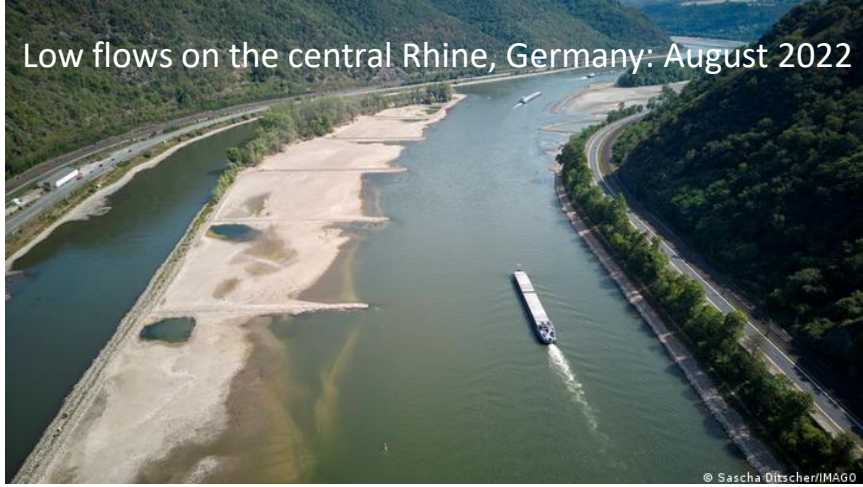
cascades

Cascading climate risks:
Towards adaptive and
resilient European Societies



A framework for understanding and responding to cross-border climate change impacts

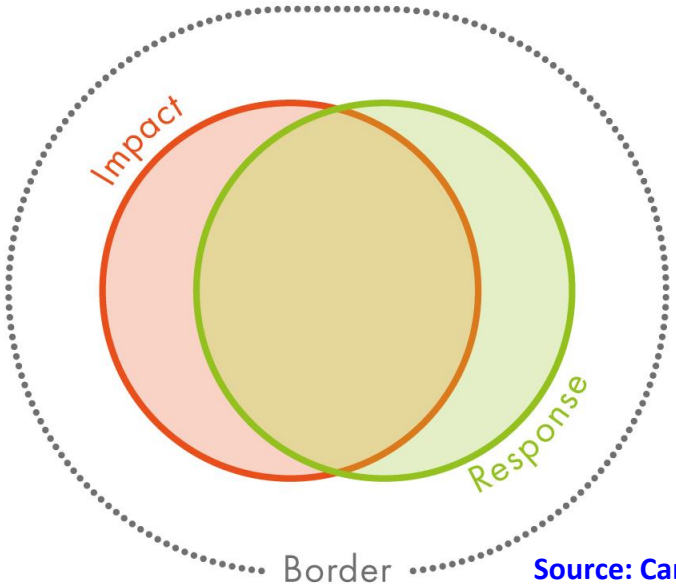
Timothy Carter[1], Magnus Benzie[2], Emanuele Campiglio[3], Henrik Carlsen[4], Stefan Fronzek[1], Mikael Hildén[1], Paula Kivimaa[1], Claire Mosoni[1], Christopher Reyer[5], Chris West[6]

1: Syke Helsinki; 2: SEI, Oxford; 3: Univ Bologna, 4: SEI, Stockholm; 5: PIK, Potsdam; 6: SEI, York

www.cascades.eu

Introduction: cross-border climate change impacts

A) CONVENTIONAL ASSESSMENT



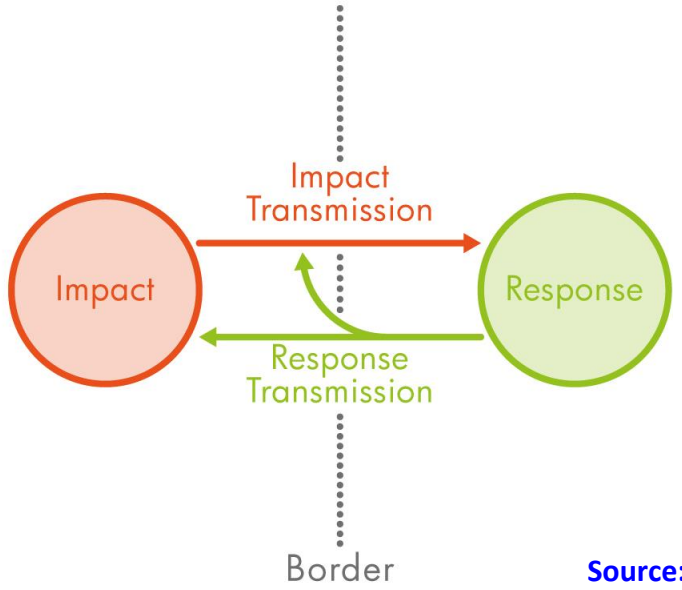
Source: Carter et al. (2021)

Example:

Impact: River flooding events in Europe

National/European response: Flood protection; land management; building regulations (exposed areas)

B) CROSS-BORDER ASSESSMENT



Source: Carter et al. (2021)

Example:

Impact: 2011 Thailand flooding; ~800 local fatalities; industrial parks inundated; global supply chains disrupted, esp. for Japanese multi-nationals

International response: Emergency aid; stock piling; alternative suppliers; development assistance for flood protection

Introduction

Terminology

- Multiple terms found in literature
- Several are used in other contexts and may be misleading or ambiguous
- Meanings may be too narrow or too broad in scope
- Two terms (essentially synonyms) used by IPCC and EEA capture the general concept:
  - Cross-border impacts
  - Transboundary impacts

Term	Reference(s)
Cascading risk	e.g. Goldin (2013); World Economic Forum
Connected risk	e.g. Galaz et al (2014); Goldin & Mariathasan (2014
Cross-border impacts	e.g. Lung et al. (2017); Benzie et al. (2019); Carter et al. (2021)
Cross-regional phenomena	e.g. IPCC - Hewitson et al. (2014), section 21.4
External impacts	suggested by survey recipients
Indirect impacts/Indirect effects	e.g. Hunt et al. (2009); Benzie et al (2013)
Interconnected	suggested by survey recipients
International dimensions	e.g. Foresight (2011); Challinor et al. (2016)
Long distance	e.g. IPCC - Oppenheimer et al. (2014), section 19.4
Non-localised impacts	suggested by survey recipients
Pathways of effects	e.g. Government of Canada (2010)
Secondary effects	e.g. Hunt et al. (2009)
Second-order effects	e.g. Flitner & Herbeck (2009)
Spillover effects	used by the European Commission
Systemic emerging risk	e.g. OECD (2003)
Teleconnected	e.g. Adger et al. (2009)
Telecoupled	e.g. Liu et al. (2013)
Traded risks	e.g. Tait & Bruce (2001)
Transboundary impacts	e.g. IPCC - Oppenheimer et al. (2014), section 19.4
Transnational impacts	e.g. Benzie et al. (2016)

Sources: Benzie et al. (2017; 2019)

Context

Some earlier literature

Regional focus	Source & Year
Global	IPCC (2014, 2022); Hedlund et al., 2018
European Union	Lung et al., 2017; Ciscar et al., 2018; Benzie et al., 2019
Nordic countries	Berninger et al., 2022
Finland	Kankaanpää & Carter, 2007; Hildén et al., 2016
Germany	Peter et al., 2021
Netherlands	Vonk et al., 2015
Norway	Prytz et al., 2018
Sweden	Schultze etal., 2022
Switzerland	INFRAS, 2007
United Kingdom	Foresight, 2011; PwC, 2013; Challinor et al., 2016
United States	Smith et al., 2018

