Submission by the Stockholm Environment Institute on behalf of the Adaptation Without Borders global partnership, relating to the development and application of methodologies for assessing adaptation needs

28 February 2021

The Stockholm Environment Institute is grateful for the opportunity to submit these perspectives to the Adaptation Committee on behalf of the Adaptation Without Borders global partnership. We would like to draw the Committee's attention to an important but underappreciated dimension of climate change: transboundary climate risk. This dimension of climate change could have important implications for the work of the Adaptation Committee and the broader institutional architecture of the UNFCCC.

Transboundary climate risks

The impacts of climate change are not confined by national borders: they affect and are amplified by trade and supply chains, capital flows, human mobility, and the sharing of natural resources among countries, regionally and globally. Likewise, actions to adapt to climate change can have impacts far beyond the jurisdiction where they are implemented. Thus, while the consequences of climate change are felt and addressed at the national and subnational levels, they also require a multilateral response that current approaches to adaptation rarely provide.

Cross-border climate risks can reverberate through the global economy, impacting all countries all around the world, often far away from the original source. These risks are poised to become larger and more significant with time. Yet many countries, businesses and organisations are unaware of these risks and underprepared for their potential effect on fragile systems.

Assessments of transboundary climate risks are therefore essential but can be highly complex, as outlined in Figure 1. The scoping and design phase serves to delimit the assessment, identify and involve appropriate stakeholders, and consider how results will be integrated into decision-making. After a detailed scoping has occurred, countries can proceed to the actual assessment, and to appraising the results.

Assessment methods

The two annexes to this submission present novel methods to assess transboundary climate risk and associated adaptation needs. Annex I presents the Source Index, a tool to identify adaptation needs in the context of food security via trade. The Source Index assesses the following aspects of global food trade:

» Risk sources: the direct impact of climate change on the production of agricultural commodities in exporting countries

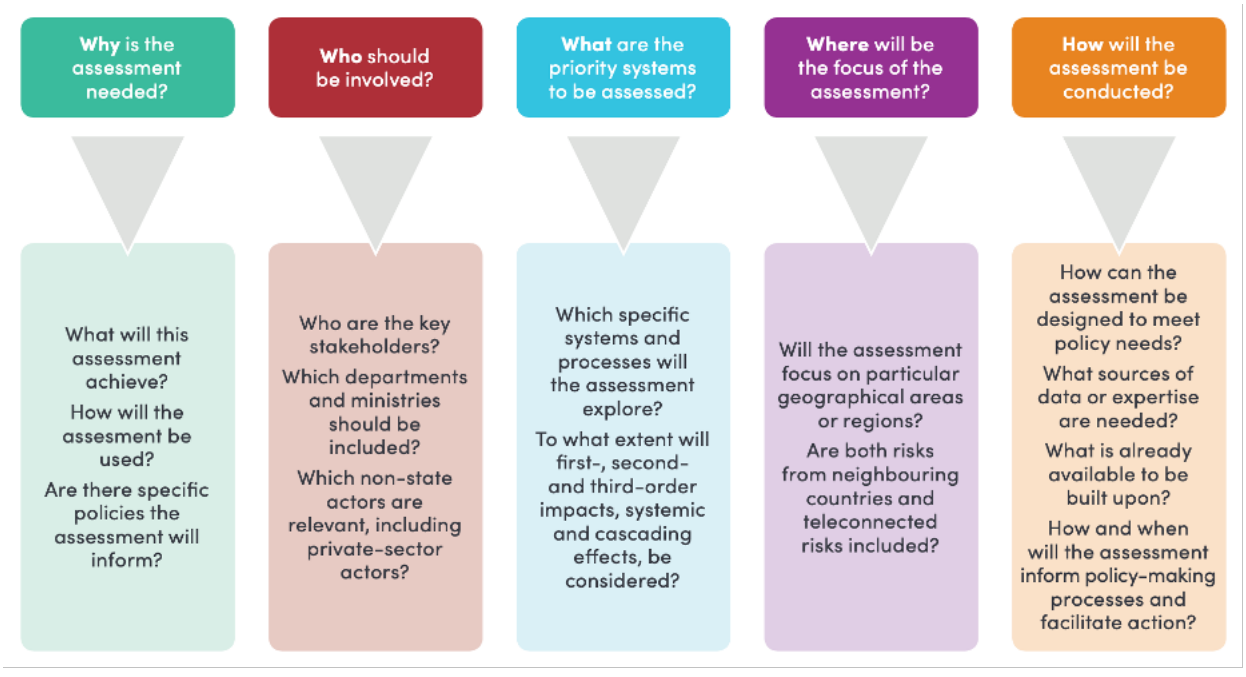
» Links: the distribution of this risk from exporters, via trade networks, to the country of final consumption
» Risk recipients: the countries that import the highest levels of risk and therefore face the biggest adaptation challenges

Annex II presents a methodology for assessing transboundary climate risk via international trade as applied to Sweden. The method explores a country's bilateral trade relations, the climate risks embedded in those trade relations, and future trends and implications for meaningful action in climate adaptation.

