EEAC 30th anniversary

PARALLEL SESSION #6
15:30-17:15

ADAPTING TO CLIMATE CHANGE UNDER TRANSBOUNDARY CLIMATE RISKS

Prof. Tim Carter
Finnish Environment Institute

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CNADS

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Finnish Climate Change Panel

#EEAC30
#CriticalDecade

EEAC

KESTÄVYYS PANEELI

SUOMEN LUONTO PANEELI

SUOMEN ILMASTOPANEELI
The Finnish Climate Change Panel

Framing cross-border climate change impacts and responses

Timothy Carter
Finnish Environment Institute (SYKE)

SYKE

Acknowledgements

Numerous colleagues in the CASCADES project are thanked for helpful insights, discussion and collaboration

https://www.cascades.eu/

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Cascading climate risks:
Towards adaptive and
resilient European Societies

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Funded by the Horizon 2020 Framework Programme of the European Union

Framing cross-border climate change impacts and responses

1. Introduction: What are cross-border climate change impacts?
2. Context: Why are we discussing them?
3. Framing: How can we describe and classify them?
4. Examples: Where in Europe can they be illustrated?
5. Responses: Which aspects of policy response merit attention?
6. Conclusions: Whither cross-border climate change impacts and responses?

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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
- Terms such as impacts, risks and responses also have their own interpretations

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)

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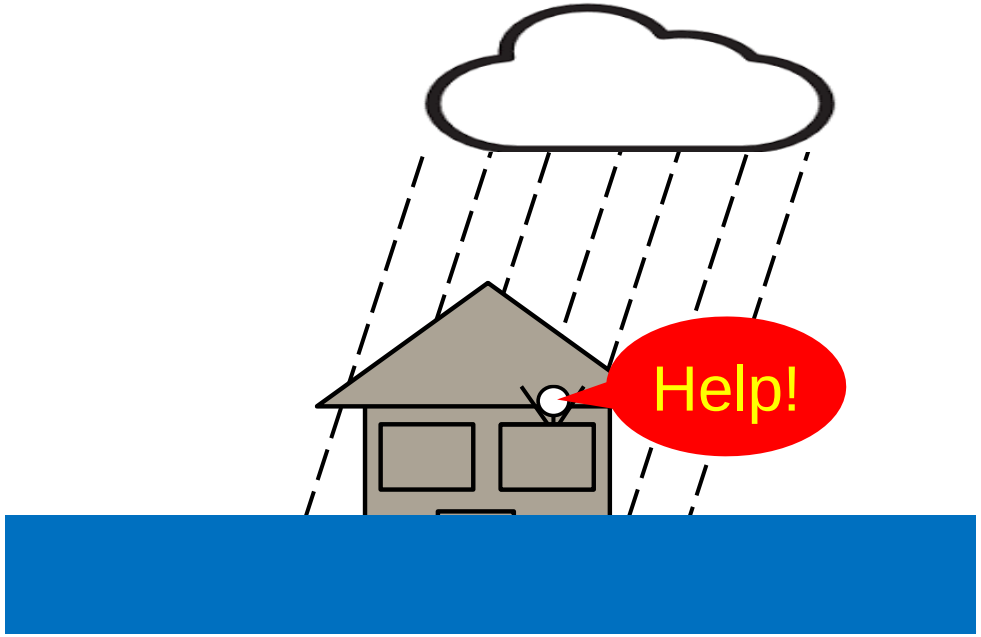
Introduction

Conventional assessment:

Impacts in a region that are due to changes of climate in that region

Impact: e.g. River flooding in Europe

European response: e.g. Flood protection; land management; building regulations (exposed areas)



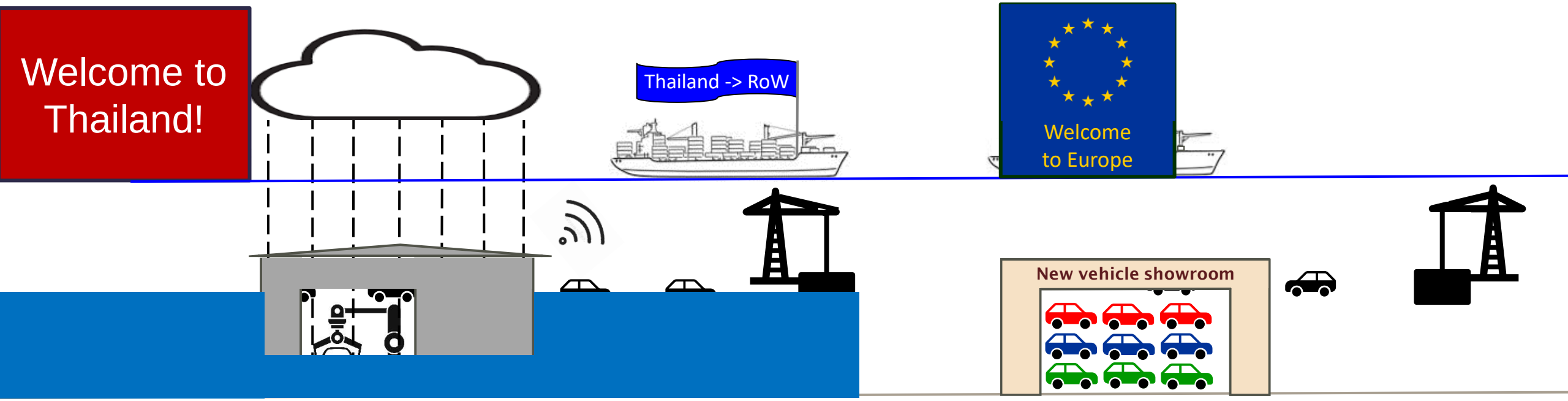
Introduction

Cross-border assessment:

Climate change-related impacts that occur remotely from the origin of the impact

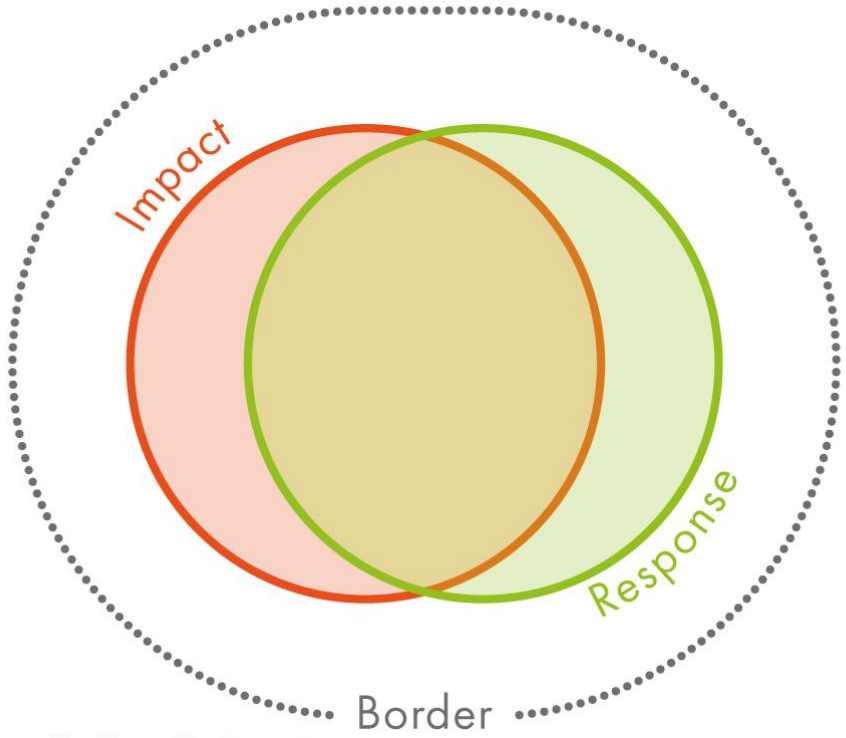
Impact outside Europe: e.g. Flooding in Thailand causing shutdown of car production, global supply chain disruption & loss of profits

European response: e.g. Emergency aid to region; identification of substitute suppliers

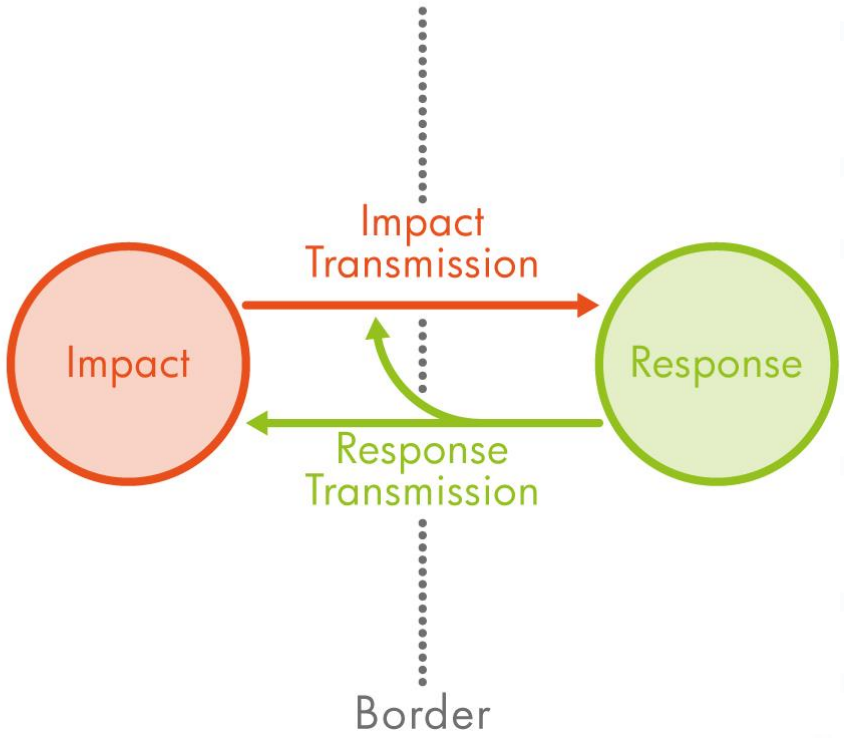


Introduction

A) CONVENTIONAL ASSESSMENT



B) CROSS-BORDER ASSESSMENT



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Source: Carter et al. (2021)

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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
- Scientific and policy frameworks required that offer systematic treatment of cross-border impacts and adaptation for building global resilience

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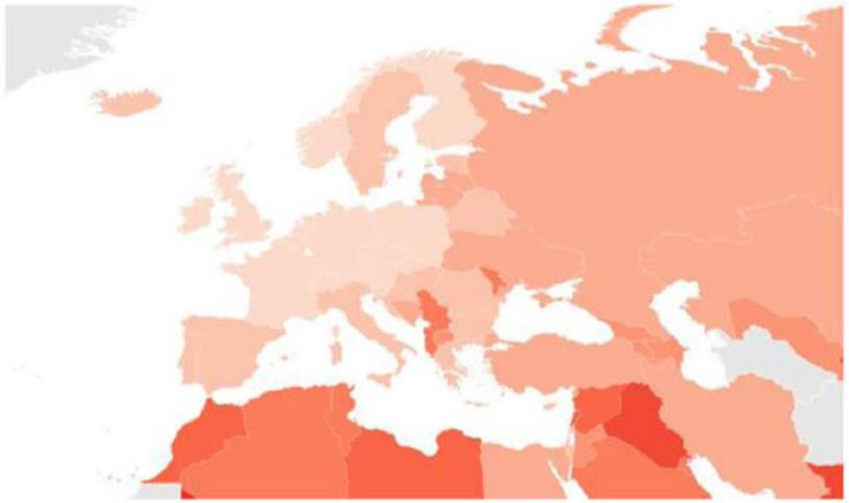
Context

