Urban Climate Change Mitigation, Adaptation, and Disaster Risk Reduction – a Review on their joint use for Spatial Resilience

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An increasing number of catastrophic events was recorded in the first two decades of the 21st century compared to the previous twenty years. The ongoing climate crisis suggests more disasters will happen, while other existing crises (ecological, energy, resources, socio-economic, geo-political, etc.) cannot be disregarded while trying to anticipate and handle them, both as possible concauses and as crucial factors in tackling them over time. Among different models and paradigms to address an uncertain era, Disaster Risk Reduction (DRR) and Climate

Introduction

An increasing number of catastrophic events was recorded in the first two decades of the 21st century compared to the previous twenty years (UNDRR, 2020) and the exposure of persons and assets increased more than vulnerability decreased (UNDRR, 2015), with impacts on the social, economic, environmental, cultural, and health sectors. The ongoing climate crisis suggests more disasters will happen, while other existing crises (ecological, energy, resources, socio-economic, geo-political, etc.) cannot be disregarded while trying to anticipate and handle them (ANONYMISED), both as possible concauses and as crucial factors in tackling them over time. So, since risk is defined as the product of the probability of hazards to happen, exposure, and vulnerability (see e.g. Cardona *et al.*, 2012), disaster risk reduction (DRR) seems all but an automatic trend, and requires instead urgent action on those three factors.

Given the complexity of hazards, and the often extensive temporal and spatial scales re-

Mitigation and Adaptation (CMA) represent two major categories aimed at inspiring urban and regional strategies, planning, and design options to pursue (climate-related) spatial resilience. This article presents a novel systematic literature review conducted through a Scopus-based query and subsequent qualitative content analysis, to understand how DRR and CMA are dealt with together in spatial planning, governance, and design, and to critically assess the depth, coherence, and disciplinary orientation of this integration. Findings highlight a fragmented and technocentric landscape, where DRR and CMA are frequently treated in parallel and rarely embedded in spatially grounded, participatory, or systemic frameworks. The review identifies significant gaps in disciplinary engagement – especially from planning, design, and political ecology – and proposes the need for a more transdisciplinary and situated understanding of spatial resilience. The literature review is ultimately aimed at providing new knowledge to strengthen DRR and CMA joint use for spatial resilience.

quired to address them, direct intervention is not always viable; when it is possible, efforts are often concentrated on managing exposure and vulnerability. This is true especially in the case of so-called *natural* risks that are considered e.g. earthquakes or volcanic eruptions, where the probability of occurrence is largely independent of human influence. When it comes to anthropogenic risks, the hazard can be tackled; this is the case of those deriving from the climate crisis, in which two strategies of action are often considered: mitigation, on one side, (see IPCC, 2022a; Working Group III) which refers to making the impacts less severe through the prevention or reduction of greenhouse gas (GHG) release into the atmosphere, while adaptation (see IPCC, 2022b; Working Group II), on the other side, consists in anticipating the adverse impacts of climate change by taking appropriate measures to prevent or minimise their damages (European Environmental Agency, 2023). In other words, mitigation tackles upstream the drivers, it points at removing or at least reducing the causes of climate change, while adaptation acts downstream to get prepared to face its consequences. It is therefore important to address them altogether, for mitigation can make adaptation easier.

Different taxonomies have been proposed to systematise hazards; according to UNDRR (2020), they are either biological, hydrometeorological, technological, geohazard, chemical, environmental, extraterrestrial, or societal; based

on the European Commission (Casajus Valles *et al.*, 2020) they can be geophysical, hydrogeological, meteorological, climatological, and human-made; finally, IPCC (2021; Working Group I) classifies hazards as: heat and cold; wet and dry; wind; snow and ice; coastal; oceanic; other.

If hazards may *also* be natural, "disasters are *not* natural" (UNDRR, 2022): "what turns a hazard into a disaster is the consequence of human decisions: where and how we build, how we access and share resources, how we protect and restore healthy ecosystems" (*ibid.*). "High vulnerability and exposure are generally the outcome of skewed development processes, such as those associated with environmental mismanagement, demographic changes, rapid and unplanned urbanisation in hazardous areas, failed governance, and the scarcity of livelihood options for the poor" (IPCC, 2022b). In other words – and practically and operationally speaking – when passing from hazards to disasters, i.e. to the actual damages to persons and assets, the spatial dimension matters (Pisano *et al.*, 2020). Associated with situated multidisciplinary skills and knowledge, urban and regional planning and governance play therefore a crucial role in Disaster Risk Reduction and Climate [Change] Mitigation and Adaptation (CMA) efforts, in the light of their potential to minimise exposure and vulnerability (risk adaptation), and to prevent or reduce the hazards (risk mitigation).

According to the World Bank (2023), 4.5 billion people are currently living in urban areas. Projections show that urbanisation, matched with the overall growth of the global population, could add two billion people more to urban areas by 2050 (United Nations, 2019). This is why it is important to address DRR and CMA from an urban perspective. Of course, local and global levels are often intertwined, as "disasters unfold across national boundaries, involving a range of interrelated hazards and complex dynamics'' (UNDRR, 2022) and requiring the building of resilience (*ibid.*). As a matter of fact, "lack of resilience and capacity to anticipate, cope with, and adapt to extremes and change are important causal factors of vulnerability" (Cardona *et al.*, 2012). The precondition for risk-informed decision making and long-term resilience lies in the establishment and maintenance of an inclusive governance system, "integrated with climate change adaptation" (UNDRR, 2022). Not surprisingly, among different models and paradigms to address an uncertain era, Disaster Risk Reduction (DRR) and Climate Mitigation and Adaptation (CMA) already represent two major scientific categories aimed at inspiring urban and regional strategies, planning, and design options to pursue (climate-related) spatial resilience. Spatial resilience is defined as "the ability of a territorial system to bounce back to desired functions after unexpected shocks and disturbances in order to improve its adaptive capacity, intending to evolve all its material and immaterial components toward a new territorial system's organisation" (Brunetta & Caldarice,

2020). In principle, space and its related resilience also encompass non-populated production sites, such as industrial parks (see Lee *et al.*, 2023), but, in the light of the above-cited interest for the increasing urbanisation trends, a focus is here dedicated to cities and highly or lowly densely inhabited human settlements.

