Climate services to upscale climate finance

Financing a resource efficient and resilient economy at the local level

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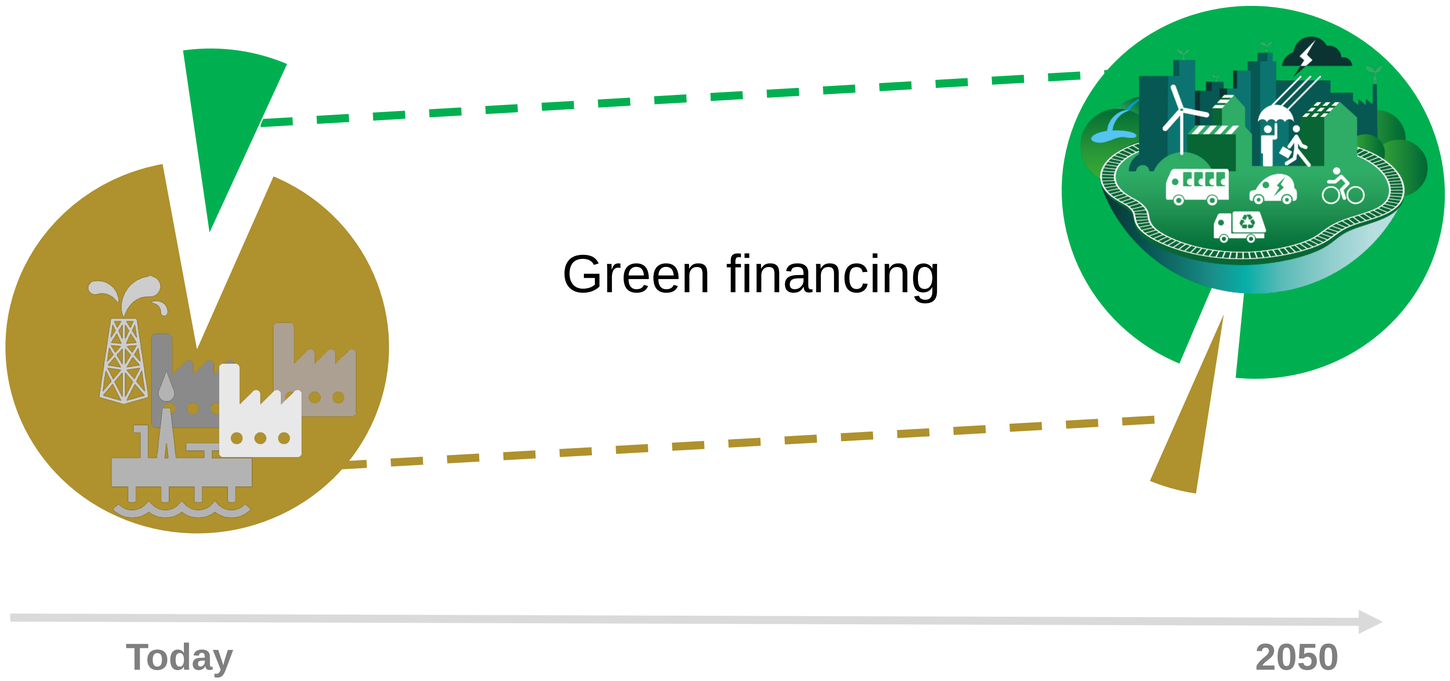
Center for International Climate Research – Oslo (CICERO)

CICERO is an interdisciplinary climate research institute.

- ✓ Contributor to the IPCC since 1992; 6 authors for Assessment Report 6 (AR6) including new Climate Finance chapter
- ✓ A pioneer of science-based climate finance research for investors
- ✓ New company established CICERO Shades of Green

CICERO Climate Finance – financial services for the transition

- ✓Green financing framework second opinions
- ✓Sustainable Edge – Shades of Green for equities
- ✓ClimINVEST – physical climate risk assessment tools and transparency
- ✓Green Asset Wallet – blockchain solutions for impact reporting



CICERO Shades of Green

°CICERO Shades of Green

- ✓10+ years of experience in the green bond market
- ✓ Over 120 issuers and 175 USD billion of bonds reviewed across 5 continents
- ✓Green and sustainability bond reviews

HSBC

THE WORLD BANK

IFC International Finance Corporation WORLD BANK GROUP

ICBC

KFW

Freddie Mac

FannieMae.

The Republic of Indonesia

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Environmental Finance Bond Awards 2019 Winner External assessment provider of the Year

Environmental Finance Green Bond Awards 2018 Winner External assessment provider of the year

Environmental Finance Green Bond Awards 2017 Winner Best external review provider

Green Bond Awards 2017 Climate Bonds Initiative

Green Bond Awards 2019 Climate Bonds Initiative

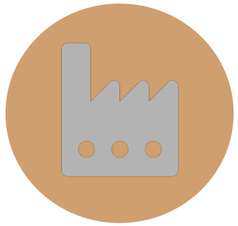
WINNER LARGEST EXTERNAL REVIEWER CICERO

CICERO Rating on Climate Impact and Risk

CICERO Shades of Green	Examples
Dark green is allocated to projects and solutions that correspond to the long-term vision of a low carbon and climate resilient future. Fossil-fueled technologies that lock in long-term emissions do not qualify for financing. Ideally, exposure to transitional and physical climate risk is considered or mitigated.	 Wind energy projects with a strong governance structure that integrates environmental concerns
Medium green is allocated to projects and solutions that represent steps towards the long-term vision, but are not quite there yet. Fossil-fueled technologies that lock in long-term emissions do not qualify for financing. Physical and transition climate risks might be considered.	 Bridging technologies such as plug-in hybrid buses
Light green is allocated to projects and solutions that are climate friendly but do not represent or contribute to the long-term vision. These represent necessary and potentially significant short-term GHG emission reductions, but need to be managed to avoid extension of equipment lifetime that can lock-in fossil fuel elements. Projects may be exposed to the physical and transitional climate risk without appropriate strategies in place to protect them.	 Efficiency investments for fossil fuel technologies where clean alternatives are not available
Brown is allocated to projects and solutions that are in opposition to the long-term vision of a low carbon and climate resilient future.	 New infrastructure for coal

Sustainable Edge: How are corporate activities contributing to the transition?

Dark Brown



Light Brown

Light Green

Medium Green

Dark Green

"We need a common taxonomy to help financial markets rigorously identify environmental outperformance and to direct investment accordingly. The EU's green taxonomy and the green bond standard are good starts, but they are binary (dark green or brown). **We need 50 shades of green."**

- Mark Carney, Governor – Bank of England

Draft communication templates

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Yara *(2017-2018)*

Yara International ASA was one of the first and is the world largest producer of mineral nitrogen fertilizer. The company also encompasses the production of nitrates, ammonia, urea and other nitrogen-based chemicals. The company is listed on the Oslo Stock Exchange and has its headquarters in Oslo. The company has around 13,000 employees, production sites on six continents, operations in more than 50 countries and sales to about 150 countries.

