

The Risk Management Impact of Climate Change & ESG

Frank Freitas, Four Twenty Seven
Michael Denton, Moody's Analytics
Cris DeRitis, Moody's Analytics

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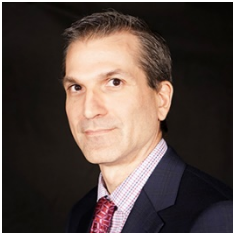
Moderator: Sam Malone, Moody's Analytics



Michael Denton
Director - Risk and
Finance Advisory
Moody's Analytics



Sam Malone
Senior Director - Research
Moody's Analytics



Cristian deRitis, PhD
Senior Director - Consumer
Credit Analytics
Moody's Analytics



Mehna Raissi
Senior Director -
Product Management
Moody's Analytics



Frank Freitas
Chief Development Officer
Four Twenty Seven

Agenda

1. Overview: ESG Investment Strategies
2. Climate Analytics: Quantification of Climate Risk
3. The Macro View: Economic Scenarios based on Climate Change
4. The Micro View: Climate Change and Credit Risk Modeling
5. Key Take-aways

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Overview: ESG Investment Strategies

Overview



ESG risk and climate change risk

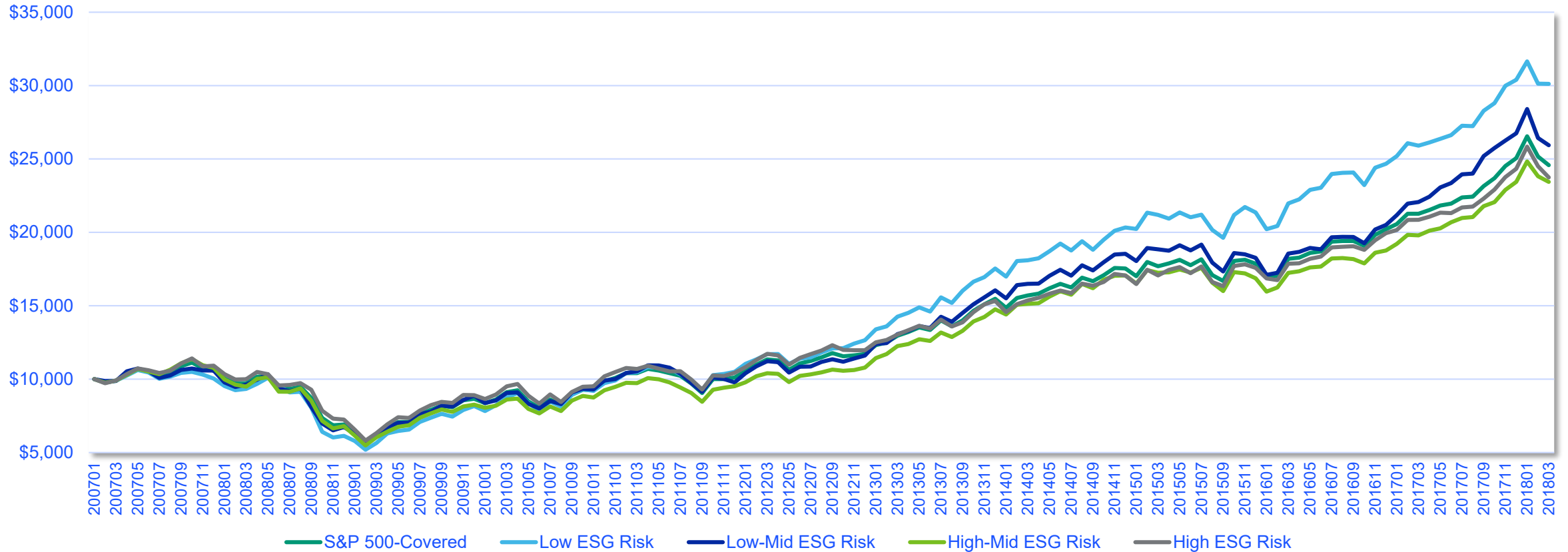
- ESG and climate risk: connected but distinct
- Growing ESG awareness and quantification: significant capital inflow
- ESG investing: > US\$20T in AUM (1/4 of managed assets worldwide)
(Forbes, 07/11/18)
- Impact firms' ability to conduct business

How should investors, firms and banks adapt?

