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Enabling informed decisions for climate risk and crisis management. The BRACE review protocol

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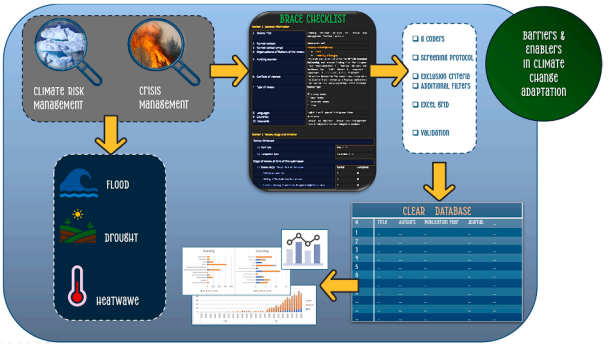
GRAPHICAL ABSTRACT



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ABSTRACT

This article outlines a structured and replicable systematic review process (BRACE) aimed at mapping global research trends on barriers and enablers to climate change adaptation. The focus is on climate hazards—floods, droughts, and heatwaves—within the frameworks of Risk Reduction (RR) and Crisis Management (CM), with attention to governance and socioeconomic factors. Results are based on the CLEAR database, generated through the multi-phase protocol BRACE, tailored to interdisciplinary climate adaptation research.

- The BRACE systematic review protocol maps global progress in climate adaptation (2000–2022).

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- The tailored protocol categorizes governance and socioeconomic factors under RR and CM.
- It allows analyzing thematic and regional bias, governance gaps, and cross-country differences.

Specifications table

Subject area	*Socioeconomic and Environmental Sciences*
More specific subject area	*Policy, governance and socioeconomic analysis in climate science*
Name of the reviewed methodology	*Progress in assessing barriers and enablers for climate-change adaptation. We build on, integrate, and go beyond PRISMA, PRISMA-ScR, CEE, PICOS tools for reviews.*
Keywords	*Climate adaptation, crisis management, risk management, disaster risk reduction, adaptation barriers, adaptation enablers*
Resource availability	• *BRACE Review-Protocol checklist available in Zenodo* • *CLEAR Database - Climate Literature on Enablers and Adaptation Responses available in Zenodo* • *Glossary defined for database compilation available in supplementary material.* • *Grid used for compilation in Excel available upon request.*
Review question	*"What are the key barriers and enablers influencing policymaking for effective climate risk mitigation and crisis management?"*

Background

The effectiveness of climate policy implementation varies widely across different contexts, shaped by a complex interplay of social, organizational, institutional, and procedural factors. These elements can either accelerate or hinder climate adaptation efforts, directly impacting a society's ability to mitigate risks and respond to crises.

Despite growing recognition of these challenges, much of the research remains confined within specialized disciplines, limiting a comprehensive understanding of the broader social, political, and institutional forces that shape climate policy outcomes. This gap has made it harder to identify the key levers for effective action.

To bridge this divide and unravel the complexities of disaster risk reduction and crisis management, we conduct a comprehensive systematic review, mapping the critical factors that influence risk mitigation and crises response strategies for three major climate hazards: floods, droughts, and heatwaves. A distinctive feature of our review is its extensive temporal and geographical coverage. Spanning more than two decades (2000–2022), this long-term perspective allows us to capture evolving trends, policy shifts, and the emergence of new challenges and solutions over time. Equally important is the review's global scope, which encompasses all countries worldwide. This wide geographical lens enables us to account for the diverse socio-economic, institutional, and environmental contexts that shape risk management and disaster responses in different regions. It also allows us to identify patterns and disparities between, e.g., high-income and low-income countries, between urban and rural areas, and across different governance systems. By integrating this breadth of data, our analysis can offer a holistic understanding of global risk governance also highlights region-specific insights that can inform more context-sensitive and equitable adaptation strategies.

Drawing upon established review frameworks, we develop a comprehensive conceptual framework – the 'BRACE' protocol (Barriers, Responses, Agents, and Climate Enablement). By adapting and integrating their strengths to align with our specific research objectives, BRACE goes beyond existing checklists. It serves as a structured and multi-step protocol designed to guide a systematic review focused on the barriers and enablers of climate change adaptation. This protocol is operationalized through a detailed analytical grid, enabling consistent extraction, classification, and clustering of information across a wide array of peer-reviewed literature. This approach not only ensures rigorous coverage and validation of the evidence but also facilitates structured, comparative, and scalable data analysis.

The BRACE framework and the resulting evidence synthesis are intended to be of high practical value across multiple domains. While they provide a solid empirical foundation for researchers, interdisciplinary scholars, and academic institutions, the implications of this work extend far beyond the academic sphere. The structured findings and analytical tools offer policy-relevant insights for climate policymakers, urban and regional planners, disaster risk reduction (DRR) agencies, and international development bodies. BRACE equips these stakeholders with a decision-support tool grounded in systematic evidence, enabling them to design and implement more context-sensitive, equitable, and adaptive climate strategies. By revealing common bottlenecks and effective enablers across sectors and regions, this work contributes to building institutional capacity, enhancing cross-sectoral coordination, and fostering resilience in the face of increasing climate risks.