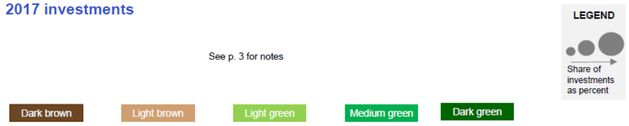
Industry (sector)
Chemicals (Materials)

Regions
Global with production sites on six continents

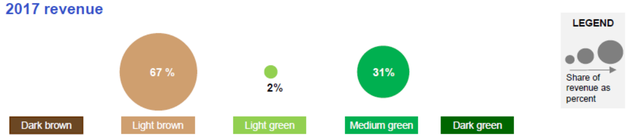
Shading investments and revenue

The Shade of Green or Brown allocated to a revenue stream or investment is a reflection of how aligned the underlying activities are to a low carbon and climate resilient future. See notes and methodology page for further details on shading.

2017 investments



2017 revenue



See p. 3 for notes on shading

KEY ANALYST QUESTIONS

GOVERANANCE

1. Does Yara have plans to increase its share of production using low emission technology such as N2O catalyst technology for all its products?
2. How do you define green and which products would you define as green? Do you have other activities that you define as sustainable?
3. Does Yara have risk management strategies for managing physical climate risks?
4. Which scenarios/assumptions do you use to assess climate risks
5. Do you foresee changes in sold products due to climate change?

ACTIVITIES

1. What were your 2017 total investments, total R&D and R&D targeted for environmental improvements? We see that Yara has stated that then 10% of investments are "sustainable". Is it possible for Yara to be more accurate on the share of sustainability? Is it 2% or 8%?
2. What are the investment/revenue numbers related to the products/activities you define as green?
3. What are the investments toward promote/increase the share renewable energy/fuels used for production?
4. What are the emissions per product/product group? We see a number of emissions reducing initiatives in the 2015 CDP response, have these been implemented? Which quantitative metrics are considered/would Yara like to consider to compare its environmental performance in the sector?

Key issues: Today, agriculture causes about one quarter of global greenhouse gas (GHG) emissions, with land use change originating from agricultural expansion being the main culprit. The manufacturing of mineral fertilizers contributes to GHG emissions, but they are also vital in limiting the need to expand farmland.

Climate change is recognized as a strategic risk by Yara, with implications for regulations, markets and operations. Yara's most significant initiative to reduce GHG emissions so far is the development and installation of N2O catalyst technology at its nitric acid plants. This technology removes about 90% of the N2O emissions in Yara's plants, and is also commercially available to third parties. Due to the significant reductions in GHG emissions from catalyst technology, Yara can offer low-carbon nitrate fertilizers. Use of nitrogen fertilizers represents both a substantial part of the indirect energy consumption and the potential environmental impact of farming. The production of other fertilizers and industrial chemicals are posing a climate risk – they involve greenhouse gas emissions in the production and in the application of the product due to soil emissions from microbe metabolism.

← **Investments**

← **Revenue**

← **Key analyst questions**

Climate Risk Awareness and Management

Scenario analysis is used to analyze how different future states can impact a business. In the context of climate risk, scenario stress testing is useful for analyzing some risks and timeframes. To prepare for transition risk and long term physical impacts, investors should consider a range of scenarios from 2ºC to 4ºC. We do not need elaborate scenario testing to prepare for physical climate change over the next 10-20 years.

Use of scenarios

1. Conducts climate scenario analysis of own activities? ☐
2. Conducts climate scenario analysis largely in line with TCFD recommendations ☐
3. Is transparent and coherent in its scenario assumptions? ☐

Climate regulations

1. Has an understanding of potential future climate-related regulations ☑
2. Has a process for analyzing impact of potential regulations ☑
3. Disclosure of climate related risks and management ☐

Key immediate physical risks

- Strong winds and intense tropical storms can damage infrastructure
- Flood events can damage infrastructure and disrupt supply chains
- Droughts: Access to water is essential in the production process.

Risk management

1. Has an understanding of which extreme weather events are likely in its area of operations ☑
2. Has a process to identify the exposure of its facilities to physical risk ☐
3. Includes physical risk exposure into the design of its physical assets ☐
4. Analyses potential physical risk impacts on external suppliers ☐

← **Physical and transition risk management**

General metrics		2017
Green Innovation	Green R&D / Total R&D	< 10%
Green Transformation	Green investments / total new investment	*TBD*
Green Growth	Green revenue / total revenue	*TBD*
Green Financing	Green bonds / total outstanding bonds	*No green bonds*
Sector specific metrics		**2017**
Emissions intensity	GHG emissions / total sold products	*0.42* (tonnes CO2eq/ *tonnes of products*)
Emissions Intensity	GHG emissions / revenue	*0.16* (tonnes CO2eq/ *1000 NOK*)
TBD	TBD	TBD

Please comment - what does Yara see as the most relevant climate-related metrics?

← **Key sector metrics**

Targets and transparency on Climate Risk

✓ Yara has a climate change strategy
✓ Yara has set emission intensity targets
✓ Yara has not yet conducted scenario analysis
✓ For its European facilities Yara is covered by the EU ETS and operates with an internal price on carbon

- ☑ Disclose in annual report
- ☑ Sustainability reporting
- ☑ Other: CDP report

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The **Green Assets Wallet** is a technology innovation that injects efficiency and trust into the green debt market

Trust

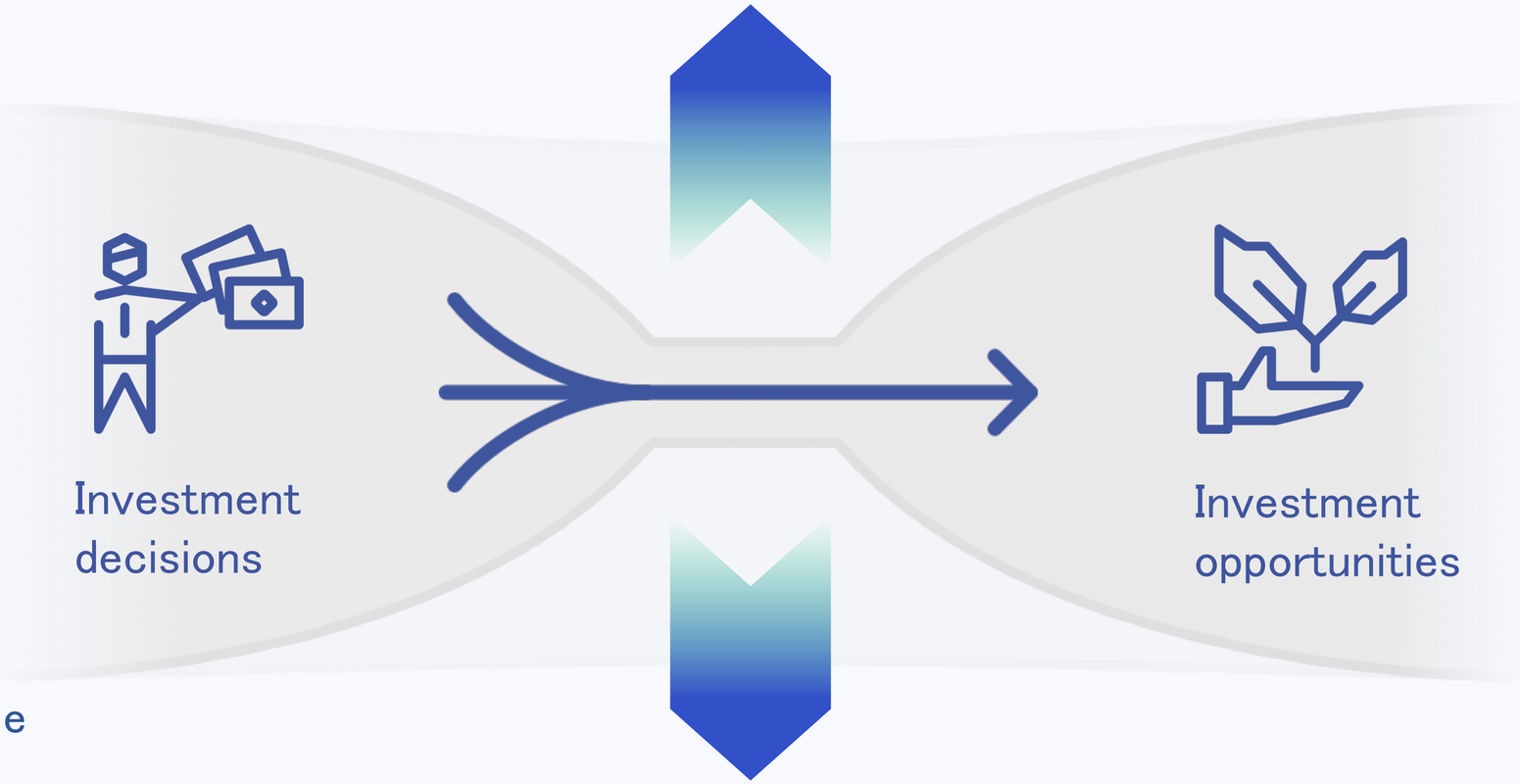
Building credibility and trust for investors and issuers