Equity Portfolio Values vs. Time



Based on highest trailing two-year RepRisk ESG Scores*

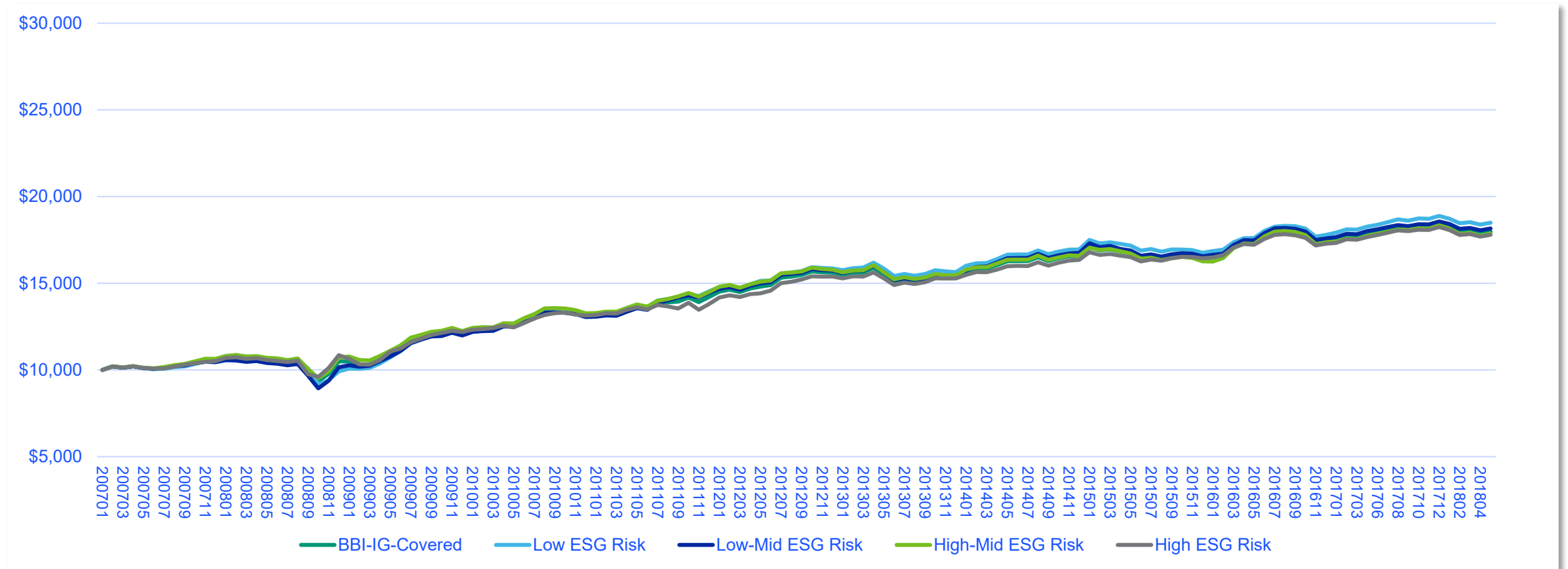


*Sourced from Bureau van Dijk, a Moody's Analytics Company

Investment Grade Bond Portfolios



Based on highest trailing two-year RepRisk ESG Scores*

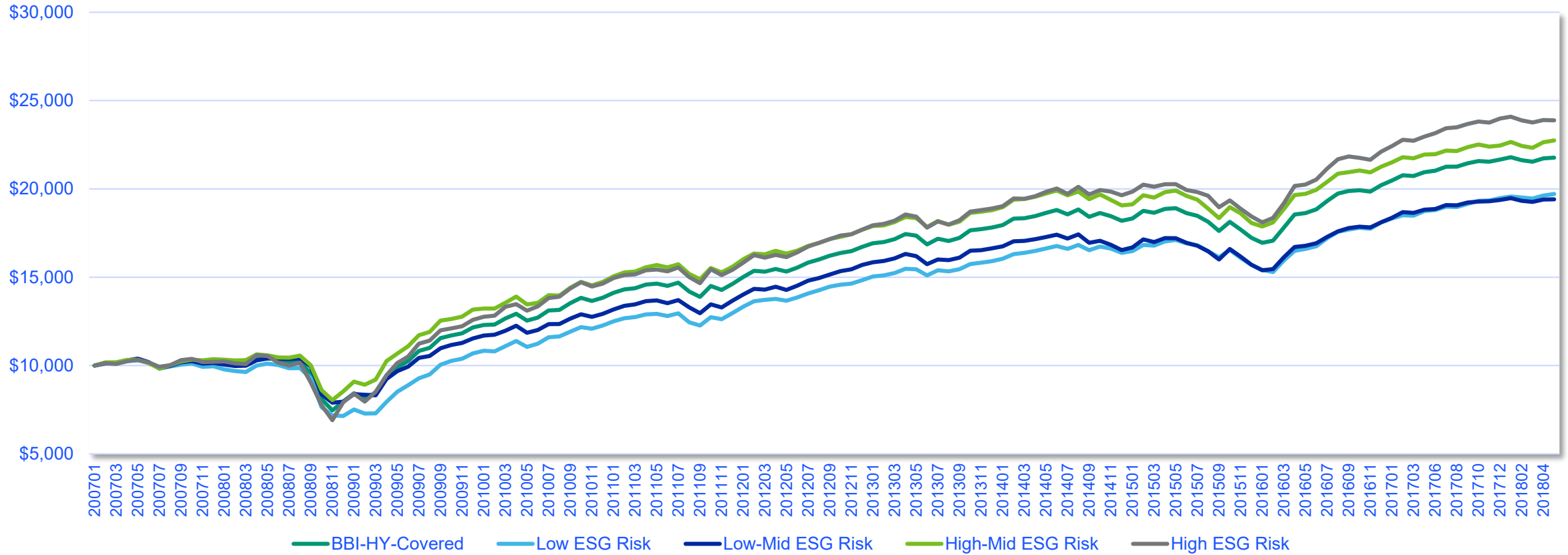


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High Yield Bond Portfolios



Based on highest trailing two-year RepRisk ESG Scores*

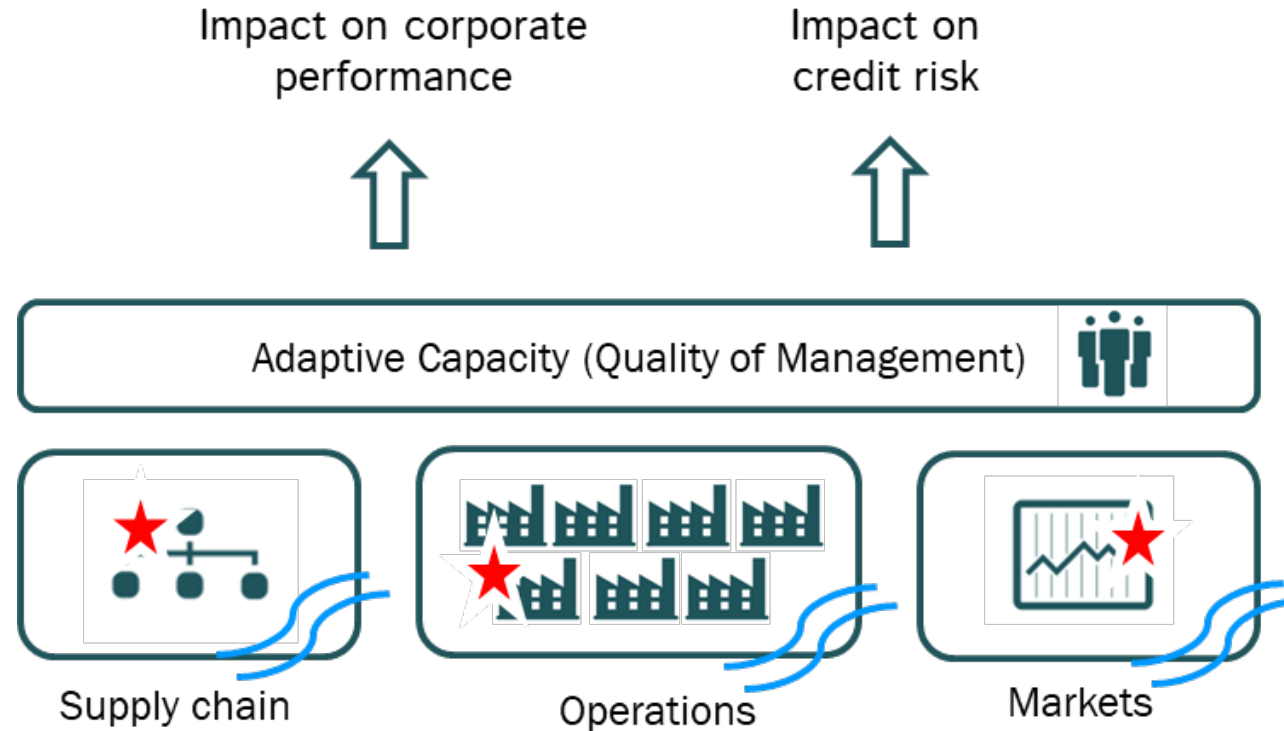


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Climate Analytics: Quantifying Climate Risk

+ Climate Change – Pathways to Performance



★ Direct impacts

- Acute or chronic climate hazards that affect directly corporate operations, supply chain or markets.
- Includes extreme precipitation, heat stress, water stress, cyclones, sea level rise, cold snaps, and winter storms
