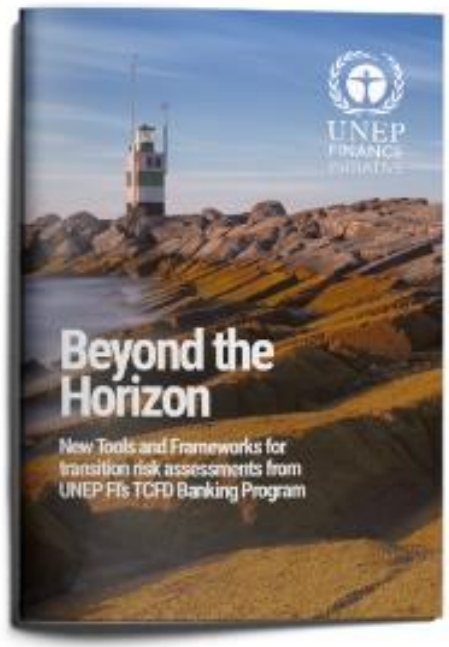
Click to play demo video



TRANSITION RISK METHODOLOGY – RESOURCE DEVELOPED DURING PHASE II (2/2)

BEYOND THE HORIZON- TRANSITION TOOLS AND HEATMAPS

- Provides a transition risk heatmap validated by the participants in the program for eight economic sectors with suggested segmentations for each sector
- Explores the impacts of a 1.5° C transition on different sectors and explores the primary risk drivers within each one
- Extends the work done in Phase I on the transition risk methodology
- Describes the application of the transition risk methodology to a variety of new economic sectors and new NGFS reference scenarios



Sector	Direct Emissions Cost	Indirect Emissions Cost	Low-Carbon CapEx	Revenue	Overall
Oil & Gas	High	Low	Moderately High	High	High
Agriculture	Moderate	Moderate	Moderate	Moderate	Moderate
Real Estate	Moderately Low	Moderate	Moderate	Moderately Low	Moderate
Power Generation	Moderately High	Moderate	Moderately High	Moderate	Moderately High
Metals & Mining	Moderately High	Moderately High	Moderate	Moderately Low	Moderate
Industrials	Moderate	Moderately High	Moderate	Moderately Low	Moderate
Transportation	Moderately High	Moderate	Moderate	Moderate	Moderate
Services and Technology	Low	Moderately Low	Moderately Low	Low	Low

Full heatmap can be viewed in the Beyond the Horizon report

4

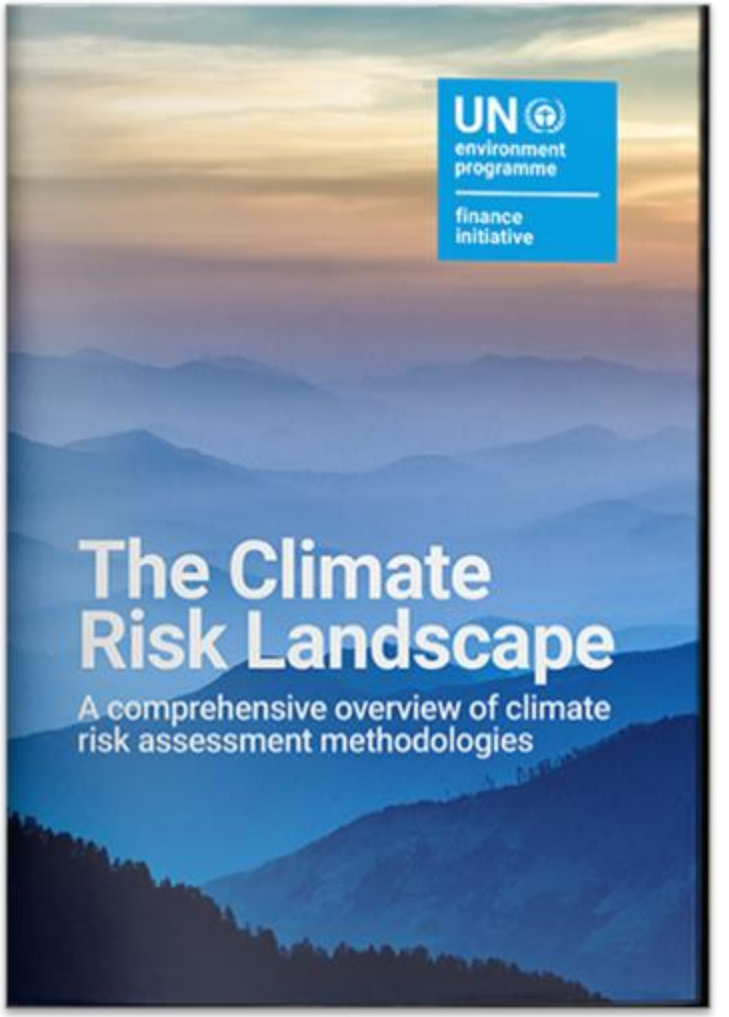
LANDSCAPE REVIEW OF CLIMATE RISK TOOLS

UNEP FI'S CLIMATE RISK LANDSCAPE REPORT COVERS BOTH TRANSITION AND PHYSICAL RISK TOOLS

Key developments

- Regulations
  - Increasing mandatory policy and regulation
  - Engagement in stress testing
  - Abundance and consolidation of service providers

- Technology
  - Most service providers are using more than one scenario provider
  - Standardization in climate risk assessments: NGFS reference scenarios
  - Combination of transition and physical risk methodologies
  - Artificial intelligence
  - Increasing data availability and usability



TOOLS FOR TRANSITION CLIMATE RISK ASSESSMENT OF FINANCIAL RISK
A KEY DECISION POINT IS THE USE OF TOP-DOWN VS. BOTTOM-UP FRAMEWORKS