Impact

Simplified reporting on green impact of investments

Validation

Cost effective and immutable validation of green investments



The Green Assets Wallet targets the bottleneck between supply & demand

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Climate risks are financial risks

Investors expect increased losses from physical impacts of climate change

→ Global losses from extreme weather rose by 86% from 2007 to 2017
(EU Commission)

→ Over 50% of total flood costs studied in the US and Nordic region were not covered by insurance
(CICERO, Flood Risk for Investors)

"PG&E: The First Climate-Change Bankruptcy, Probably Not the Last"

Wall Street Journal (May,2019)

FSB's TCFD recommends disclosure of climate risk

TCFD TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES

Physical climate risk service providers:

THE WORLD BANK

south pole

CARBON DELTA

MERCER

427 Four Twenty Seven Climate Solutions

ACCLIMATISE building climate resilience

WORLD RESOURCES INSTITUTE

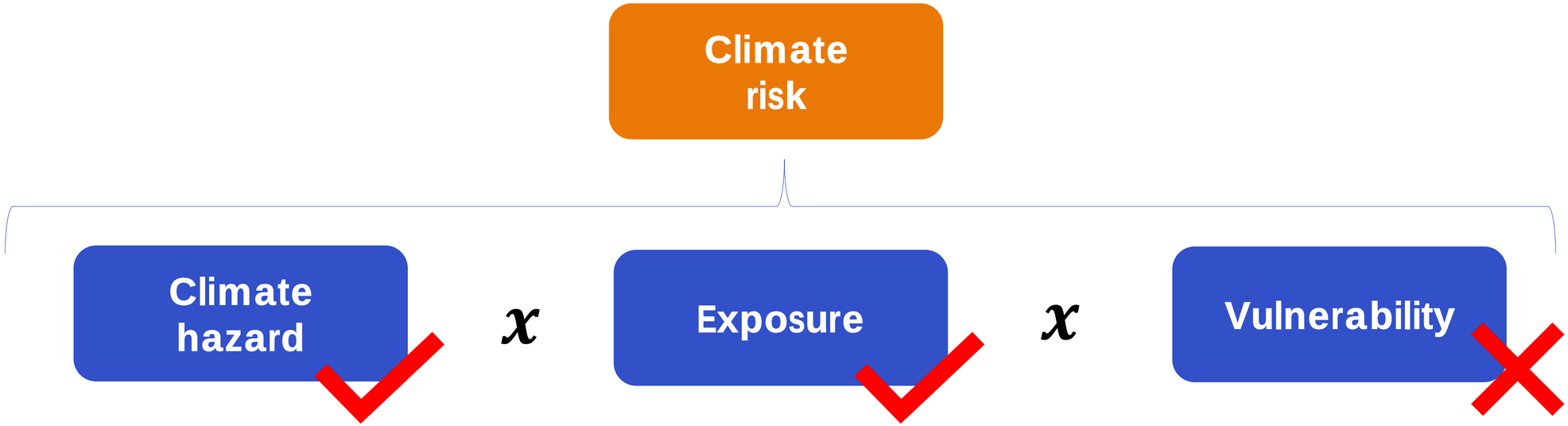
Trucost ESG Analysis S&P Global

carbone 4

European Bank for Reconstruction and Development

Physical climate risk =

$$f(hazard\ x\ exposure\ x\ vulnerability)$$



Climate data
- Chronic versus acute hazards
- Climate models, resolution, scenarios

Probability
- Climate projections

Asset location and hazard distribution
- Climate hazard maps

Sector materiality, asset sensitivity and adaptive capacity
- Impact chains
- Building materials, soil subsidence, topography
- Insurance coverage, early warning systems, rainwater or flood management systems

ClimINVEST objectives

Help investors responding to TCFD – physical risk.