- Can be measured in physical terms and estimated in financial terms

Indirect impacts

- Climate hazards that affect the broader economic, human or natural environment corporations depend upon
- Transmission pathways from climate hazards to corporations may include ecosystem collapse, migrations, social license to operate, impacts on human health, etc.
- Impacts on the corporate value chain are difficult to predict and quantify

Source: Four Twenty Seven in <https://www.ebrd.com/news/2018/ebd-gceca-publish-recommendations-on-physical-climate-impacts-in-financial-reporting-.html>

+ A Grounded Example



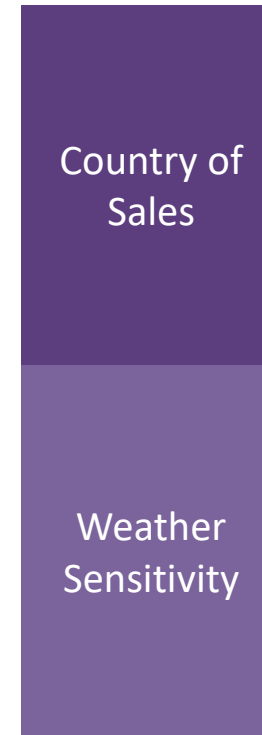
Supply Chain Risk



Operations Risk



Market Risk



*Available 2020

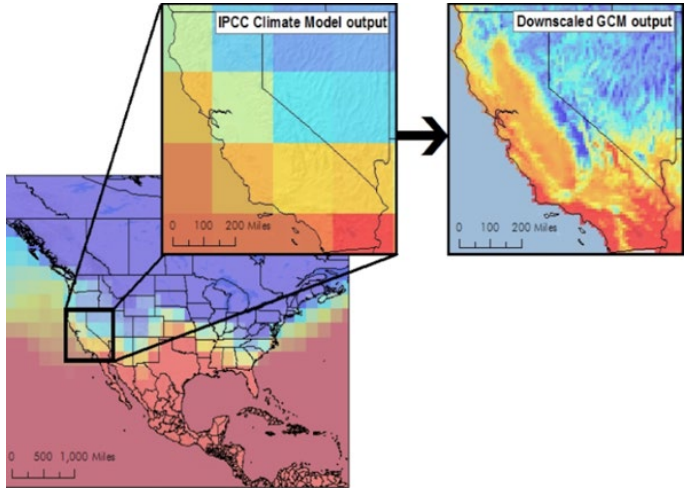
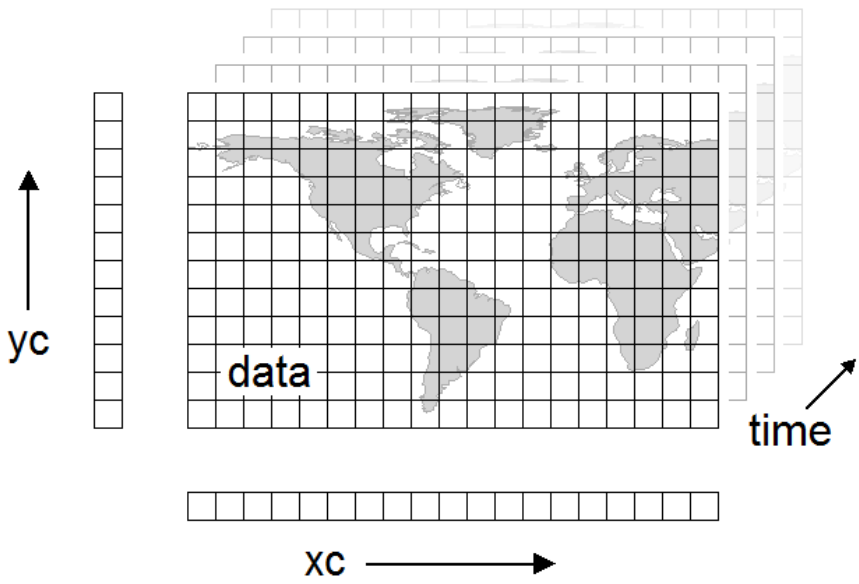