Vulnerability to direct climate impacts
occurring within countries (**ND-GAIN** Index)



Darker colours indicate higher vulnerability

0.21	0.26	0.29	0.31	0.35
0.39	0.45	0.5	0.54	0.62

ND-GAIN = Notre Dame Global Adaptation Initiative
36 indicators of exposure, sensitivity or adaptive capacity across six life-supporting sectors: food, water, health, ecosystem service, human habitat and infrastructure

Exposure to transnational climate impacts
originating outside country borders (**TCI** Index)

Darker colours indicate higher exposure

0.4	0.43	0.47	0.49	0.51
0.54	0.56	0.59	0.66	0.82

TCI = Transnational Climate Impacts
Nine indicators: representing biophysical, finance (2), people (2) and trade (3) pathways and an index of globalisation

Source: Benzie et al. (2019)

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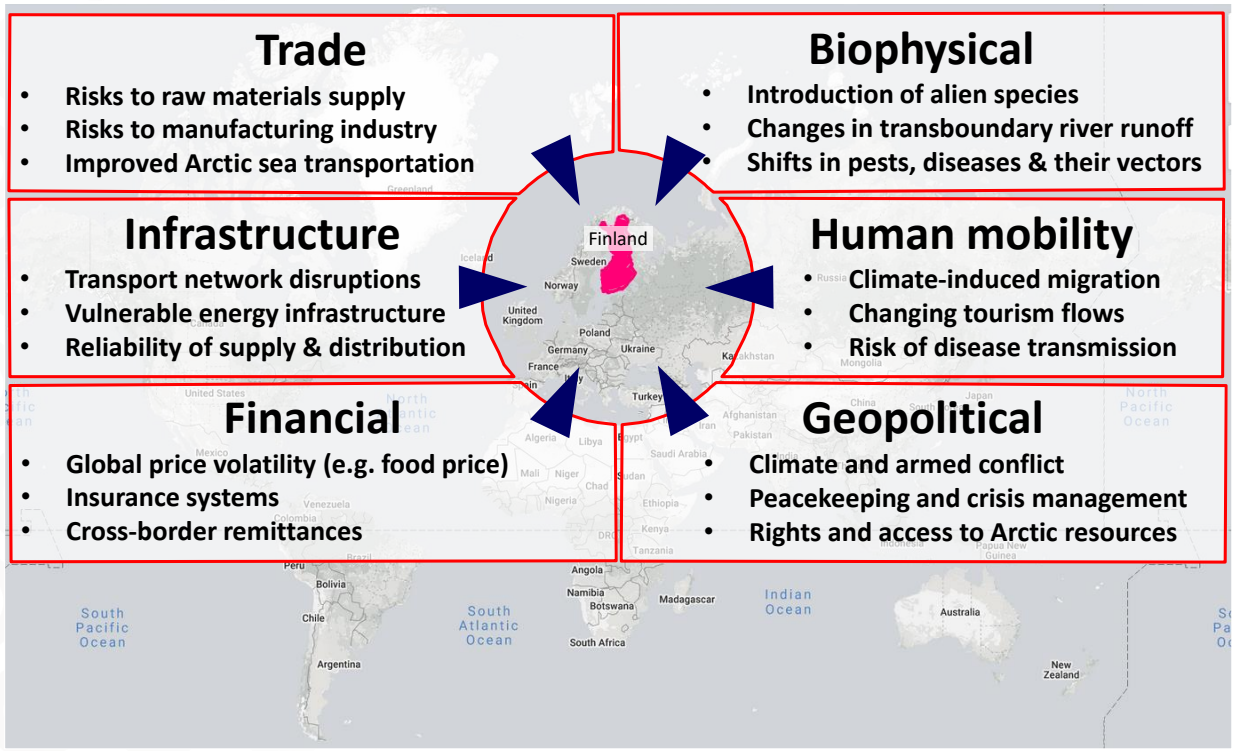
Context

Pathways of cross-border impacts relevant to Finland



Sources: EEA (2017); Hildén et al. (2016)

Risks and opportunities for Finland arising from cross-border impacts of climate change

Pathway \ Sector	Primary and manufacturing industries	Energy	Transport	Business and finance	Tourism	Population	Human health	Biodiversity	Foreign policy	Development cooperation
Cognitive / psychological: Trade	1	2	3	4			5	6	7	8
Infrastructural	9	10	11	12	13	14	15	16		17
Financial	18	19	20	21	22					23
Human mobility		24	25	26	27	28	29	30		31
Biophysical	32	33	34		35		36	37	38	39
Geopolitical	40	41	42	43	44	45	46		47	48

Potential impacts: Mainly beneficial | Mixed/neutral | Mainly adverse | Not applicable

Modified from Hildén et al. (2016)

Context

Three ongoing international partnerships/projects

https://www.cascades.eu/

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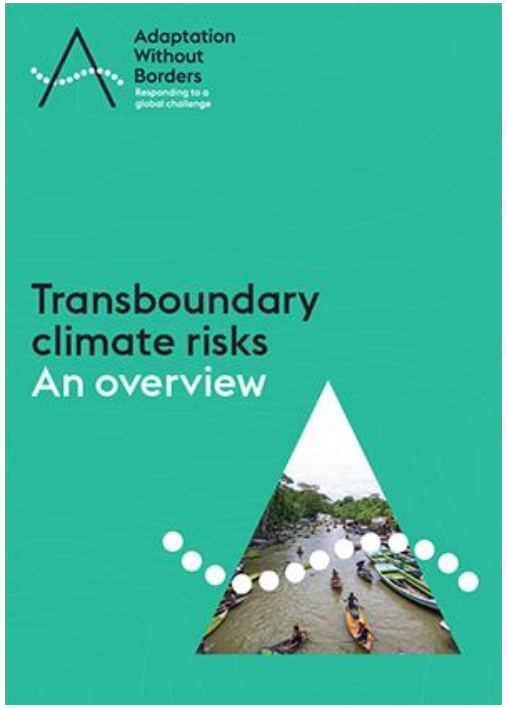
Cascading climate risks:
Towards adaptive and
resilient European Societies

https://climatestorylines.eu/

Receipt

Remote Climate Effects and their Impact on European sustainability, Policy and Trade

https://adaptationwithoutborders.org/



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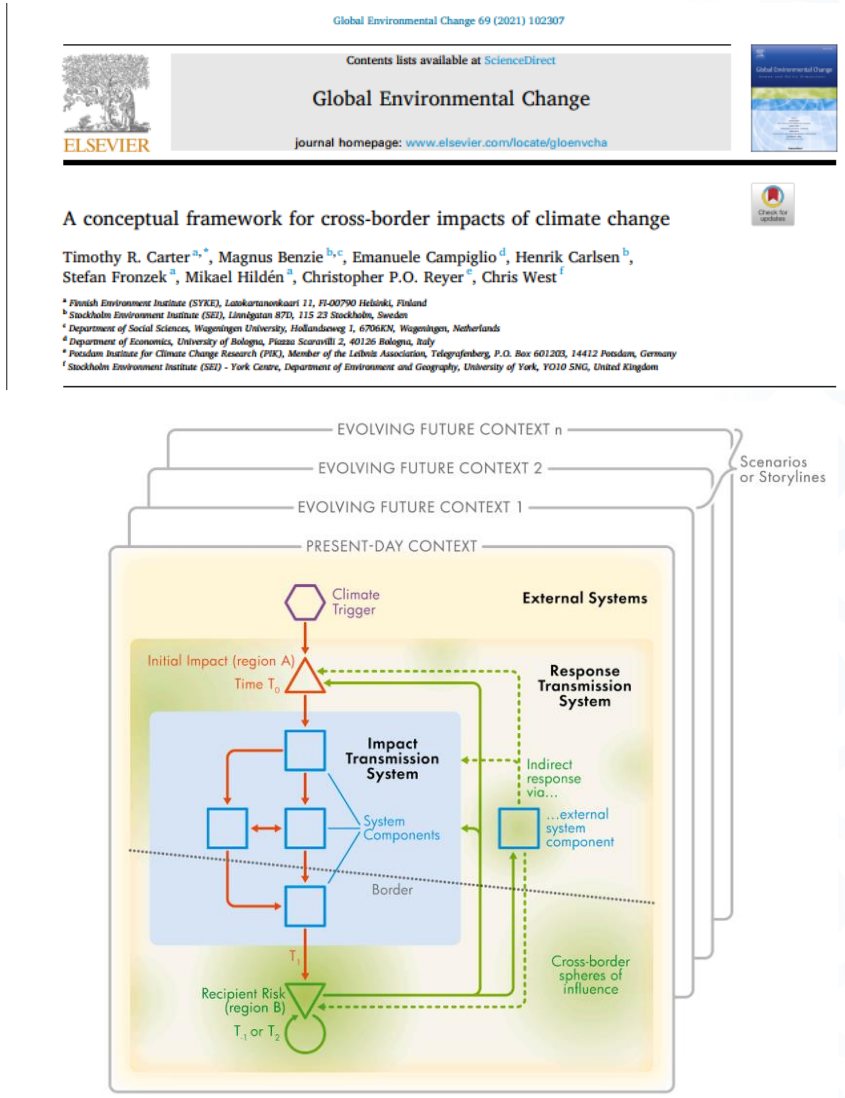
Framing

CASCADES Conceptual Framework – aims:

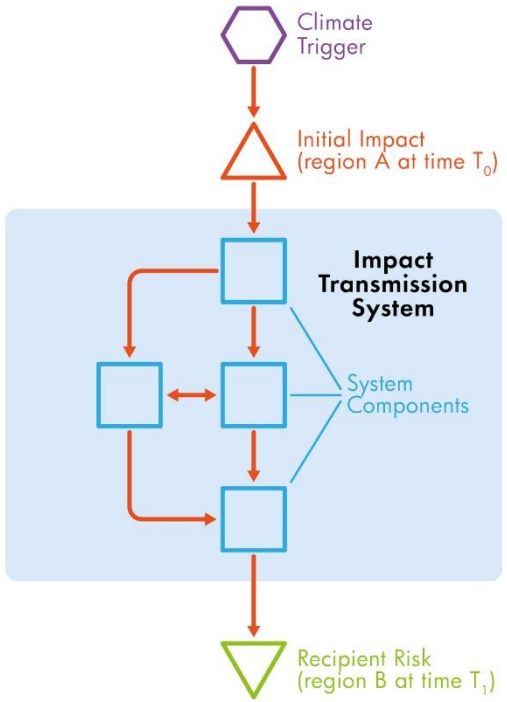
- to describe the conceptual basis and process of cross-border impacts of climate change
- to offer a methodological framework that is generally applicable across the CASCADES project
- to provide a common point of reference for operationalizing practical case examples within the project
- to raise awareness 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



