Risk storylines: a community-led discussion between disaster and climate science

BAMS
Meeting Summary

Risk Storylines: A Community-Led Discussion between Disaster and Climate Science

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A Community-Led Discussion between Disaster and Climate Science

What: An international workshop brought together researchers and practitioners to exchange experiences in developing and applying climate and disaster risk storylines. Discussions focused on integrating quantitative and qualitative evidence and on expanding storylines to include nonclimatic risk drivers such as exposure, vulnerability, and their underlying drivers. The event featured a dynamic blend of high-level keynote talks, case studies, practical sessions, and poster presentations. Participants engaged in lively discussions, shared insights, and collaborated on hands-on activities aimed at developing actionable risk storylines.

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1. Introduction

Climate-related hazards are increasing in frequency and intensity due to climate change, resulting in cascading impacts across different environmental and human systems (IPCC 2022; European Environment Agency 2024). To better anticipate and respond to such events, there is a growing demand from adaptation practitioners and disaster risk reduction experts for operational and integrative assessments that can reflect the complexity of interconnected risk pathways, including dimensions such as vulnerability and resilience. While scientific advances have led to the development of conceptual frameworks (Simpson et al. 2021; Hochrainer-Stigler et al. 2023), the development of coherent and practical assessment methods remains a key challenge.

In this context, climate and disaster risk storylines have emerged as promising approaches to foster holistic understanding and support decision-making across scales and sectors. While climate and risk storylines share similarities, they serve complementary purposes. Climate storylines describe plausible evolutions of climate variables and related drivers, offering structured ways to explore uncertainty (Shepherd et al. 2018). Risk storylines build upon these by incorporating exposure, vulnerability, and capacity dimensions to reflect the full complexity of risk dynamics in socioeconomic systems (Van den Hurk et al. 2023; Jacket al. 2024). Beyond communication, both approaches offer analytical depth, allowing for the exploration of cascading effects, critical thresholds, and emerging risks not easily captured by probabilistic models. Despite their growing use, gaps remain in how storylines are conceptualized and applied across disciplines and contexts.

This paper presents the INQUIMUS workshop, which addressed these gaps by bringing together four state-of-the-art perspectives. Using predefined guiding questions, participants identified ways to develop integrated and operational storylines closing gaps between the climate change adaptation and disaster risk reduction communities.

2. Workshop objectives and format

The 2024 "INQUIMUS" international collaborative workshop was held in Bolzano (Italy) in December 2024 to discuss storyline-based approaches for an improved understanding of and managing climate-related risks. Participants explored how to integrate quantitative and qualitative evidence into storylines, including nonclimatic risk drivers such as exposure and vulnerability with a particular attention to social aspects. Moreover, the workshop aimed to understand how storylines can support risk managers in challenging their current risk management practices and to identify key elements that define good practice in storyline development.

This collaborative workshop was part of a series of highly interactive workshops called "INQUIMUS"[1] (from Latin "we say") initiated in 2014 to allow researchers, practitioners, and stakeholders to debate the integration of quantitative and qualitative assessment methodologies for multidimensional phenomena, identify common achievements and methodological challenges, and identify insights and future ways ahead. The 2024 workshop lasted 3 days and featured a dynamic blend of high-level keynote talks, case studies, practical sessions, and poster presentations. The workshop consisted of the following activities:

[1] https://www.inquimus.org.

- State-of-the-art (SOTA) talks: Thematic impulses provided by a few lecturers to provide a specific perspective or application of storylines (see section 3).
- Breakout groups: Participants were divided into breakout groups to collaboratively reflect on the SOTA talks and discuss preselected guiding questions (see section 4). The groups were carefully composed to ensure a balanced mix of academic backgrounds, levels of expertise, and geographical or institutional affiliations.
- Plenary sessions: Results from breakout groups were reported and jointly discussed.
- Poster sessions: During the coffee breaks, participants had the opportunity to share their activities and results linked to the development and application of storylines through posters.

Overall, the INQUIMUS 2024 workshop brought together approximately 70 participants from diverse backgrounds and with a broad range of professional experience, from early career researchers to senior experts and practitioners, representing institutions across Europe and beyond. Participants had the opportunity to engage in thought-provoking discussions, share experiences, and collaborate on hands-on activities aimed at developing actionable risk storylines.