Method details

Approach comparison for review analyses

Several established guidelines are commonly followed to conduct systematic and scoping reviews of the literature, ensuring methodological rigor and reproducibility.

One of the frameworks most widely recognized is **PRISMA** (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), which provides a checklist designed for systematic reviews and meta-analyses. PRISMA covers key aspects, including the review

protocol, study selection, data extraction, and synthesis methods [5,8]. In addition to the PRISMA framework, an extension specifically designed for scoping reviews, known as **PRISMA-ScR** (PRISMA Extension for Scoping Reviews), has been developed to enhance the clearness and transparency of scoping review reporting [9]. While PRISMA emphasizes systematic synthesis and critical appraisal, PRISMA-ScR expands its checklist to accommodate the exploratory nature of scoping reviews. Key modifications include a greater focus on clarifying the purpose and rationale of the review, explicitly detailing eligibility criteria, and a greater focus on evidence mapping rather than on quantitative synthesis.

For environmental and policy-related reviews, **CEE Guidelines** (Central and Eastern European Guidelines for systematic reviews in Environmental Sciences) provide tailored guidance by emphasizing contextual, regional, and socio-economic factors [3].

For more oriented policy and community-based aspects, the **Salsa** (Systematic Approach to Literature Synthesis and Assessment) framework [1,4] is another tool for conducting systematic reviews, particularly in environmental and sustainability research. Salsa provides an inclusive, participatory approach that allows stakeholders—such as policymakers, community members, and experts—to contribute to the review process in context-specific issues. Finally, the **PICOS framework** [7] is a widely used tool in systematic reviews and meta-analyses, particularly useful for reviews in clinical and health research. PICOS, which stands for Population, Intervention, Comparison, Outcome, and Study Design, helps formulate clear research questions and define the key components of a review.

Depending on the review objective, the subject of interest, and the specific research question, scholars select one guideline over another based on the strengths and orientation of each. To facilitate a critical comparison, Table 1 presents a schematic overview of these review tools. This comparison sets the stage for highlighting the advantages of our integrated approach presented in the following pages.

To address the research question, "*What are the main barriers and enablers in policymaking for climate risk and crisis management?*", we draw upon these established review frameworks, adapting and integrating their strengths to align with our specific research objectives, while going beyond their checklists, as outlined in the next sections.

Review protocol and strategy

Overview

Drawing on established review methodologies, we developed the **BRACE** (Barriers, Responses, Agents, and Climate Enablement) approach, which synthesizes their strengths into a comprehensive, rigorous, and structured review framework. This tailored method guides our systematic literature review aimed at identifying and evaluating studies on barriers to, and enablers of, climate change adaptation. We focus on adaptation efforts within risk reduction (RR) and crisis management (CM), emphasizing climate hazards such as floods (FL), droughts (DR), and heatwaves (HW).

By adapting existing protocols to the specific contexts of social sciences, risk governance, and policy analysis, the BRACE approach ensures alignment with both established methodologies and the unique needs of these disciplines, where understanding complex

Table 1
Comparison of review tools and approaches.

Framework/Tool	Strengths	Limitations
Salsa (Stakeholder participation)	• Flexible, participatory approach to include stakeholders in the review process. • Emphasizes the integration of local knowledge and context. • Focuses on sustainability and multi-disciplinary research. • Integrates qualitative & quantitative information.	• Can be resource-intensive and time-consuming due to stakeholder involvement. • May lack standardization, leading to variations in implementation. • Does not structure results around policy/governance variables. • May rely on consensus involving risk of bias assessment. • Lacks an explicit validation process.
PICOS	• Helps defining key components of the research question: PICOS elements. • Useful for structuring systematic reviews and meta-analyses. • Applicable across various fields and research types.	• Primarily useful for clinical and health-related reviews; may be less applicable to other disciplines without adaptation. • Limited in handling complex, multi-dimensional issues like environmental factors or socio-political contexts. • Lacks standardization and checklist • Lacks an explicit validation process
PRISMA (Medical Research)	• Provides evidence-based checklist for systematic reviews and meta-analyses. • Enhances transparency and reproducibility in reporting. • Widely accepted and recognized in academic publishing.	• May not fully address context-specific challenges, especially in non-health domains. • Primarily focused on reporting, rather than guiding the review process itself. • Primarily designed for quantitative meta-analyses, less flexible for qualitative studies. • May rely on consensus involving risk of bias assessment. • Lacks an explicit validation step.
CEE Guidelines (Environmental Research)	• Provides tailored guidance for environmental science reviews. • Emphasizes regional and environmental context	• Limited generalizability outside the environmental sciences field. • May lack specificity in areas outside environmental and ecological concerns, limiting its applicability to broader policy or social research. • Uses critical appraisal but lack the multi-coder validation approach. • Lacks an explicit validation process

societal systems, policy decisions, and governance frameworks is essential. The BRACE protocol and the resulting catalogue of scientific articles, the **CLEAR** (Climate Literature on Enablers and Adaptation Responses) database, are made publicly available to support further research.

As a first step, following and adapting the PICOS framework, we identify the components listed in Table 2, as the structural elements for our review.