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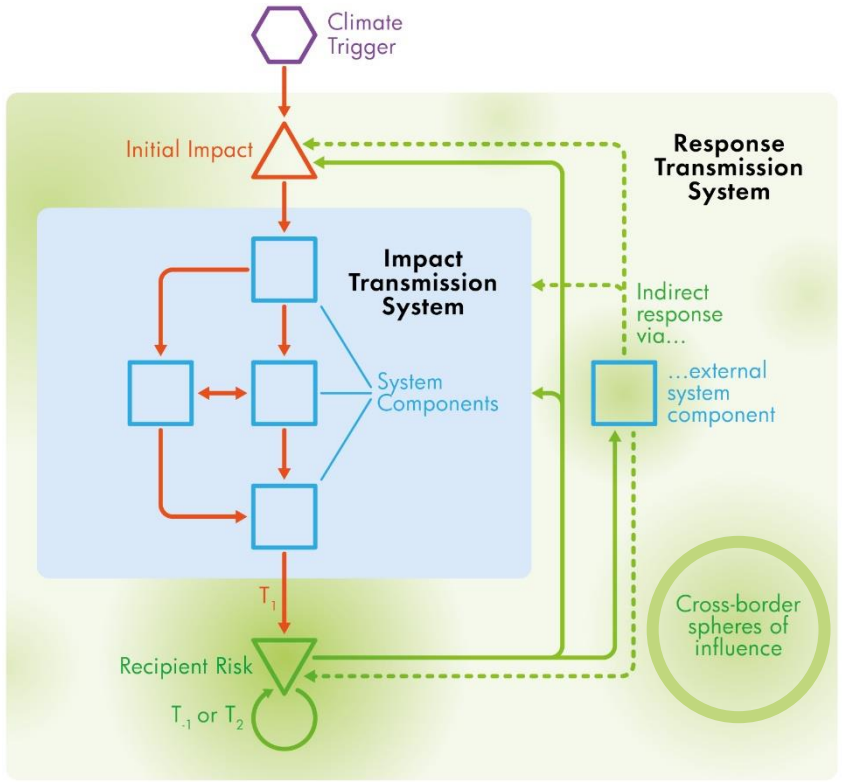
Source: Carter et al. (2021)

Framing

Response transmission system



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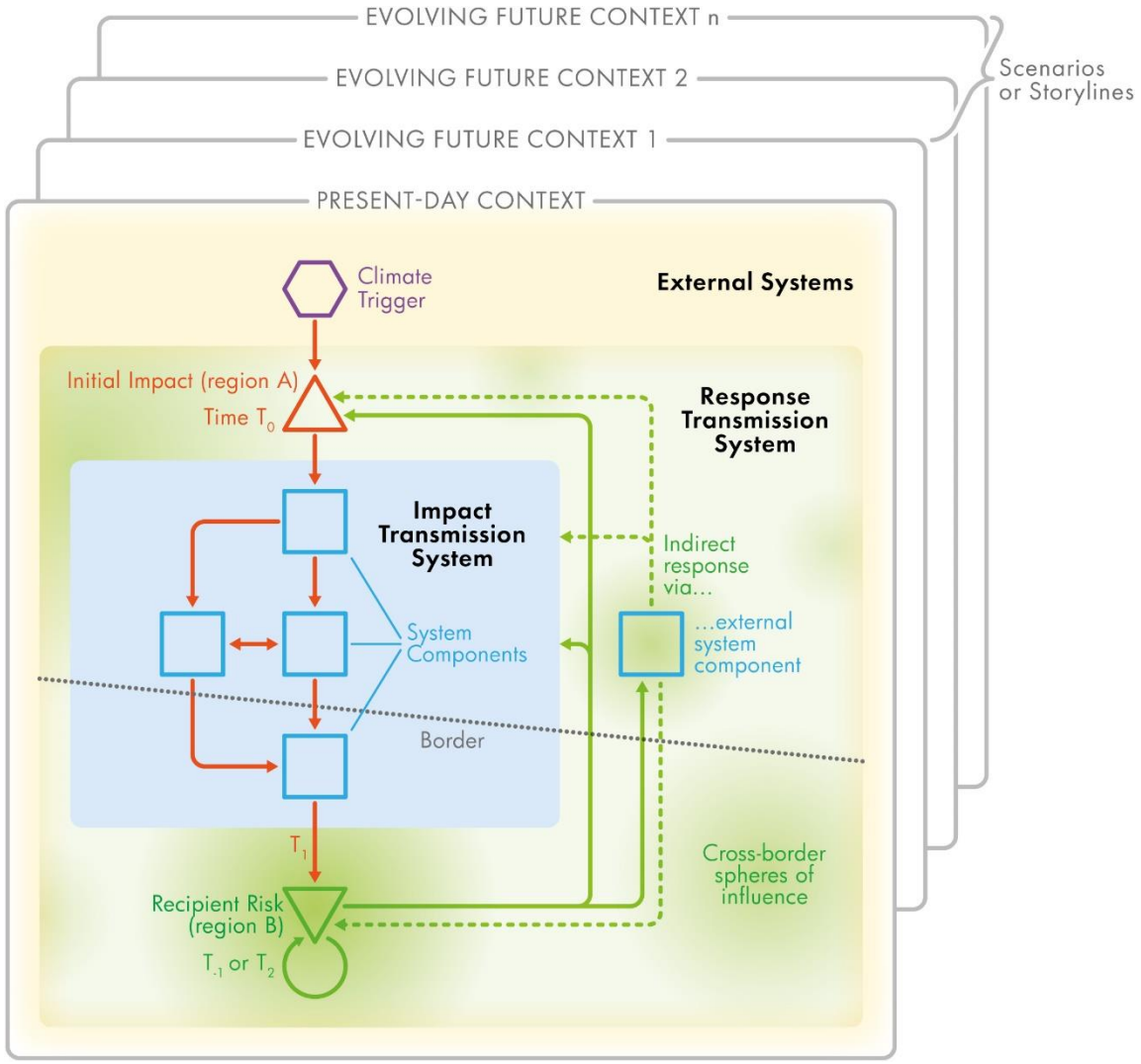
Source: Carter et al. (2021)

Framing

Conceptual Framework



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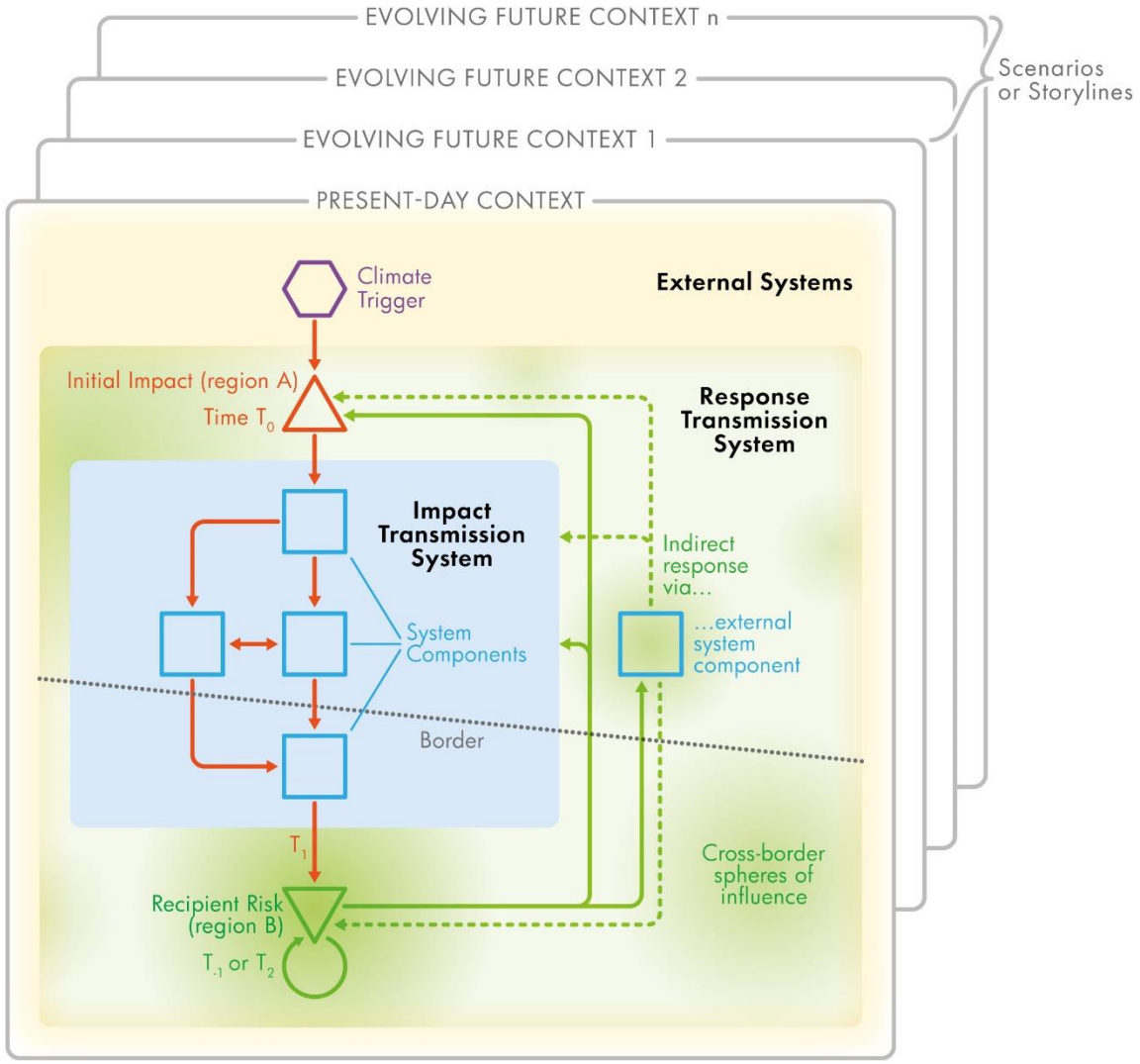
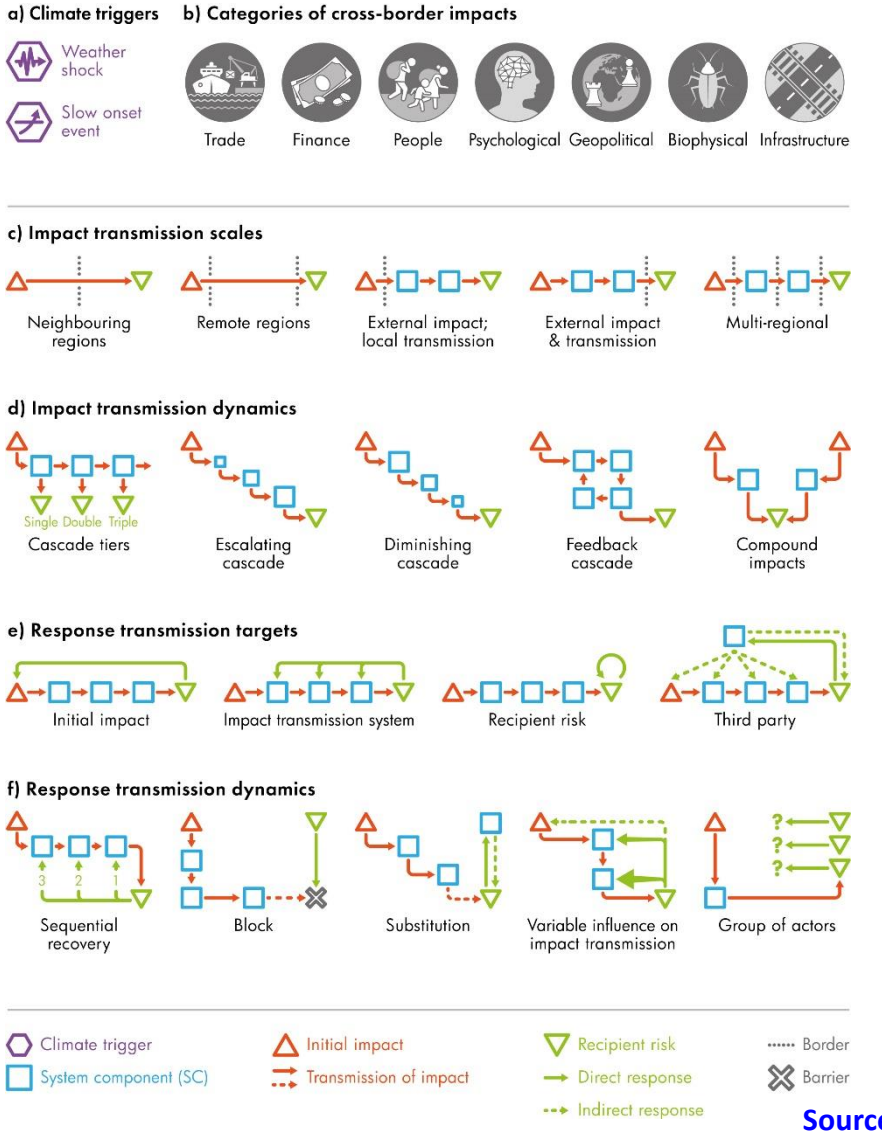
Framing