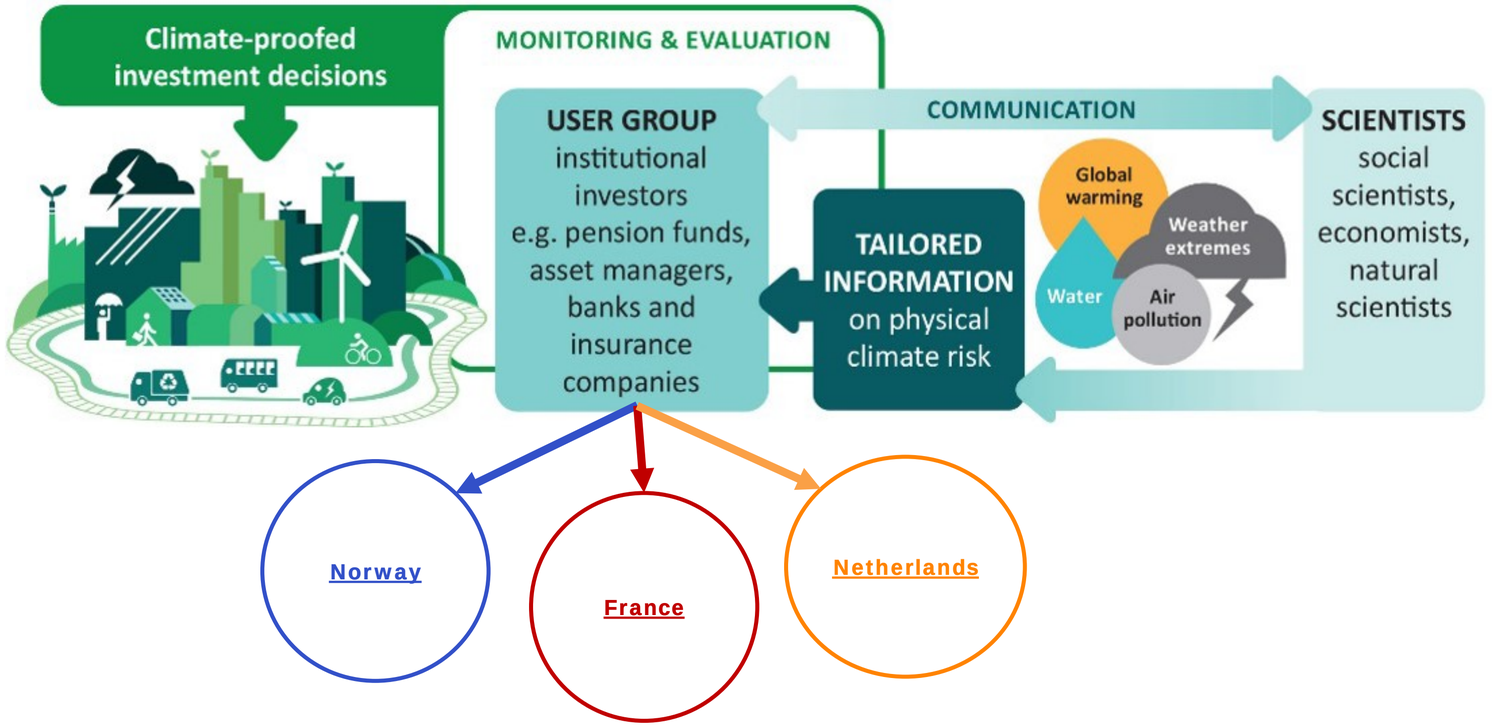
- Climate, physical and financial indicators
- Sector materiality
- Impact chains linking climate with finance

Shed light on climate risk assessment services.

- Transparent methodology
- Publicly available data
- Disclosure of uncertainties and constraints

ClimINVEST

Better tools for climate-proofed investments



Research consortium

°CICERO
Center for International Climate Research

carbone 4

WAGENINGEN
UNIVERSITY & RESEARCH

Climate Adaptation Services

I4CE
INSTITUTE FOR CLIMATE ECONOMICS

METEO FRANCE

2017 — Understanding user needs and identifying gaps

2018 — Co-design relevant indicators on climate risk

2019 — Mapping and visualizing risk for investors

2020 — Evaluate, synthesize and raise awareness

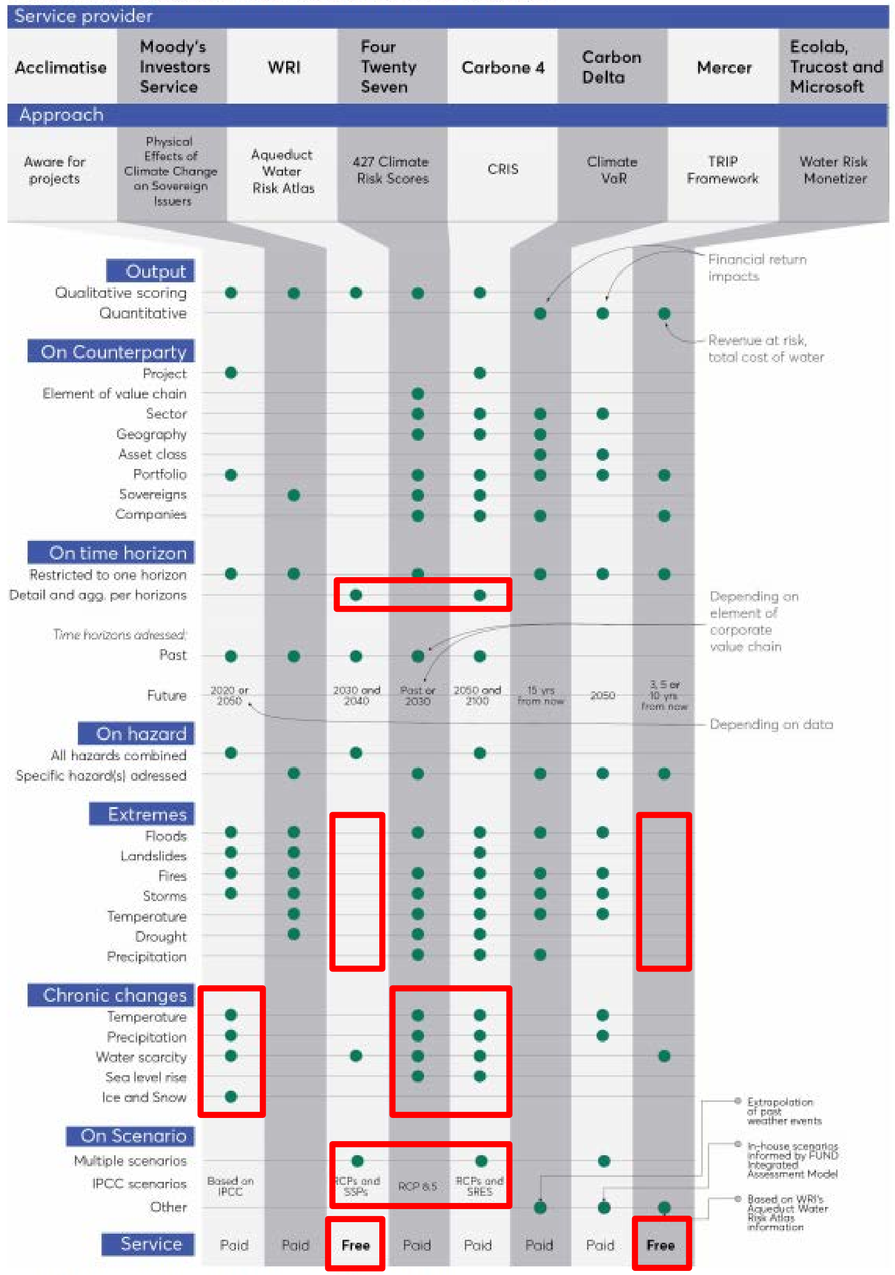
Phase 1 results: user needs and existing approaches

Physical Climate Risk: Investor Needs and Information Gaps, 2019 – conclusions

Take aways:

- Publicly available approaches only water scarcity
- **Scenarios.** WRI and Carbone 4 give scenario options over multiple time horizons
- **Time horizons.** WRI, 427 and Trucost include 10 year time horizon
- **Hazards.** 427, Carbone 4 and Acclimatise include chronic changes
- Limited disclosure of climate data, asset vulnerability, and methodologies

Table 1. Details of available approaches on physical climate risk analysis



*) Note that Carbone4 is a research project partner in the ClimINVEST project.
**) Ecolab, Trucost and Microsoft are referred to collectively as "Trucost".
Source: I4CE (2018).

