RISKKAN
Knowledge Action Network

on Emergent Risks and Extreme Events

- Reducing Disaster Risks under Environmental Change –

https://www.risk-kan.org/

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Risk KAN mission

The Knowledge-Action Network on Emergent Risks and Extreme Events aims to facilitate a structured integration and synthesis of scientific expertise with professional and local knowledge on emergent and systemic risks in the context of global environmental change, and thereby also to identify crucial research and practice gaps. By working towards (systemic) risk-aware development, the Risk KAN strives to support a robust achievement of the Sustainable Development Goals. Reducing complex systemic (disaster) risk in an integrated manner requires scientific collaboration among existing expert communities and multiple stakeholders. The Risk KAN is a joint initiative of the three International Science Council (ISC) programmes Future Earth, Integrated Research on Disaster Risk (IRDR) and the World Climate Research Programme (WCRP) and, the World Meteorological Organizations (WMO´s) World Weather Research Programme (WWRP). This partnership and the new spaces for action-oriented research opened by integration and facilitated by new interaction between existing networks, which is visualized in Figure 1.

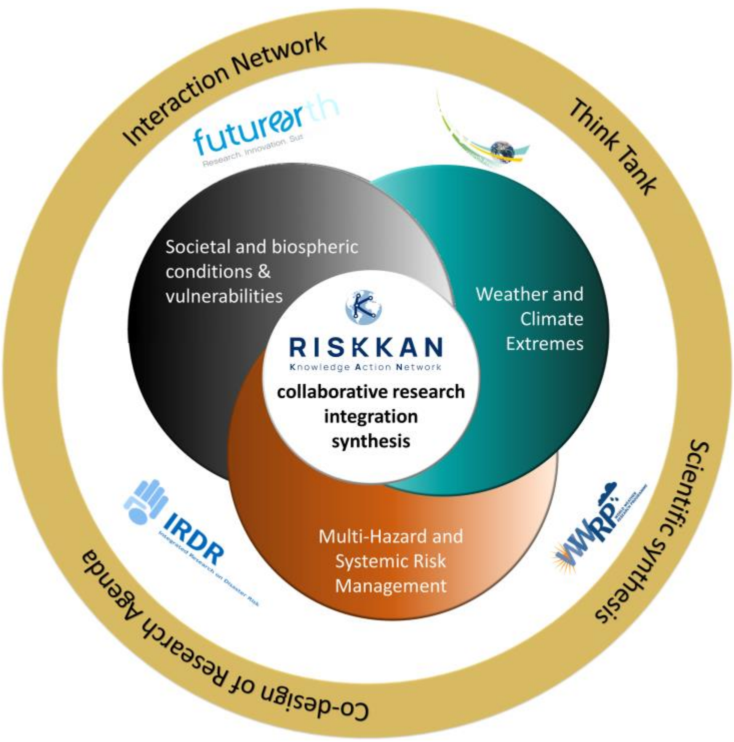

Figure 1: Conceptual illustration of the idea and scope of the Risk KAN.

<u>Motivation</u>

The frequency and impact of disasters continue to rise both in developing and industrialized countries. Many are the result of environmental events that are extreme or that have extreme impacts on economic, health, infrastructure, socio-ecological, and other systems. This is despite the development of science and technology in detecting, understanding and predicting natural hazards and vulnerability, and in supporting actions aimed at reducing and recovering from event impacts. Insufficient resilience across many sectors has the potential to severely threaten the achievement of the majority of the Sustainable Development Goals (SDGs). If research, science, governance, technology and communication are properly utilized, loss and damage can be significantly reduced.

Globalization contributes to global systemic risk through dependencies within and across social systems affecting people worldwide. The COVID-19 global pandemic is a recent example of the adverse impact of globalization, highlighting systemic interdependencies and the unequal burden of impact underwritten by social inequalities. At the same time, the global response has, to a degree, also catalysed the ability to mitigate impacts through real-time communication, mobilisation of resources, and collaborations. The critical systems interdependencies amplified by underlying vulnerabilities highlight that there is a growing need to better understand current and future systemic risks, risk governance and societal responses in the context of a changing climate. This includes improving our understanding on how systemic risk emerges in terms of its root causes, including both biophysical and socio-economic aspects, and how resilient social, natural and interlinked systems can be built in response, while embracing key intergovernmental agendas (e.g. the Paris Agreement, the Sendai Framework for Disaster Risk Reduction and the Sustainable Development Goals).