Typologies



Source: Carter et al. (2021)

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Examples

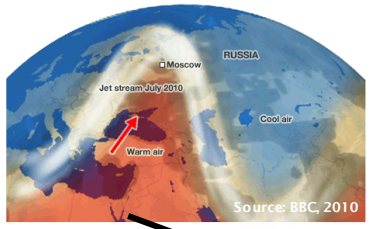
2010: Severe weather & UK food affordability

Russia: wheat production shortfall

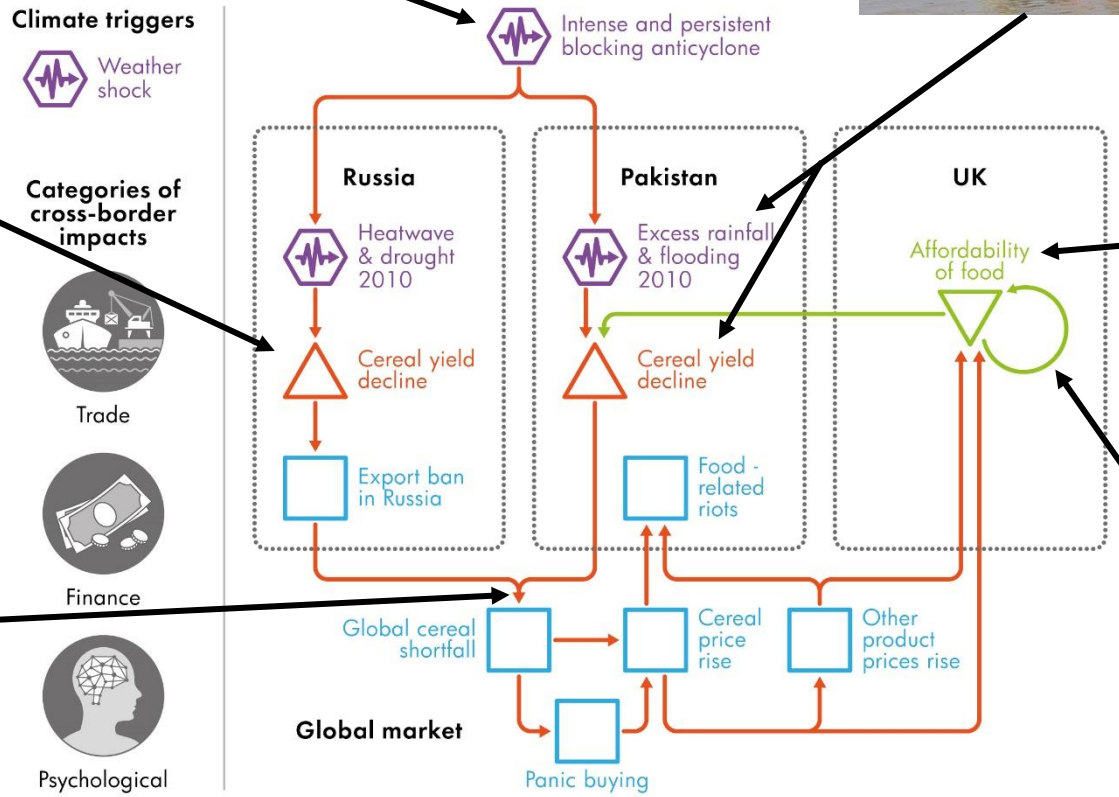
Russian export ban + world price

Source: Welton, 2011

Atmospheric Rossby wave excitation intensified by greenhouse gas forcing



Pakistan: 2010 Severe flooding



UK: affordability of food

UK: Emergency food banks

Based on Challinor et al. (2018)

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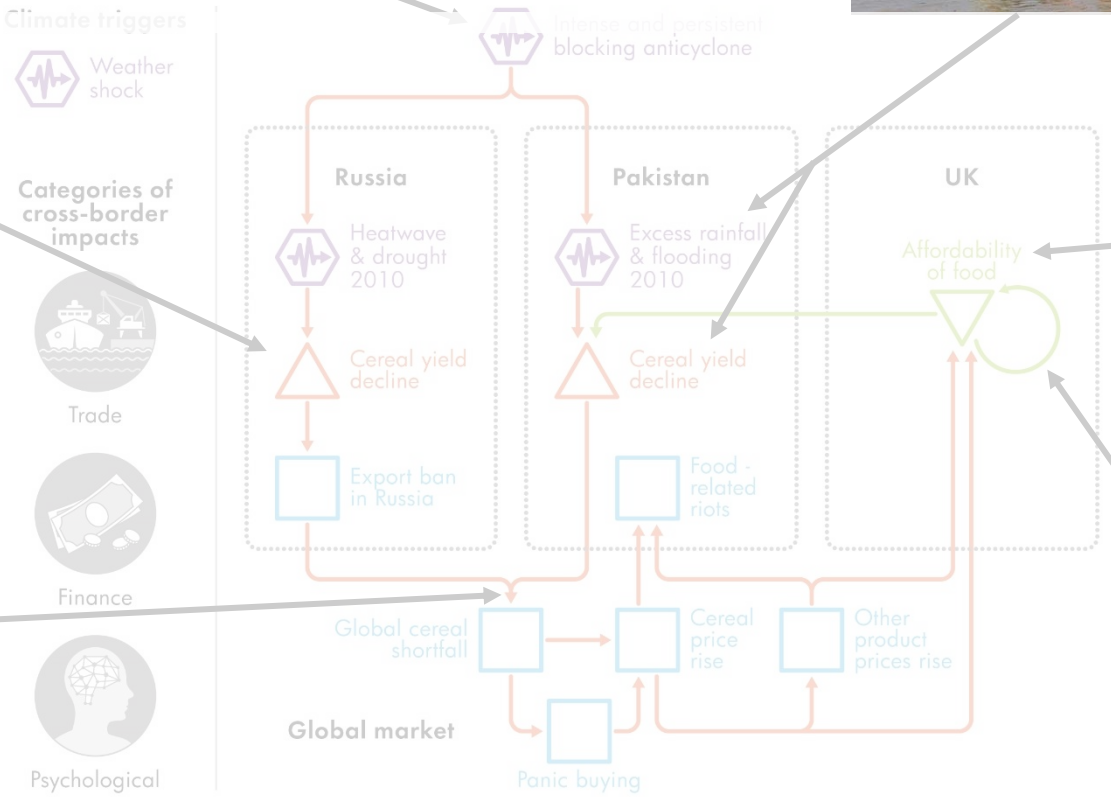
Atmospheric Rossby wave excitation intensified by greenhouse gas forcing

Pakistan: 2010 Severe flooding

Pakistan: 2022 Severe flooding

Russia: wheat production shortfall



UK: affordability of food

Russian export ban + world price

Source: Welton, 2011

UK: Emergency food banks

Based on Challinor et al. (2018)