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Phase 2: Identify, calculate and map climate hazard indicators

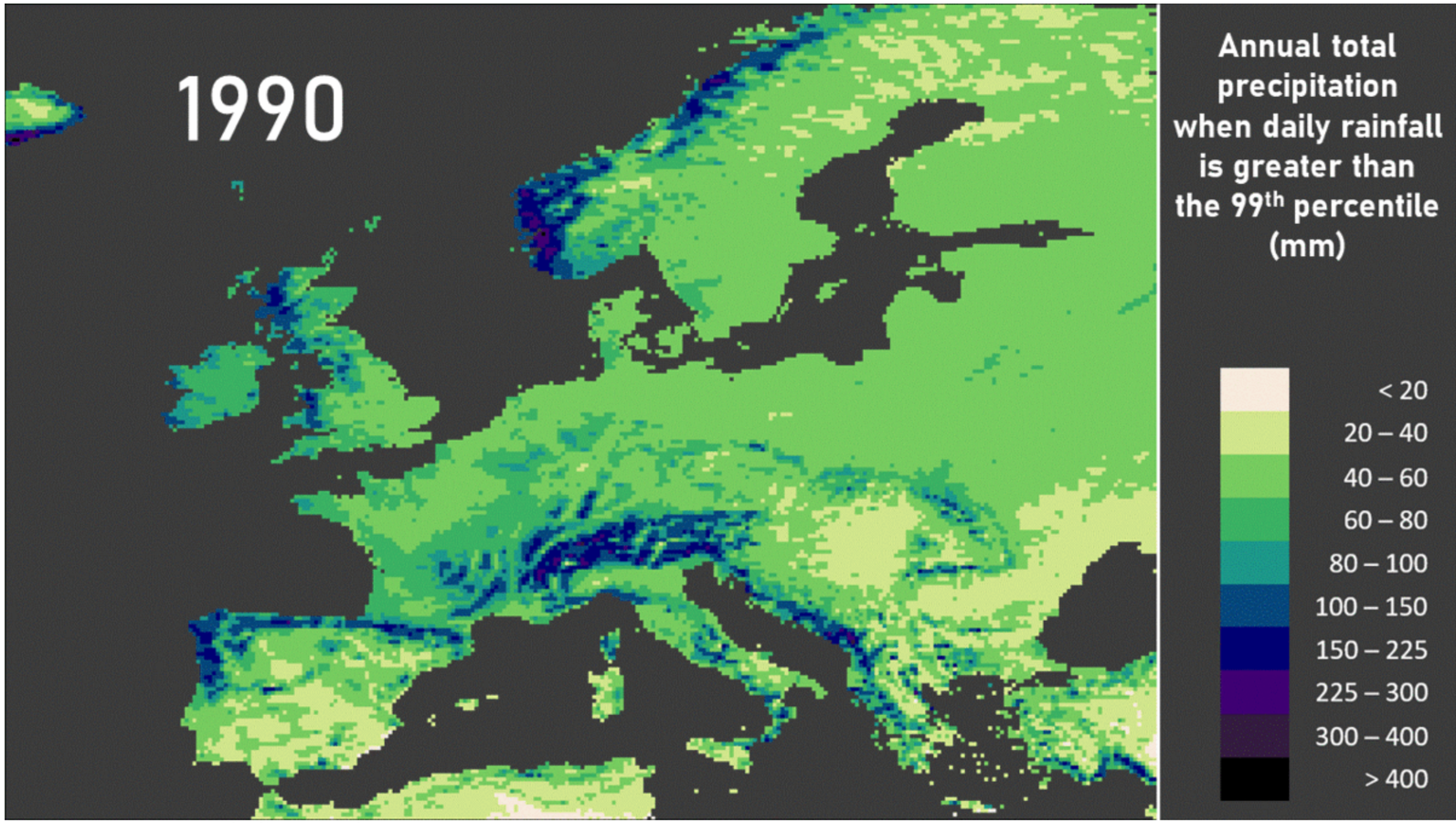
Hazard	Indicator
Baseline	Average temperature per day/night for winter/summer (winter = December, January, February. Summer June, July, August)
Cold temperature trends	Frequency of days where max temp is under absolute threshold (0 D) (Ice Days)
Hot temperature trends	Frequency of days where minimum temperature is over absolute threshold (35 C)
Heat/cold wave – duration	Heat/cold wave duration (in days) - CSDI and WSDI
Heat/cold wave – magnitude	Heat/cold wave magnitude (in days) (max or min temp of the heat/cold wave and length)
Heat/cold wave	HDD – heating degree days
Heat/cold wave	CDD – cooling degree days
Flood / storm surge – chronic	Frequency of very wet days (>20mm) expressed in percentile (95th)
Flood / storm surge – chronic	Frequency of extremely wet days (>20mm) expressed in percentile (99^{th}) R99p
Flood / storm surge - acute	Consecutive number of extreme wet days (CWD) - RX5day
Flood / storm surge - acute	Maximum daily rainfall RX1day
Flood / storm surge – acute	Maximum daily rainfall over 5 days (RX5day)
Flood / storm surge - chronic	Total wet day precipitation PRCPTOT
Droughts – acute	Consecutive dry days CDD
Droughts - chronic	Maximum length of dry period - # of dry days (NDD) and # of wet days (NWD)

e.g. mapping intensity of extreme precipitation over time in Europe, BAU (RCP 8.5)

- ✓ **Climate hazard:** extreme rain bursts
- ✓ **Probability:** high

e.g. Norway - summer seasons will be drier overall, but have more very intense short bursts of rain

- ✓ **Exposure:** (depending on asset location)
- ❑ **Vulnerability:** X



Source: CICERO and Climate Adaptation Services
**Year is the middle of the 20 year span, so 1990 = 1981-2000, 2020=2011-2030, 2040=2031-2050*