There is a fundamental lack of understanding of integrated human, ecological, and physical processes shaping systemic risks from cascades of impacts and feedbacks in the context of the Anthropocene. Key obstacles to understanding and informed action often surround data gaps, governance, communication and behavioral changes. Data gaps result from limitations in the compatibility of existing data, the need for agreements between data holding institutions to support joined-up analysis of cascades and feedbacks, lack of local access, capacities and ownership of data. Partially missing adequate governance structures and legislation for emergent complex risks and systemic risks further compound these challenges. Communication barriers such as language, format, channels and access, in addition to deliberate and fake news are also challenging socio-technological transformation processes.

Without better understanding of the root causes of risks, which are co-determined by social, technical and physical system interactions, the opportunity will be missed to reduce risk through development, and break cycles of risk accumulation. Increasing risks of loss and damage are related to historical conditions as well as unsustainable and inequitable development that increases exposure, vulnerability and reduces the scope for enhanced social and individual wellbeing as an outcome of disaster response and risk management. Breaking cycles of risk accumulation requires not only fundamental and action-oriented science but for science to be a stakeholder in facilitating and contributing to policy processes at all scales on the risk-development nexus. Even if challenging, science should also aim to hind- and forecast system dynamics, employing system models and artificial intelligence, and strive for the integration of traditional knowledge.

Weather and climate extremes are a key concern in terms of changing disaster risks, through both direct impacts on humans or indirect impacts mediated by ecosystems, technology and

natural resources. Global environmental – in particular climate – change shifts the context conditions for all hazards and risk analysis leading to changing frequencies, intensities, and durations of weather and climate extremes, challenging current norms, rules and beliefs regarding efficient and sufficient disaster risk reduction. A particular concern are emergent risks from multi-hazards, compound events and cascading extremes that can amplify impacts on society, and may even lead to abrupt system changes or tipping points. These phenomena are mediated through rapid social changes including globalization, urbanization, lifestyle, land use change, socio-economic inequality, and migration. Reducing these emergent risks will therefore require knowledge, exchange and systemic integration across a wide range of disciplines.

The full solution space for disaster risk reduction also includes reflection on and redirection of development priorities, practices and trajectories in the context of global environmental change. Recognising disaster causation as a function of development characteristics requires a fundamental reappraisal of the relationship between development, risk and risk management. Risks can only partially be managed through preparedness, response and recovery. This realization is especially acute because of complex, interwoven and cascade-shaped hazard impacts and risks emerging from existing adverse development pathways. Globalised development pathways and global environmental change both expose local places to globalised processes, masking simple cause and effect relationships and governance solutions for risk management. This situation underscores the simultaneous need for identification and implementation of generalised vulnerability reduction and resilience-building practices.

Multi-hazard interactions and cascading impacts including those involving technological hazards and social/political impacts are recognized but not yet supported by an integrated systematic science agenda. To date, most interventions focus on single hazards and sectoral interventions. This contrasts with international agreements that recognize the challenge posed by systemic, complex and cascading risk. The Sendai Framework for Disaster Risk Reduction (SFDRR), the UN Sustainable Development Goals (SDGs), UNFCCC Paris Agreement and New Urban Agenda in particular are clear about the need for integrated work that can cut across societal and policy sectors and scales. The international science community needs to be better connected across different areas of expertise in order to contribute to each of these agendas, for example through the UN Science and Technology Major Group and the Intergovernmental Panel on Climate Change (IPCC) process.

Principles of the KAN

The following KAN principles will guide the organizational structure, aims and objectives, rationale for collaboration, working routines and research objectives:

Collaborative, including partnerships between scientific communities, societal actors and ecosystems at risk, administrative, business and policy actors.