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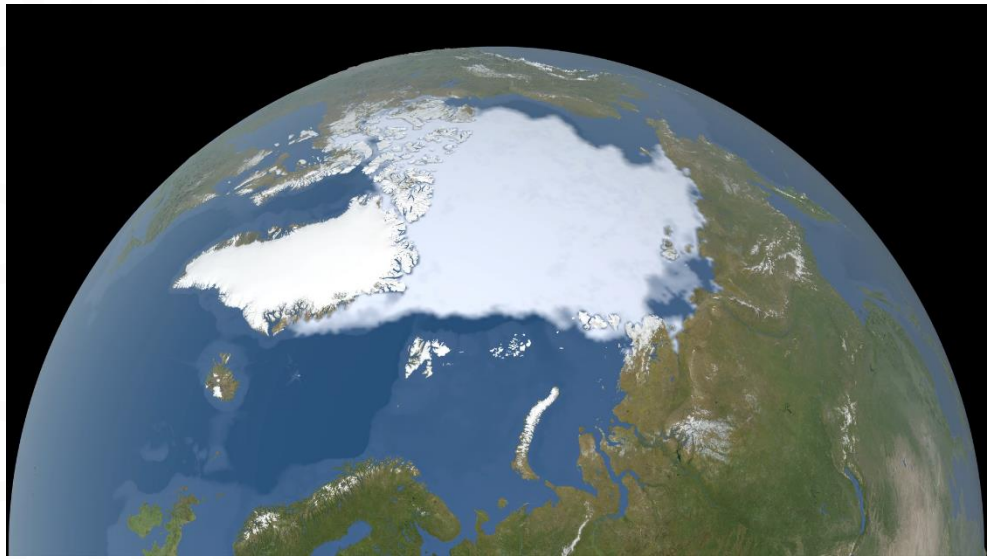
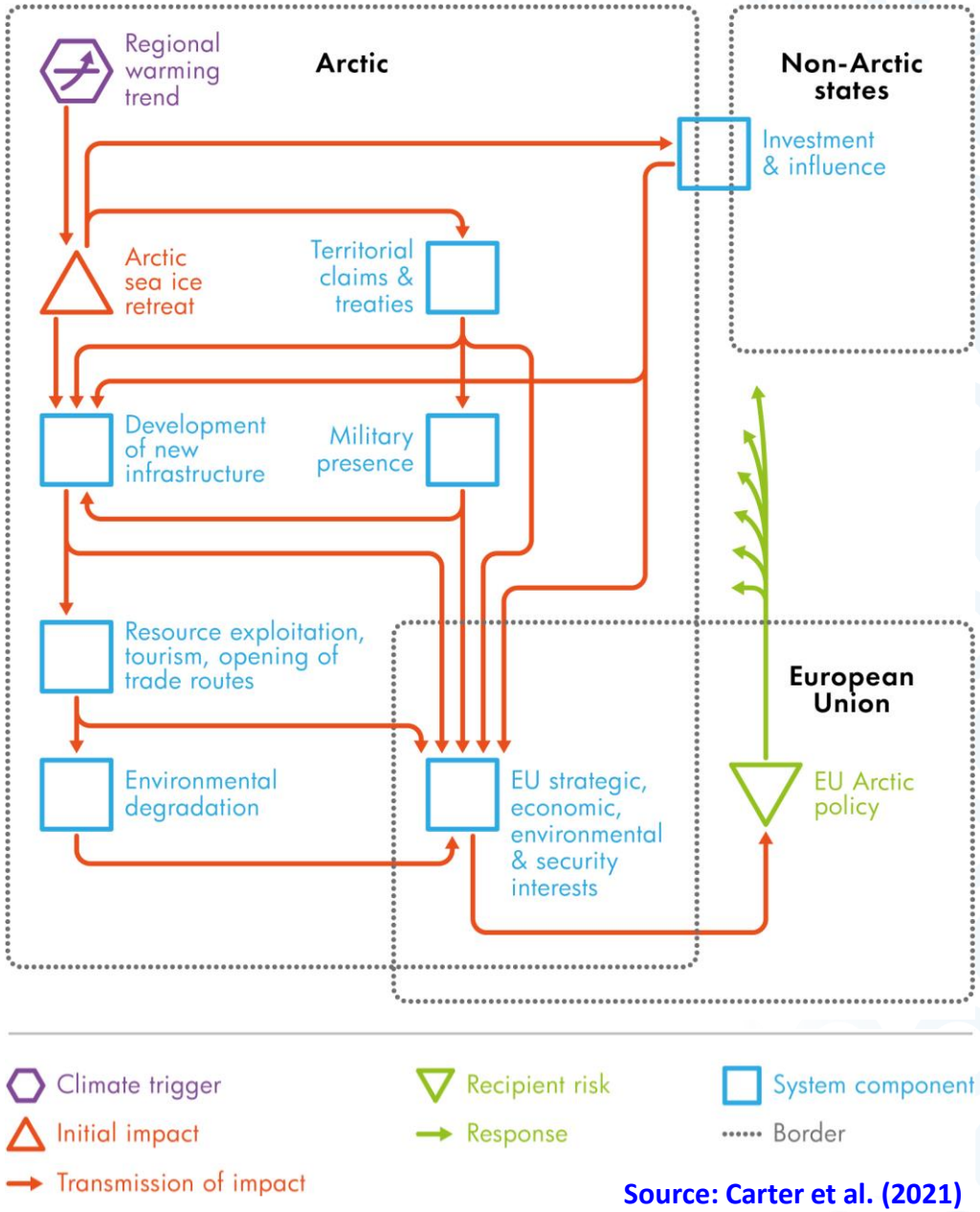
Examples

Retreat of Arctic sea ice



Source: NASA/Goddard Space Flight Center Scientific Visualization Studio

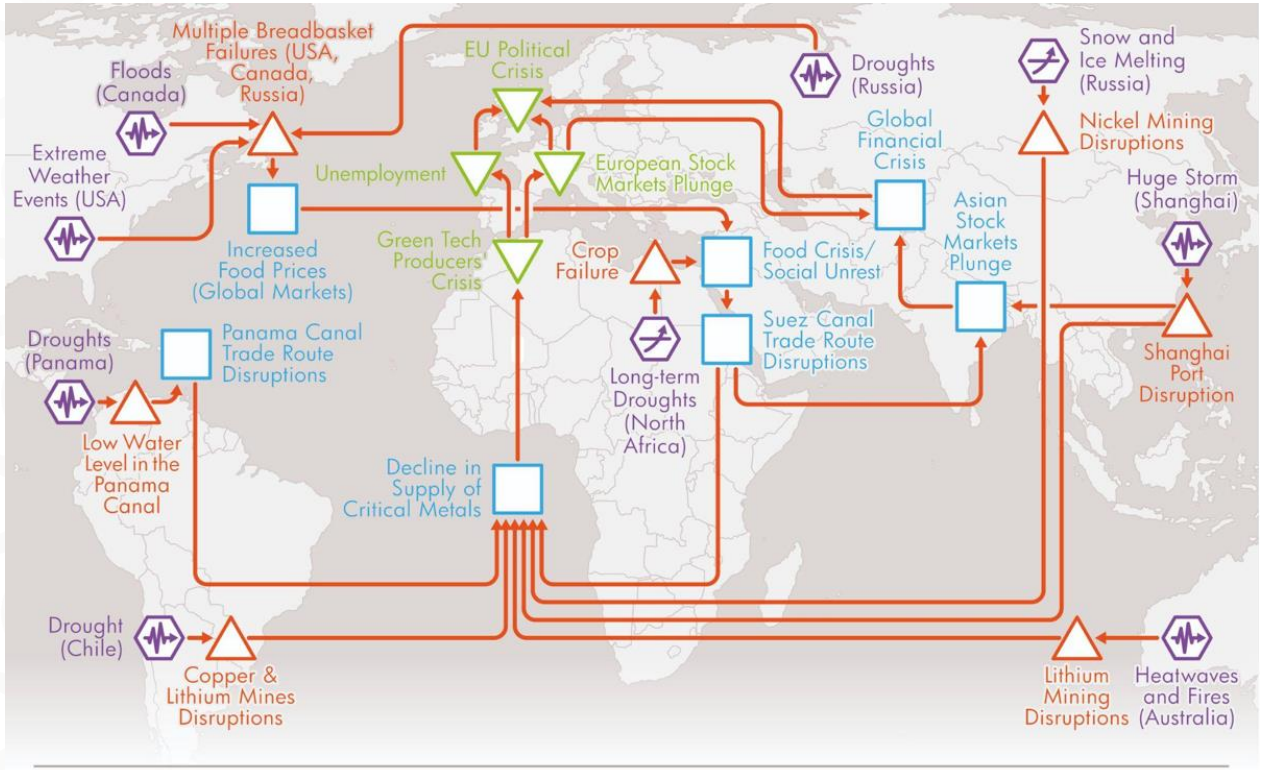


Source: Carter et al. (2021)

Examples

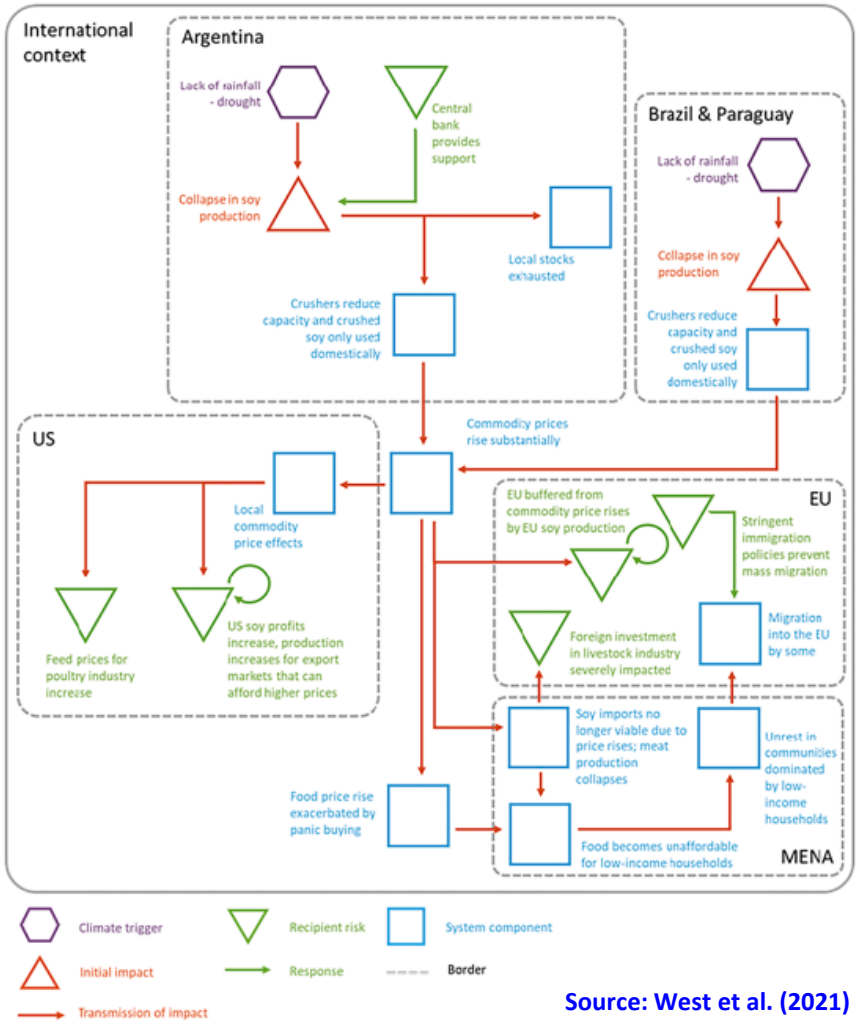
Applications of the Conceptual Framework

Simulation storyline represented in the CASCADES Conceptual Framework format



Source: West et al. (2021)

Impact and response transmission pathways related to potential future drought in Argentina (and other parts of South America) under an SSP3-based scenario



Source: West et al. (2021)

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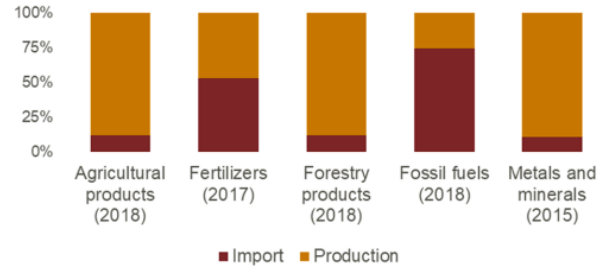
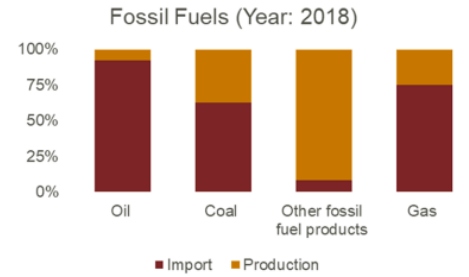
Examples