Climate Data Presents Unique Challenges

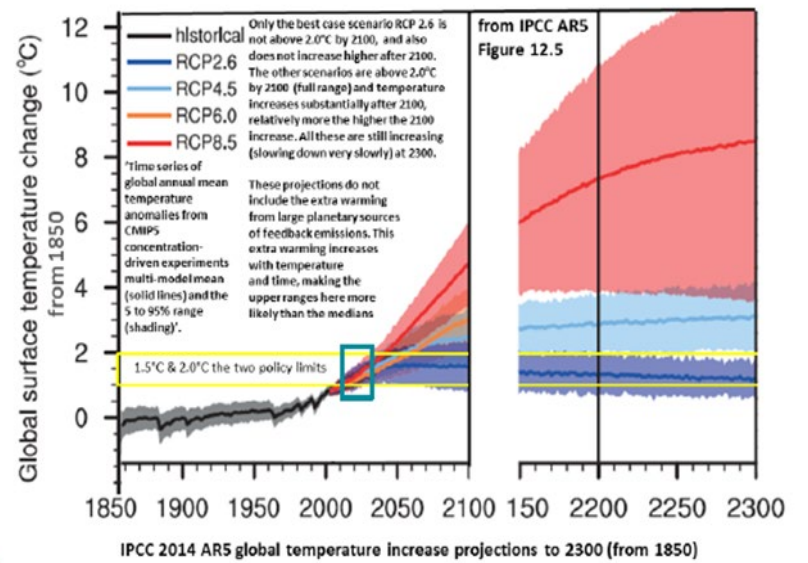
Terabytes of Data

Varying Resolutions

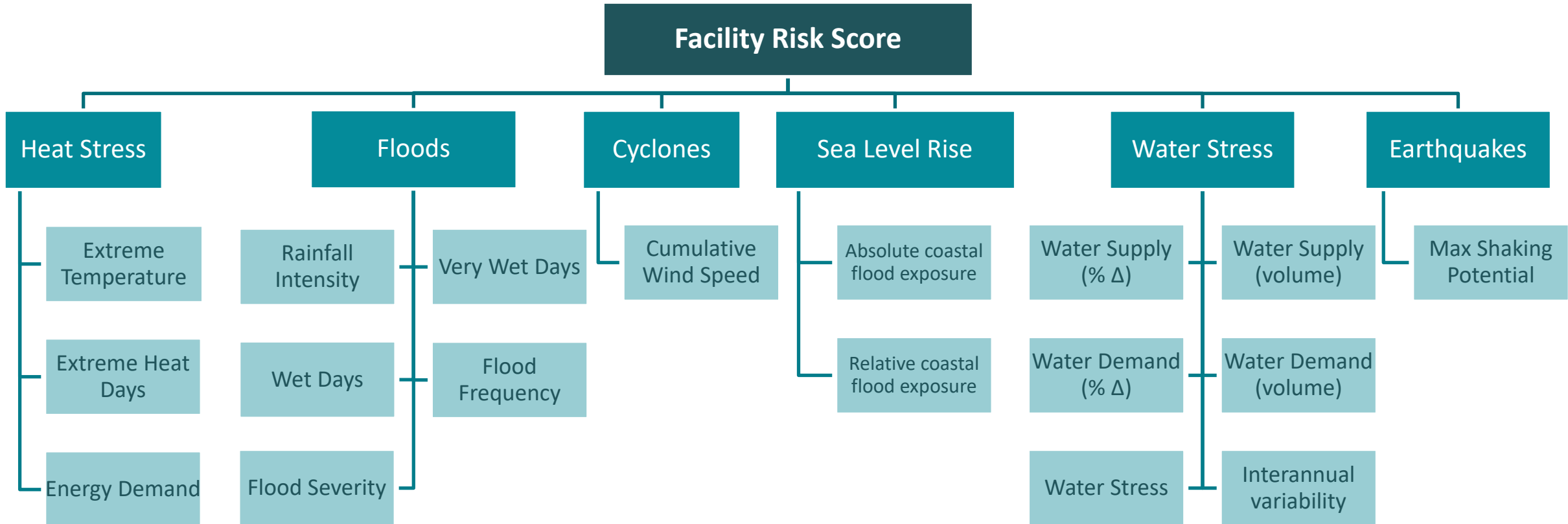
Over A Long Horizon



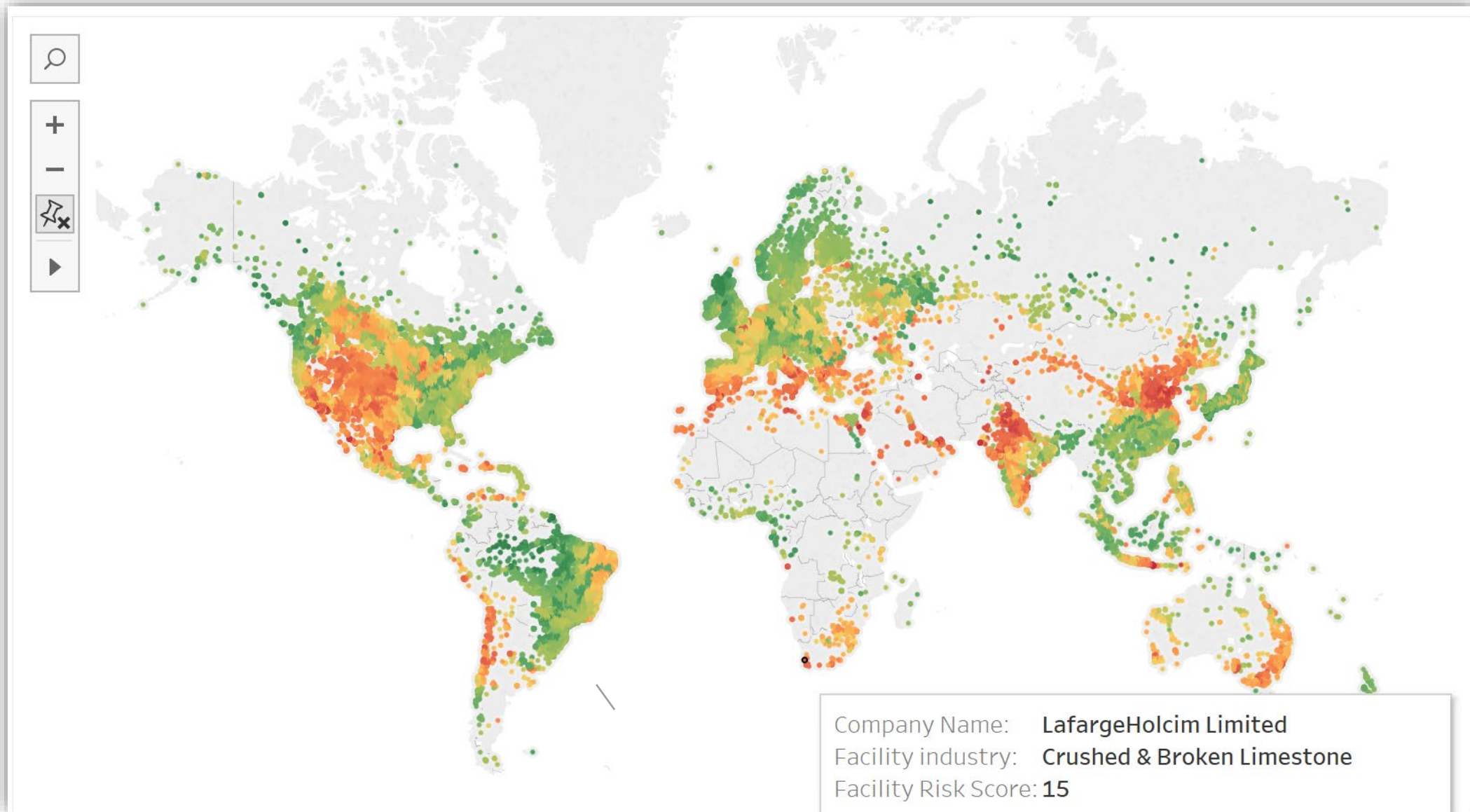
IPCC AR5 temperature increases 1850-2300



+ Risk Indicator Framework



+ Practical Example – Global Water Stress



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The Macro View: Economic Scenarios Based on Climate Change