To ensure **transparency**, our review protocol is structured into clear, defined phases and incorporates a **multi-step filtering process.** Going beyond major review approaches described above, **double-blind validation** ensures that personal biases do not influence the selection process, while coder agreement rates and third-party mediation further reinforce the validity of the decisions made, ensuring a higher level of consistency and objectivity. According to the specific checklist of the PRISMA-ScR guidelines, our review protocol is consistent with all the quality steps for systematic reviews which were verified. The **analytical framework** used in this approach goes well beyond the check lists provided by existing review guidelines, since it is specifically designed to integrate different policy dimensions and aspects, which is crucial for reviews focusing on social sciences and governance.

In response to the need for more sophisticated **data management** and **analysis tools**, we have developed an enhanced and adaptable analytical grid as a core component of the BRACE protocol. Unlike conventional data extraction forms—such as those based on the PICOS framework—which primarily capture study design and outcome variables, our grid systematically incorporates additional dimensions that reflect the complex, **multi-level nature** of climate adaptation processes. Specifically, the BRACE **analytical grid** captures information along three novel and interrelated dimensions:

1. **Governance mechanisms** – including decision-making arrangements, institutional architectures, policy instruments, and levels of coordination;
2. **Socioeconomic drivers** – such as equity considerations, resource availability or constraints, and socio-political contexts influencing adaptive capacity;
3. **Actor constellations** – detailing the roles, relationships, and interactions among key stakeholders, including government bodies, civil society, private actors, and international agencies.

By integrating these dimensions, the grid enables a more systemic and relational analysis that moves beyond descriptive checklists. It allows us to explore how barriers and enablers are embedded in broader institutional and social contexts, and how their interactions influence adaptation outcomes. This structure also supports cross-comparison across climate hazards (floods, droughts, heatwaves), governance settings, and geographic regions, facilitating pattern recognition and higher-order interpretations.

Technically, the grid is implemented in a structured Excel format that is flexible, user-friendly, and compatible with analytical software such as R, Python, NVivo, or bibliometric tools. It is designed to accommodate both peer-reviewed and gray literature, and is easily updatable, filterable, and replicable—supporting transparency and consistency across review stages.

Ultimately, this analytical design enhances the explanatory power of the review, enabling a deeper understanding not only of **what** barriers and enablers are reported, but also of **how** and **why** they manifest and matter in shaping effective climate risk reduction and crisis management strategies across diverse contexts.

Summarizing, our review protocol presents a comprehensive and adaptable framework designed to ensure high-quality and transparent research in the context of social sciences, risk governance, and policy analysis. Each step has been carefully designed to balance scientific rigor with flexibility, making it applicable to various research contexts, particularly those involving policy and governance studies. More specifically, we intended to turn the challenges of our research objectives into strengths of our review protocol, as listed below:

Ø **Comprehensive and Expansive Scale** – Our review stands out for its broad geographical and temporal coverage, spanning all countries worldwide and an extended timeframe (2000–2022). It adopts a multidimensional approach, analyzing a complex matrix of barriers and facilitators that influence climate change adaptation, while also integrating risk management and crisis response—two domains that are rarely considered together, partly due to the different timing of intervention. Risk management primarily focuses on proactive strategies aimed at assessing, mitigating, and preparing for potential threats, whereas crisis management deals with reactive measures, emphasizing immediate response and post-event recovery. By bridging these perspectives, our approach provides a more holistic understanding of adaptation challenges, recognizing the importance of both preparedness and long-term resilience.

Table 2
Picos framework.

PICOS	Description
Population	Local governments, communities, organizations, and vulnerable groups involved in, or affected by FL, DR, HW, as well as stakeholders in RR (e.g., policymakers, disaster management professionals) and CM (e.g., emergency response teams).
Intervention	Climate adaptation measures aimed at managing FL, DR, HW, including policies, practices, strategies, programs, decision-making frameworks and disaster preparedness actions.
Comparison	Regions or communities without effective adaptation measures, or with varying levels of success in implementing adaptation strategies.
Outcome	Identification of key barriers and enablers to climate adaptation, impact on RR and CM, and improvements in resilience to climate hazards.
Study Design	Systematic reviews, case studies, cross-sectional studies qualitative and quantitative research, interviews, and surveys assessing barriers and enablers to climate adaptation.

- Ø **Inclusion of Emerging Perspectives and Longitudinal Insights** – by adopting a longitudinal approach to literature, our review captures emerging themes and paradigms (e.g., trends in insurance adoption and evolution in mechanisms of climate communication). It traces how these topics and frameworks have evolved over time, identifying critical knowledge gaps that can inform future research directions.
- Ø **Innovative Methodology** – Our review adopts a mixed-methods approach by integrating empirical, theoretical, and review studies within a single framework, resulting in a broader interpretative model. It combines an exploratory review with well-established conceptual models widely recognized in the literature (e.g., PRISMA, CEE, etc.), while also enhancing them by incorporating additional dimensions and validation steps, creating a more robust integrated approach. Finally, it explores interdisciplinary implications and ripple effects across different research domains, embracing a systemic perspective.