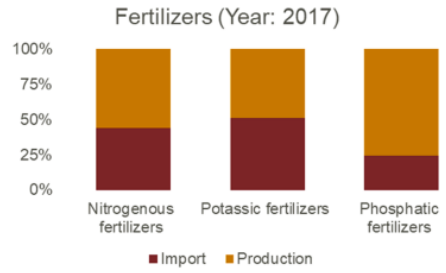
Europe's connections & exposure

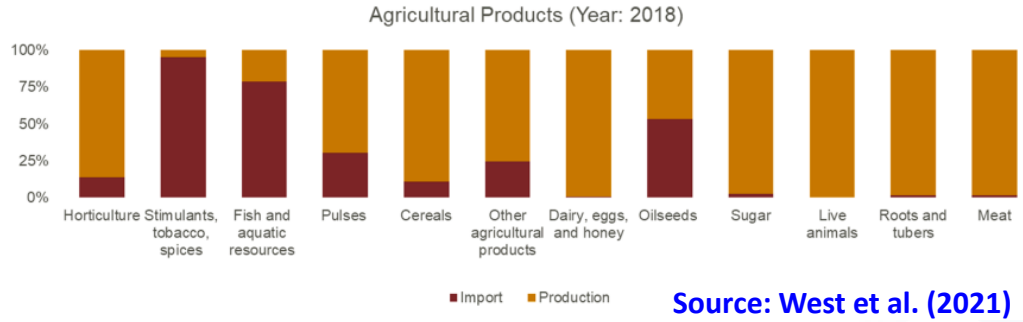
- Typical pathway through production of traded commodities (e.g. shortfalls, price spikes, volatility)
- There are varied dependencies on imported commodities

Relative contribution of imports to material dependency (imports plus production) in the EU27









Source: West et al. (2021)

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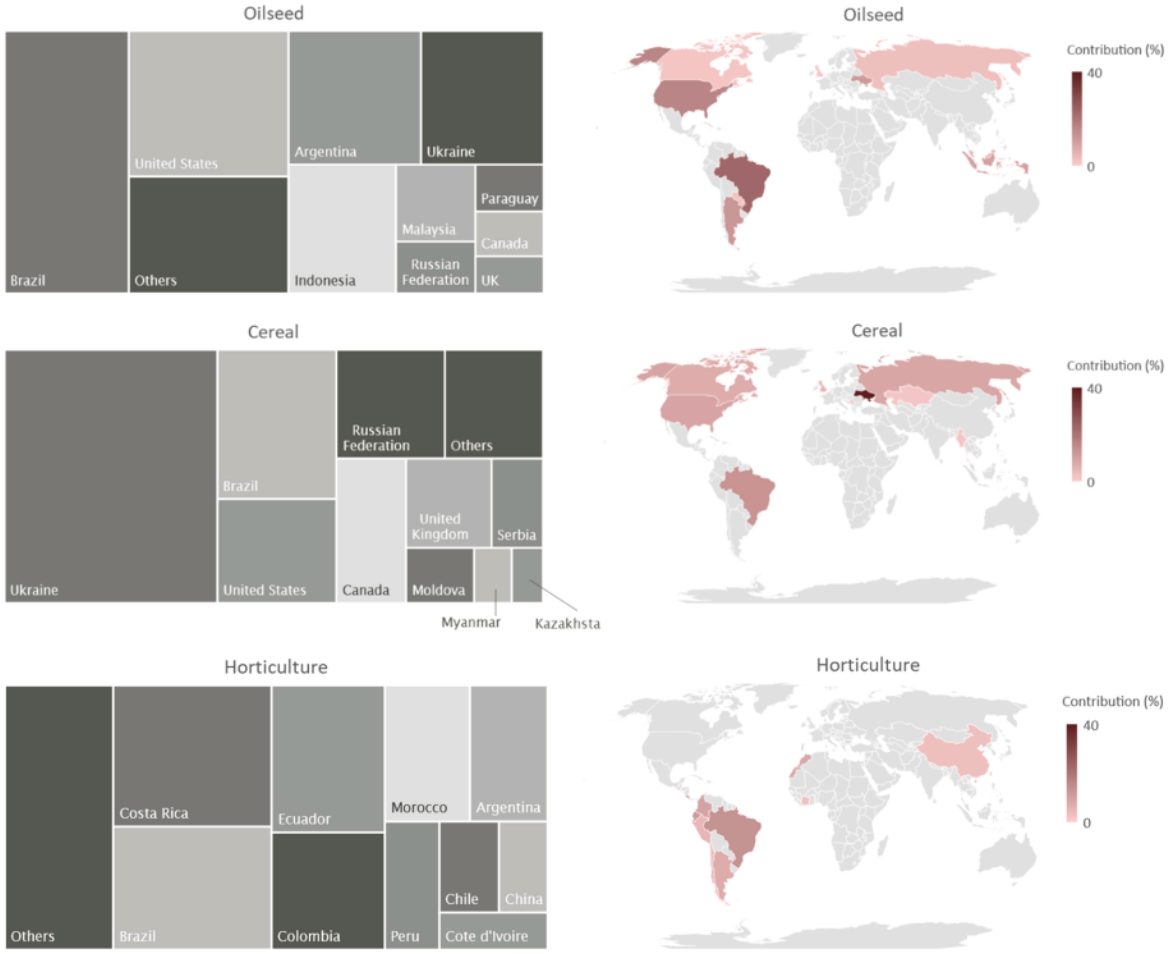
Examples

Europe's connections & exposure: Trade

- Typical pathway through production of traded commodities (e.g. shortfalls, price spikes, volatility)
- There are varied dependencies on imported commodities
- Risk concentrated in certain sectors or geographies:
  - more exposed for climate events
  - easier for targeting policy intervention
- Does international trade exacerbate or mitigate risk?

Import sources of selected agricultural commodities into the EU27 from non-EU27 countries in 2018



Source: West et al. (2021)

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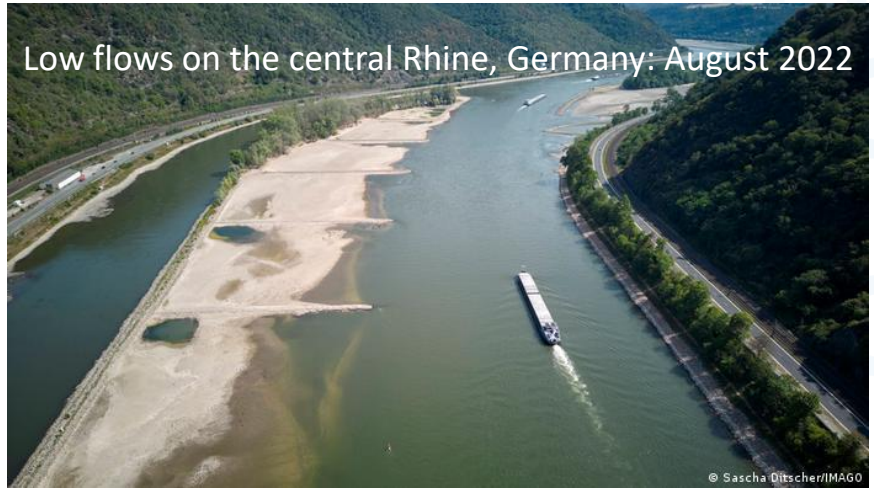
  - easier for targeting policy intervention
- Does international trade exacerbate or mitigate risk?
- Transportation infrastructures & operations (e.g. port inundation; river transportation; maritime chokepoints)
- Climate change can also present novel opportunities or risks (e.g. slow onset events may open new trading routes in the Arctic)



Source: West et al. (2021)

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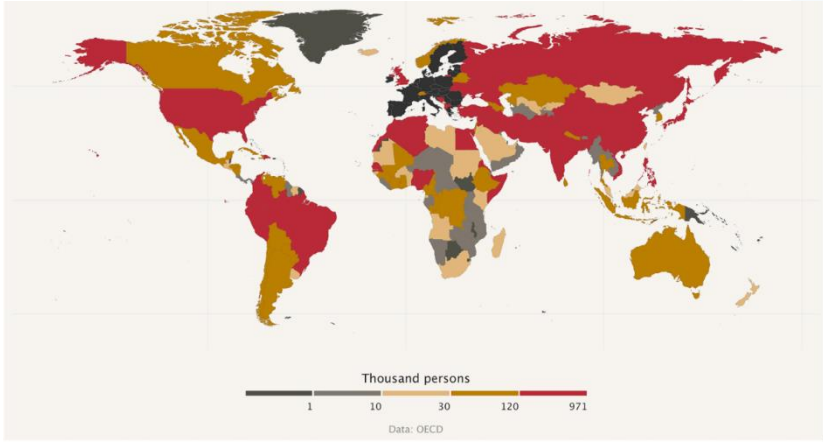
Examples

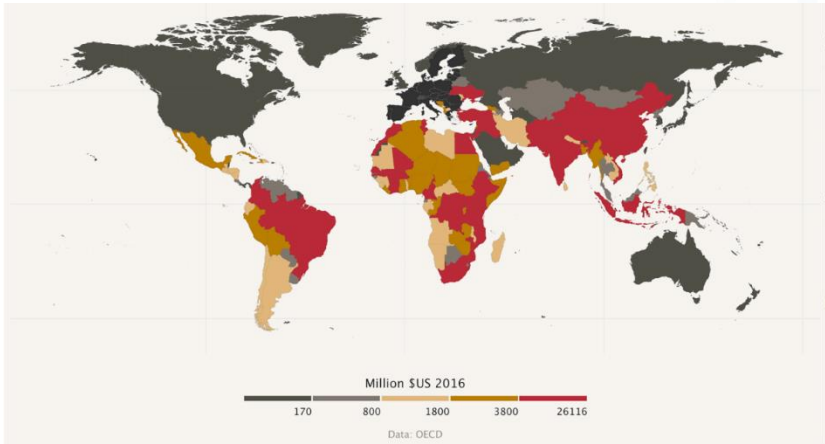
Europe's connections & exposure: Human security

- Data analysis indicates neighbourhood effect
- Migration as a response is contested; long period studies are needed for better understanding of processes
- Migration may increase due to shocks to agricultural productivity & livelihood opportunities
- Higher potential for adaptation in slow-onset events
- Overseas development assistance is a marker of EU connection to and involvement in non-EU countries
- ODA flows disproportionately to near-Europe and Africa

Total number of migrants reaching the EU27, between 2007 and 2016



Total gross overseas development assistance from the EU27 to non-EU countries, between 2008 and 2017



Source: West et al. (2021)

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Examples

Europe's connections & exposure: Finance

- Increasing awareness of risk for global financial stability
- Large focus on climate transition risk
- Analyses of physical climate risks are more recent, but cross-border impacts little studied

Breaking the tragedy of the horizon

Mark Carney

Former Governor, Bank of England from 2013-2020

Climate change can affect financial stability through:

1. Physical risks
2. Liability risks
3. Transition risks

The catastrophic impacts of climate change will be felt beyond the traditional horizons of most actors