Emerging evidence for:

- Cross-border exposure to climate change impacts
- Observed and potential impacts originating from overseas (e.g. reported in national risk assessments)
- Distinguishable pathways of impact transmission (e.g. trade, human security, finance)
- Complexity of systems and processes that may mediate or exacerbate risk exposure
- Gaps or shortfalls in awareness, understanding and policy preparedness

Framing

CASCADES Conceptual Framework – aims:

- to describe the conceptual basis and process of cross-border impacts of climate change
- to offer a methodological framework that is generally applicable
- to provide a common point of reference for operationalizing practical case examples
- to raise awareness of the risks and opportunities resulting from cascading cross-border climate change impacts for supporting adaptation and enhancing resilience

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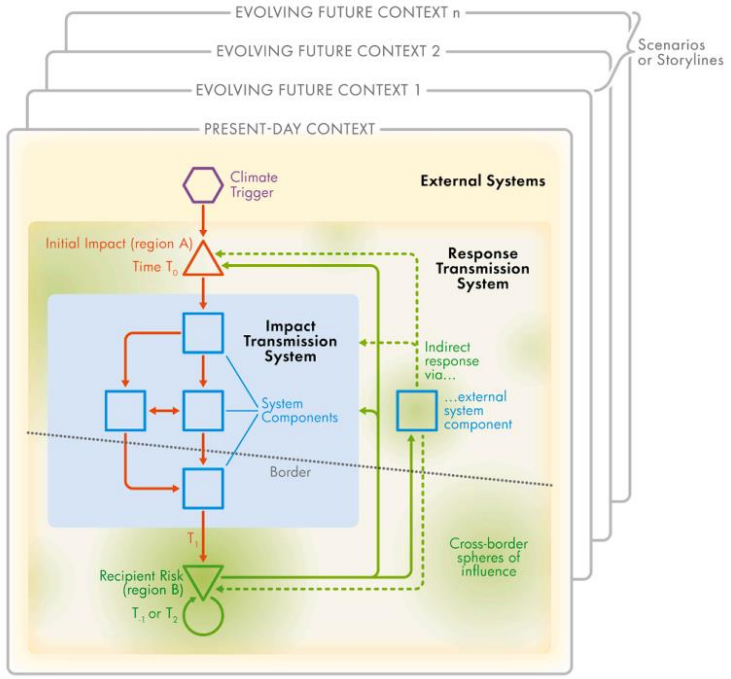


Source: Carter et al. (2021)

Framing

Impact transmission system

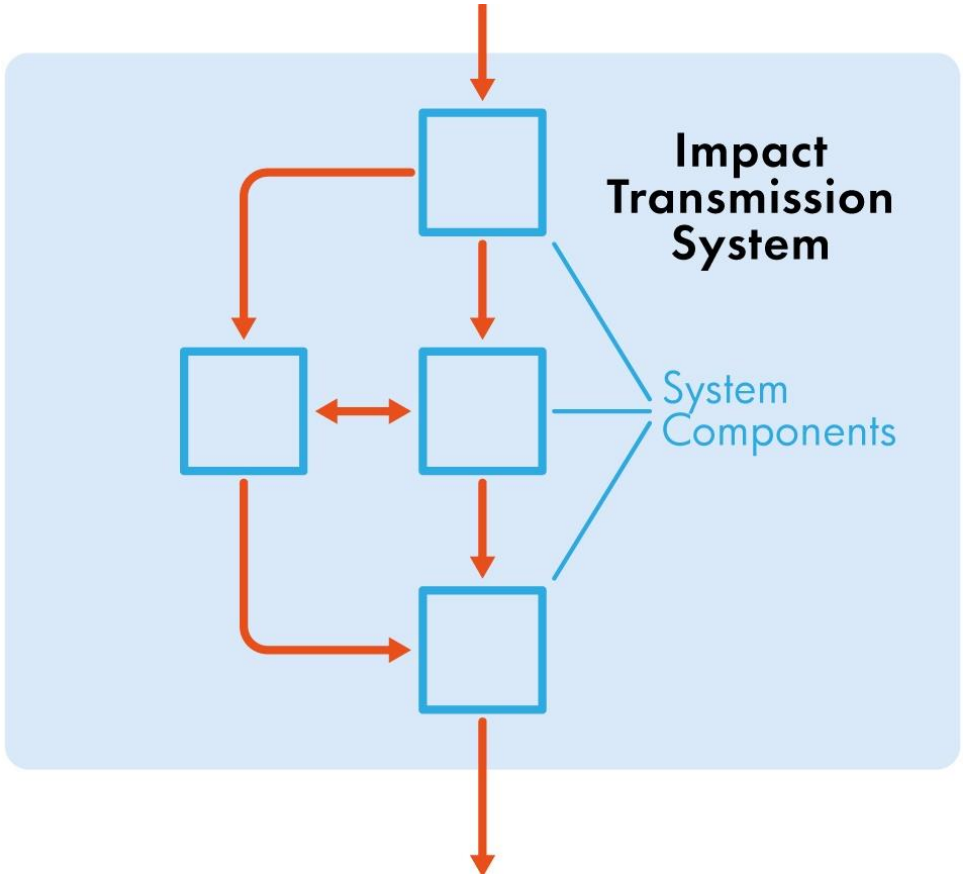
Attribution

Source:
https://www.climatesignals.org/

Source: Carter et al. (2021)