Phases of the review protocol

Methodologically speaking, the BRACE review protocol follows a five-step process (Fig. 1):

- *Document extraction (Phase 1)* – Initial retrieval of relevant articles.
- *Preliminary database cleaning (Phase 2)* – Application of specific exclusion criteria to refine the selection.
- *Screening and classification (Phase 3)* – Definition of screening principles and creation of an analytical grid to cluster the articles into thematic groups.
- *Final dataset refinement (Phase 4)* – A final cleaning step based on the clustering grid.
- *Reporting and Data visualization (Phase 5)* – Synthesis of major results and data visualization.

This five-phase process spanned one year of work and resulted in a final database of articles for analysis. The research team comprised seven scholars from diverse disciplinary backgrounds: one economist, one anthropologist, four political scientists, and one sociologist. To enhance the robustness of the selection process and mitigate potential selection bias arising from the researchers' varied expertise and interests, two validation steps were introduced—one after Phase 2 and another after Phase 4. Below, each step is briefly described.

Phase 1: document extraction

The first phase of the review process focuses on identifying and extracting relevant literature from the Scopus database which is chosen due to its unique features and coverage. Scopus tends to have a broader and more diverse coverage in fields such as social sciences, policy analysis, and governance. It provides robust search features, including advanced filtering and customization options for refining searches, which can help narrow down the vast literature to the most relevant studies for our review. Finally, it is updated very frequently, meaning that recent research and publications on rapidly evolving topics like climate change and crisis management are more likely to be included. This is especially important for topics where literature is growing quickly, and new research is emerging regularly.

The keyword search strategy is hazard-specific and categorizes keywords into two distinct themes: "risk reduction" and "crisis management." By associating 'risk reduction' with terms like governance, adaptation, and resilience, it aligns these concepts with long-term planning and preventive measures. On the other hand, pairing 'crisis management' with disaster preparedness and emergency

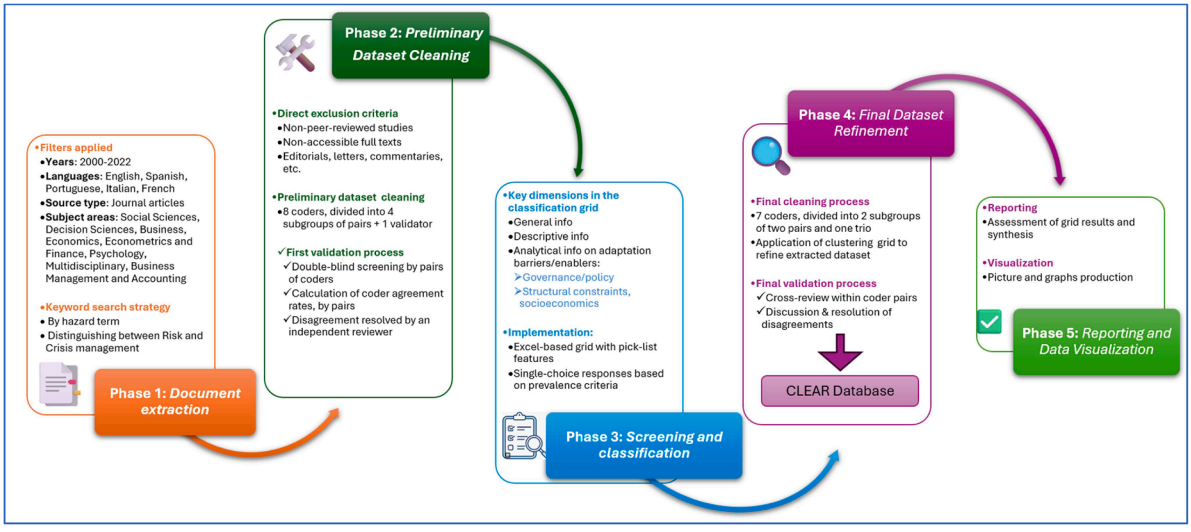

Fig. 1. BRACE review protocol.

response highlights its focus on immediate, reactive measures in the face of a crisis. This differentiation allows for targeted searches that can yield more relevant results for each theme.

To ensure a structured and coherent selection, the research team engaged in multiple rounds of discussions and idea-sharing sessions. These exchanges allow the team to align their perspectives and establish a common ground for defining the initial exclusion criteria. A set of filters is applied to refine the document search, as reported in Fig. 1, to prevent an overly broad scope. The review was deliberately restricted to topics related to policy, governance, and socioeconomic analysis in climate science by selecting the following Subject Areas: *Social Sciences; Multidisciplinary; Decision Sciences; Business, Management and Accounting; Economics, Econometrics and Finance; and Psychology*. Additionally, further extractions were conducted for three specific Subject Sub-Areas within the broader Subject Area of "Physical Sciences": *General Environmental Science; Environmental Science (miscellaneous); and Management, Monitoring, Policy and Law*.

Through collaborative discussions, the team refines the approach, ensuring that the document extraction phase is both comprehensive and methodologically sound before moving forward with dataset cleaning. The complete search queries used to extract data are reported in supplementary material (ANNEX 1: Search Queries).

