From systemic drought risks to systemic resilience: a novel framework to guide research and policy

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Key messages

1. **Drought** risks are on the rise and their **effects are increasingly felt across communities, economic sectors, ecosystems, borders and entire societies**
2. To comprehensively assess and manage drought risks, and avoid response risks/maladaptation, **a systemic perspective is needed**
3. We propose a **novel systemic framework** to better inform drought risk research and policy

Problem statement

In recent years, the world has faced extreme droughts with severe **direct, cascading and often systemic impacts** across communities, sectors, ecosystems, and borders. **Droughts also interact with other hazards in complex ways**, for example leading to compound heat-drought events, wildfires or aggravated impacts when concurring with other hazards and shocks. At the same time, **policy responses to droughts can also lead to response risks/maladaptation**, for example when the establishment of reservoirs leads to overreliance and in turn increases vulnerability.

- Combined, these characteristics pose a **challenge to our ability to grasp drought risks in their full complexity, and to manage them in a comprehensive way**.
- This **calls for a paradigm shift in how we look at, assess and manage drought risks**: from a predominantly single risk/sectoral to a systemic perspective.

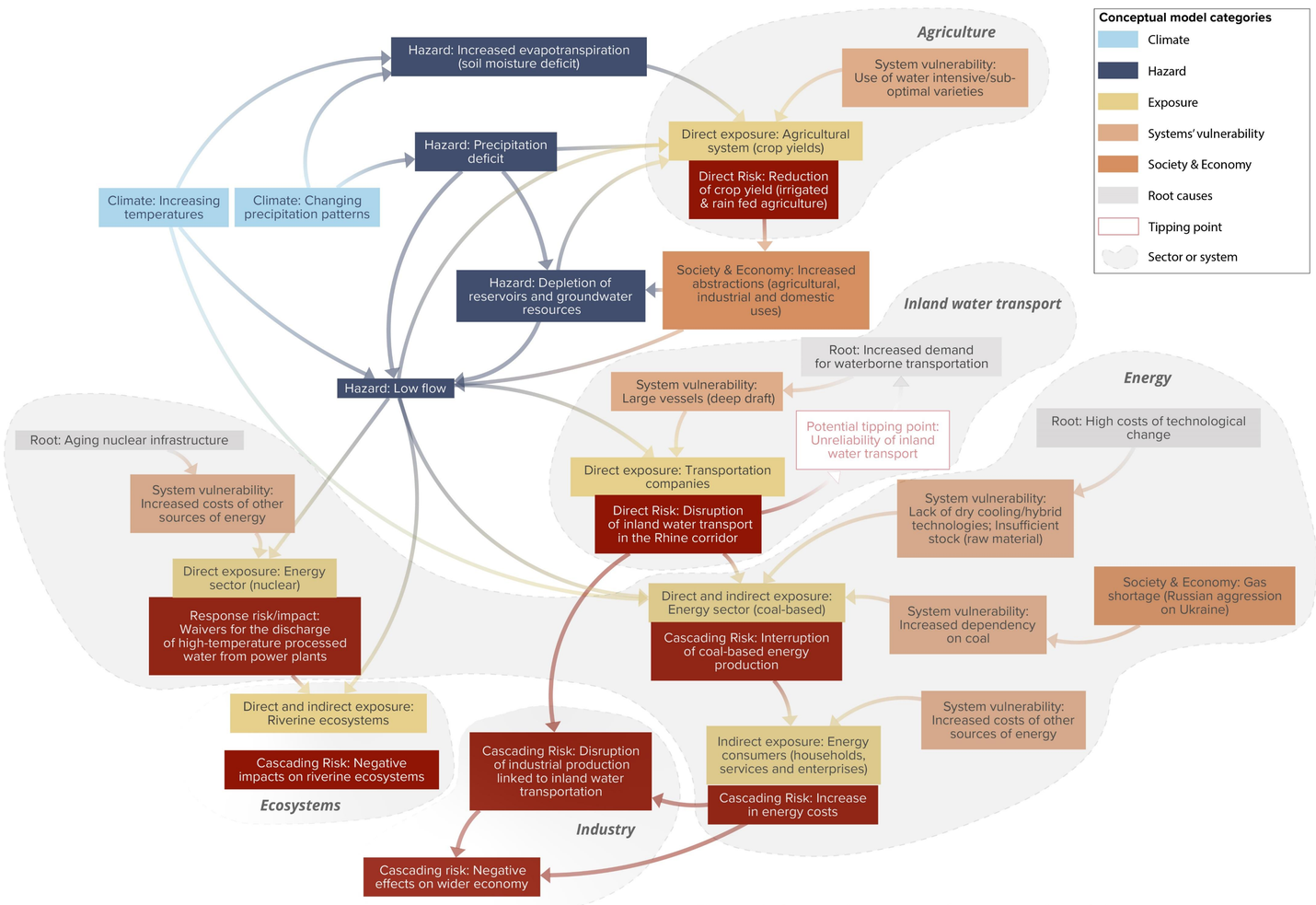

Figure 1. Systemic nature of drought risks & impacts as observed in the Rhine corridor during the 2022 drought in Europe

A novel systemic framework

Addressing this need, we propose a **novel drought risk framework** that highlights the **systemic nature of drought risks** (Fig. 2).