e.g. Heatwave impacts

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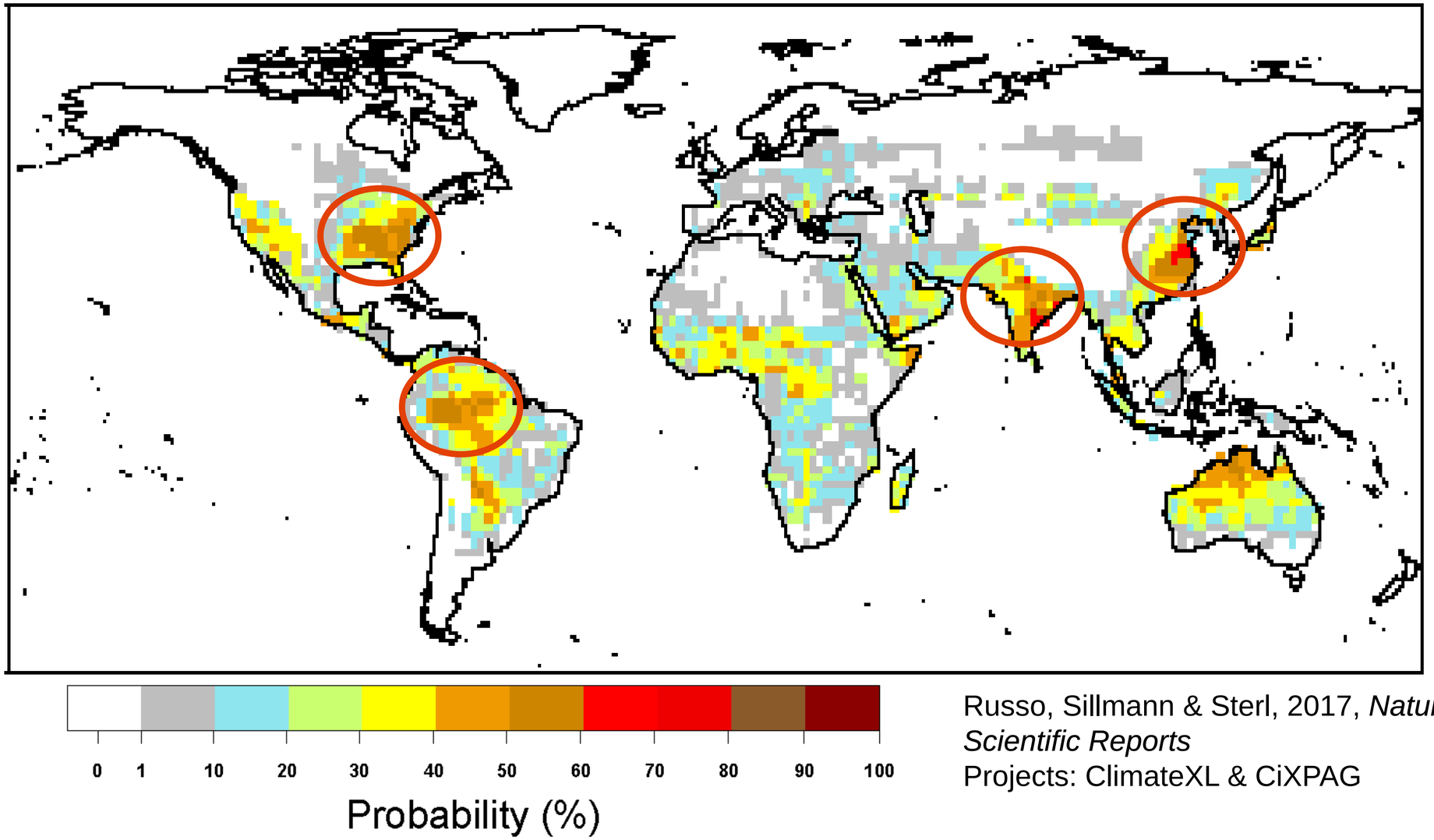
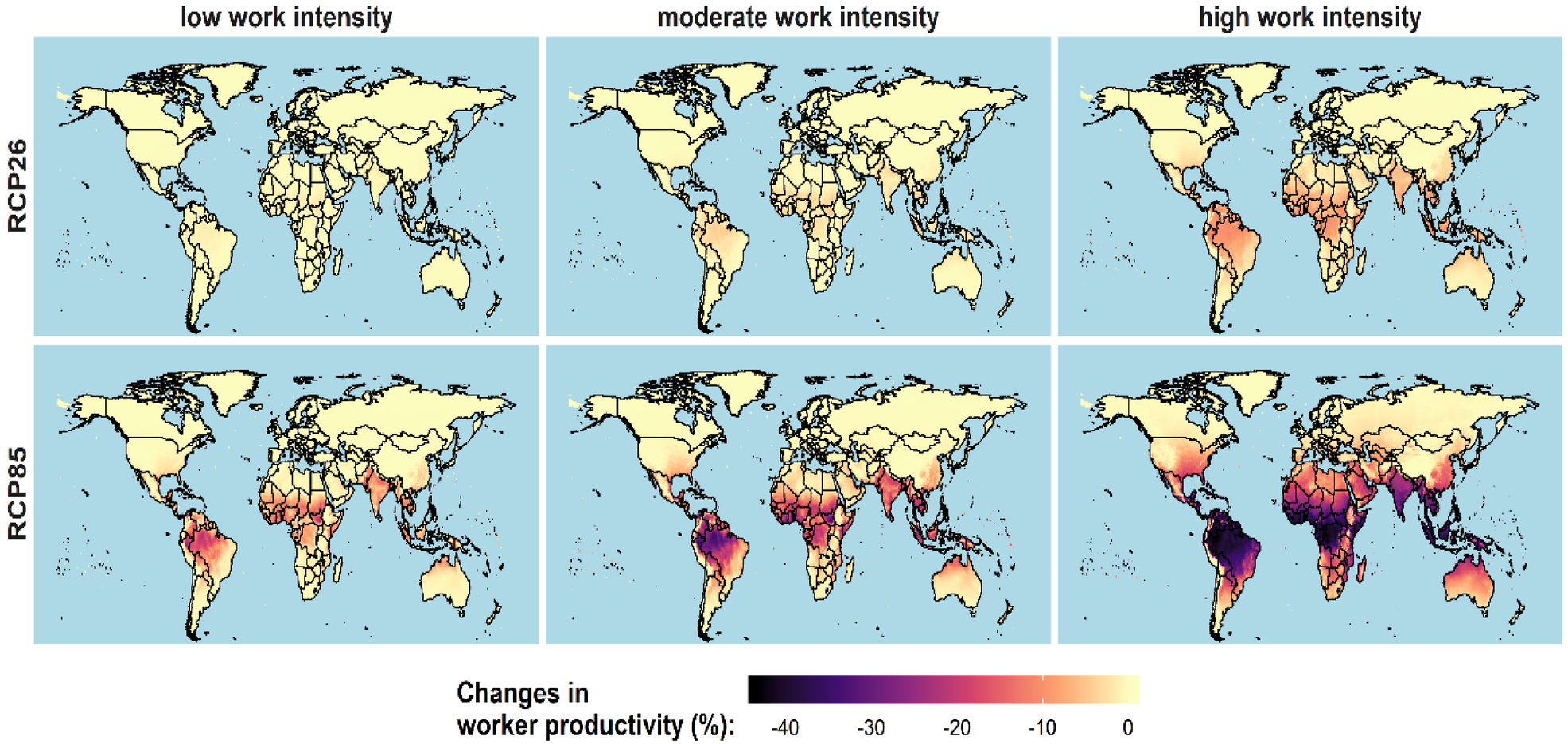
Hot spot regions