Framing

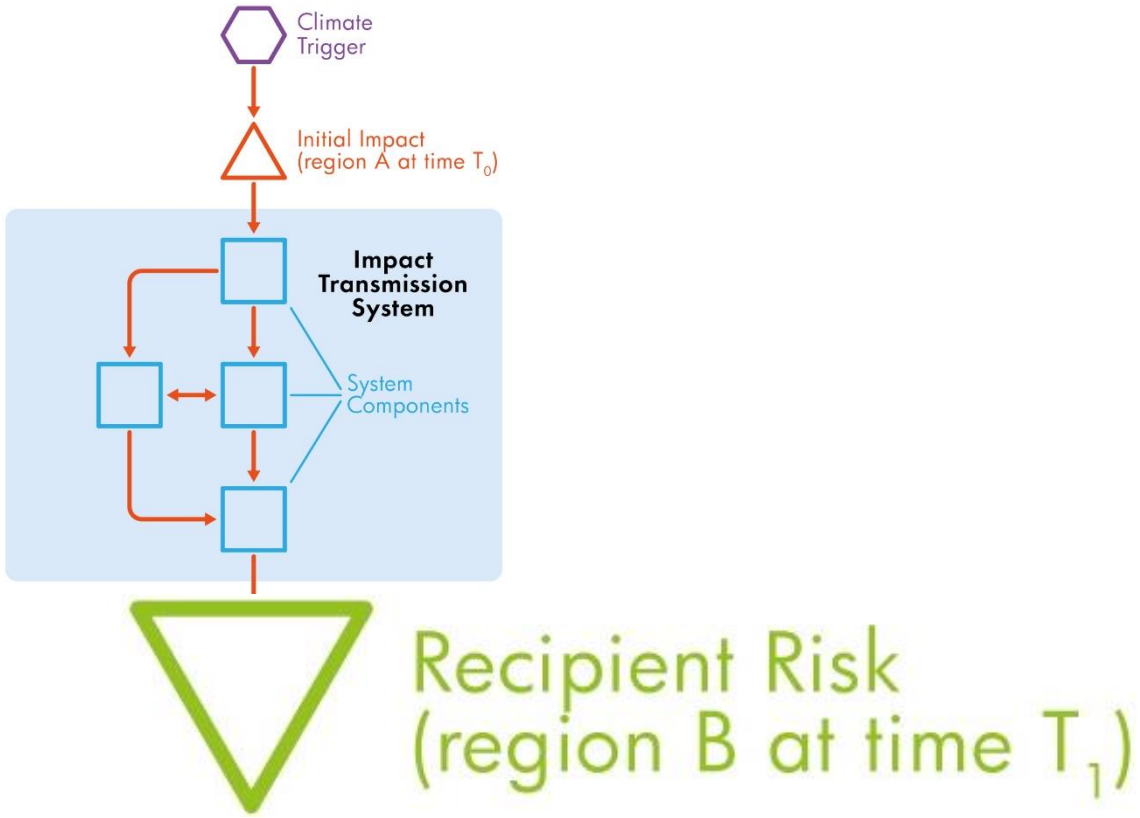
Impact transmission system



Source: Carter et al. (2021)

Framing

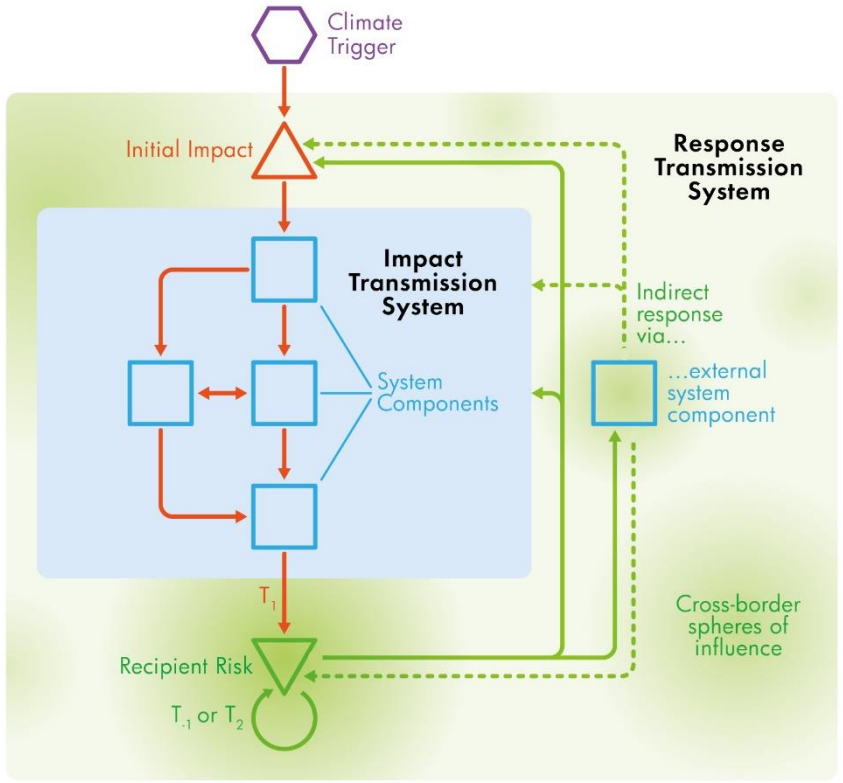
Impact transmission system



Source: Carter et al. (2021)

Framing

Response transmission system



Source: Carter et al. (2021)

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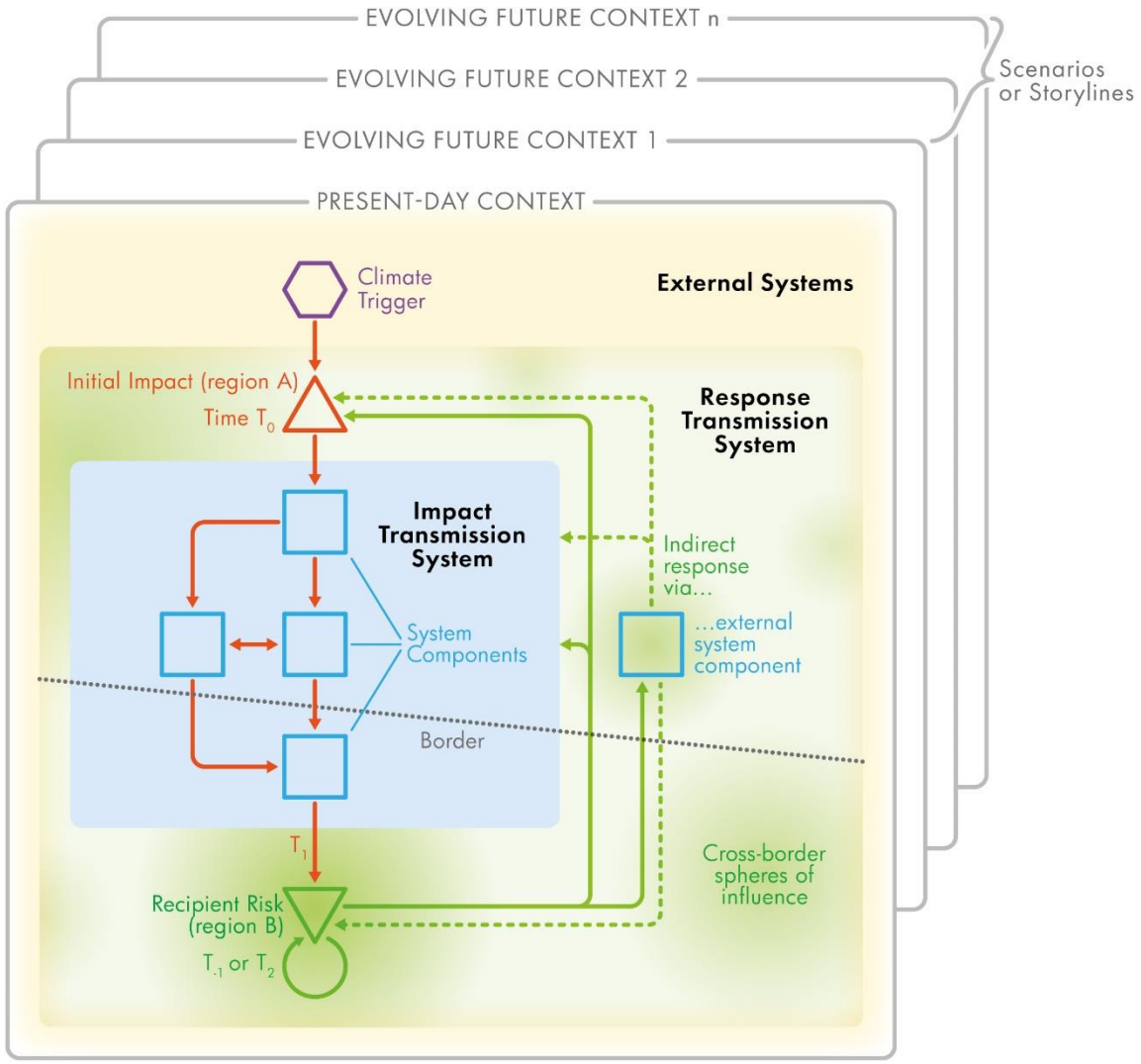