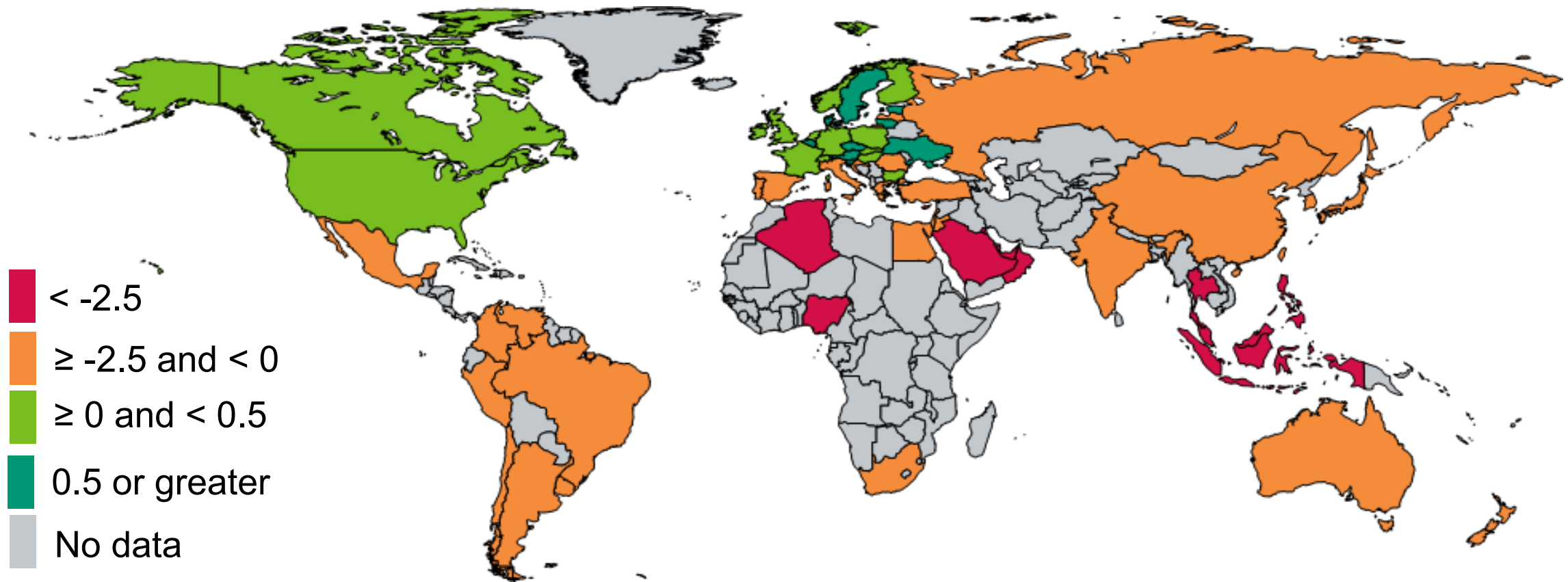
Economic Consequences of Climate Change



- » Macroeconomic growth (productivity, labor force)
- » Regional impacts (e.g. natural disasters)
- » Industry impacts (e.g. travel, logistics, energy, health, agriculture)
- » Residential and commercial real estate (property values)
- » Financial markets and institutions (e.g. bank stress testing)
- » Federal, state, local governments (e.g. revenues, costs)
- » Geopolitical relationships (e.g. refugee flows)
- » Policy responses (e.g. cap & trade, carbon tax)