Phase 2: preliminary dataset cleaning

In Phase 2, an initial exclusion process was applied based on the following criteria: non-peer-reviewed studies, inaccessible full texts, and non-research articles (e.g., editorials, letters, commentaries, conference abstracts, and proceedings).

Then, a systematic selection procedure ensured a filtered and methodologically robust dataset. This was performed by a team of eight coders, organized into four subgroups of pairs (each handling approximately 2000 articles) and supervised by one validator to guarantee consistency and accuracy. The selection process was carried out systematically through a structured three-step approach: screening, duplicate removal, and validation:

Screening

- Title & Abstract and Key-words Screening: The relevance of articles was first assessed based on these components, mentioned as the most efficient by the literature [6].
- Full Text Screening: If the title and abstract did not provide sufficient information to determine relevance, the full text was reviewed.

Articles were excluded according to the following exclusion criteria:

- Articles that did not directly address risk or crisis management.
- Articles that addressed risk or crisis management but not in relation to climate change.
- Purely technical papers that only briefly mentioned policy without meaningful discussion.

Duplicates removal

Given the keyword-based search strategy distinguishing *risk reduction* from *crisis management*, we recognize that the boundary between these themes is often blurred—many risk reduction measures may also serve crisis management functions. To maintain analytical clarity and avoid double-counting, we calculated overlap rates to identify and remove duplicates. Duplicates were defined as records retrieved under both thematic categories based on matching titles and DOIs. The overlap rates were computed as the proportion of these shared records relative to the total number of records in each category. This process was applied both to the thematic sets (*Crisis Management* vs. *Risk Reduction*), and across records extracted from six main hazard areas and their three corresponding sub-areas (Tables 3 and 4). This approach ensured that articles relevant to both themes were appropriately represented without inflating the dataset.

Table 3
Duplicates Between Main Areas and Sub-Areas.

Hazard Type	*Theme*	*Total Records*	*Duplicates*	*Filtered Records*	*Duplicates Rate (%)*
Floods	***CM***	445	83	***362***	***18.6%***
	RR	6628	1487	***5141***	***22.4%***
Drought	***CM***	306	60	***246***	***19.6%***
	RR	2386	513	***1873***	***21.5%***
Heatwaves	***CM***	12	2	***10***	***16.0%***
	RR	255	59	***196***	***23.1%***

Note: These rates reflect the proportion of records shared between broader hazard categories and their respective sub-themes.

Table 4
Overlap Between Crisis Management and Risk Reduction.

Hazard Type	*Total Records (CC+RR)*	*Number of Duplicates*	*Filtered Records*	*Overlap Rate (%)*
Floods	*5503*	*105*	***5398***	***1.9%***
Drought	*2119*	*52*	***2067***	***2.4%***
Heatwaves	*206*	*0*	***206***	***0%***
Tot	***7827***	***157***	***7671***	

Note: These values represent the percentage of records appearing in both themes for each hazard.

Validation

To ensure quality control, a double-blind screening of 100 sample records was conducted by four coder pairs. Also, coders' agreement was derived by relying on Cohen's coefficients calculation [2], reported in Table 5.

The first group of coders demonstrated a relatively low level of agreement, suggesting potential ambiguities in the instructions or coding process. To address this, further discussions were held to clarify the guidelines and categorization criteria. Ambiguous articles were then re-examined until consensus on their classification was achieved. In cases where disagreements persisted, a third independent reviewer was consulted to resolve them. This rigorous process ensured that only relevant studies aligned with the research scope were included in the final CLEAR dataset.

Phase 3: screening and classification

In Phase 3, a comprehensive classification grid was developed through an iterative and collaborative process involving seven scholars of the research team.

The final key dimensions in the classification grid include general and descriptive article information (geographical focus, research design, policy cycle stage, targeted adaptation action, scope of analysis), as well as analytical insights into adaptation barriers and enablers. The latter were distinguished into factors directly related to governance and policymaking - such as policy absence, policy malfunctioning, and policy coordination – and factors existing outside these policy processes, particularly those associated with structural constraints or socioeconomic aspects. Drawing from the existing literature, these "internal" and "external" barriers/enablers to policy and governance processes were further categorized into multiple analytical dimensions, as outlined in Fig. 2. These dimensions were collectively defined and formalized in a glossary reported in the Supplementary Material (Annex 2. Glossary: Descriptive and Analytical Dimensions) to facilitate coders' work in identifying, selecting, and organizing article-related information within the classification grid.

The grid's final structure was refined through two rounds of test compilations, followed by discussions and adjustments to ensure clarity and relevance. This process led to modifications and realignments of the grid's categories and subcategories, enhancing the framework's coherence and applicability. The final classification grid was implemented in Excel, featuring a pick-list format to ensure usability and consistency. Responses were recorded as single-choice entries, based on predefined prevalence criteria.