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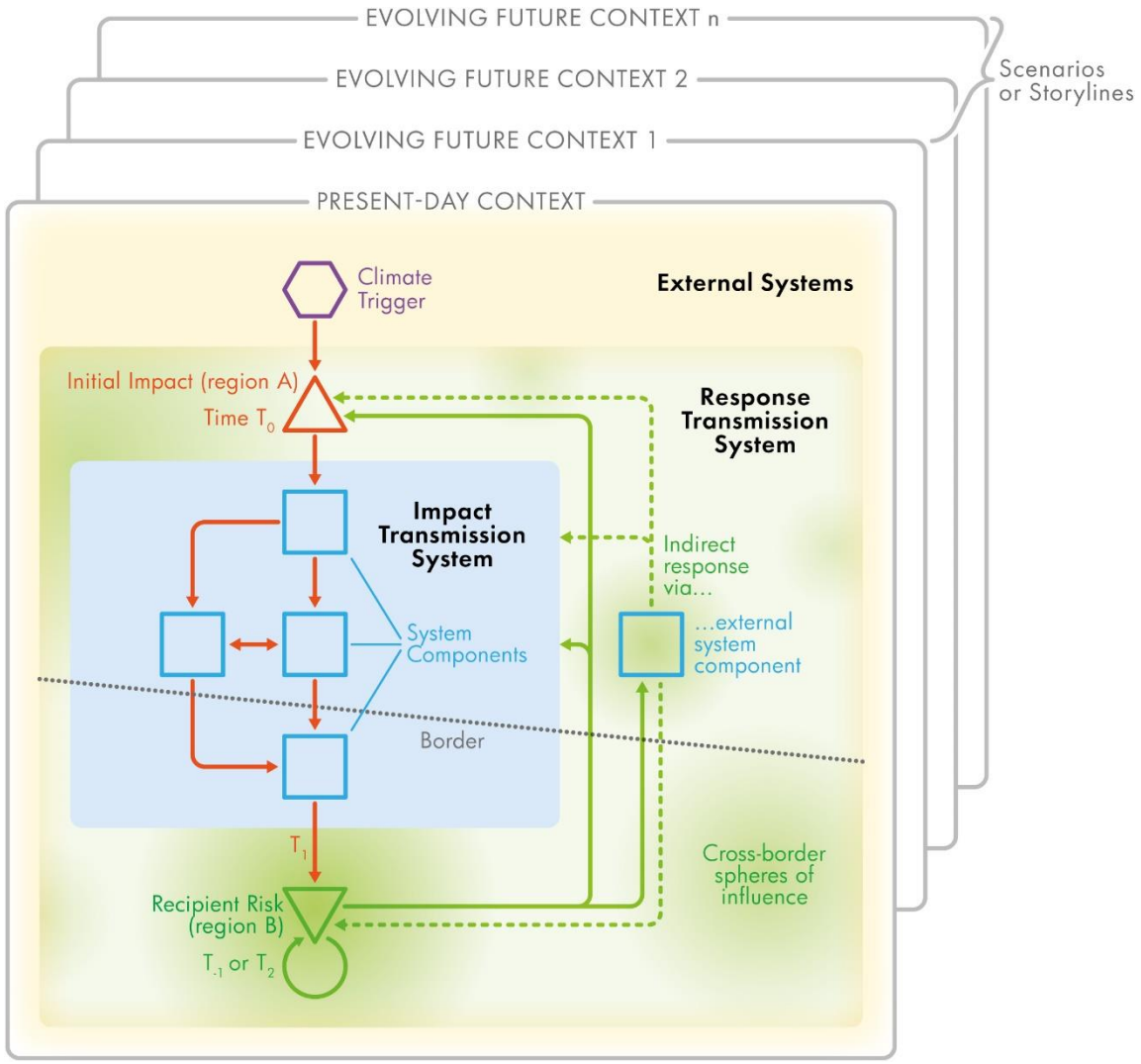
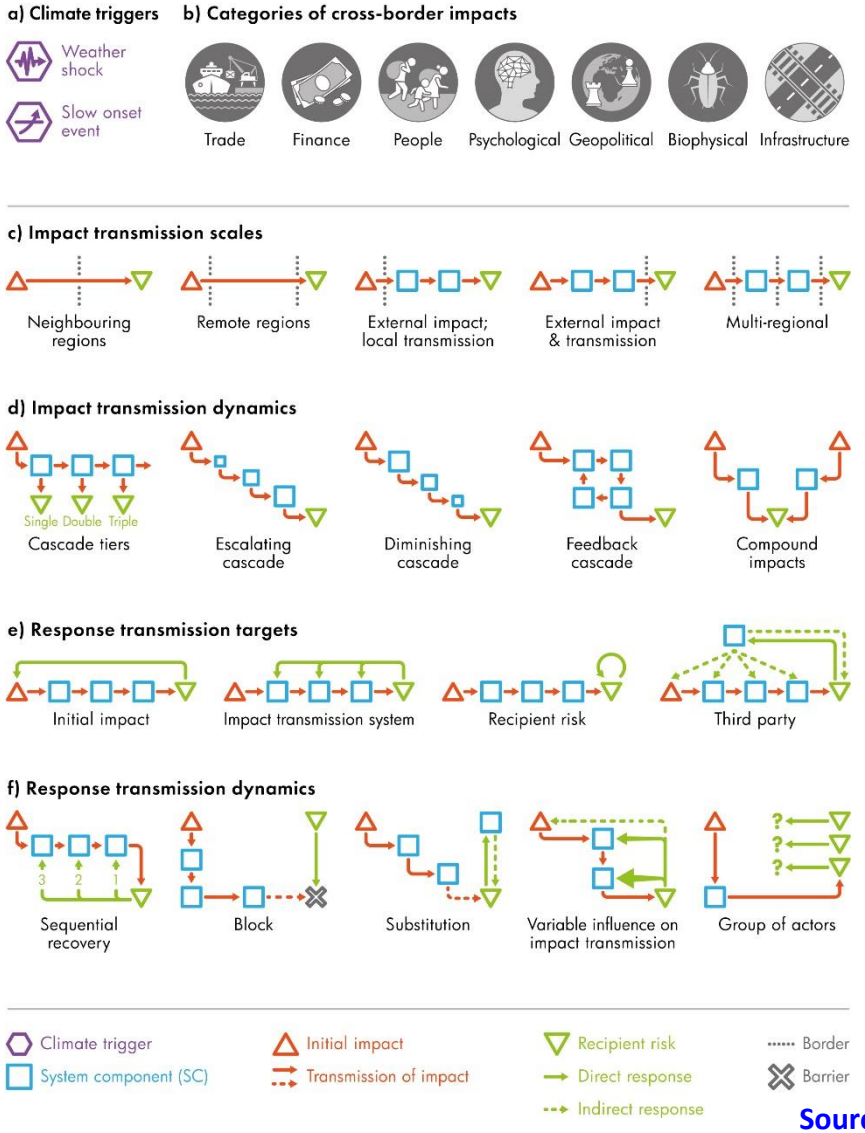