Africa, Middle East and Southeast Asia Hit Hard

% change in real GDP in 2048 assuming RCP 8.5

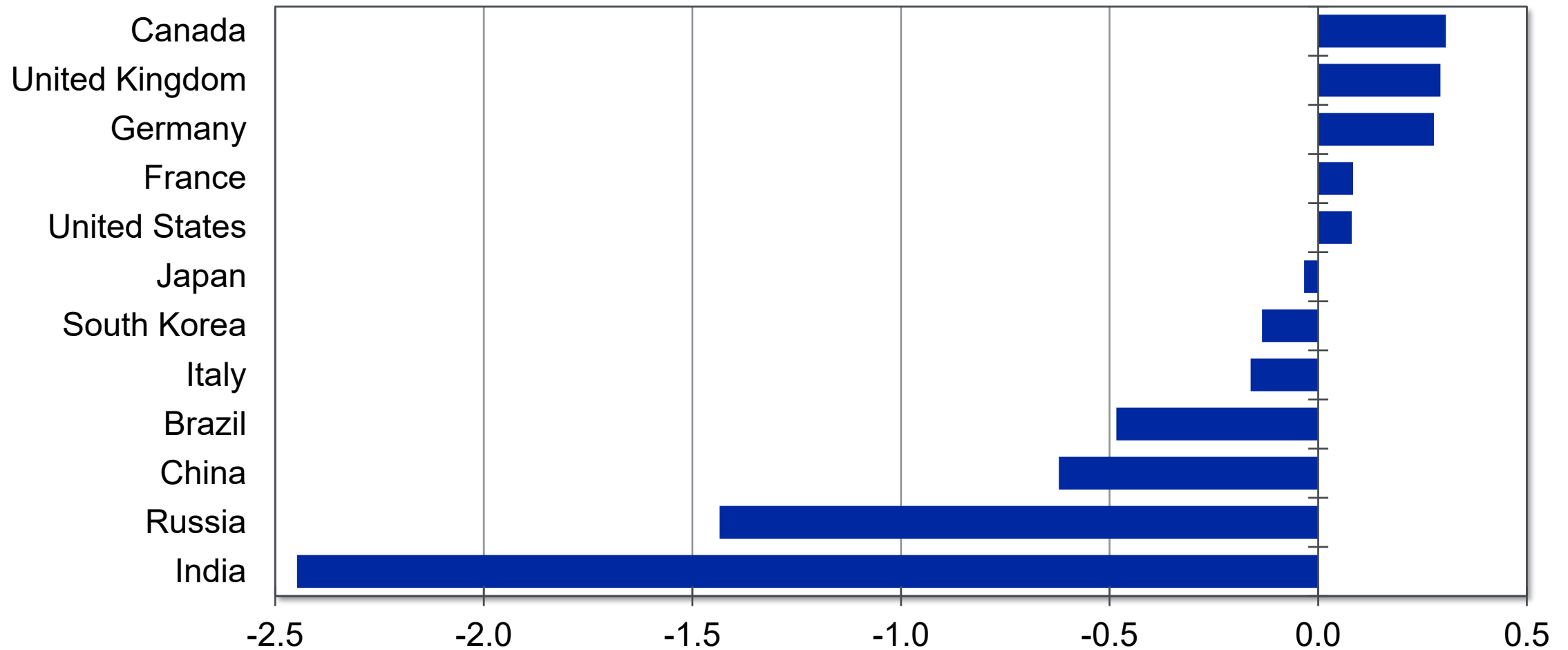


Source: Moody's Analytics

Developed Economies Less Impacted



% change in real GDP in 2048 assuming RCP 8.5

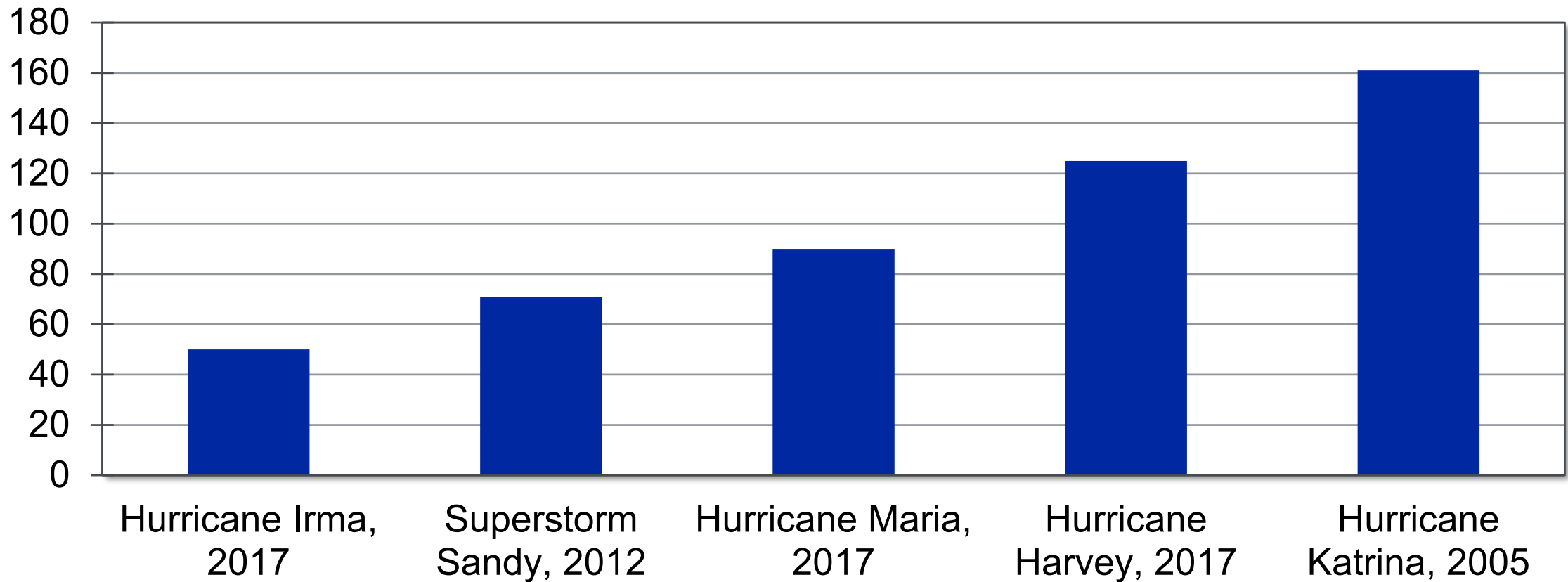


Sources: World Bank, Moody's Analytics

Natural Disasters Are Expensive



Costliest weather events in U.S. history, \$



Sources: NOAA, Moody's Analytics

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The Micro View: Climate Change and Credit Risk Modeling

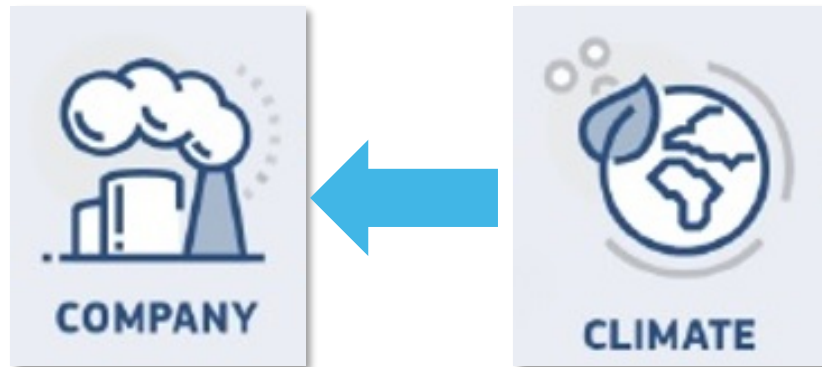
Enterprise Risk's activity in Climate Risk

Ongoing research in climate risk and ESG challenges



Two very different assessments

Climate Risk



Concern for lenders and investors

ESG



Concern for many stakeholders

Climate Risk focus

- » Financial materiality and credit worthiness impacts
 - credit models (European banks)
 - › Scenario conditioning