Ways forward

The Stockholm Environment Institute, on behalf of the Adaptation Without Borders global partnership, encourages the UNFCCC Adaptation Committee to consider transboundary climate risk and associated adaptation needs in its deliberations on the global goal on adaptation and the global stocktake. For more information on Adaptation Without Borders, please refer to https://www.adaptationwithoutborders.org.

Figure 1: Key questions for scoping and designing an assessment of transboundary climate risk (source: "Climate-Resilient Trade and Production: The Transboundary Effects of Climate Change and Their Implications for EU Member States", Adaptation Without Borders Policy Brief 1, Adams et al., 2020).



Annex I

A tool to identify adaptation needs in the context of food security via trade – the Source Index

This annex is based on Adams et al (2021) Climate Change, Trade and Global Food Security – A Global Assessment of Transboundary Climate Risks in Agricultural Commodity Flows, a forthcoming report by the Stockholm Environment Institute on behalf of the Adaptation Without Borders initiative[1].

The Source Index (Adams et al, 2021) traces the distribution of climate risk via global trade in six key global agricultural commodities: wheat, maize and rice, which are staple crops for many people worldwide; soy and sugarcane, which are embedded as ingredients in many processed foods and drinks consumed worldwide; and coffee, which is a luxury crop grown mostly by smallholders in developing countries and consumed all over the world. This suite of six highly traded commodities provides an overview of how the risks resulting from climate change impacts on agricultural production will be distributed throughout the global trade system.

Countries will have to adapt not only to the direct, domestic impacts of climate change, but also to the transboundary risks that will result from global interconnections, such as food and drink supply chains. Increasingly, imported foods are vital for meeting the dietary needs of people at all income levels. Climate risks to global food supply chains may therefore have significant impacts on food security and be an important priority for national adaptation planning. This is true for countries at all levels of development.

The Source Index assesses the following aspects of global food trade:

- Risk sources: the direct impact of climate change on the production of agricultural commodities in exporting countries – these can be either positive (opportunity, i.e. increased yields) or negative (risk, i.e. decreased yields)
- Links: the distribution of this risk from exporters, via trade networks, to the country of final consumption, for example important bilateral relationships between exporters and importers
- Risk recipients: the countries that import the highest levels of risk and therefore face the biggest adaptation challenges

[1] The report will soon be available on www.sei.org. The methodology and all results (data and visualisations) will be openly available here after the Index is launched, which is currently scheduled for March 2021.

Agricultural Trade and Adaptation Needs

Exporters will need to adapt agricultural production where it is at risk from climate change, for example as a result of more variable weather, increased extreme events such as drought and flooding, or where slow onset changes gradually undermine the resilience of certain farming practices, for example where temperature increases make it impossible to continue growing a reliable and profitable coffee crop for export.

In order to support this kind of adaptation, exporters need to know how their export crops might be impacted by climate change, their relative exposure to climate risk versus other exporters of the same commodity (i.e. competitors on the international market) and possibly which trade partners might be affected by this change in risk (e.g. as the basis for enhanced bilateral cooperation to support adaptation).

This information is provided by the Source Index.

Importers will need to adapt to increased price volatility for key commodities, and in extreme cases – for example during market crises – to absolute shortages in some traded commodities. They might do this by reducing demand for risky commodities or substituting or diversifying supply (where feasible and affordable), if they cannot afford to absorb future price shocks. Depending on their level of exposure to climate risks via trade, this may present a strategic challenge to national adaptation planning, especially where countries simultaneously face climate risks to domestic agriculture as well as to their imports.

In order to support this kind of adaptation, importers need to know which imported commodities are likely to most affected by climate change impacts, how they are currently linked to the most risky exporters of these commodities and how potential substitute trade partners might be affected by future climate change (i.e. where adaptation may deliver new opportunities).

This information is provided by the Source Index.

Bilateral and multilateral donors, climate funds and international organisations may also identify adaptation needs for themselves, as well as their recipients and members, in light of information about the distribution of climate risk via agricultural commodity markets. They may need to adapt to increased volatility generally in commodity markets that underpin global food security. They may also need to increase capacity to support countries and vulnerable people during food price crises, as well as to target investments that build resilience in global markets, for example by strategically increasing the resilience of agricultural production in high risk exporting countries and by increasing storage facilities in import-dependent countries, or facilitating cooperation and improving the governance of global commodity markets to reduce price volatility.