3. State-of-the-art talks highlighting different storylines perspectives

Each state-of-the-art talk sought to address the topic of risk storylines from a different thematic perspective, presenting different applicational examples. The four perspectives are briefly presented below, while the media recordings of the talks along with the related slides are available online.[2]

[2] https://www.eurac.edu/en/institutes-centers/center-for-climate-change-and-transformation/pages/inquimus-2024.

The Disaster Risk Reduction (DRR) Practitioner Perspective by Veronica Casartelli (CMCC) provided a practitioner's perspective on using storylines and scenarios in DRR, underlying how these two terms are used differently by climate scientists and disaster risk management (DRM) practitioners. DRM-oriented scenarios comprise an integrated synthesis of descriptive and evaluative data, complemented by explanatory cartography, to assess the potential impacts of an adverse event on human populations, assets, animal life, and the natural environment. The primary objective of these scenarios within a civil protection plan is to guide decision-making activities. DRM-oriented scenarios, presented as narratives, are used to conduct exercises that test DRM systems and practices, ultimately identifying ways for improvement, known as resilience pathways. These scenarios are cocreated with cross-sectoral stakeholders at different territorial levels and are intended to address the increasing complexity and systemic nature of disaster risks, which require transformative changes in risk governance. The Union Civil Protection Mechanism (UCPM) scenario-building initiative was presented as a portfolio of unionwide, cross-sectoral, and multicountry transboundary scenarios to drive policy actions and improve the UCPM.

The Climate-Risk Perspective by Ted Shepherd (University of Reading) addressed the uncertainty in climate change, often leading to a "cascade of uncertainty" that can obscure climate information content. Storylines provide a way to navigate this uncertainty by

offering a physical basis for partitioning uncertainty, exploring the boundaries of plausibility, improving risk awareness, and strengthening decision-making. Examples of climate risk storylines, such as a rain-on-snow event in the Swiss Alps and the 2003 heat wave in central France, illustrated the practical application of these concepts. The storyline approach can be seen as conditional attribution, consistent with the IPCC Detection and Attribution Guidance Paper (2010) and standard practice in other aspects of climate science. Storylines represent the uncertainty space discretely and can be extended into the human domain to represent intervention and decision points, crucial for adaptation.

The Multi-Hazard Perspective by Julia Crummy (BGS) provided a comprehensive overview of multirisk storylines. She emphasized the significance of understanding past events and their impacts on communities and exposed assets for effective decision-making. Julia highlighted the application of the storyline approach in the MYRIAD-EU project, funded by the European Union's Horizon 2020 research and innovation program. She discussed the January 2022 eruption of the Hunga Tonga–Hunga Ha'apai volcano, which produced a massive atmospheric shockwave, a tsunami, and an eruption column over 50 km high. This event caused significant direct and far-reaching impacts, underscoring the complexity of multirisk events due to interconnected hazards and sectors. Using qualitative and semiqualitative tools like scenario planning and forensic analysis, the storyline approach can be used to describe past or plausible future events, characterizing causal and temporal relationships between risk drivers and impacts within a system.

The Socioeconomic Perspective by Simona Pedde (WUR) explored the socioeconomic aspects in risk storylines and their application in climate change adaptation and DRR. Scenarios and pathways were described as complementary tools to explore future uncertainties—vulnerability is not only the outcome of exposure to hazards but also a driver entailing a lack of capacities to withstand, recover, or adapt. The U.K. shared socioeconomic pathways (U.K. SSPs) and the concept of archetypes were presented as lenses to explore uncertainties in scenarios and determine the sustainability or vulnerability of social-ecological systems. The need for transformative visions to guide pathways was emphasized. Such visions should comply with sustainability values, involve multidimensional changes, and define the capacities required for transformation. She concluded with a call for more integration in science to understand desirable futures and a shift in mindset from risk aversion to acceptance of unknowns through setbacks in the learning process.