 - › Inclusion of climate factors
 - › Scorecarding
 - Increasing regulatory pressure for TCFD reporting, globally
- » Primary subject of 427 research

Climate risk modelling and research

Scenario based analyses: critical support for Climate Risk (TCFD) reporting – similar to stress tests



Climate Scenarios

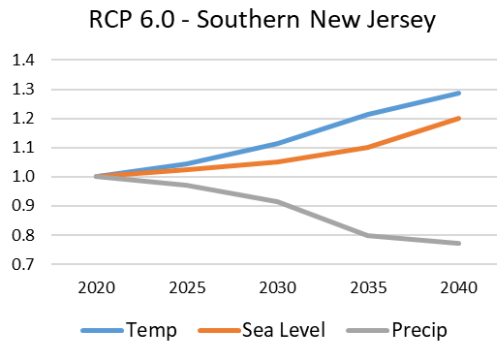
Mapping or conversion

Local macro-scenarios

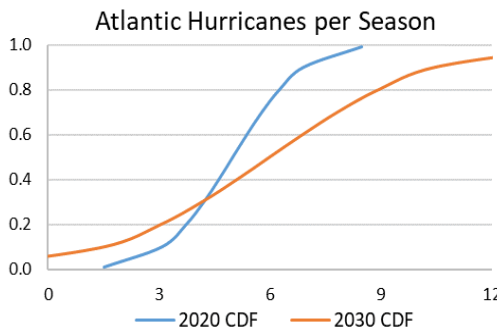
Credit Models

Disclosure & Reporting

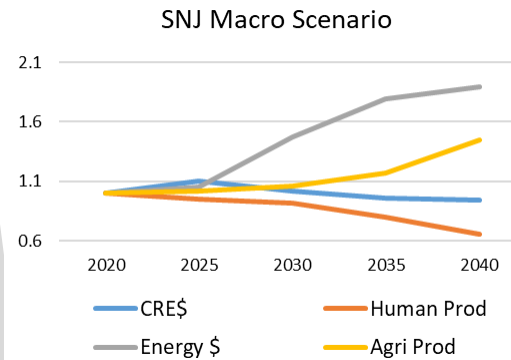
Transition Risks



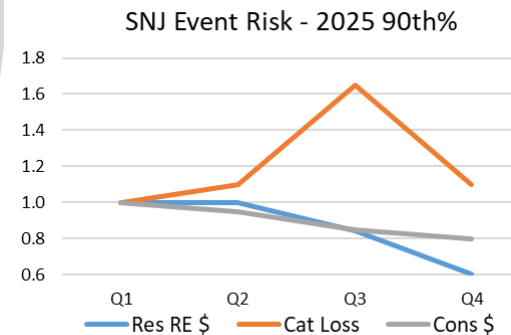
Physical Risks



Econometric or qualitative



Models or Scorecards



Balance sheet
Total loans and leases
Total securities (HTM)
Total securities (AFS)
Total securities
Total assets
Total liabilities
Total equity capital
Aggregated Charge-offs
Total loan and lease net charge offs
Income and Expense
PPNR
Net income
Provisions
Total gains (losses)