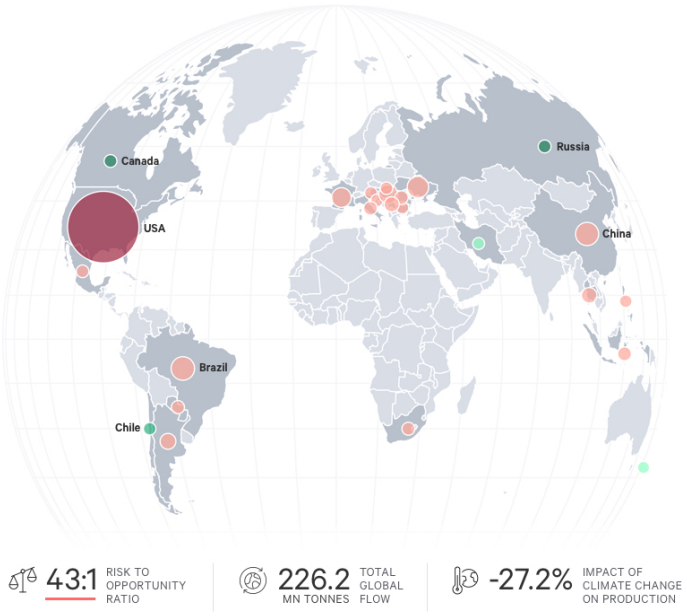
In order to support this kind of adaptation, systemic actors such as these need to know which commodities are likely to face the biggest risks from climate change, which agricultural exporters play a key role in the distribution of these risks and which types of countries are most exposed to the risks via their import profiles.

This information is provided by the Source Index.

Example outputs from the Source Index

Note – the report introducing the Source Index has not yet been published. Please do not reproduce any results. Contact the authors if you have any questions, or to express interest in using the data.

Commodity overview – showing the highest risk exporters for a given commodity (red circles and bars, see table on right hand side, below), exporters with the most significant opportunities to increase production as a result of climate change (green circles and bars), as well as an overview of the risk to opportunity ratio for each commodity (i.e. the projected total decrease in global production versus the projected increase) and other relevant high level information.



#	EXPORTER	TOTAL SHARE OF GLOBAL RISK (%)	TOTAL EXPORTS (TONNES)	IMPACT OF CLIMATE CHANGE ON PRODUCTION
1	USA		64.18mn	-45.5%
2	Brazil		20.33mn	-22.1%
3	China		32.81mn	-15.5%
4	Ukraine		9.66mn	-29.5%
5	France		8.25mn	-32.2%
6	Hungary		4.55mn	-45.0%
7	Argentina		18.04mn	-6.8%
8	Thailand		3.14mn	-48.7%
9	Serbia		6.11mn	-41.4%
10	Indonesia		3.47mn	-21.0%
11	Italy		1.61mn	-32.1%
12	Romania		1.97mn	-34.3%
13	Paraguay		1.85mn	-24.5%
14	South Africa		2.36mn	-8.7%
15	Mexico		1.88mn	-35.6%
16	Austria		0.99mn	-29.2%
17	Slovakia		0.53mn	-39.9%
18	Croatia		0.34mn	-40.3%
19	Bulgaria		1.08mn	-17.9%
20	Philippines		1.26mn	-25.3%
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5	Iran		0.10mn	23.5%
4	New Zealand		0.14mn	69.7%
3	Chile		0.52mn	67.1%
2	Canada		4.49mn	17.0%
1	Russia		1.58mn	12.7%

Figure 1 Global Risk Exporters – Maize

An alternative presentation of this data is also offered in Sankey diagrams (see example below), which rank exporters from the most at risk to those with the highest projected opportunities, tracing the flow of commodities from these exporters to all importing countries.