Although a significant overlap exists between the problems that disaster risk reduction and climate change adaptation seek to address (Mercier, 2010), the article distinguishes them according to the following definitions: DRR as the strategy to prevent, reduce, and manage existing, new, and residual risks, thus contributing to strengthen resilience and helping achieve sustainable development (UNDRR, 2017); CMA as the strategy to anticipate the adverse effects of climate change and to take appropriate action to prevent or minimise the damage they can cause, while making the impacts of climate change less severe by preventing or reducing the emission of greenhouse gases (GHG) into the atmosphere (EEA, 2023).

The ultimate goal of the present article is to support risk-informed decision-making for long-term resilience at the urban and metropolitan level, by finding out possible common approaches and detecting possible gaps, biases, and margins for further studies. With a focus on the two aspects of resilience that are currently present in the United Nations agenda and that can be addressed spatially, as per another globally recognised issue such as the increasing urbanisation, this will be done by building a comprehensive and up-to-date literature review on urban climate change adaptation and mitigation and on urban disaster risk reduction, jointly addressed from a spatial perspective. The specific research question consists in the understanding of whether and to what extent CMA and DRR are addressed through the scientific and professional lenses of spatial studies:. such a review is meant to offer the most recent state of the art on those topics, whether and when addressed altogether in terms of urban and regional planning, governance, and design, while critically understanding whether research gaps and margins for improvement exist.

Materials and method

To support risk-related decision-making for long-term resilience, the article develops a comprehensive and up-to-date literature review. The review is operated by analysing the Scopus database on urban climate change adaptation and mitigation and urban disaster risk reduction, according to the following specifications.

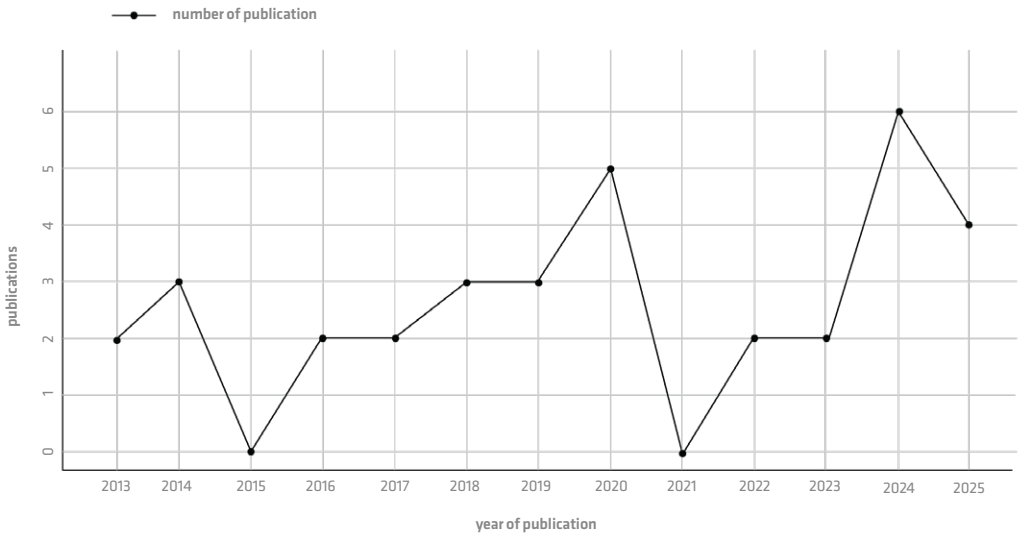
The systematic literature review is based upon the following inclusion criteria:

- date: up to May 30, 2025;
- language: English;
- peer review: not requested, since books, grey literature, letters, viewpoints, and editorials may be useful;
- type of publication: any, if present in Scopus;
- citation: none, since recent and/or niche pa-

Publications resulting from the literature review: references, publication type, and number of citations as of May 30, 2025.