Russo, Sillmann & Sterl, 2017, *Nature Scientific Reports*

Projects: ClimateXL & CiXPAG

Heat impacts on worker productivity



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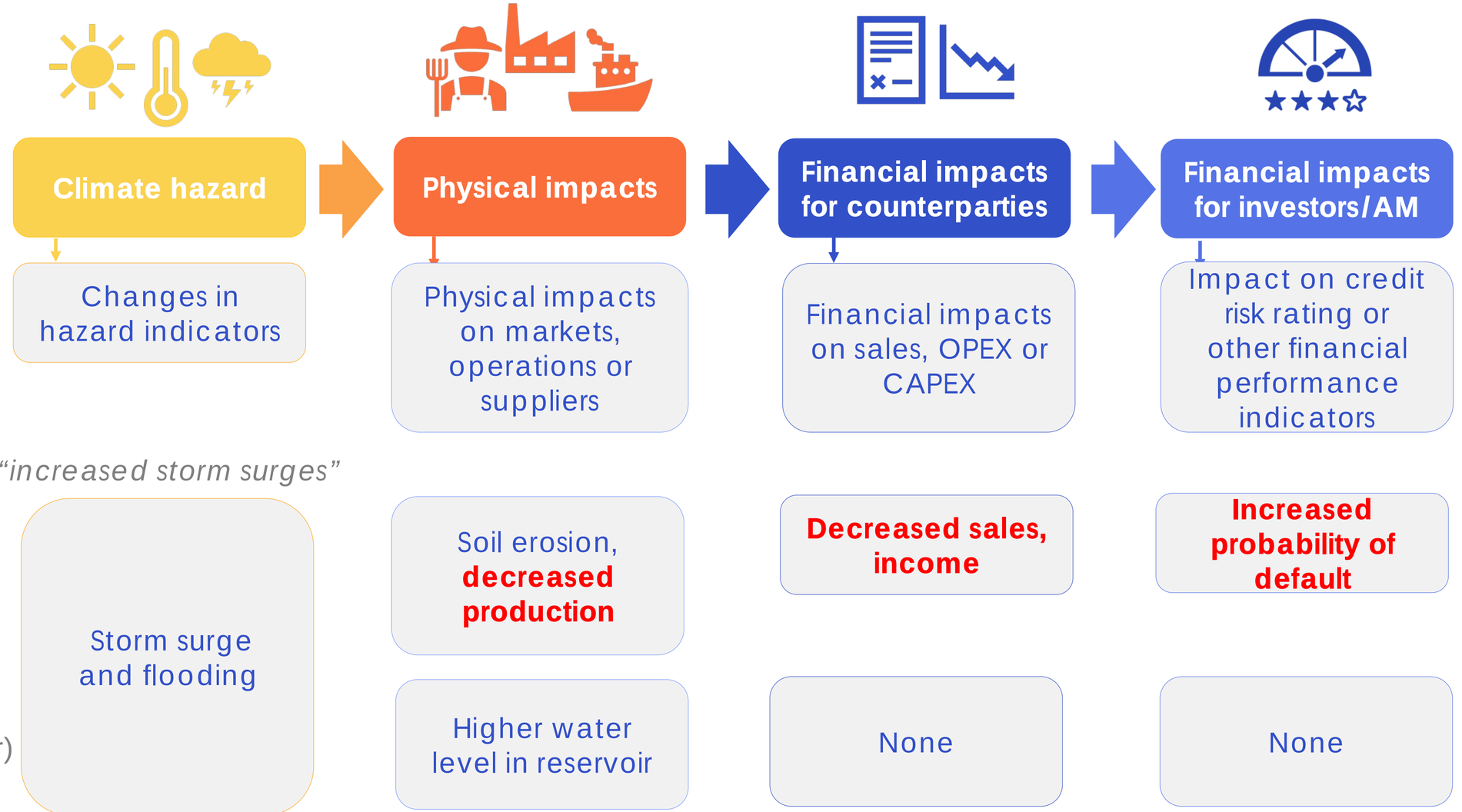
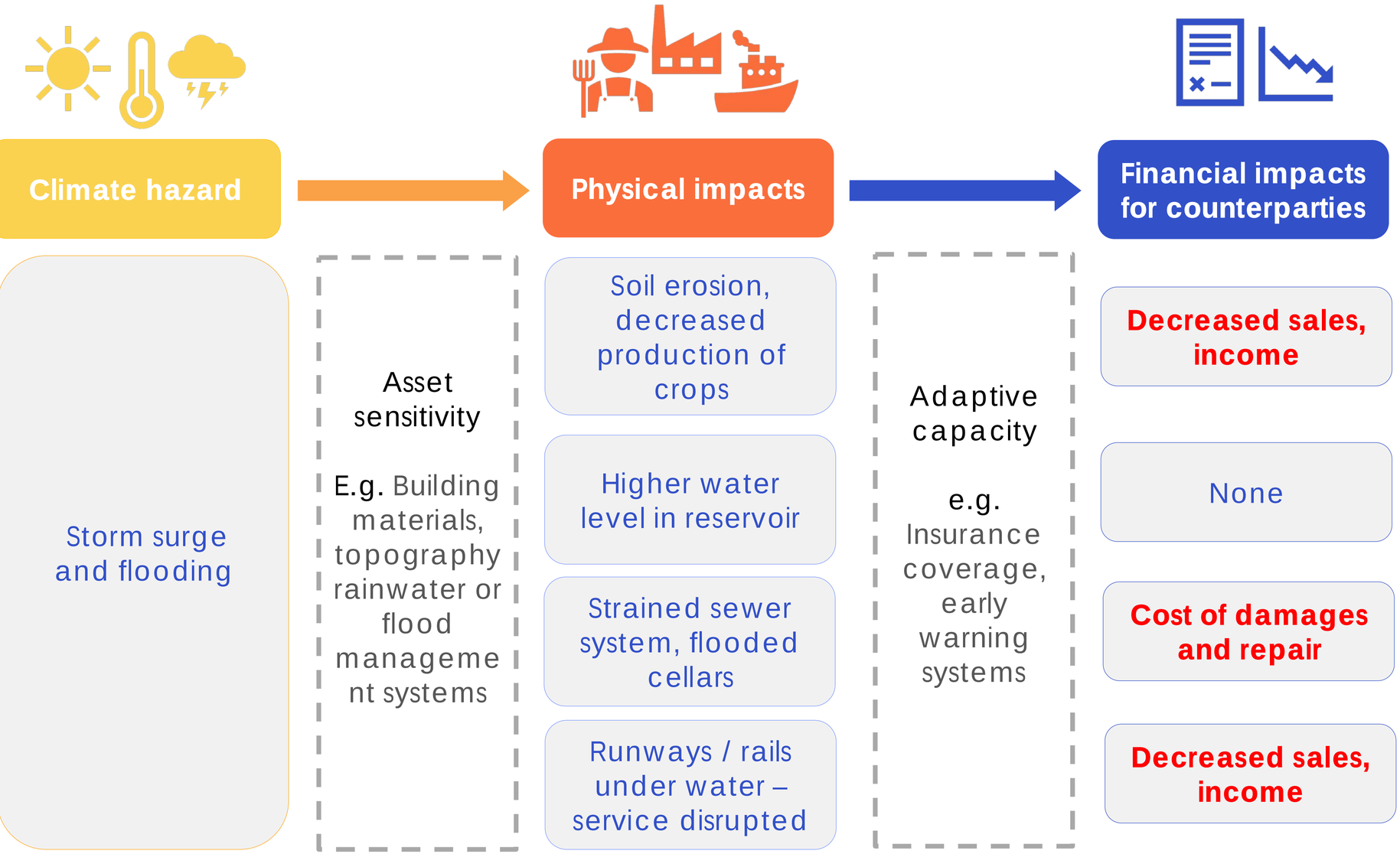
Orlov, Sillmann, Aunan, Aaheim etc. 2019 (sub. in *GEC*)
Project: ClimINVEST & EXHAUSTION