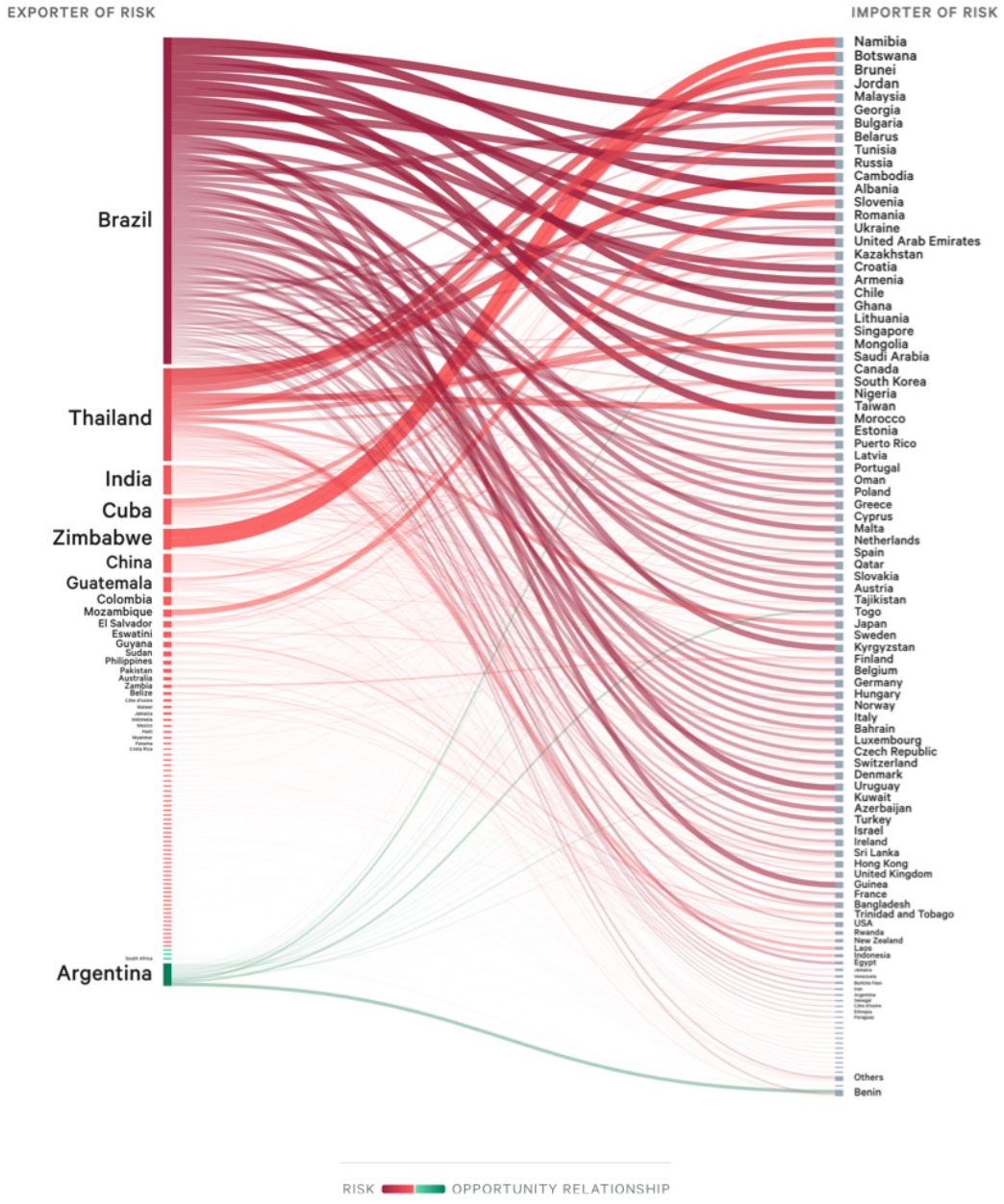
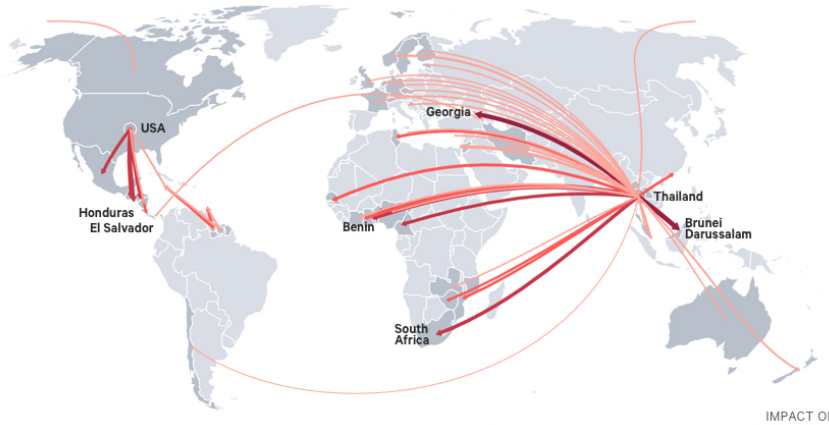


Figure 2 Trade flows and transboundary climate risks - Sugarcane

Key bilateral relationships – this is the result of (a) high changes in the production of a commodity in an exporting country; and (b) high levels of dependence on that particular commodity flow by the importing country.



#	EXPORTER	IMPORTER	RISK TO BILATERAL TRADE	BILATERAL TRADE FLOW (TONNES)	IMPORTER'S TOTAL STOCK	IMPACT OF CLIMATE CHANGE ON PRODUCTION
1	Thailand	Brunei Darussalam		0.10mn	0.13mn	-34.9%
2	Thailand	Benin		0.66mn	0.85mn	-34.9%
3	Thailand	Georgia		0.07mn	0.10mn	-34.9%
4	USA	Honduras		0.10mn	0.17mn	-31.4%
5	Thailand	South Africa		1.10mn	2.01mn	-34.9%
6	USA	El Salvador		0.08mn	0.15mn	-31.4%
7	Thailand	Togo		0.15mn	0.30mn	-34.9%
8	USA	Guatemala		0.08mn	0.15mn	-31.4%
9	Thailand	Cameroon		0.17mn	0.36mn	-34.9%
10	USA	Mexico		0.73mn	1.41mn	-31.4%
11	Thailand	Senegal		0.75mn	1.71mn	-34.9%
12	Guyana	Trinidad and Tobago		0.02mn	0.05mn	-35.5%
13	Thailand	Ghana		0.44mn	1.15mn	-34.9%
14	Guyana	Jamaica		0.03mn	0.09mn	-35.5%
15	Thailand	Tunisia		0.02mn	0.04mn	-34.9%
...	...		...	...	...	...
25	Suriname	Trinidad and Tobago		<0.01mn	0.05mn	-44.4%
26	USA	Jamaica		0.02mn	0.09mn	-31.4%
27	Thailand	New Zealand		0.04mn	0.19mn	-34.9%
28	Thailand	Nigeria		1.20mn	6.20mn	-34.9%
29	Thailand	Norway		0.04mn	0.22mn	-34.9%
30	Thailand	Switzerland		0.07mn	0.39mn	-34.9%
...	...	...	...	...	...	...
45	Thailand	Netherlands		0.09mn	0.72mn	-34.9%
46	Thailand	Estonia		<0.01mn	0.02mn	-34.9%
47	Thailand	Puerto Rico		0.01mn	0.09mn	-34.9%
48	Thailand	Germany		0.29mn	2.47mn	-34.9%
49	Thailand	United Kingdom		0.26mn	2.28mn	-34.9%
50	Thailand	Zambia		<0.01mn	0.05mn	-34.9%