Tab. 1

Short reference	Publication type	Number of citations
Ajibade (2017)	Scientific journal article (Research paper)	110
Attolico (2014)	Scientific journal article (Conference proceedings)	0
Banwell et al. (2020)	Scientific journal article (Research paper)	17
Biancifiori et al. (2024)	Scientific journal article (Conference proceedings)	0
Bogaard et al. (2016)	Book chapter(Conference proceedings)	11
Cadiz (2018)	Scientific journal article (Conference proceedings)	10
Carlone & Mannocchi (2024)	Scientific journal article (Research paper)	1
Cervelli et al. (2020)	Scientific journal article (Research paper)	27
Devès et al. (2018)	Book chapter	4
Djalante & Lassa (2019)	Scientific journal article (Invited viewpoint)	35
Espada et al. (2017)	Scientific journal article (Research paper)	33
Galderisi (2014)	Scientific journal article (Research paper)	7
Hanna et al. (2025)	Scientific journal article (Research paper)	0
Indal & Arriola (2024)	Scientific journal article (Research paper)	0
Islam et al. (2025)	Scientific journal article (Research paper)	0
King & Gurtner (2017)	Book chapter	0
King et al. (2016)	Scientific journal article (Research paper)	77
Klima & Jerolleman (2014)	Scientific journal article (Research paper)	13
Lam & Delina (2024)	Scientific journal article (Research paper)	0
Ling & Fujino (2013)	Book chapter	0
Myers et al. (2020)	Scientific journal article (Research paper)	2
Perney & D'Angelo (2023)	Scientific journal article (Research paper)	4
Rani et al. (2020)	Scientific journal article (Conference proceedings)	10
Schneider et al. (2022)	Scientific journal article (Research paper)	2
Sethi et al. (2025)	Scientific journal article (Report)	2
Sharkus et al. (2025)	Scientific journal article (Research paper)	0
Taramelli et al. (2019)	Scientific journal article (Review)	21
Tulloch et al. (2020)	Scientific journal article (Research paper)	32
Wamsler (2013)	Scientific journal article (Meeting report)	4
Widiati & Irianto (2019)	Scientific journal article (Conference proceedings)	0
Yoshikawa & Koshiyama (2024)	Scientific journal article (Conference proceedings)	2



Publications distribution over time.
Fig. 1

pers are considered to still matter, and possibly make a difference instead.

Exclusion criteria are:

- duplicates, i.e. same author(s) and similar content or editorial describing a paper in a given Special Issue or book review or preface/afterword talking about their related book;
- unobtainable publications;

Search terms for the collection of results (titles, abstracts, and keywords, through Scopus);

- Climate AND mitigation AND adaptation AND "disaster risk reduction" AND urban OR spatial OR regional OR city OR cities OR town AND planning OR governance OR design.

Results

3.1. General information

The Scopus search by titles, abstracts, and keywords produced 41 items; 7 articles have been discarded based on the established exclusion criteria. The criteria by which they have not been included is the obtainability. One of the articles is not retrievable as finished/completed source but as a repository version (Wamsler, 2013), however for the sake of the relevancy to this research it has been included. **Table 1** shows the resulting scientific works, listed in alphabetical order and organised by publication type and number of citations as of May 30, 2025 (as per their respective publisher's webpages or, as a second choice, in Scopus, and – if need be – in Google Scholar). 31 items (84%) have been published in scientific journals, of which 21 are research articles (68%), 7 conference proceedings (23%), 1 invited viewpoint (3%), 1 review (3%), and 1 meeting report (3%); 4 items are book chapters (11%), and 2 are a book (5%). The approach taken in the publications is a scientific one, on the other hand, some scientific contributions are authored (Attolico, 2014) or co-authored (e.g. Djalante & Lassa, 2019) by non-research experts.

Geographical distribution of authors' affiliations.

Tab. 2

Continent	Country	#
Africa		3
	Uganda	1
	Tanzania	1
	Kenya	1
Asia		14
	Bangladesh	1
	Hong Kong	1
	India	1
	Indonesia	2
	Iraq	1
	Japan	3
	Malaysia	1
	Philippines	1
	Vietnam	1
Europe		13
	France	1
	Germany	1
	Italy	7
	The Netherlands	1
	Spain	1
	Sweden	1
	Switzerland	1
North America		9
	Canada	3
	United States of America	6
Oceania		5
	Australia	4
	New Zealand	1
South America		1
	Chile	1
undefined		2

Top institutions among authors' affiliations.
Tab. 3

Institution	Country	#
University of Naples Federico II	Italy	3
James Cook University	Australia	2
Griffith University	Australia	2
Istituto Universitario di Studi Superiori di Pavia	Italy	2
Hospital of Potenza	Italy	1

3.2. Distribution over time

The items resulting from the literature review at hand are distributed in a timeline ranging from 2009 and 2025 (**Figure 1**), most of which (17, i.e. 65%) were published between 2016 and 2020, namely the year after and the same year as two milestones by the United Nations agency for the coordination of disaster risk reduction, respectively UNDRR (2015) and UNDRR (2020), also corresponding to the five years immediately following the Paris Agreement (UNFCCC, 2015), setting climate related goals and pledges.

3.3. Top authors, top affiliated institutions, and related geographical distribution

Geographically speaking (**Table 2**), most of the authors come from Europe (30%) and from Asia (28%), , followed by North America (21%); Oceania (12%), , African (7%) and South American (2%) affiliations are much fewer. Based on the Brandt line (ICIDI, 1980), the authors' affiliations are mostly located in the Global North (72%), and close to a third of them are in the Global South (28%). Affiliations are counted based on each publication, so the (rare) authors who are present in two publications are counted twice.

The sample of resulting scientific works here is too little, and, inside it, the multiple publications by the same authors are too few to apply Price's law on scientific productivity in each field (Price, 1976).

The top authors in the resulting publications, with two works each, are:

- Yetta Gurtner (Centre for Disaster Studies, James Cook University, Townsville, Queensland, Australia);
- David King (Centre for Disaster Studies, Centre for Tropical Urban and Regional Planning, School of Earth and Environmental Sciences, James Cook University, Townsville, Queensland, Australia).