- *Our research emphasizes that solutions and policies to tackle growing and increasingly complex and systemic drought risks should not only consider the underlying drivers of drought risks for different sectors, systems or regions, but also be based on an understanding of sector/system interdependencies, feedbacks, dynamics, compounding and concurring hazards, as well as possible tipping points and globally and/or regionally networked risks.*

The framework served as guidance for the 2023 **European Drought Risk Atlas** and the upcoming **Global Drought Atlas** which will be launched at the UNCCD COP16 in December 2024.

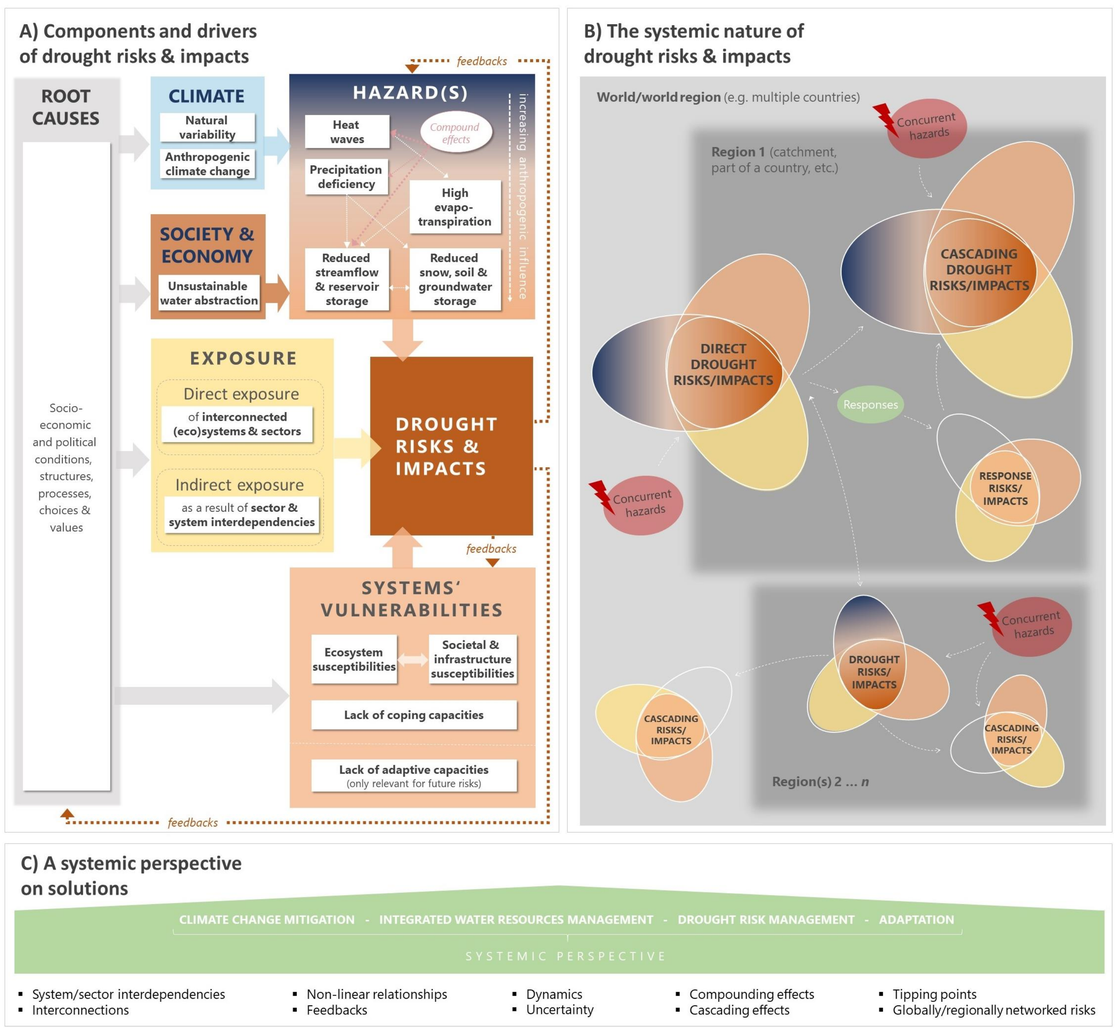

Figure 2. Characterizing the systemic nature of drought risks and impacts

(a) Drought risks and impacts for communities, sectors and systems result from the complex, dynamic, non-linear interaction of drought hazards, direct and indirect exposure and systems' vulnerabilities. Drought hazards are influenced by climate change as well as societal pressures on water resources, such as unsustainable water abstraction leading to water scarcity. Underlying these components of risks are root causes that stem from socio-economic and political structures, processes, choices and values.

(b) Direct drought risks and impacts can lead to further cascading effects on communities, sectors and systems in the same region or distant areas which are not necessarily directly affected by the drought hazard as a result of indirect exposures through the interdependence of sectors and systems and their vulnerabilities. Often these risks and impacts are compounded and further exacerbated by concurrent hazards. Furthermore, risk management and adaptation responses to drought impacts can lead to possible response risks.

(c) The systemic nature of drought risks calls for systemic solutions, i.e. actions that consider system/sector interdependencies, interconnections, non-linear relationships, feedbacks, dynamics, compounding and cascading effects, possible tipping points, globally/regionally networked risks, and account for uncertainty.

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