Figure 3 Top 50 high risk bilateral trade relationships – Rice

Exporter profiles – a summary of the effect of climate change on exports of all commodities from each major exporting country, including information about the recipients (importers) for whom this creates a major risk.

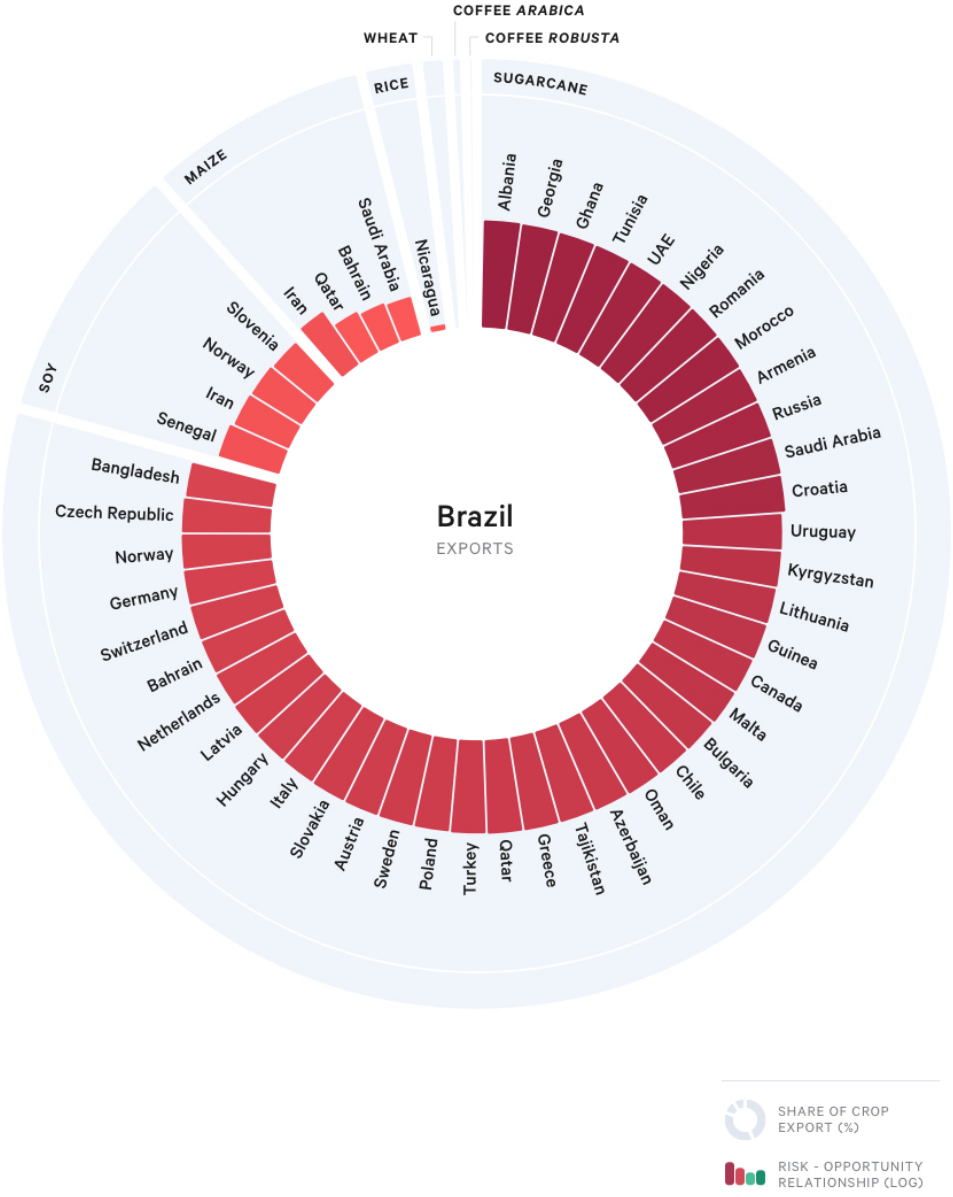


Figure 4 Key trade relationships and climate risk – Brazilian exports

Importer profiles – summarizing the exposure of importers to climate risk via their dependence on flows that are projected to be negatively (and positively) affected by climate change impacts.