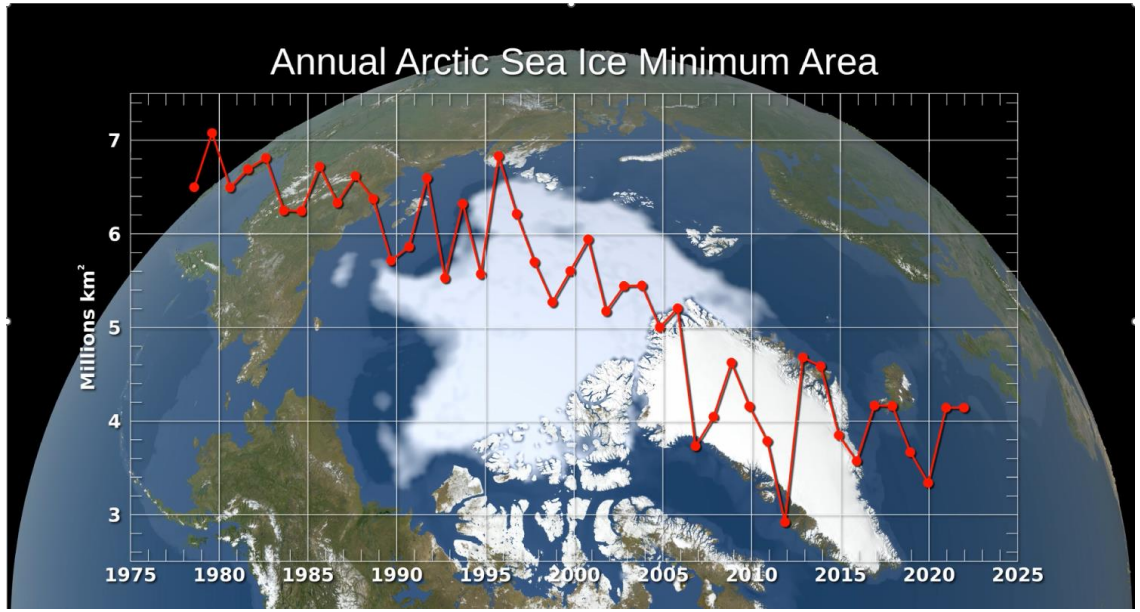
Typologies



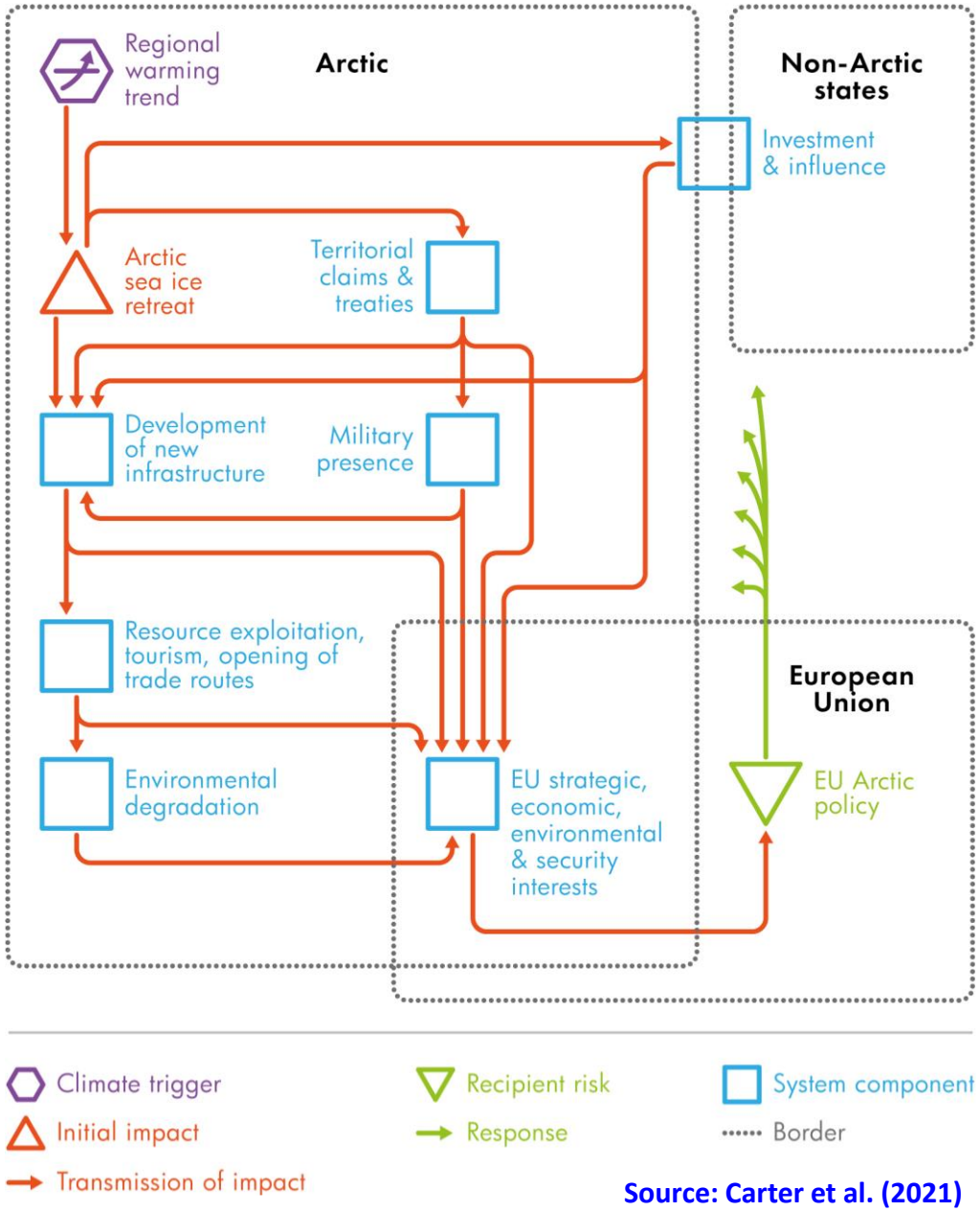
Source: Carter et al. (2021)

Illustrating the framework

Retreat of Arctic sea ice



Source: NASA/Goddard Space Flight Center Scientific Visualization Studio



Source: Carter et al. (2021)

2022)