Synthetic, moving toward synthesizing existing scientific knowledge across sectors, using common terminologies and categories for analysis.

Open, for all data, analysis ideas and outcomes.

Inclusive, respecting gender, career stage and geographical equity, with particular attention to the most vulnerable groups, e.g. LDCs, LLDCs, SIDS.

Cutting-edge, innovative, developing tools and analysis based on excellent science and technology.

Solution-oriented, using existing and generating new knowledge and data to address tangible risk management challenges.

Aims of the KAN

- **To build a global network of science excellence and practitioner expertise across disciplines** and sectors to accelerate integration and synthesis for ground breaking and solution-oriented research and synthesis for systemic and disaster risk reduction, and for respective governance and decision making under global environmental and societal change
- **To identify priorities and support complementarity of research on systemic risk**, including the interaction of climate-change induced extreme events and other disasters
- **To explore and enhance the role of science as an active participant in transformation to sustainability and resilience** through systematic scientific synthesis and research, facilitation and convening roles among diverse science communities and in collaboration with societal actors (business, administration, policy, NGOs)

Objectives of the KAN

- To provide an open platform for scientific communities from across science disciplines and engineering working on extreme events, systemic risk, disaster risk reduction and governance under the umbrella of Future Earth, IRDR, WCRP and WWRP programs, to exchange information, knowledge and data, and to co-define a collective scientific focus beyond any single partner.
- To engage with societal actors from local/national/international legislative bodies, administration, business sector, practitioners, civil society and UN frameworks to design research agendas and create new knowledge for effectively reducing disaster risks through partnerships and joint outputs supporting informed decision-making.
- To stimulate groundbreaking and solution-oriented scientific research and synthesis with major impact on the creation of effective strategies for transitioning development from a risk accumulation to a risk reduction process.
- To address systemic, complex and cascading risks by synthesis of various scientific approaches and products, in application to small-scale frequent disasters and large-scale geophysical and climate extremes, also in order to contribute to the Sustainable Development Goals.
- To encourage a common conceptualization of risk and associated terminology across science and practice communities, if applicable, and make efforts to provide or generate the necessary data and knowledge to feed into both communities and to fill in disaster data gaps where needed.

Rationale for Collaboration

Each of the four co-proposing programmes brings a specific science orientation and community of practice:

Future Earth, covers various sustainability research agendas through its interconnected thematic Global Research Projects and KANs, cutting across the nexus of social and environmental sciences and engaging stakeholder expertise, focusing on longer-term development and associated risk scenarios with a broad sustainability perspective to risk and vulnerability.

IRDR contributes a core focus on vulnerability and risk analysis from behaviours through to social sciences and a multi-hazard understanding of risk, it also brings close connections to the United Nations Office for Disaster Risk Reduction (UNDRR) and through its International Centres of Excellence to nationally embedded action-oriented research excellence.

WCRP brings in extensive expertise and data resources on climate change, weather and climate

extremes and other climate related hazards, and is contributing significantly to the IPCC assessment reports.
WWRP as WMO's international programme for advancing and promoting research activities on weather, its prediction and its impact on society contributes its expertise in Multi-Hazard Early Warning capabilities of the end-to-end warning chain from observation to forecast to response.

Strength in collaboration

The four programmes believe that collaboration can provide holistic understanding on the complex interaction among various hazards, emergent risks, and impacts on the society, effective solutions, and incentives for funders to support scientific activities for a more risk resilient society. By collaborating through the Risk KAN, the programmes can:

- Cover a wide range of scientific expertise and identify and fill the gaps which were not well recognized by single programmes.
- Provide integrative synthesis capacity across disciplines by a mix of inter-/trans-disciplinary expertise.
- Align and coordinate joint research agendas. Risk KAN aligns with and contributes to the DRR research agenda "Framework for Global Science in Support of Risk-Informed Sustainable Development and Planetary Health" elaborated in 2021 by IRDR, ISC and UNDRR.
- Jointly engage and contribute to existing international stakeholder interactions and develop joint activities in areas of mutual interest:
    - ➢ Future Earth: ISC, United Nations Educational, Scientific and Cultural Organization (UNESCO), WMO, United Nations University (UNU), Sustainable Development Solutions Network (SDSN), United Nations Environment Programme (UNEP), Belmont Forum, Science and Technology in Society (STS) forum, IPCC, Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and other strategic partners
    - ➢ IRDR: ISC, UNDRR, UN Major Group of Science and Technology, UNDRR Global Risk Assessment Framework (GRAF), Global Platform on Disaster Risk Reduction and its regional platforms, and Partners
    - ➢ WCRP: WMO, Intergovernmental Oceanographic Commission of United Nations Educational, Scientific and Cultural Organization (UNESCO-IOC), IPCC, and Partners
    - ➢ WWRP: WMO, IPCC, and Partners

  and through ISC:
    - ➢ Union and National members, Regional Offices/Committees, Urban Health & Wellbeing and other Thematic Organizations, Monitoring and Observation systems, Data and Information related initiatives, and more international academic societies/partners
- Share experiences and methodologies in research and stakeholder engagement,
- Share resources including secretariat supports and budgets in some of the operations
- Coordinate outreach to common funders (e.g. Belmont Forum)
- Collaborate in capacity building of young researchers, professionals and the supporting national systems

Possible research agenda examples

1. What were the expected potential impacts that might be caused by extreme events across different sectors?
2. Which SDGs are endangered by lack of resilience against extreme events in which way?
3. What are the data gaps to be filled, standards and methods to be developed to understand risk and resilience?
4. What are the most important measures to understand underlying vulnerability and hazard factors to build resilience?
5. What are the major obstacles to build resilience against extreme events and disaster risk?
6. How can science, research, teaching and learning be best positioned to support critical reflection and goal orientation towards more resilient and sustainable development pathways?
7. What local to global governance and risk communication arrangements best support equitable and sustainable risk reduction?
8. How to incorporate knowledge into decision-making tools and wider governance contexts to better deal with global systemic risks that are unprecedented or that have unforeseen knock-on effects?
9. How can science and technology provide opportunities for innovation and economic growth and what are the largest obstacles to overcome, across and between sectors (lack of knowledge, lack of governance, etc.) in order to find and establish sustainable and just solutions for reducing disaster risk?

Box 1: Glossary (adapted from IPCC AR5 or indicated otherwise)

Compound Event: Events that refer to multiple drivers that combine to affect hazards contributing to societal or environmental risk (Workshop on compound events, ETH Zurich)

Disaster: Severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic, or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery.

Emergent risk: A risk that arises from the interaction of phenomena in a complex system, for example, the risk caused when geographic shifts in human population in response to climate change lead to increased vulnerability and exposure of populations in the receiving region.

Extreme weather or climate event: An extreme weather event is an event that is rare (normally be as rare as or rarer than the 10th or 90th percentile) at a particular place and time of year. By definition, the characteristics of what is called extreme weather may vary from place to place in an absolute sense. When a pattern of extreme weather persists for some time, such as a season, it may be classed as an extreme climate event, especially if it yields an average or total that is itself extreme (e.g., drought or heavy rainfall over a season).

Extreme event in the context of this KAN: Rare (low probability) event (bio-geophysical) with high-impact on society.

Hazard: The potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources.

Key risks: are potentially severe adverse consequences for humans and social-ecological systems resulting from the interaction of climate-related hazards with vulnerabilities of societies and systems exposed. Risks are considered "key" due to high hazard or high vulnerability of societies and systems exposed, or both.

Risk: The potential for consequences where something of value is at stake and where the outcome is uncertain, recognizing the diversity of values. Risk is often represented as probability of occurrence of hazardous events or trends multiplied by the impacts if these events or trends occur. Risk results from the interaction of vulnerability, exposure, and hazard. In this report, the term risk is used primarily to refer to the risks of climate-change impacts.

Risk assessment: The qualitative and/or quantitative scientific estimation of risks.

Vulnerability: The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.