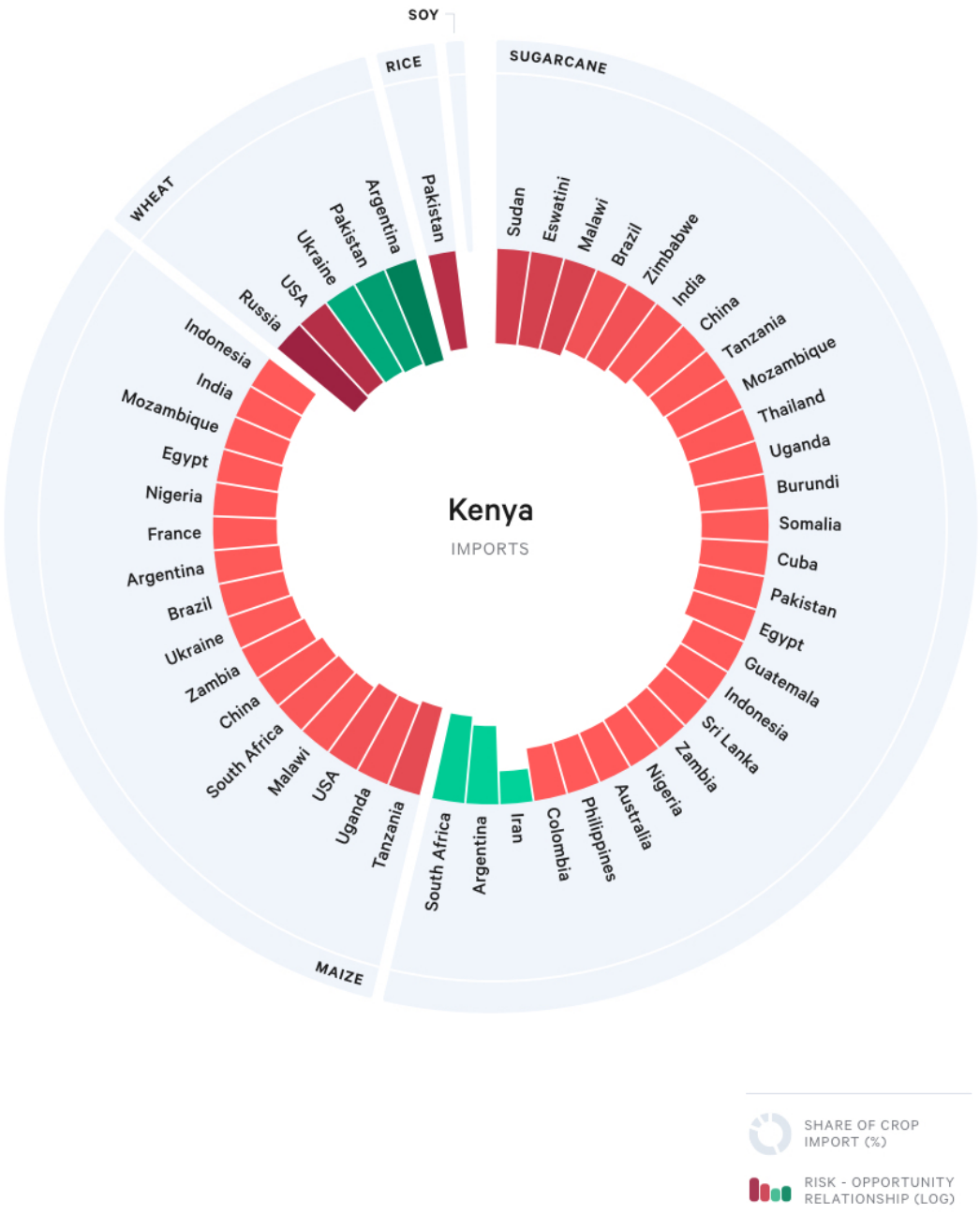


Figure 5 Key trade relationships and climate risk – Kenyan imports

Annex II

New Risk Horizons: A methodology for assessing transboundary climate risk via international trade: the case of Sweden.

This annex is based on Lager and Benzie (2021) New Risk Horizons: Sweden's exposure to climate risk via international trade, a forthcoming report by the Stockholm Environment Institute on behalf of the Adaptation Without Borders initiative[1].