Source: Speech at Lloyds of London (Carney, 2015)
https://www.bankofengland.co.uk/news/speeches

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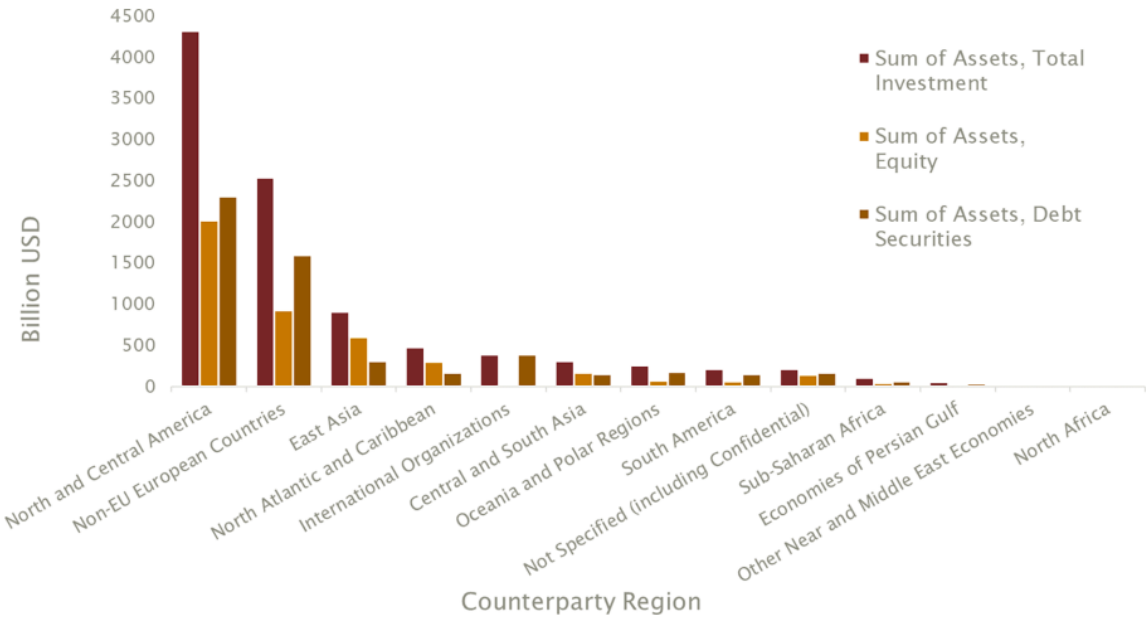
Examples

Europe's connections & exposure: Finance

- Increasing awareness of risk for global financial stability
- Large focus on climate transition risk
- Analyses of physical climate risks are more recent, but cross-border impacts little studied
- The EU financial sector is particularly exposed to climate risks via portfolio investments
- High importance attached to public and private insurance; greater cash reserves in regions of high physical risk
- The UNFCCC Warsaw International Mechanism for coping with Loss and Damage in the developing world is envisaged as a global climate change risk sharing mechanism

Shares of equity and debt instruments in total outward portfolio investment positions from the EU27



Source: West et al. (2021)

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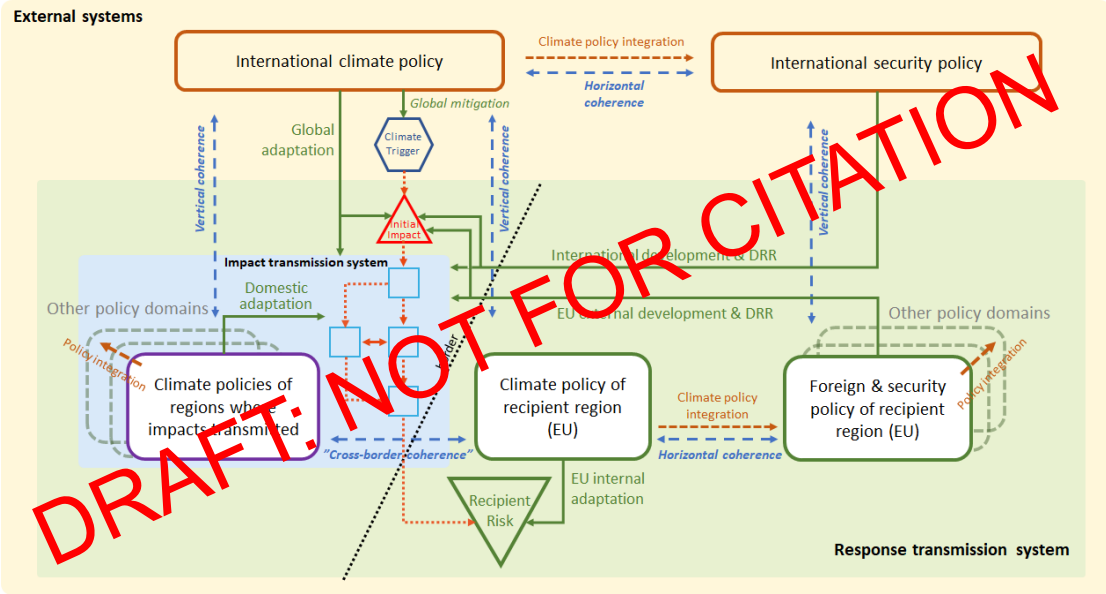
Responses

Policy coherence and policy integration

- Policy coherence and policy integration are important for linking policies in EU member states, in the EU itself and internationally
- **Policy coherence** refers to policies that mutually reinforce each other, reduce conflicts and promote synergies to achieve jointly agreed objectives.
- **Policy integration** refers to the mainstreaming of specific policy goals (e.g. climate change adaptation) into the instruments and design of other policy domains.
- These can be horizontal (between policy domains), vertical (between jurisdictional levels of governance) and/or cross-border

Framework for policy integration and coherence analysis in the context of cross-border impacts of climate change, highlighting the role of foreign and security policy in relation to climate policy



Source: Kivimaa et al. (submitted)

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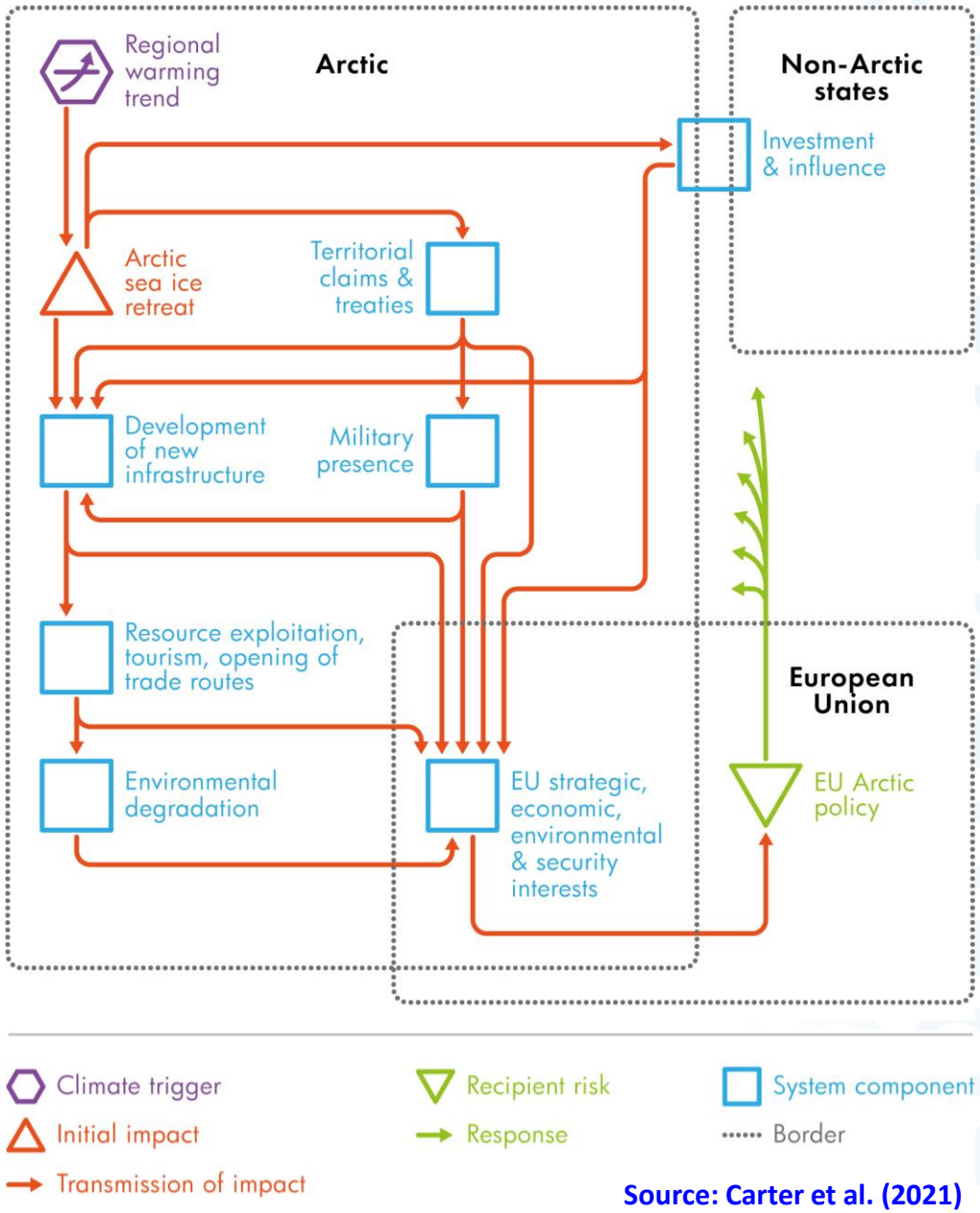
Responses

Some potential synergies and conflicts concerning EU Arctic Communication with respect to the Arctic Council's policies

	Examples of potential synergies	Examples of potential conflicts
Horizontal coherence	Environment, security and trade connected in EU Arctic strategy. Security policy for surveillance of emergencies, accidents, and disasters possibly applicable to responding to weather shocks. Aims for EU to collaborate with Arctic states on environmental/climate issues also increase stability in the area (synergistic with foreign and security policy).	Deeper coordination of adaptation with foreign and security policy appears missing. Weak integration of climate change into trade and finance policy outputs and outcomes (in the EU Arctic strategy). Arctic paradox: EU aims to curtail carbon emissions, while continuing to benefit from raw materials and shipping routes in the Arctic for trade purposes.
Vertical coherence	Vertically coherent responses in actions to reduce impacts from climate-related natural disasters, such as floods or wildfires Heavy fuel phase-out in Arctic shipping based on IMO decision	Banning heavy fuel oil shipping in tension with international principles on freedom of navigation and the right of innocent passage.
Cross-border coherence	Environmental protection objectives in the EU and the Arctic Council. Similar principles on adaptation & indigenous communities in the Arctic Council & the EU. Climate change identified as a comprehensive threat & aiming to make the Arctic more resilient (integration of policy objectives)	Resource & land exploitation by EU and other Arctic states vs. indigenous peoples' adaptation capabilities. The EU's objective to ban further fossil fuel exploration in the Arctic vs. some Arctic states' energy/security policy plans.