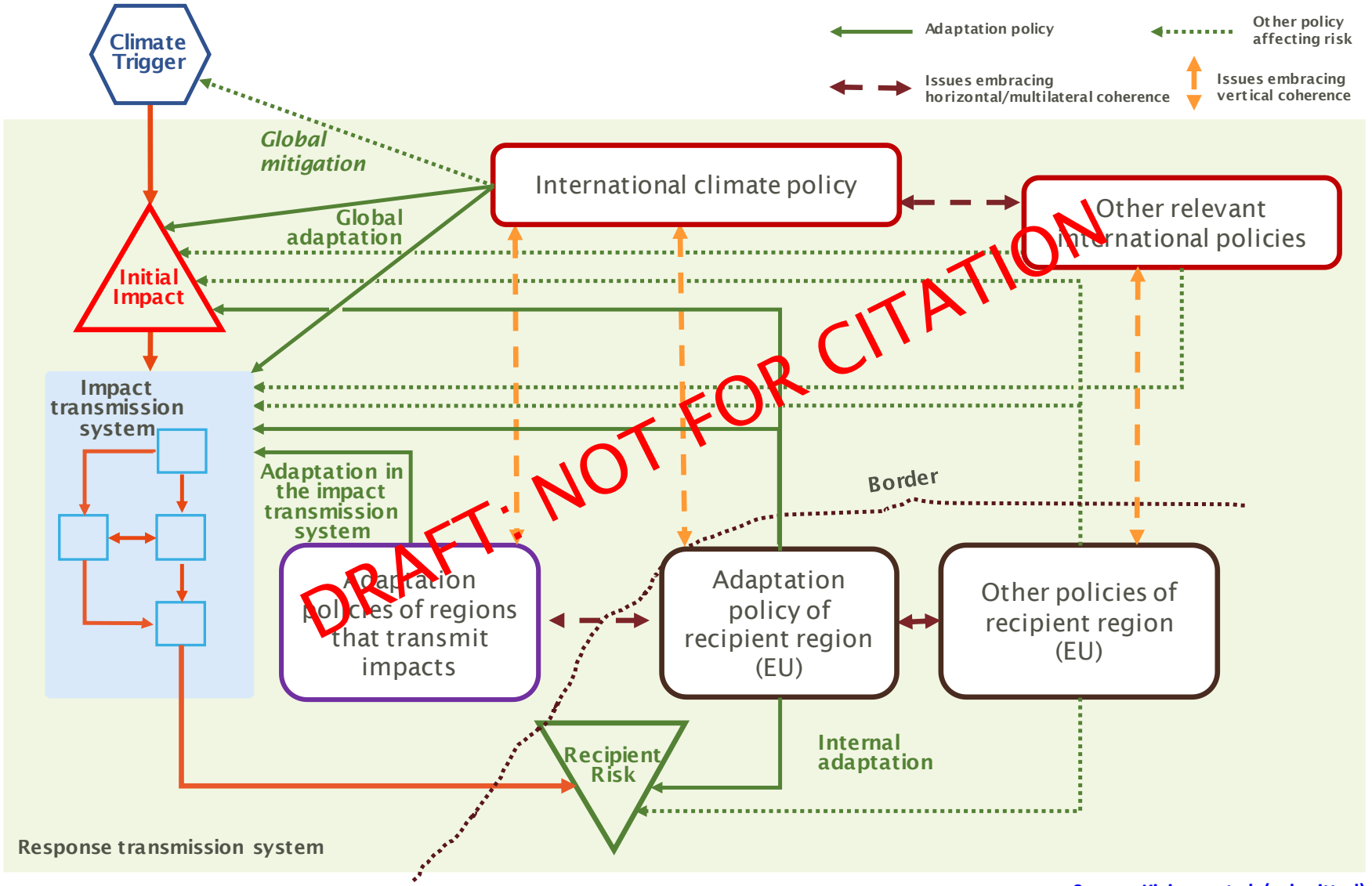
Responses

Policy coherence and policy integration

- **Policy coherence:** policies that mutually reinforce each other, reduce conflicts and promote synergies to achieve jointly agreed objectives
- **Policy integration:** the mainstreaming of specific policy goals (e.g. climate change adaptation) into the instruments and design of other policy domains

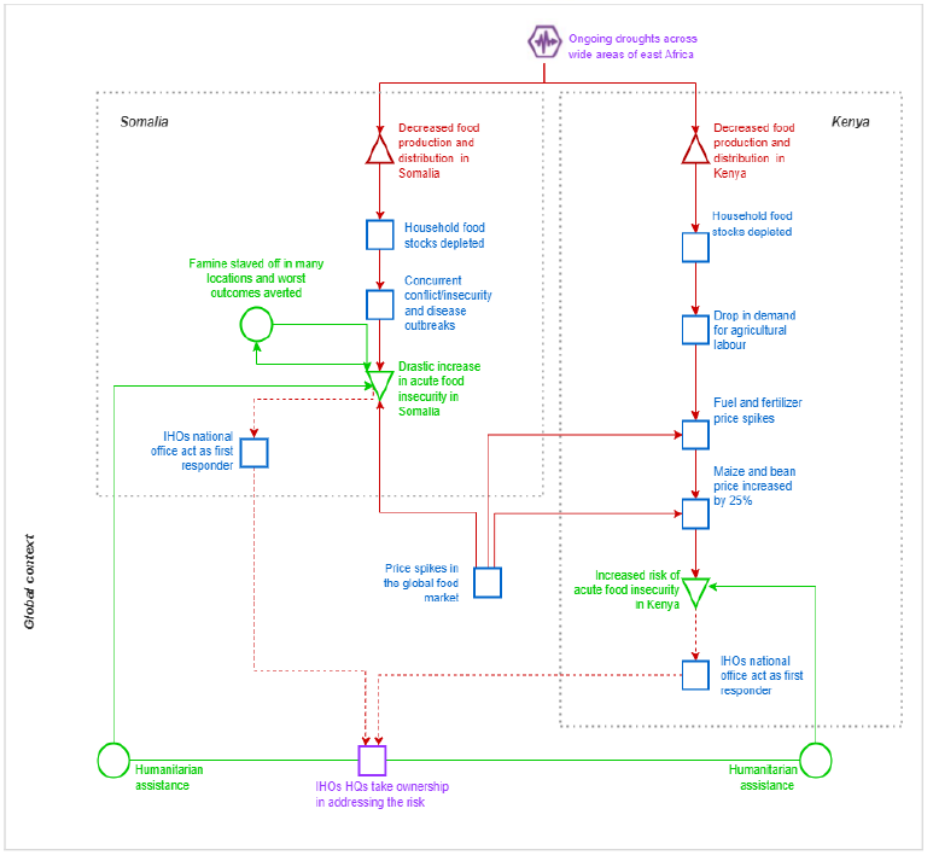
Source: OECD

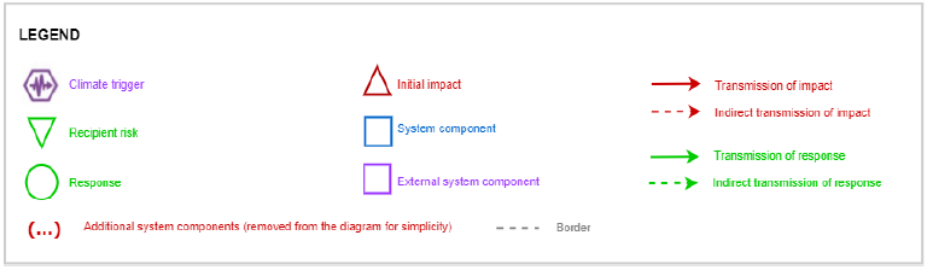
Responses



Source: Kivimaa et al. (submitted)