Perspectives on transition risk tools

Transition Hazards	Policy	
	Technology	
Risk analysis	Level of analysis	Asset
		Firm
		Sector
		Country
	Impact Channel	Macroenvironment
		Supply chain
		Operations and assets
		Markets and clients
	Depth	Exposure
		Sensitivity
		Adaptive Capacity
	Approach	Top-Down
		Bottom-Up

- Assumes markets are driven by policy and technology
- Assesses a range of variables and assumptions:

Level of analysis

Impact Channel

⇩ TD / BU ⇧

Depth of analysis

TOOLS FOR PHYSICAL CLIMATE RISK ASSESSMENT OF FINANCIAL RISK (1/2)

COMMERCIALLY-AVAILABLE TOOLS WERE EVALUATED AGAINST A FRAMEWORK DURING PHASE II

Assessment framework for tool providers

			2DII (1)	2DII (2)	BAR	C4	CFIN	CT	CW	MA-VE	MIS	MSCI
	Scenario Basis		"IEA ETP | (IEA WEO) | (G'peace)"	IEA ETP	"Bespoke, or | Industry standard, e.g. IEA"	"Bespoke | (based on IEA ETP, IPCC, ...)"	"IEA ETP | IEA WEO"	"IEA WEO | IEA ETP (B2DS)"	"IEA ETP | IEA WEO"		IEA WEO	Bespoke (PIK-REMIND, IIASA, GCAM)
Scenarios	<2.0°C (RCP 2.6)		✓	✓	✓	✓	✓	✓		✓		✓
	2.0°C (RCP 4.5)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	3.0°C (RCP 6.0)		✓	✓	✓	✓				✓		✓
	>4.0°C (RCP 8.5)				✓	✓			✓	✓	✓	✓
	Disorderly?			✓	✓		✓			✓		✓
Time horizons	Near term (2025-2040)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Medium term (2050)				✓		✓					
	Long-term (2100)						✓[iii]					
Transition Hazards	Policy		✓	✓	✓	✓	✓		✓	✓	✓	✓
	Technology		✓	✓	✓	✓	✓		✓	✓	✓	✓
Risk analysis	Level of analysis	Asset	✓		✓			✓	✓	✓		✓
		Firm	✓		✓	✓	✓	✓		✓	✓	✓
		Sector	✓	✓	✓	✓	✓	✓	✓	✓		✓
		Country			✓	✓	✓		✓	✓		✓
	Impact Channel	Macroenvironment		✓	✓	✓	✓		✓	✓		✓
		Supply chain			✓	✓	✓		✓	✓		(✓)[i]
		Operations and assets	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Markets and clients	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Depth	Exposure	✓	✓	✓	✓	✓	✓	✓	✓		✓
		Sensitivity	✓	✓	✓	✓	✓	(✓)[v]	(✓)[vi]	✓		✓
		Adaptive Capacity		✓	✓	✓	✓			✓		
	Approach	Top-Down		✓			✓				✓	
		Bottom-Up	✓		✓	✓		✓	✓	✓		✓

Notes

- **Building a tool for robust quantification of physical risk in financial terms is a large endeavour**
- Commercial tools and analytics are designed for various purposes e.g:
  - Portfolio assessment
  - Security selection / investment appraisal
- They can differ in their approaches to risk analysis:
  - Impact channels covered
  - Methods and approaches for impact assessment

TOOLS FOR PHYSICAL CLIMATE RISK ASSESSMENT OF FINANCIAL RISK (2/2)

WHILE TOOLS HAVE EVOLVED IN RECENT YEARS BANKS IDENTIFIED DATA GAPS AND FURTHER IMPROVEMENTS NEEDED

Topic	Key issues
Physical asset locations and other characteristics	Some tools incorporate datasets on locations of physical assets for listed companies But they do not take account of asset design, age and condition Data are lacking for unlisted companies / SMEs
Supply chains and market demand	Tools use sector- or country-level trade data and input-output tables Data are lacking on suppliers and customers at counterparty level
Unlisted companies and SME counterparties	Climate risks facing unlisted companies / SME counterparties are unknown
Counterparties' adaptation and resilience measures	Ability of counterparties to adapt / cope with physical risk is not captured (except sovereigns)
Intangible assets	Lack of research on climate impacts on intangible assets (e.g. brand value, social license to operate, environmental performance)
Engagement	Engagement with counterparties can help to improve assessments

5

NEXT SESSION

QUESTIONS AND DISCUSSION

Poll questions

- Has your institution used transition scenarios to conduct analysis?
- Has your institution used physical risk models to conduct analysis?
- What insights have these tools provided you and your team?
- What challenges have you faced in using these tools and what suggestions do you have for enhancement?

Polling will be provided during the session

Discussion questions (after the session with your team)

- How is your institution using the insights of climate risk analysis? What are ways you would like to use this information in the future?
- Who "owns" climate risk at your institution? What departments are involved in working on this issue?
- What outstanding questions do you have about the UNEP FI transition and physical risk methodologies?

UPCOMING SESSION

Next session: Understanding physical and transition risks

Date: 31 March 2021

Participants

- Senior-level sustainability managers
- Bank executives
- On-ground implementing colleagues

Agenda

1. Integrating climate risk insights throughout the organization

2. Good practices around TCFD disclosures and climate risk management

Learning objectives

- Develop the knowledge to take initial steps towards climate risk management and disclosure
- Collaborate to launch a country focused/MENA TCFD working group to continue the TCFD journey

THANK YOU FOR YOUR ATTENTION!

IF YOU HAVE ANY QUESTIONS ABOUT TODAY'S CONTENT OR UNEP FI'S TCFD PROGRAMS, PLEASE DO NOT HESITATE TO REACH OUT

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UNEP FI

David Carlin@un.org