Phase 4: final dataset refinement

In the final phase of data processing, a thorough cleaning and refining process was conducted. The final cleaning of the dataset focused on a deeper application of the content validation criteria. At this stage, papers were excluded if: (a) they did not address barriers or enablers to climate change adaptation and lacked emerging perspectives or longitudinal insights (e.g., trends in insurance adoption, shifts in risk perception, evolution of climate communication mechanisms, or community participation in policymaking); or (b) they examined barriers or enablers but not from the perspective of public policy, risk reduction or crisis management. The final cleaning involved all the seven coders, divided into two subgroups, consisting of two pairs and one trio, with each coder reviewing approximately 300 articles. The clustering grid defined in Phase 3 was applied to further refine and structure the extracted CLEAR dataset. To enhance reliability and coherence a final validation and quality control consisted of a cross-review performed within coder pairs. Disagreements were discussed and resolved through collective deliberation. Fig. 3 shows the screening results by process step and hazard type, from the first extraction to the final CLEAR database containing 999 scientific articles.

Table 5
Cohen-K coefficients, for each pair of coders.

Pairs	Cohen's coefficients
Pair 1 (Coders 1-2) – slight agreement	0,139
Pair 2 (Coders 3-4) – moderated agreement	0,472
Pair 3 (Coders 5-6) – moderated agreement	0,463
Pair 4 (Coders 7-8) – almost perfect agreement	0,829

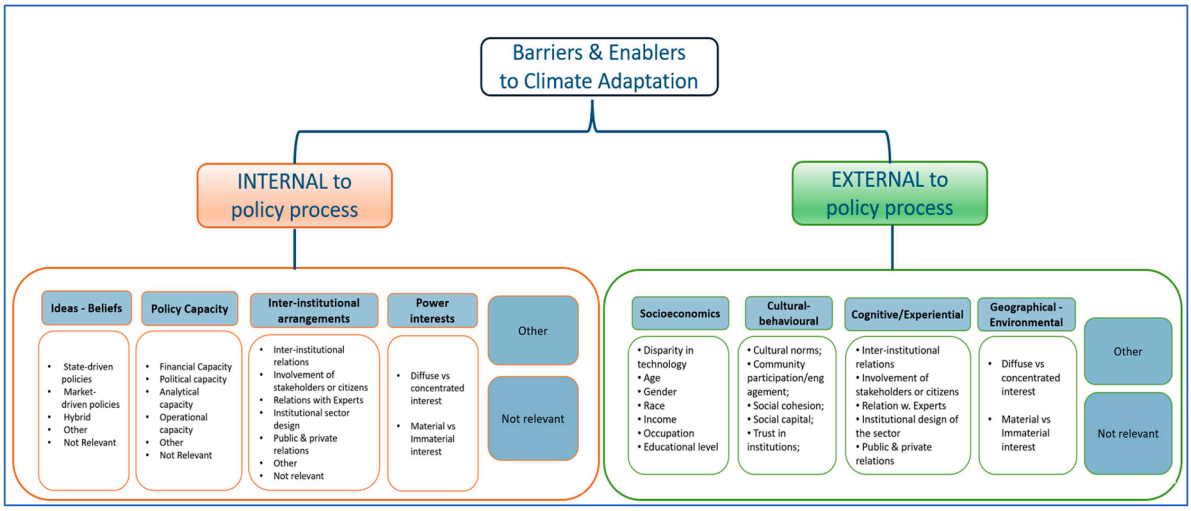

Fig. 2. Analytical dimensions for barriers/enablers internal/external to the policy process.