Source: Kivimaa et al. (submitted)



Source: Carter et al. (2021)

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Framing cross-border climate change impacts and responses

1. Introduction: What are cross-border climate change impacts?
2. Context: Why are we discussing them?
3. Framing: How can we describe and classify them?
4. Examples: Where in Europe can they be illustrated?
5. Responses: Which aspects of policy response merit attention?
6. **Conclusions: Whither cross-border climate change impacts and responses?**

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Conclusions

Europe's exposure to cross-border risks

- Informational landscape for risk assessment currently insufficient
- Cross-border impacts recognized in the EU Adaptation Strategy
- Risk is likely concentrated in certain sectors or geographies (e.g. trading of oilseeds, EU investment abroad)
- EU's exposure to risk is heavily influenced by the context and actions of others

New EU Strategy on Adaptation to Climate Change (Forging a climate-resilient Europe)

3.3. Strengthen global engagement and exchanges on adaptation

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The impacts of climate change have knock-on effects across borders and continents. *Even local climate impacts have regional or global repercussions, and such transboundary climate risk can reach Europe. For instance, the disruption of port infrastructure could hamper or even close down trade routes, both for commodities and goods, with potential cascading effects across international supply chains. ……*

Source: European Commission (2021)

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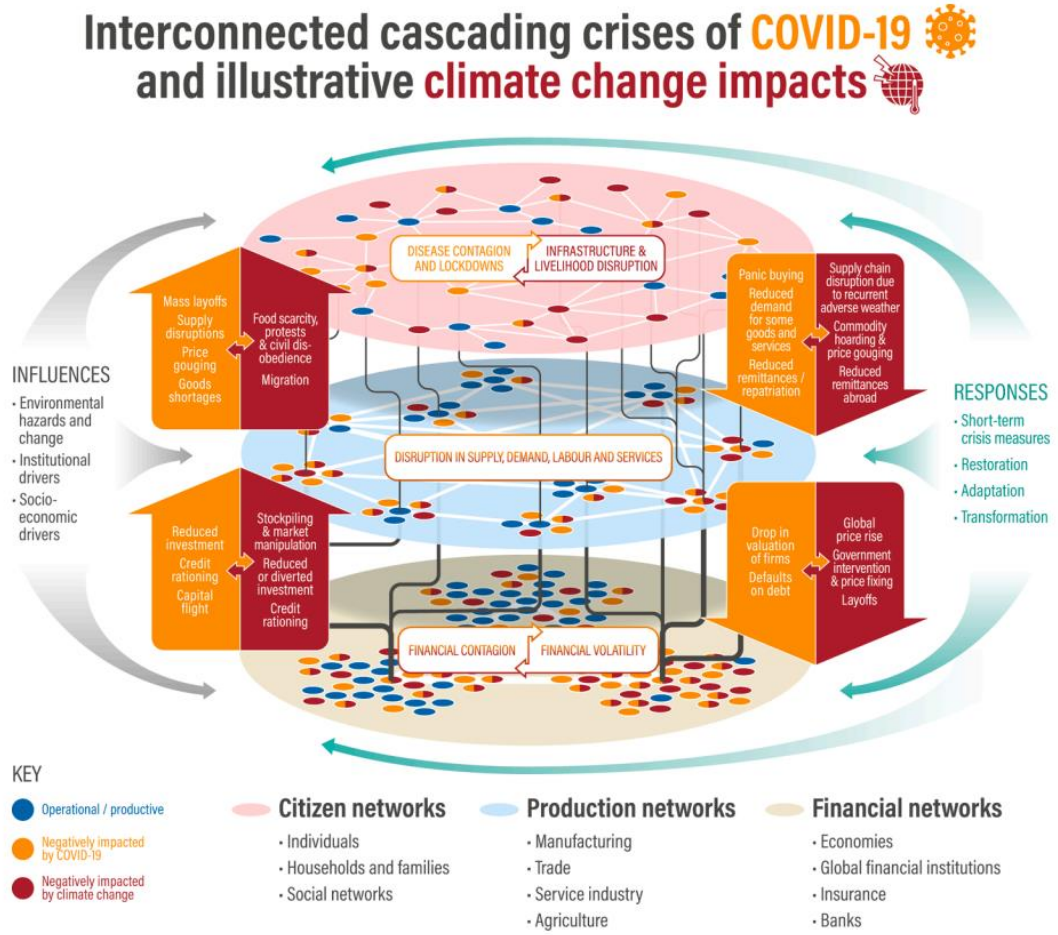
Conclusions

Europe's exposure to cross-border risks

- Informational landscape for risk assessment currently insufficient
- Cross-border impacts recognized in the EU Adaptation Strategy
- Risk is likely concentrated in certain sectors or geographies (e.g. trading of oilseeds, EU investment abroad)
- EU's exposure to risk is heavily influenced by the context and actions of others
- Useful lessons from historical shocks (e.g. commodities, Covid, Ukraine, Ever Given & Affinity V blockages)
- The CASCADES Conceptual Framework is being applied in a number of different contexts for helping to understand complex interactions



Source: Ringsmuth et al. (2022)

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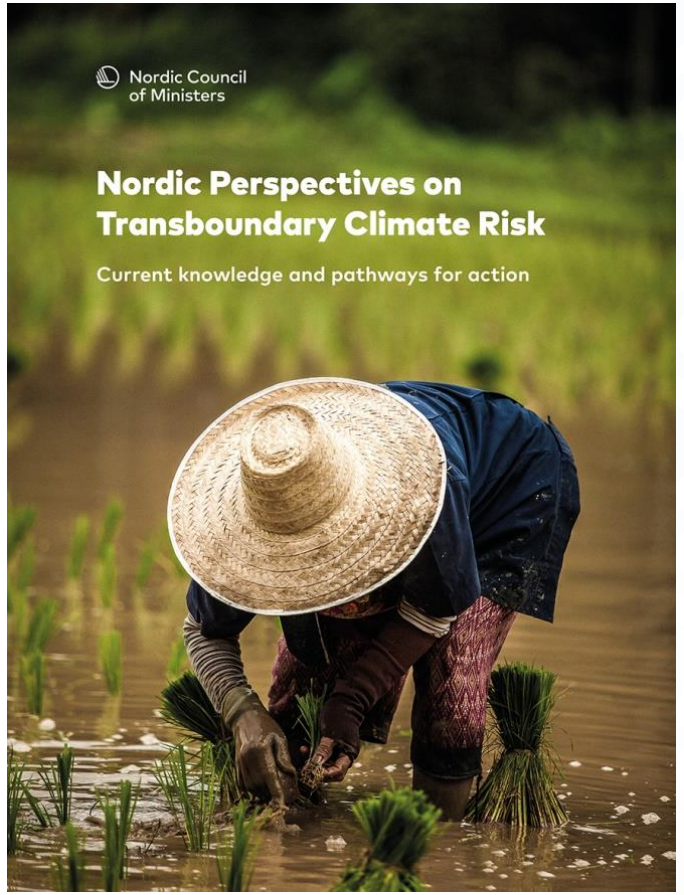
Conclusions

Recommendations for future co-operation

- Improve the knowledge base
- Foster mutual learning and sharing of adaptation best practices in policy and business
- Raise awareness about transboundary risks among decision-makers
- Share existing practical tools to address transboundary risks
- Deepen co-operation in contingency planning around transboundary risks
- Build alliances with partners in the global South to facilitate mutual learning
- Engage with the private sector in discussing and planning on transboundary climate risks
- Integrate transboundary climate risks into development cooperation, including research and finance



Source: Berninger et al. (2022)

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Conclusions

Additional research & policy needs

- Analysis of transboundary climate risks in priority sectors other than agriculture and food, such as energy and transport
- Roles of local, national and regional authorities in addressing transboundary climate risks
- Risk ownership – responsibilities and coordination
- Loss and Damage, liability and compensation will require more research on attribution as well as improved understanding of impact transmission
- Climate and socioeconomic scenarios for projecting impacts require more recognition of cross-border linkages & connectivity
- Policy simulation methods appear promising engagement tools for depicting how risks may emerge and shift and for identifying likely leverage points for policy intervention

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Sources: West et al. (2022) & various

Energy Policy 115 (2018) 418–425

The importance of transnational impacts of climate change in a power market

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Environment Systems and Decisions (2019) 39:3–15
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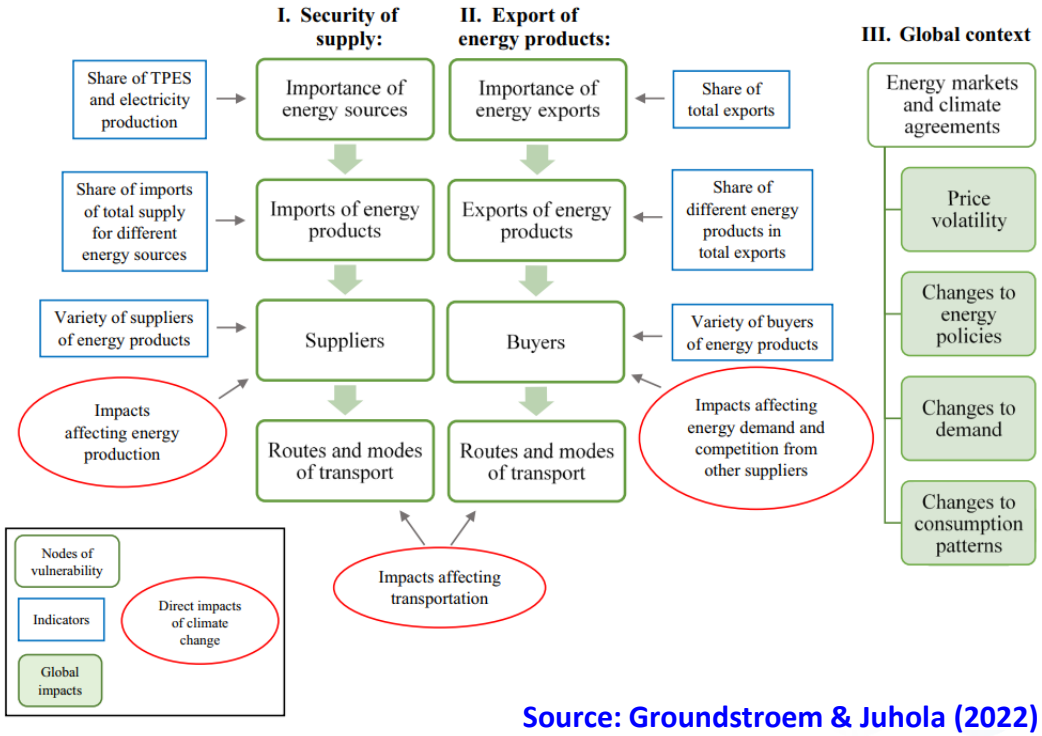
A framework for identifying cross-border impacts of climate change on the energy sector

Fanny Groundstroem[1] · Sirkku Juhola[1]



Source: Groundstroem & Juhola (2022)

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