Some institutions are recurring in the analysed publications, as shown in **Table 3**. Top three institutions are all universities: University of Na-

Authors' disciplinary distribution.
Tab. 4

Disciplinary cluster	ERC codes	# Authors
Earth science; hydraulics; hydrodynamics; water management; engineering; hazard mitigation; disaster studies	PE8	30
Mathematics	PE1	1
Ecology; soil pedology; agricultural and environmental sciences	PE10	12
Urban and regional planning; urban systems design; urban sustainability; environmental governance, policy and planning; geography	SH2	32
Political science, law, sustainability science	SH2	3
Sociology and Anthropology	SH3	4
Molecular Biology, Biochemistry, Structural Biology and Molecular Biophysics	LS1	4

ples Federico II (with its Department of Agricultural Science and its Department of Civil, Architectural and Environmental Engineering), James Cook University (namely, its Centre for Tropical Urban and Regional Planning at the School of Earth and Environmental Sciences and its Centre for Disaster Studies) and Griffith University (namely, its Australian Rivers Institute and its School of Environment and Science).

Affiliations concentrate in the Global North (72%) while many cases studied are in the Global South. This asymmetry matters: knowledge is produced about southern territories but largely by northern institutions, with predictable consequences for what counts as "evidence" and which interventions are preferred (engineering-heavy, finance-legible). The recurrence of a few institutions also hints at epistemic clustering that can narrow methodological repertoires.

3.4. Authors' disciplinary distribution

As seen at the end of the previous sub-section, even inside the same institution, authors may be affiliated with different departments, focusing on different aspects of climate change adaptation and mitigation and of disaster risk reduction. Authors' core disciplines have been found in the webpages of their institutions and/or in their personal webpages, and clustered based on multiple occurrences (i.e. in each cluster, pairs or triplets of disciplines may be associated with the same author), as shown in **Table 4**.

Authors' disciplinary clusters per year of publication and number of publications.
Fig. 2

Half of the authors (43 i.e. 50%) are affiliated with disciplines falling under the Physical Sciences and Engineering (PE) macro-sector of the European Research Council (ERC, 2020), including earth science, hydraulics, hydrodynamics, water management, engineering, hazard mitigation, disaster studies (PE8), mathematics (PE1), ecology, agricultural sciences and environmental sciences (PE10). Authors working within the Social Sciences and Humanities (SH) macro-sector represent 39 individuals (45%), with concentrations in urban and regional planning, urban systems design, urban sustainability, environmental governance, policy and planning, and geography (SH2: 32 authors), as well as political science, law, sustainability science (SH2: 3 authors), and sociology and anthropology (SH3: 4 authors). A smaller portion (4 i.e. 7%) operate within the Life Sciences (LS) macro-sector, specifically in fields such as molecular biology, biochemistry, and structural biology (LS1).
The disciplinary distribution of authors shows a predominance of hard and technically applied sciences, suggesting that a technocentric approach may exist in addressing CMA and DRR. This tendency will be further verified in the following content analysis. However, there is a substantial representation of scholars from urban and regional planning, geography, environmental governance and related domains. This aspect might signal a significant spatial and policy-oriented engagement with the topic.
The temporal distribution of publication in comparison with the disciplinary distribution, re-

Journals, book series and publishers' publications impact factor

Tab. 5

Journal/Book Series/Publisher	(Parent) Publisher	Location	Impact factor*
Springer Water	Springer	Cham, Switzerland	N/A
International Journal of Disaster Risk Reduction	Elsevier	Amsterdam, The Netherlands	4.5
Procedia Economics and Finance	Elsevier	Amsterdam, The Netherlands	N/A**
E3S Web of Conferences	EDP Science	Les Ulis, France	0.8***
World Bank Publications	World Bank	Washington, DC, United States	N/A
Procedia Engineering	Elsevier	Amsterdam, The Netherlands	N/A**
Ecological Indicators	Elsevier	Amsterdam, The Netherlands	7.4
Earthscan	Taylor & Francis	London, United Kingdom	N/A
Springer Climate	Springer	Cham, Switzerland	N/A
Progress in Disaster Science	Elsevier	Amsterdam, The Netherlands	3.8
International Journal of Disaster Resilience in the Built Environment	Emerald	Bingley, United Kingdom	1.9
WIT Transactions on Ecology and the Environment	WIT Press	Ashurst Lodge, United Kingdom	0.2
Geophysical Monograph Series	Wiley	Hoboken, NJ, United States	N/A
Journal of Homeland Security and Emergency Management	DeGruyter	Berlin, Germany	1.0
Tsukuba International Office	N/A	Tsukuba, Japan	N/A
IOP Conference Series: Earth and Environmental Science	IOP Science	Bristol, United Kingdom	0.2***
CLEAN – Soil, Air, Water	Wiley	Hoboken, NJ, United States	1.4
Lecture Notes in Energy	Springer	Cham, Switzerland	N/A
Community, Environment and Disaster Risk Management	Emerald	Bingley, United Kingdom	N/A
Remote Sensing	MDPI	Basel, Switzerland	4.1
Biological Conservation	Elsevier	Amsterdam, The Netherlands	4.4
Climate and Development	Taylor & Francis	Abingdon, United Kingdom	3.5
Pakistan Journal of Life and Social Sciences	Elite Scientific Publications	Accra, Ghana	N/A