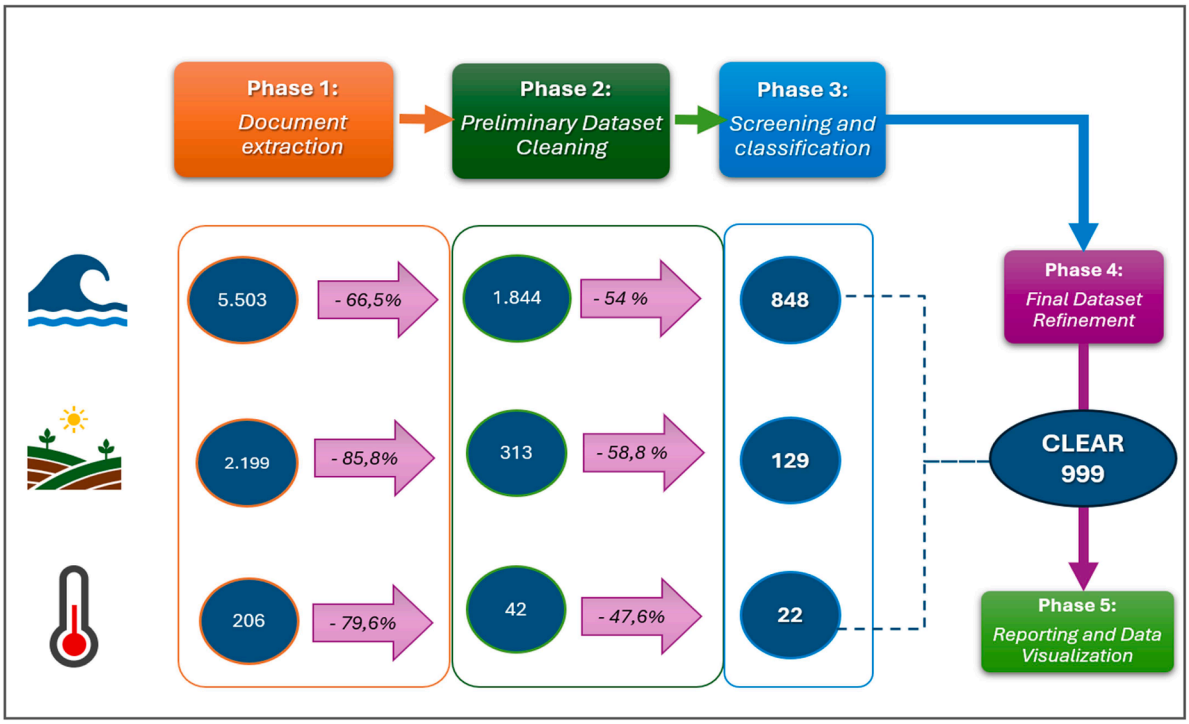

Fig. 3. Process leading to the CLEAR database with corresponding number of scientific articles selected.

Phase 5: reporting and data visualization

In the final phase of a systematic review, reporting and data visualization help effectively communicating findings. This stage has involved synthesizing results and ensuring transparency and producing data visualization to enhance clarity and impact of resulting outcomes. We used narratives with graphical representations, flow diagrams and different plot types to illustrate complex relationships and grasp trends and heterogeneity in outcomes. Examples of condensed visual representations are reported below. For example, in Fig. 4, data highlights a growing focus on RR over CM, with floods receiving the most attention especially after 2010. This reflects growing scientific and policy attention to disaster risk management. The surge in RR publications and the significantly fewer and more stable publications in CM suggest a stronger focus on prevention and risk mitigation rather than emergency response.

According to Fig. 5, the geographical distribution of scientific publications reveals significant disparities across hazards and

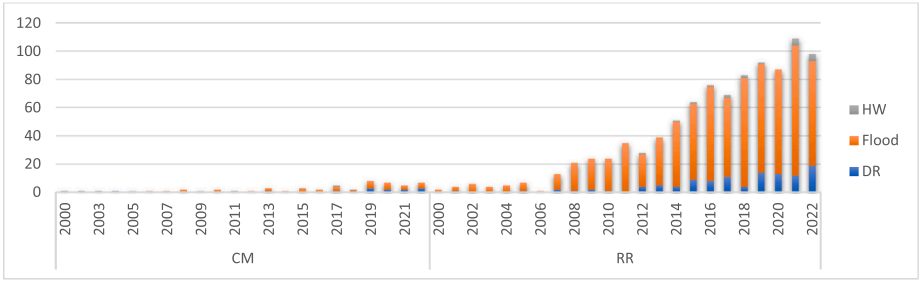

Fig. 4. Number of scientific articles published from 2000 to 2022 on Crisis Management (CM) and Risk Reduction (RR), related to barriers/enablers and concerning three types of hazards: heatwaves (HW), floods, and droughts (DR).

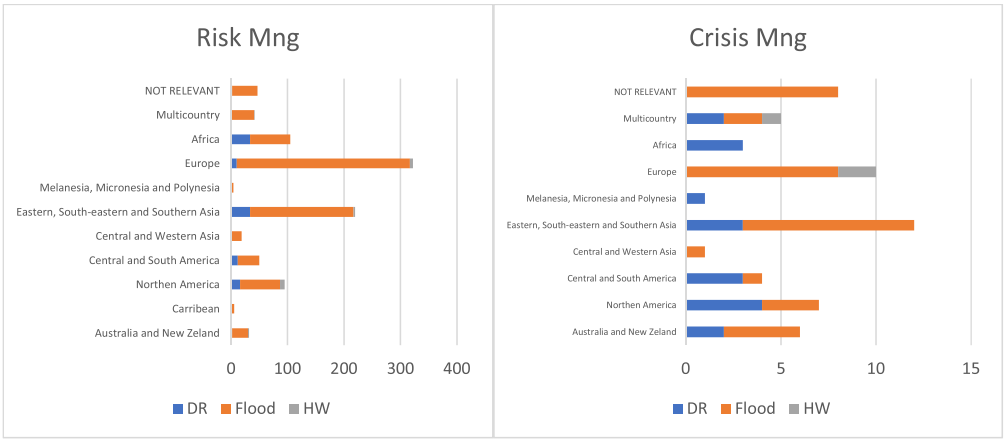

Fig. 5. Geographical distribution of scientific publications (2000–2022) addressing barriers and enablers to climate change adaptation in Crisis Management (CM) and Risk Reduction (RR) across three hazard types: heatwaves (HW), floods, and droughts (DR).

regions. Floods receive the most research attention particularly in Europe and Eastern, South-Eastern, and Southern Asia. In contrast, droughts and heatwaves are underrepresented, despite their growing relevance due to climate change. Research on drought is concentrated in Africa, Eastern/Southern Asia, and North America, while research on barriers and enablers to heatwaves adaptation appears only in a few studies, mainly in Europe and North America. The near absence of heatwave-related research in Africa, Latin America, and Asia highlights a critical knowledge gap, particularly in regions increasingly exposed to extreme temperatures.