Illustrating the framework

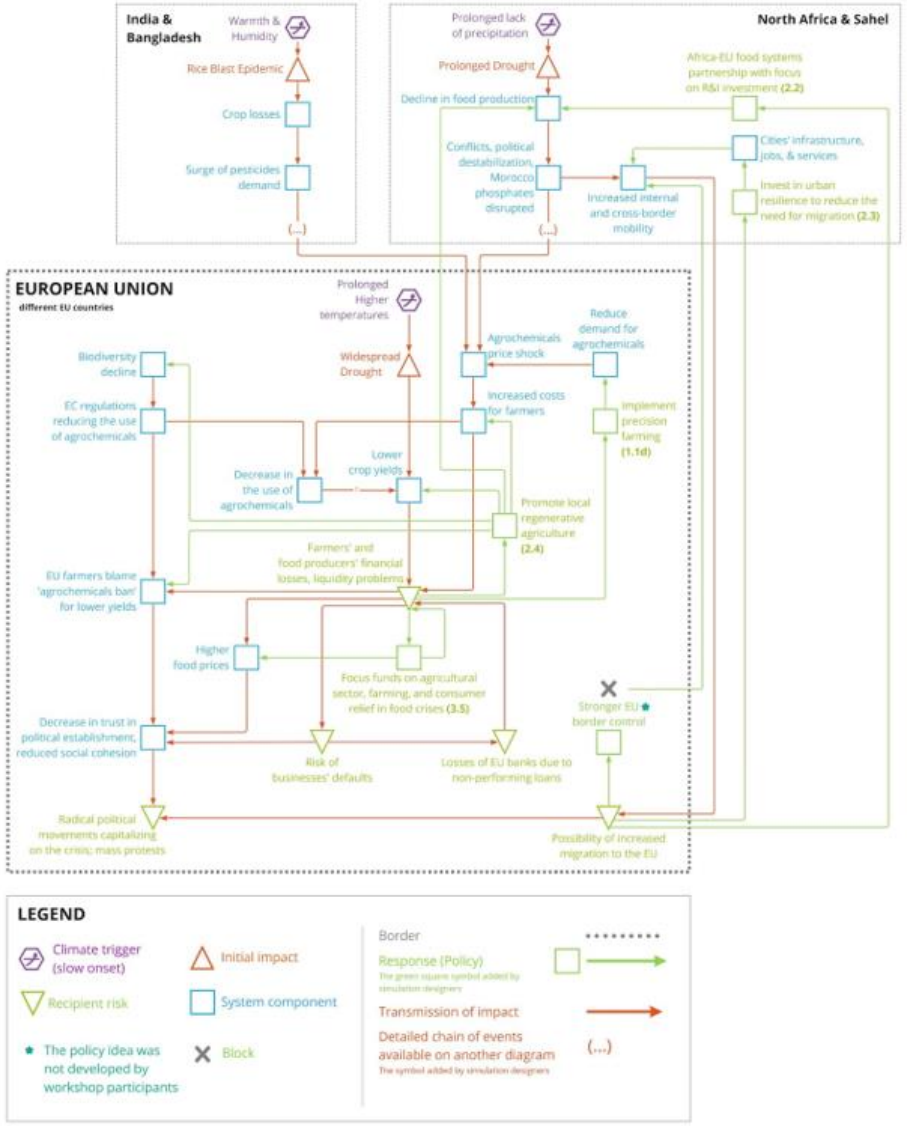




System-wide adaptation to drought in the context of the 2022 West African food security crisis

Source: Knaepen et al. (2023) CASCADES Deliverable 4.5.

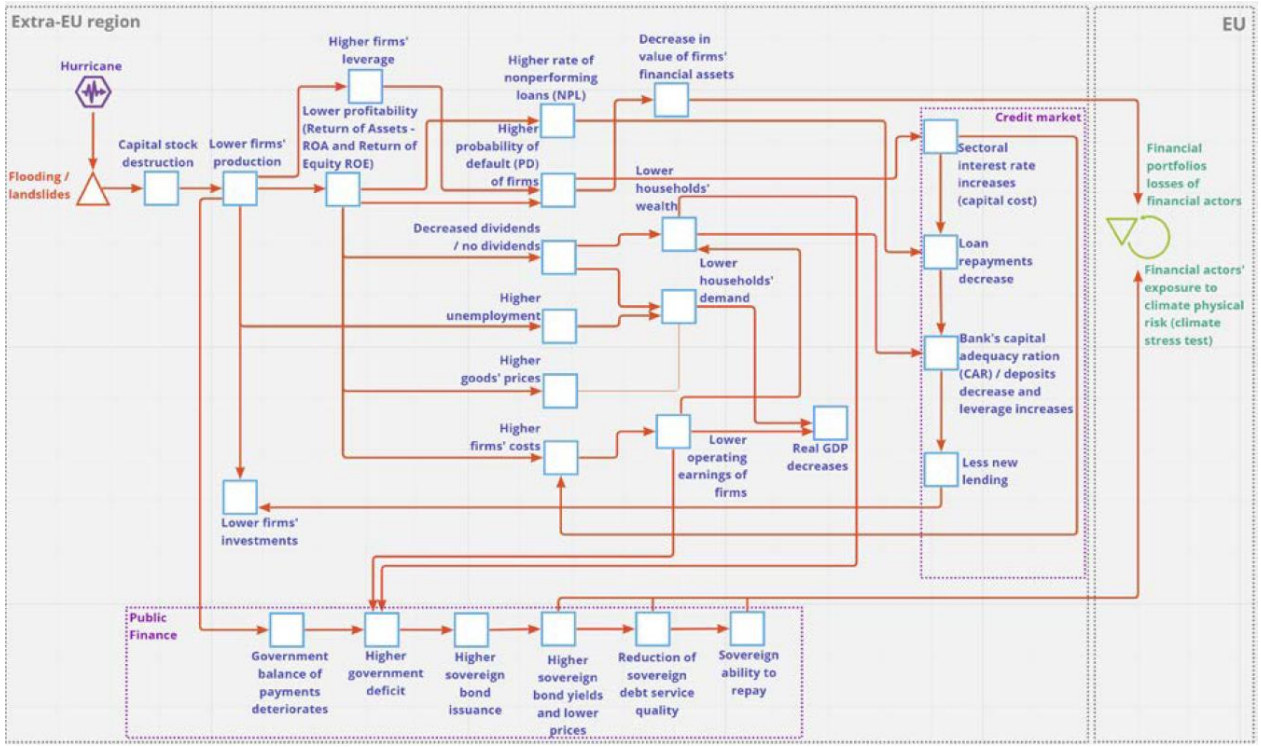
Illustrating the framework



Participatory exercise to imagine plausible cross-border impacts of teleconnected climate events on the food system, risks to the EU and some potential policy responses