Town and Regional Planning	University of the Free State	Bloemfontein, South Africa	0.6
Journal of Water Resources Planning and Management	American Society of Civil Engineers (ASCE)	Reston, United States	3
International Journal of Disaster Resilience in the Built Environment	Emerald	Bingley, United Kingdom	1.1
Theoretical and Applied Climatology	Springer	Cham, Switzerland	2.7
Lecture Notes in Networks and Systems	Springer	Cham, Switzerland	0.6**
Climate Smart Development in Asia	Taylor and Francis	London, United Kingdom	N/A
Scientific Reports	Springer Nature	London, United Kingdom	3.9
Climatic Change	Springer	Cham, Switzerland	4.8
Irrigation and Drainage	Wiley	Hoboken, NJ, United States	1.7
Sustainability	MDPI	Basel, Switzerland	3.3
Land	MDPI	Basel, Switzerland	3.2
Climate	MDPI	Basel, Switzerland	3.2
Environmental Research Communications	IOP Science	Bristol, United Kingdom	2.5
Environmental Science and Policy	Elsevier	Amsterdam, The Netherlands	5.2

*approximated to decimals
**discontinued
***impact score

veals again a dominance of technical and environmental, indicating a possible constant presence and central role of engineering and earth sciences in climate and risk research. Urban and regional planning disciplines have surprisingly maintained a steady presence, with surges in 2020 and 2014. It might appear that the hard sciences have been communicating almost directly with planning practices and urban studies, with an almost steady increase in spatial studies' interest in the topic. Ecological and Environmental sciences show a more sporadic pattern, peaking in 2020, likely reflecting a growing awareness in nature-based dimensions. Social Sciences and Life Sciences appear only recently and in small numbers, suggesting a delayed but emerging transdisciplinary engagement with CMA and DRR. Mathematics, as a singular occurrence, appears in a research article in collaboration with another author coming from Social Sciences; this presence is justified as the study process structured interviews which could require mathematical and statistical analysis.

The PE dominance (50%) with SH2 as second pole confirms a two-pillar architecture: modelling/engineering and policy/planning. Missing are political ecology, environmental humanities, and design practice as epistemic engines (not just recipients of models). This imbalance helps explain why DRR and CMA appear "in parallel" rather than operative within spatial projects.

3.5. Journals, book series, and publishers

The works resulting from the literature review at hand are mostly published (**Table 5**) by El-

sevier, with 7 items (21%), followed by Springer with 5 items (15%) and Multidisciplinary Digital Publishing Institute (MDPI) with 4 items (12%); Wiley has 3 items (9%) and Taylor and Francis has 2 items (6%). Based on the aforementioned Brandt line, most of the publishers are from the Global North (86%), the two exceptions from the Global South are Elite Scientific Publications, located in Ghana, and the University of the Free State in South Africa with one publication each (3%). Overall, 53% of the publications are available in open access; 55% when limiting to papers in scientific journals. When available, the impact factors of scientific journals range between 0.2 and 7.4.

The book series related to the selected book chapters are within Springer Climate series (Springer) (Deves *et al.,* 2018), the book *Climate Smart Development in Asia* printed by Routledge (Taylor & Francis) (Ling & Fujino, 2013) and the series of conference proceedings collection *Lecture Notes in Networks and Systems* (Springer). The book *Communicating Climate Change Information for Decision-Making,* part of the Springer Climate series, includes interdisciplinary research focusing on climate change sciences, fields of knowledge such as ecology, water management and communication sciences (Serrao-Neumann *et al*., 2018). *Climate Smart Development in Asia* explores topics around economics, finance, business and sustainable and global development (Srinivasan et al., 2012). The third and last book series *Lecture Notes in Networks and Systems* can contain proceedings of conferences in the fields of decision making, applied sciences, engineering, computer sciences, economics, social and life sciences.

The fields of the journals cover the following disciplines: earth sciences and their implications, environmental sciences, engineering, urban studies, geography, and the social sciences (International Journal of Disaster Risk Reduction; Ajibade, 2017; Banwell *et al.*, 2020); economics and finance (Procedia Economics and Finance; Attolico, 2014); environment, energy, and earth sciences (E3S Web of Conferences; Bogaard *et al.*, 2016); engineering (Procedia Engineering; Cadiz, 2018); ecological modelling, ecology, evolution, behaviour and systematics (Lecture Notes in Networks and Systems; Biancifiori *et al.,* 2024); disaster risk reduction, response, emergency management and recovery (Progress in Disaster Science; Djalante & Lassa, 2019); disaster risk reduction, response and reconstruction to reduce the impact of natural and anthropogenic hazards (International Journal of Disaster Resilience in the Built Environment; Espada *et al.*, 2017; King *et al.*, 2016); sustainable development (WIT Transactions on Ecology and the Environment; Galderisi, 2014); homeland security and emergency management (Journal of Homeland Security and Emergency Management; Klima & Jerolleman, 2014); earth sciences and environmental sciences (IOP Conference Series: Earth and Environmental Science; Rani *et al.*, 2020; Widiati, 2019); environmental safety

Keyword occurrences (higher than two).

Tab. 6.a

#	Keyword	Number of occurrences
1	Climate Change	19
2	Risk Assessment	13
3	Disaster Risk Reduction(s)	11
4	Disaster Management	10
5	Sustainable Development	7
6	Resilience	6
7	Disasters	6
8	Adaptation	6
9	Urban Planning	5
10	Decision Making	5
11	Climate Change Adaptation	5
12	Adaptive Management	5
13	Risk Perception	4
14	Risk Management	4
15	Mitigation	4
16	Urban Development	3
17	Strategic Approach	3
18	Land Use Planning	3
19	Green Infrastructure	3
20	Governance Approach	3
21	Extreme Event	3
22	Ecosystems	3
23	Disaster Mitigation	3