The method presented in "New Risk Horizons: Sweden's exposure to climate risk via international trade" (Lager and Benzie, 2021) explores Sweden's bilateral trade relations (using and comparing multiple methods for trade analysis), the climate risks embedded in those trade relations, and explore future trends and the implications for meaningful action in climate adaptation in a globally connected world. The trade data analysis aims to provide a comprehensible illustration of possible applications of different datasets for distinct purposes in assessing transboundary risk for any specific country, and to provide an overview of limitations and common pitfalls in engaging with the trade data for climate risk assessments. The method also includes a deep dive into one specific supply chain - the climate risk embedded in the Swedish consumption of Brazilian soy - to investigate how current best-in-class data can be utilized to undertake a detailed trade-related climate risk assessment for a single supply chain.

The method has revealed trade links between Sweden and countries that are more vulnerable to climate change – links that are often hidden or obscured by conventional trade statistics. This amounts to a new horizon of risk: the previously unseen risk from climate change impacts in vulnerable countries that Sweden is linked to via the second and third tiers of its trade profile. The governance implications of the assessment are extensive. Sweden - and other countries embedded in and dependent on the global trade system - can only rely on a robust multilateral process to build resilience to climate change throughout its trade network. Sweden has been used as a 'case' this report, but similar analysis could be carried out in other countries. Very few countries have yet conducted detailed assessments of trade-related climate risk. The first step, therefore, is to encourage and facilitate such assessments in other countries: to assess and communicate national level exposure to transboundary climate risks via trade.

The data inputs used for this method are all open source and/or have been made freely accessible by authors. The results will be made openly available on an interactive web platform at publication (including access to input data). The method used is thoroughly described in the report with to facilitate application to other countries and cases (depending inevitably on the availability of trade and supply chain data for the subject of study).

[1] The report will soon be available on www.sei.org. The methodology and all results (data and visualisations) will be openly available here after the report is launched, which is currently scheduled for March 2021.

International Trade and Adaptation Needs

The research highlights specific prioritized adaptation actions to address transboundary climate risk via international trade:

- The need for international cooperation to address trade-related climate risks (regional and global)
- Transboundary adaptation investment and support – to build resilient supply chains.
- Knowledge production and sharing on systemic and cross-border effects of climate change and measures to address transboundary climate risk via trade, specifically for nation states' national adaptation plans and processes (including risk assessment methods and improved national accounting).
- Addressing the issue of policy coherence for cross-cutting issues such as trade-related climate risk (concerns a wide array of policy areas such as; trade, foreign affairs, civil contingency, climate and the environment, private sector, development cooperation and regions and municipalities)
- Focus on economic sectors and engage and involve private sector actors.
- Addressing market mechanisms for climate resilient trade systems (eg. WTO).

Example outputs:

Note – the report has not yet been published. Please do not reproduce any results. Contact the authors if you have any questions, or to express interest in using the data.

Sub-index result of the method assessing climate risk embedded in the supply chain of Brazilian soy for Swedish end consumption. The method provides municipality-level risk analysis combining eight sub-indices for projected climate impacts on the supply chain as well as detailed data on the origin of soy produced in Brazil for Swedish end consumption. The sub-index results below illustrates the magnitude and likelihood of exposure to climate risk in the production and transport of Brazilian consumed in Sweden.

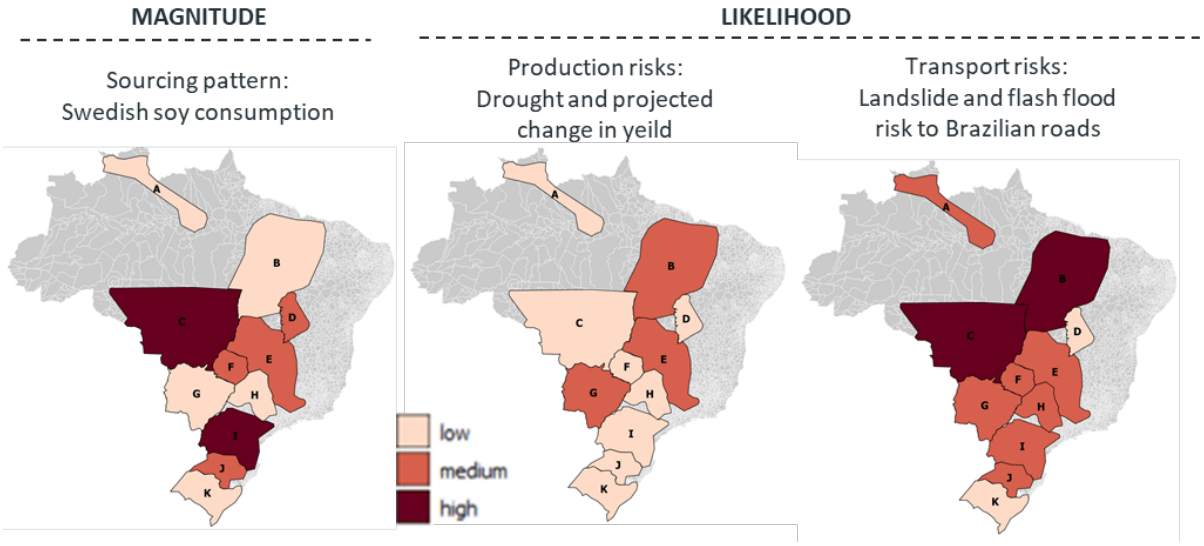


Figure 1. sub-index results of climate risk exposure in the supply chain of Swedish consumption of Brazilian soy. Typological regions based on risk levels and types, collated from municipality level results.