Source: Mikaelsson et al. (2022) CASCADES Deliverable 6.1

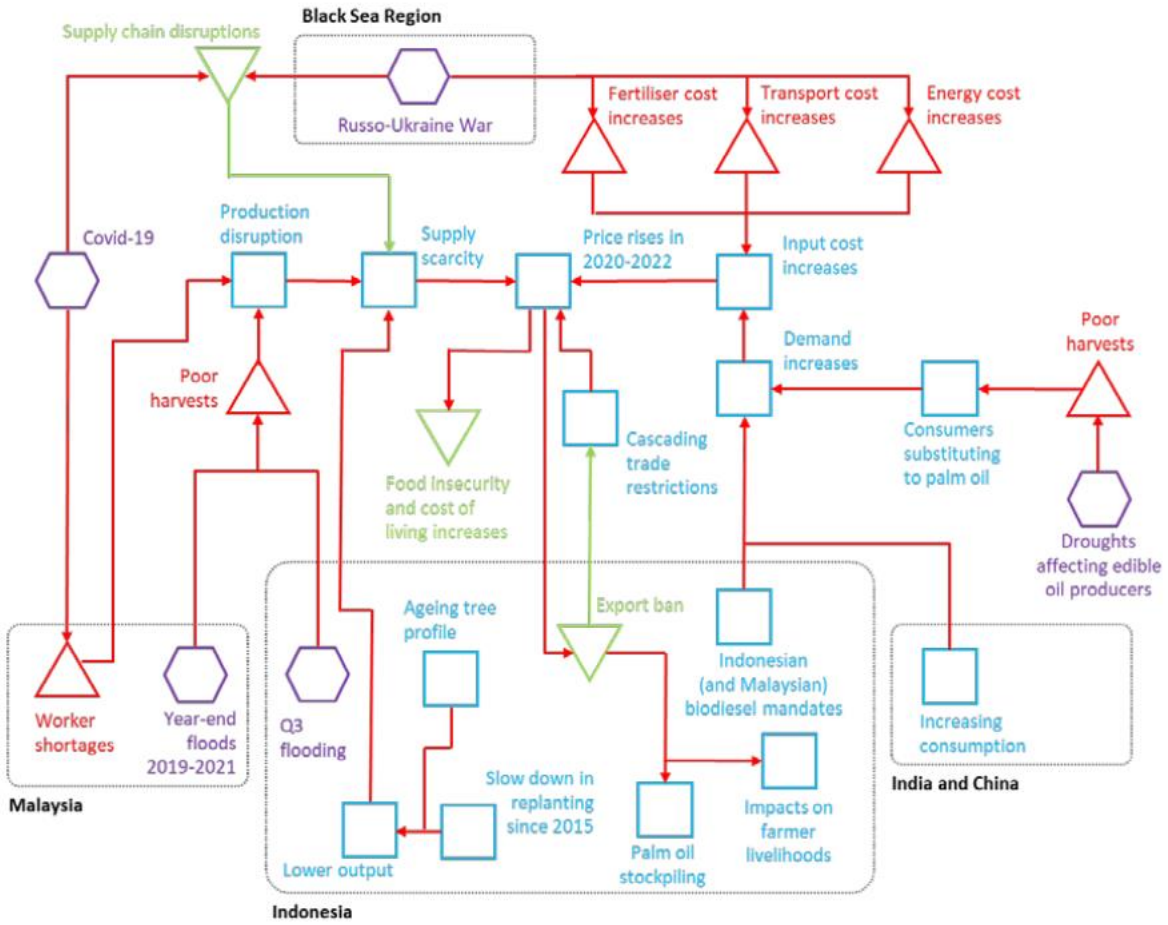
Illustrating the framework



Implications of climate shocks (hurricanes) in non-EU regions for the portfolios of EU financial institutions

Source: Monasterolo et al. (2022) CASCADES Deliverable 5.1.

Illustrating the framework



Representing cross-border impacts attributable to multiple drivers, with feedbacks

Impacts to palm oil prices and supply resulting from a confluence of climatic-, Covid-19- and Russia-Ukraine conflict-linked impacts, including the introduction of Indonesian trade restrictions

Source: West et al. (2022) CASCADES Deliverable 3.6.

Illustrating the framework

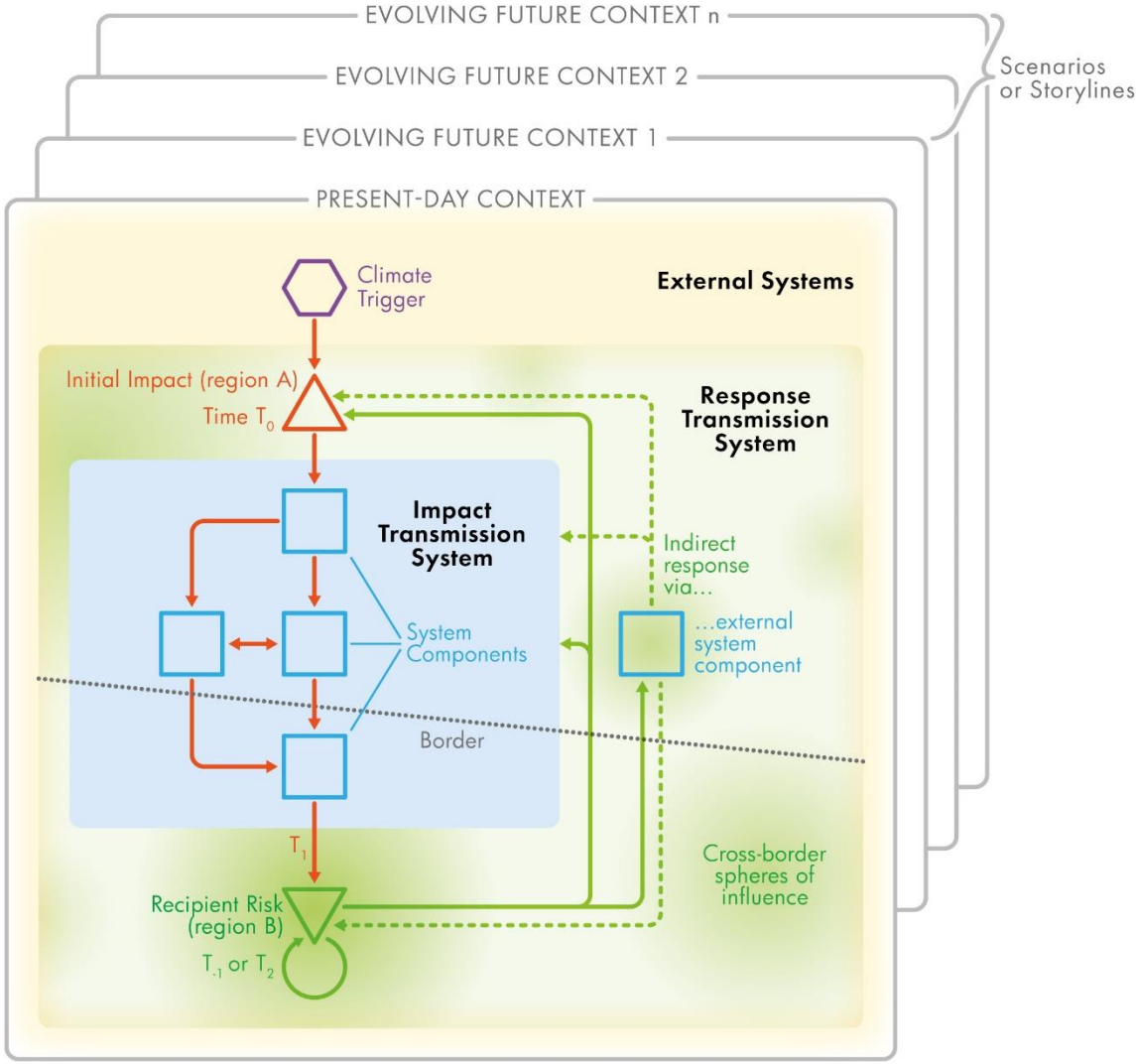
Source: Magnuszewski et al., pers. comm)

Policy simulation exercises use the framework as background for structuring an interactive role-playing environment for real-time decision-making to address plausible future challenges

Source: https://arcticfuture.socialsimulations.org/

Summary

- A framework for examining cross-border climate change impacts and responses, comprises:
  - An impact transmission system
  - A response transmission system
- It is applicable for addressing different categories of cross-border impacts
- It can address both present-day and future conditions
- It can be extended to consider how adaptation to cross-border impacts is typically served by policy across regions, domains and levels of governance
- It offers standard notation for depicting complex nodes, linkages and outcomes that allows for creative interpretation



Thanks for listening!

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Potsdam Institute for Climate Impact Research, Potsdam, Germany, 16-18 October 2023