Keyword occurrences (clustered by affinity).
Tab. 6.b

#	Keywords	# occurrences
1	Risk Analysis, Mapping, Management; (Natural) Disaster Risk Reduction (DRR) and Mitigation, Local Government and DRR, Emergency Management	32
2	Climate Change: Adaptation, Mitigation, Science and Policy, and/or Governance	31
3	City / Territorial / Urban / Resilience / Planning	11
4	Resilience, resilience planning, and resilient	8
5	Flooding or Coastal Risks, Flood risk and or management, Flood Mitigation, Flood Governance, Flood Damage Mitigation	6
6	Ecosystems, Ecosystem Services, Ecosystem-based Management, Vegetation and Energy Indices, or Regulating Services	4
7	Sustainability Science, Environmental Justice, or Environment and Sustainability	4
8	(Resilient) Cities, Future City, Built Environment	3
9	Infrastructure or Green Infrastructure	3

and sustainability: air pollution, waste management, the water cycle, and environmental conservation (Schneider *et al.*, 2022); science and application of remote sensing technology (Remote Sensing; Taramelli *et al.*, 2019); conservation science: biological, sociological, ethical, and economic dimensions (Biological Conservation; Tulloch *et al.*, 2020); interfaces between climate, development, policy, and practice to make analysis of climate and development issues (Climate and Development; Wamsler, 2013).

Of all editorial positions, only two book series explicitly address city and urban planning, urban studies, communities and human settlements, and urban development (Eltinay & Egbu, 2024; Ling & Fujino, 2013), and only one scientific journal is primarily concerned with such subjects and topics (Town and Regional Planning). Nevertheless, two journals cover urban studies together with engineering and with earth and environmental sciences (International Journal of Disaster Resilience in the Built Environment; Town and Regional planning). These cases represent a disciplinary exception, since engineering, earth sciences, environmental sciences, and development studies – together with life sciences – are rather the regular foci of the book series and journals that host the publications of the present literature review. Finally, it may be interesting to note that disaster risk reduction

and emergency management appear as the core topics of four journals in which five papers are published, i.e. well below one third of the total selected scientific articles.

3.6. Keywords

The study of keywords can reveal the internal connections of scientific knowledge with a given discipline (Liao & Furuya, 2023). Thus, a frequency analysis of keywords can offer a preliminary overview of the hotspot in a specific subject (Pan *et al.*, 2023).

Related to the literature review at hand, keywords – which were found in 16 out of 26 publications – are reported in **Table 6.a**, limited to occurrences higher than one, in **Table 6.b**, clustered by affinity.

Other occasionally occurring keywords include: habitat connectivity; governance, future city, forestry, flood risks; flood risk management; flood maps; finance; equitable disaster management; environmental justice; environmental impact assessment; energy indexes; energy crop; ecosystem services; ecosystem resilience; ecosystem; economic growth; development planning; decision making; decision support system; copernicus services; conservation management; community; co-design; climate model; cities; built environment; building; bioenergy; biodiversity; artificial intelligence; anthropogenic pressures; agriculture; abandoned land.

Although "Climate Change" shows a higher frequency (19 occurrences), no other keyword emerges as overwhelmingly dominant; the remaining terms show relatively balanced frequencies (**Table 6.a**). Most of the keywords occurring more than once are either directly (#2–6, #8, #12) and quasi-immediately (#9–10) related to the search terms, or corresponding to currently dominant frameworks and narratives (#1, #7) which such search items fall within. When keywords are grouped by affinity (**Table 6.b**), CMA and DRR are addressed with comparable emphasis (31 and 32 occurrences respectively), which is unsurprising inasmuch as they represent the core paradigms of the literature review at hand; terms related to resilience are still important (#3), as outlined above; cities and more generally built environment on the one side and spatial planning on the other – i.e. the main foci of CMA and DRR in the present contribution – also rank high (#4 *ex aequo*). Next are some terms related to ecosystem services and to environmental and sustainability sciences (#6 *ex aequo*), whose connections to CMA and DRR have been outlined (Munang *et al.*, 2013). The crucial impacts of land use on disaster risk (Burby, 1998; Su *et al.*, 2021) and climate change (Pielke Sr, 2005; Dale *et al.*, 2011; Popp *et al.*, 2014) have been also clear for quite a long time, yet the occurrence of related keywords is poor (they only appear twice), and so is their overall presence in the selected publications' contents and highlights, as shown in the next section.

3.7. Publications' contents and highlights

Content-wise, the most used words have been

Most used words in selected publications.

Tab. 7

#	Most used words	Occurrences
1	Climate	816
2	Change	558
3	Risk	508
4	Adaptation	377
5	Local	342
6	Disaster	342
7	Policy	331
8	Urban	329
9	Planning	327
10	Flood	323
11	Development	230
12	Management	223
13	Community	200
14	Land	199
15	Resilience	195
16	Heat	195
17	Implementation	190
18	National	163
19	Reduction	179
20	Coastal	175
21	Water	172
22	Mitigation	168
23	Economic	164
24	Rainfall	160
25	City	158
26	Green	157
27	Government	156
28	Energy	150
29	Research	140
30	Policies	139

searched for in the selected works, excluding determinative and indeterminative articles, adverbs, pronouns, conjunctions, and cited references. The resulting words are ranked in **Table 7** based on their occurrence.