Scorecards will bridge the risk modeling gap

Scorecard notching can be applied in the near term, while more data is gathered, and more analytics are developed

Potential Scorecards

Climate Risk Factors
Heat Stress
Wildfires
Extreme Precipitation
Hurricanes
Sea Level Rise
Water Stress
Socioeconomic



Hypothetical Scorecard - Wildfires

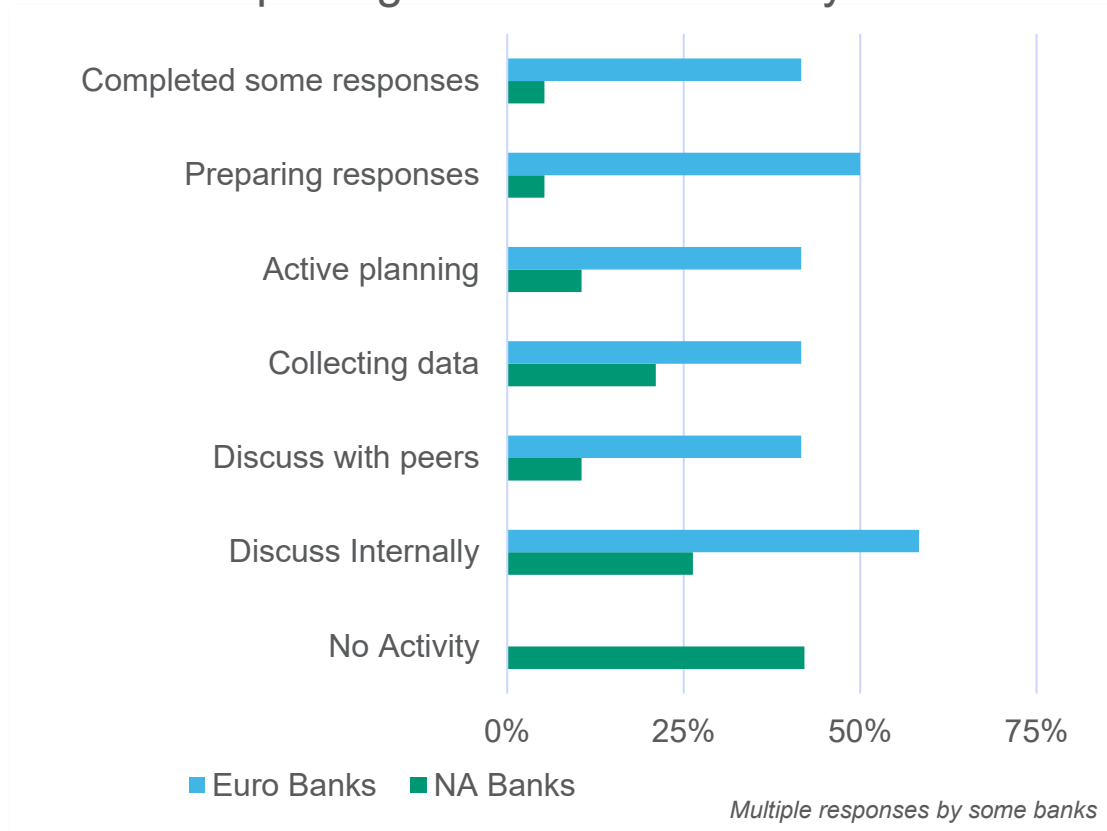
Factor	Weight	Assessment	Score
Location exposure	20%	Direct exposure; 1-2 x / yr	75
Staff displacement	10%	Non-critical	15
Facility Replacement	20%	Fully replaceable; 8-12 mo	50
Business Interruption	25%	Partial redundancy; 6-12 mo	60
Insurance coverage	25%	Structure and contents only	33
Final Score			50

Bank Climate Risk activity varies by region

Distinct differences in North American and European bank preparation

Bank Preparation

Banks reporting Climate Risk activity



Preliminary survey results

- » MA's global banking survey of Climate Risk preparation: early results re TCFD
 - Europe: 2/3 of all responding banks have completed some level of climate risk reporting, remaining 1/3 are preparing
 - North America: 57% of responding banks have done no more than discuss internally
- » Potential regulatory pressure (and voluntary disclosure) in the US?

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Key take-aways

Take-aways



1

ESG tools have become indispensable for many investors and risk managers

2

We now have data-driven, forward-looking climate risk analytics

3

Macroeconomic scenarios and credit-risk tools that capture climate risk are available and evolving

MOODY'S
ANALYTICS

Samuel W. Malone
Senior Director
Moody's Analytics
Samuel.Malone@moodys.com

Michael Denton
Senior Director
Moody's Analytics
Michael.Denton@moodys.com

Frank Freitas
Chief Development Officer
Four Twenty Seven
ffreitas@427mt.com

Cristian DeRitis
Senior Director
Moody's Analytics
Cristian.Deritis@moodys.com

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