A striking imbalance exists between Risk Reduction and Crisis Management research. While long-term adaptation strategies dominate across all regions, real-time crisis response remains marginal. This is particularly concerning heatwaves, which require immediate intervention to prevent fatalities. Additionally, the lack of multicountry and cross-regional studies suggests a missed opportunity for collaborative efforts in climate adaptation.

These findings indicate that research priorities do not fully align with the evolving risks posed by climate change. Future studies should broaden the focus to include droughts and heatwaves, particularly in vulnerable regions, while strengthening research on Crisis Management to enhance immediate disaster response capabilities. Addressing these gaps will be essential to ensuring a more equitable and effective approach to climate adaptation.

Conclusion

This systematic review methodology offers a structured framework for analyzing climate risk and crisis governance challenges in the context of climate change adaptation, distinguishing by hazard type. By categorizing barriers and enablers, it supports policy-makers in identifying critical intervention points for effective risk and crisis management strategies. Key findings from the systematic review include evidence on thematic and regional bias, governance gaps and limited cross-country analyses. The relevance of this review is particularly timely, as the acceleration in the frequency and severity of climate-related risks urgently requires evidence-based insights to strengthen adaptation policies and crisis management strategies. The results are expected to inform not only the academic community but also decision-makers, practitioners, and organizations working in climate policy, crisis management, disaster risk reduction, and humanitarian response.

Specifically, the findings highlight a pressing need to enhance research on Crisis Management, particularly in developing regions, to improve real-time disaster response strategies. Expanding cross-regional collaborations is crucial to addressing knowledge gaps,

especially in Africa, Latin America, and Asia. Policymakers and researchers should also prioritize localized adaptation research to ensure equitable climate resilience.

Future studies should strive for a more balanced focus across different hazards, ensuring that droughts and heatwaves receive attention comparable to floods. Additionally, research should broaden its scope to incorporate a wider range of climate hazards while maintaining a balance between long-term adaptation strategies and immediate crisis response.

Finally, future research could refine the analytical dimensions considered in BRACE protocol and expand the CLEAR dataset to cover additional climate hazards. This article establishes a foundation for forthcoming publications that will present the specific synthesis results of the analysis conducted, offering a deeper exploration of these findings.

Ethics statements

No ethical concerns apply to this research as it is based on literature publicly available and accessible via Scopus.

Supplementary material *and/or* additional information

ANNEX 1. Search Queries
ANNEX 2. Glossary: Descriptive and Analytical dimensions
Table 1: Descriptive dimensions.
Table 2: Analytical dimensions.

CRediT authorship contribution statement

Melania Michetti: Conceptualization, Methodology, Investigation, Supervision, Writing – original draft, Writing – review & editing. **Alexandra D'Angelo:** Investigation, Validation, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.mex.2025.103672.

Data availability

No data was used for the research described in the article.

References

[1] A. Booth, A. Sutton, D. Papaioannou, Systematic Approaches to a Successful Literature Review, 2nd ed., SAGE Publications, 2016.
[2] J. Cohen, A coefficient of agreement for nominal scales, Educ. Psychol. Meas. 20 (1) (1960) 37–46, https://doi.org/10.1177/001316446002000104.
[3] Version 5.1 Collaboration for Environmental Evidence, in: A.S. Pullin, G.K. Frampton, B. Livoreil, G. Petrokofsky (Eds.), Guidelines and Standards for Evidence synthesis in Environmental Management, 2022. Version 5.1, www.environmentalevidence.org/information-for-authors.
[4] M.J. Grant, A. Booth, A typology of reviews: an analysis of 14 review types and associated methodologies, Health Info. Libr. J. 26 (2) (2009) 91–108, https://doi.org/10.1111/j.1471-1842.2009.00848.x.
[5] A. Liberati, D.G. Altman, J. Tetzlaff, C. Mulrow, P.C. Gøtzsche, J.P.A. Ioannidis, M. Clarke, P.J. Devereaux, J. Kleijnen, D. Moher, The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration, PLoS Med. 6 (7) (2009) e1000100, https://doi.org/10.1371/journal.pmed.1000100.
[6] F.J. Mateen, J. Oh, A.I. Tergas, N.H. Bhayani, B.B. Kamdar, Titles versus titles and abstracts for initial screening of articles for systematic reviews, Clin. Epidemiol. 5 (2013) 89–95, https://doi.org/10.2147/CLEP.S43118.

[7] A.M. Methley, S. Campbell, C. Chew-Graham, R. McNally, S. Cheraghi-Sohi, PICO, PICOS and SPIDER: a comparison study of specificity and sensitivity in three search tools for qualitative systematic reviews, BMC Health. Serv. Res. 14 (2014) 579, https://doi.org/10.1186/s12913-014-0579-0.
[8] D. Moher, L. Shamseer, M. Clarke, D. Ghersi, A. Liberati, M. Petticrew, P. Shekelle, L.A. Stewart, PRISMA-P Group, preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement, Syst. Rev. 4 (2015) 1, https://doi.org/10.1186/2046-4053-4-1.
[9] A.C. Tricco, E. Lillie, W. Zarin, K.K. O'Brien, H. Colquhoun, D. Levac, et al., PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation, Ann. Intern. Med. 169 (7) (2018) 467–473, https://doi.org/10.7326/M18-0850.