Impact chains for vulnerability assessment



Source: Carbone 4 and CICERO

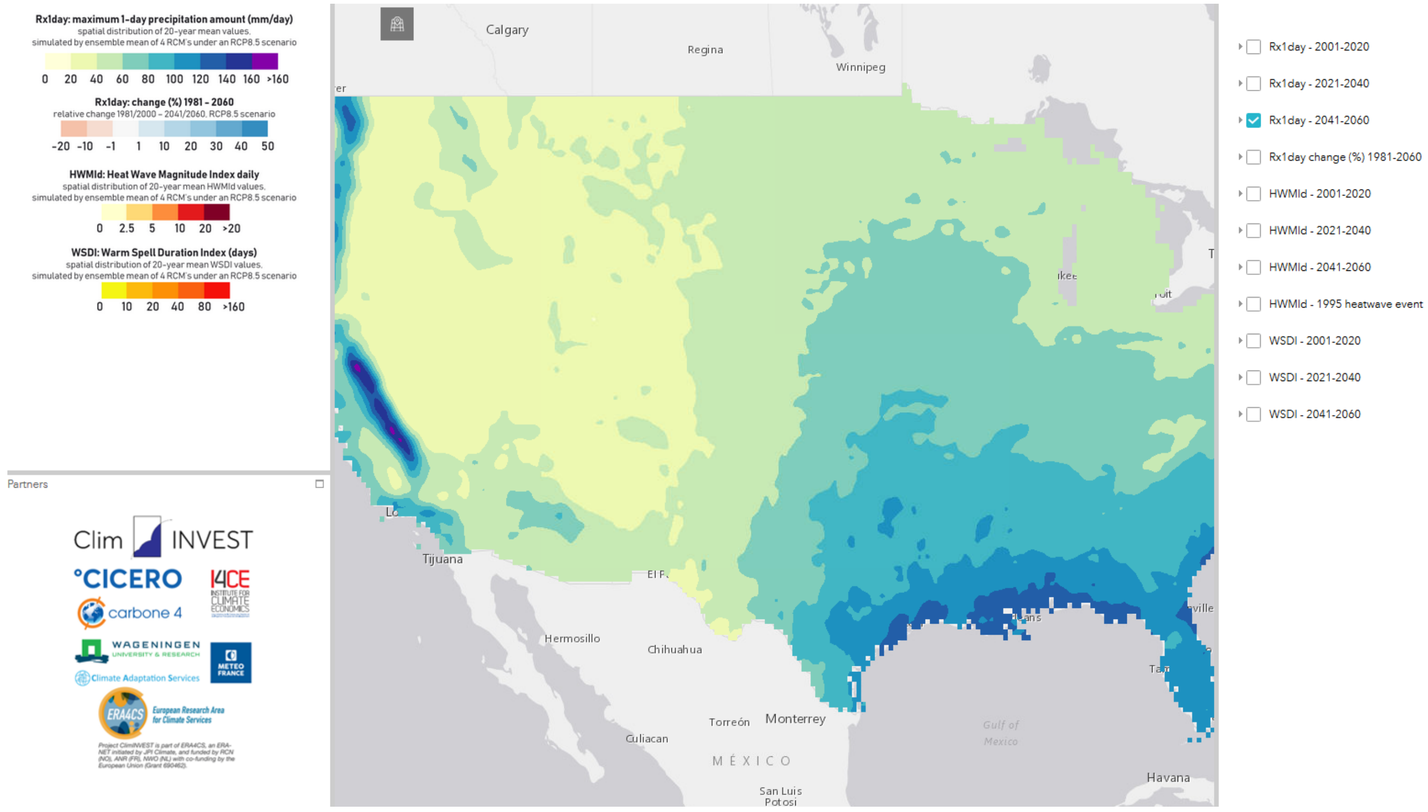
Vulnerability continued -



Source: Carbone 4 and CICERO

What’s next

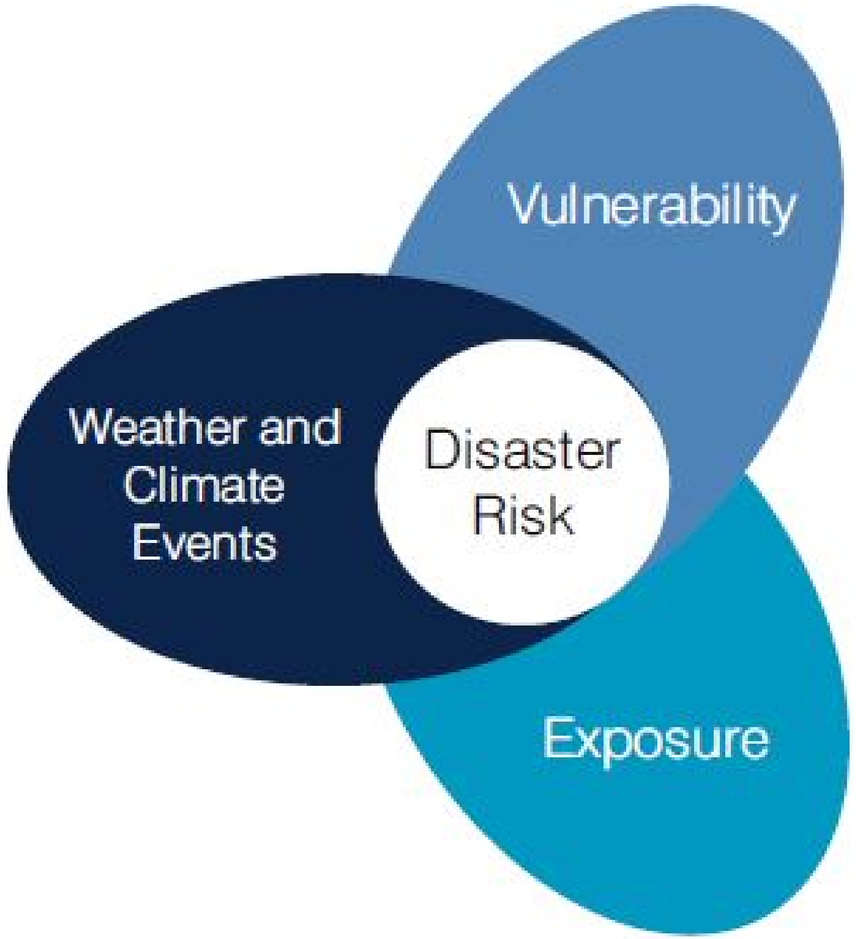
- **Climate hazard maps -** business as usual and best case scenarios for EU
- **Impact chains.** Link climate hazard to financial impact
- **Suite of fact sheets and case studies**
  - Calculating climate risk
  - Time horizons
  - Impact chains and sector materiality
  - Key concepts and indicator dictionary
  - Droughts, heat stress, flooding and storm surges
- **Investor feedback workshops in Oslo, Rotterdam, Paris**



Interactive atlas developed by ClimINVEST partner CAS for a Dutch user pilot project

Interim take aways

- Translation services between scientists and investors are needed.
- Existing services are not transparent and raise questions about coverage.
- Climate hazards should be weighted according to materiality / sensitivity.
- Investors want decision support and user friendly tools.
- **Ethical question raised:** are we climate redlining?



Thank you

For more information see: https://www.cicero.oslo.no/en/climinvest