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

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Introduction: cross-border climate change impacts

A) CONVENTIONAL ASSESSMENT

Impact: River flooding events in Europe
National/European response: Flood protection; land management; building regulations (exposed areas)

Example: Source: Carter et al. (2021)

B) CROSS-BORDER ASSESSMENT

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

Example: Source: Carter et al. (2021)
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

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

### Some earlier literature

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

Source: Carter et al. (2021)
Framing

Impact transmission system

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)
Framing

Source: Carter et al. (2021)
Framing

Typologies

- a) Climate triggers
  - Weather shock
  - Slow onset event

- b) Categories of cross-border impacts
  - Trade
  - Finance
  - People
  - Psychological
  - Geopolitical
  - Biophysical
  - Infrastructure

- c) Impact transmission scales
  - Neighbouring regions
  - Remote regions
  - External impact: local transmission
  - External impact & transmission
  - Multi-regional

- d) Impact transmission dynamics
  - Cascade hier
  - Escalating cascade
  - Diminishing cascade
  - Feedback cascade
  - Compound impacts

- e) Response transmission targets
  - Initial impact
  - Impact transmission system
  - Recipient risk
  - Third party

- f) Response transmission dynamics
  - Sequential recovery
  - Block
  - Substitution
  - Variable influence on impact transmission
  - Group of actors

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)
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.
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

Illustrating the framework

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.
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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