Exposure to transboundary climate risk via international trade: the case of Sweden. Below are doughnut charts showing total share of imports/inputs to Sweden together with the climate vulnerability of trade partners. The illustration provides a comparison of assessment methods across four different types of trade datasets; national toll statistics (SCB), input-output (IO) data in value added (OECD's WIOD), and embedded land and water resource footprint (from PRINCE project).

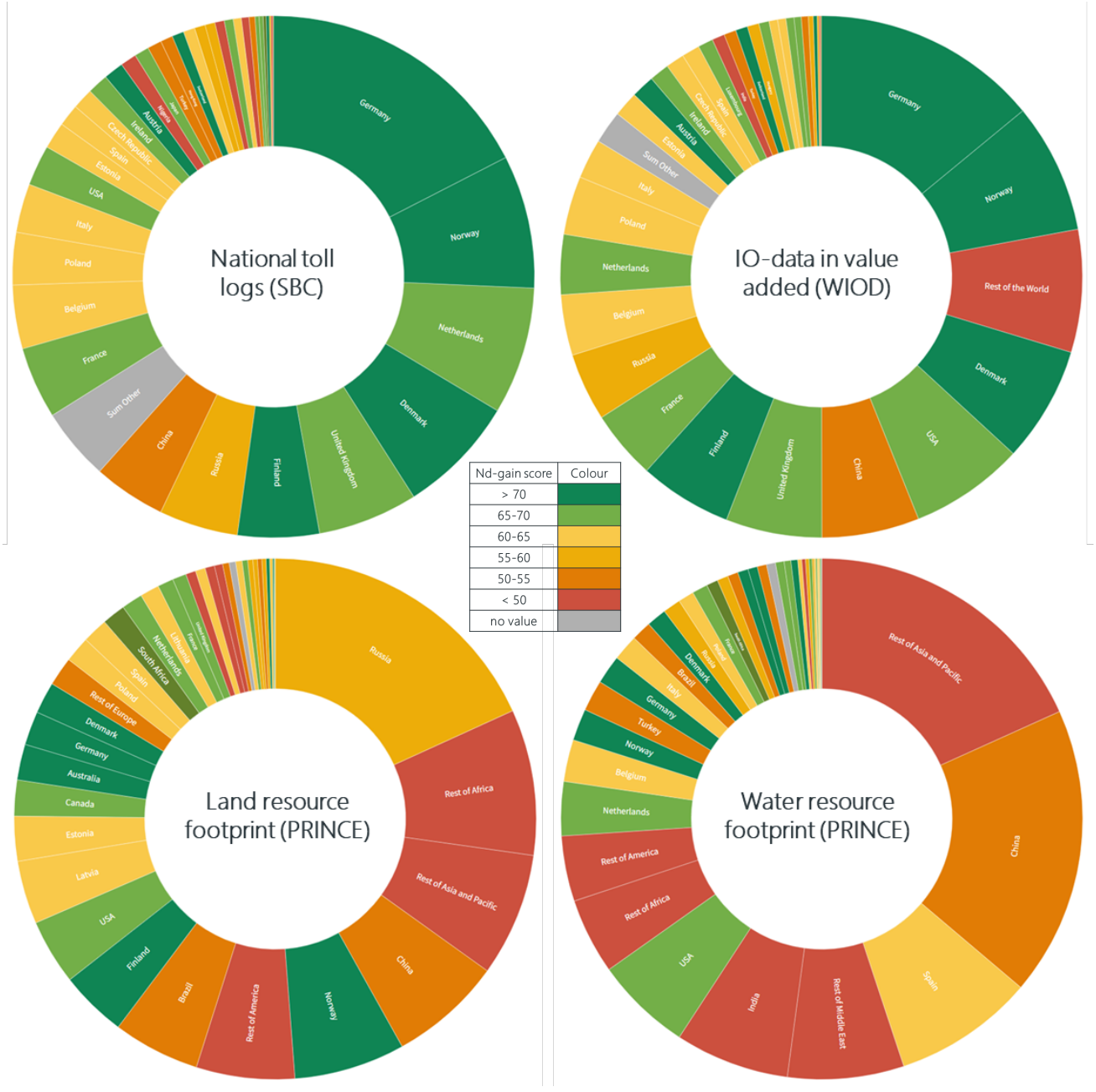


Figure 2 Climate risk in traded inputs to Sweden according to four trade data sets. Colour according to ND-GAIN country index ranges from green (low climate vulnerability) to red (high climate vulnerability)