Items #1–4, #6 and #8–9 are all part of the search items (title, abstracts, and keywords), so their frequent occurrence is no surprise. In **Table 7b** are listed only the terms included in the research query in order of ranking. "Reduction" only ranks #20 followed at #23 with "mitigation", while interesting to note how "governance" and "disasters" (i.e. #49 and #68) are ranked really low in comparison to other terms like "resilience" or "economic" (i.e. #15 and #23). . The word "Cities" – also ranked quite low at #64 – is found coupled with "smart" and "future" (Ajibade, 2017), or "resilient" and "communities" (Djalante & Lassa, 2019). Among the terms that are not included in the search items, we can find "resilience" (#15), which is actually quite a trendy word in the considered timeframe, and business-oriented words such as "development" (#11), "management" (#12), "implementation" (#17), and "economic" (#23). Some words can suggest the type of risks and climate change topics tackled in the selected literature: "flood" #10, "heat" #16, "coastal" #20, "water" #21. Even though climate is concerned (#1 word by occurrence), the adjective "environmental" does not even appear in the table as it only ranks #68, together with "environment", "ecology", "ecological", and alike do not even appear in the first 100 words.

3.8. Publications' reading, summary, critique and relevance to query

This section synthesises findings from 34 academic contributions that address the integration of Climate Change Adaptation (CCA) and Disaster Risk Reduction (DRR) within urban and spatial planning. For each article, a brief summary is provided, followed by a critical reflection and an assessment of its relevance to the central research question. Rather than serving as a purely descriptive inventory, these readings are used to trace recurring patterns of discourse, disciplinary positioning, and methodological orientation across the reviewed literature. Together, they form the analytical groundwork for the subsequent cross-comparison (Section 3.9) and the interpretive discussion (Section 4), where broader tendencies and gaps are systematically articulated.

- **Ajibade (2017)** analyses critically the Eko Atlantic City project in Lagos, Nigeria, a development that has been framed mediatically and politically as a climate resilient response to coastal inundation risk of the area. Through a political ecology lens, the study intends to expose how mega-projects such as Eko Atlantic City, while claiming to enhance resilience, often reinforce capitalist accumulation, socio-spatial inequality and ecological degradation. It highlights how it can be problematic to detach the term 'resilience' from social and environmental justice, arguing that this can in fact create

'maladaptation'. While highly relevant to the discourse on CCA, CCM and urban resilience, the article does not engage with spatial planning or design practices. Its methodology is instead grounded in geography and critical social sciences, offering a structural critique rather than operational planning insights;

- **Attolico (2014)** examines how DRR is integrated into land use planning in the province of Potenza, Italy. It emphasises the importance of stakeholder engagement and institutional awareness in the face of increasing climate-related risks. The study offers a governance framework that supports territorial decision making for risk management, while highlighting the need for municipalities to be aligned with funding opportunities. While the article acknowledges the role of urbanisation in shaping exposure and adaptive capacity, its contribution remains on procedures and assessment tools rather than spatial or design strategies. It does offer generic guidelines for institutions, but overlooks that potential of local communities' knowledge as a proactive force in territorial planning. CCA and CCM are mentioned but not explored in depth;
- **Banwell *et al.* (2020)** examine the barriers to implementing climate resilience policies in the Araucanía Region of Chile, highlighting the gap between international agreements and local realities. Using a mixed-methods approach, primarily based on questionnaire data, the study frames climate resilience as a convergence of DRR, CCA, and CCM, and argues for the essential role of community engagement in achieving sustainable development. The findings reveal a disconnect between policymakers and local populations: while officials assume that communities are disengaged or unaware, the data show that local actors possess significant awareness and culturally embedded knowledge to address climate risks. The article identifies socio-political, economic, and cultural factors as key obstacles to effective resilience implementation. Methodologically, it engages directly with participatory planning practices, making it relevant to urbanism both conceptually and in terms of applied tools, particularly regarding the inclusion of local knowledge in spatial governance. However, It does not engage with operational spatial planning or urban design practices;
- **Biancifiori *et al.* (2020)** present a case study on the use of participatory design and gamification to support Nature-Based Solutions (NBS) in urban regeneration, focusing on the redevelopment of Fioccardo Park in Turin. Through the *Start Park* board game, the study simulates a co-design process with students, aiming to raise awareness on climate change, promote social engagement, and inform adaptive planning. The main contribution lies in translating citizen partic-

ipation into a structured, replicable method that connects policy frameworks with local experimentation. While the approach fosters interaction and shared decision-making, its reliance on students as stand-ins for community members limits its external validity, and its application remains confined to the pre-design phase, without yet addressing spatial or operational dimensions. Nonetheless, the study offers relevant insights for integrating Climate Change Adaptation (CCA), Disaster Risk Reduction (DRR), and participatory planning into urban practice, emphasising the value of early engagement, transparent processes, and context-sensitive governance;

- **Bogaard *et al.* (2016)** present the early stages of a research project aimed at developing Coastal Early Warning Systems (CEWS) across 11 European sites. While primarily focused on prevention, mitigation, and preparedness, the article notably incorporates CCA as part of its objective, aligning with broader resilience frameworks. The project emphasises the creation of generic, engineer-driven decision-support tools, targeting hazard anticipation and risk communication in coastal areas. Although relevant to the discourse on climate resilience and risk reduction, the article remains outside the scope of spatial or urban planning, offering no direct engagement with design practices or planning processes. Its relevance to the research query lies in its technical contribution to DRR and CCA, rather than in its integration into planning or participatory governance frameworks;
- **Cadiz (2018)** introduces the UP NOAH initiative (Nationwide Operational of Hazards for the Philippines), a geospatial research project focused on multi-hazard risk mapping in the Philippines to support DRR. The study applies GIS-based tools to identify high-risk areas, aiming to inform prevention strategies and early interventions. While the project is primarily oriented toward risk mitigation rather than long-term climate adaptation, it does position spatial mapping as a planning-relevant tool, connecting scientific data to territorial governance. Its contribution lies in operationalising hazard awareness through spatial analysis, but it does not engage with adaptive planning or design approaches. The study is relevant to the research query in terms of DRR and geospatial integration, though its framing remains more technical than participatory or design-oriented;
- **Carlone & Mannocchi (2024)** examine the institutional and societal barriers to the adoption of Nature-Based Solutions (NBS) for DRR within the socio-ecological system of Emilia-Romagna. Through a qualitative case study, the article highlights how, despite being recognised as effective DRR tools, NBS remain marginal in practice due