Finally, the Storytelling in Journalism Perspective, by Anna Violato (Radar Magazine), provided an insightful look into how science journalists use narratives and stories to report on science, climate change, and other issues, underscoring the importance of narratives and stories in journalism. She stressed the importance of story arcs, relatable characters, and mindful framing to avoid stereotypes and biases, also warning against ignoring data or evidence that might not fit well with the story.

4. Guiding questions

To guide the group discussions, the workshop used a set of structured guiding questions, organized around key thematic areas related to the development and use of risk storylines (see Table 1).

5. Main takeaways and conclusions

Several aspects of the workshop format contributed to the success of the INQUIMUS 2024 workshop:

- The agenda offered a well-balanced mix of plenary inputs, group work, and informal exchanges, fostering active engagement, reflection, and peer learning.

Table 1. Guiding questions organized around thematic areas.

Stakeholders and practitioners	Socioeconomic aspects
• What is the role of stakeholders/practitioners in codeveloping and employing storylines? • How do storylines need to be shaped to be understood and used by stakeholders in an impactful way? For example, which elements, quantitative vs qualitative/spatially explicit?	• What role do social and socioeconomic aspects play considering the disaster risk reduction (DRR) and the climate change adaptation (CCA) perspectives? • Which social aspects should be included in storylines and from which sources should they be derived?
Complexity and generalization	**Toward standardization, integrating other approaches**
• How to deal with complexity and ensure plausibility, particularly in multihazard/multirisk applications? • How quantitative should storylines be? How does this depend on the specific scope and application?	• What are, if any, the core components of risk storylines? • To what extent do we need to standardize risk storylines to allow for comparability and improved shareability? • What role does storytelling/narrative components, scenario planning, forensic analysis play?

- The SOTA talks offered a valuable overview of the diverse ways storylines are understood and applied in practice across different contexts, serving as inspiration to foster discussion during the group sessions.
- The workshop brought together participants with a wide variety of disciplinary and professional backgrounds, including experts from both the climate change adaptation and disaster risk reduction communities. This diversity enriched the discussions, allowing for multiple perspectives on the development and use of risk storylines and fostering interdisciplinary understanding and collaboration.
- A broad range of EU-funded projects was represented, with insights shared in both breakout group discussions and poster sessions, enriching the exchange of experiences and practices.
- The workshop's informal and open atmosphere encouraged exchanges and peer learning. Participants felt comfortable sharing challenges and uncertainties alongside successes, which fostered a collaborative environment and helped build trust across disciplinary and institutional boundaries.

The following key insights into storylines emerged from the workshop discussions, reflecting shared experiences and perspectives across disciplines.

- Risk storylines prove especially valuable when they are developed in close collaboration with practitioners, ensuring they respond directly to challenges being faced in real-world decision-making.
- Their strength lies in the ability to combine both quantitative data and qualitative insights through structured, transparent processes.
- By incorporating not only physical hazards but also socioeconomic drivers, responses, and associated uncertainties, storylines offer a more comprehensive understanding of risk.
- Plausibility is key to leverage the advantages of storylines but is not always clearly addressed. A joint effort is required by stakeholders and scientists to strike a balance between, for example, the expected likelihood of the events to unfold and their perceived usefulness by stakeholders.
- Although the flexibility of the approach allows for different applications, a basic standardization would help in mainstreaming the application of risk storylines and would allow for the development of larger collections across projects or institutions.

In summary, risk storylines are particularly useful in addressing complex, interconnected, and uncertain risk dynamics (e.g., cascading and compounding events) that are difficult to capture with conventional methods. In doing so, they support the identification of concrete adaptation and risk mitigation options, making them highly relevant for applications ranging from civil protection planning to climate adaptation strategies. Cocreation with practitioners and other stakeholders involved in disaster risk management facilitates exploration and communication of uncertainties, using narratives to explore relationships that quantitative models cannot. This integrated approach bridges the gap between theoretical concepts and operational needs, offering decision-makers more actionable and context-sensitive risk information.

Further work is required to significantly advance this approach in an interdisciplinary and risk-oriented framework. A joint paper is under development to further elaborate on the outcomes of the discussion and to suggest a potential roadmap for future activities.

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