to resistance from technical professionals, limited policy integration, and socio-economic constraints. The study positions NBS within the framework of spatial planning, identifying governance and cultural shifts as necessary conditions for their mainstreaming. Directly relevant to the research query, the article reinforces the potential of NBS in planning but underscores the structural inertia that hinders their full implementation;

- **Cervelli *et al*. (2020)** investigate the potential of marginal areas for hosting bioenergy crops, aligning with the European renewable energy agenda. Using land use change modelling and scenario-based ecosystem service (ES) assessment, the study explores spatial strategies for sustainable development. While the concept of resilience is mentioned, it is drawn primarily from policy references and not elaborated within the spatial or ecological dynamics of the study. The framing of ES as exact and quantifiable overlooks ongoing debates about their contextual and socio-ecological variability. Furthermore, concerns arise from the monocultural approach to crop selection, particularly the ecological appropriateness of using riparian species without restoring wetland conditions. Although the article does not directly address CCA or CCM, it engages with planning tools and spatial decision-making, offering indirect relevance to sustainability-oriented territorial governance;
- **Chandra *et al*. (2023)** investigate how Pacific Small Island Developing States are addressing climate-induced Non-Economic Loss and Damage (NELD), with particular attention to cultural, ecological, and identity-related impacts. Through stakeholder interviews and policy analysis, the article reveals a persistent disconnect between emerging adaptation and relocation strategies and the formal recognition of intangible losses in governance frameworks. Although spatial dimensions are not central, the study's emphasis on cultural erasure, traditional knowledge, and biotic relations invites deeper reflection within biocentric urbanism. It challenges technocratic approaches to climate planning by foregrounding non-technical, life-anchored values, even if it stops short of engaging directly with design or spatial planning practices;
- **Cottar & Wandel (2024)** analyze the post-2021 flood recovery in Merritt, British Columbia, focusing on municipal approaches to flood mitigation and the contested potential of managed retreat. Through interviews with local officials, the study underscores the dominance of short-term rebuilding over long-term adaptation, constrained by political hesitation, funding gaps, and housing pressures. While not centered on spatial planning, it offers valuable insight into how local governance structures and policy inertia can obstruct transformative responses to

climate risk. The article is particularly relevant for urban resilience planning, highlighting the need to bridge emergency recovery with proactive land-use and relocation strategies;

- **Devès *et al*. (2018)** critically examine the structure and knowledge production processes of the IPCC, highlighting the limitations of its top-down, expert-driven model in supporting the bottom-up implementation of the Paris Agreement. The chapter advocates for a more inclusive, multi-actor and interdisciplinary approach to CCA and DRR, arguing that broader stakeholder engagement could help bridge the persistent gap between science and policy. While the study is not directly situated within urban planning or spatial design, its call for transdisciplinary integration offers an implicit relevance to urbanism, particularly in its potential to incorporate diverse knowledge systems and contextual responses to risk;
- **Djalante & Lassa (2019)** assess progress on Priority 2 of the Sendai Framework for DRR, focusing on governance as a key enabler of risk reduction. The authors stress that disaster impacts are deeply rooted in social vulnerability, particularly affecting marginalised populations, and call for adaptive governance models that respond to these structural inequalities. The study proposes a five-step pathway – from recognising community vulnerabilities to institutionalising adaptive governance – but its recommendations remain primarily within the political and institutional realm. While not directly engaging with spatial planning or design, the governance shifts outlined could support more equitable territorial strategies, making the article indirectly relevant to spatial resilience discourse;
- **Galderisi's (2014)** structure is around the integration of CCA and DRR in urban planning, the article offers a valuable theoretical framework for understanding adaptation phases across European contexts. The study critiques the limited intersectoral coordination and vagueness of vulnerability indicators, proposing a more systemic planning logic beyond isolated tools. While it lacks operational design applications, it remains an asset for resilience-oriented planning;
- **Hanna *et al.* (2025)** introduce a novel evaluation tool for riverine flood policies in New Zealand, highlighting institutional inconsistencies and a slow but significant shift toward risk-informed planning. The work enriches DRR-CCA integration discourse with a governance-focused lens, emphasising policy coherence over design. It's particularly relevant for translating adaptive principles into actionable planning criteria;
- **Indal & Arriola (2024)** explore how LGUs in Basilan Province implement CCM and DRR strategies through local policies and administrative action. While the study sheds light

on institutional barriers in resource-scarce contexts, it remains descriptive and detached from spatial or design perspectives. Nonetheless, it offers critical insights into governance challenges shaping local climate resilience efforts in the Global South;

- **Islam *et al.* (2025)** analyze long-term precipitation trends along coastal Bangladesh, revealing spatial and seasonal variability linked to monsoons, land use, and the Sundarbans. While methodologically robust, the study remains within climatological boundaries, offering limited engagement with planning or governance. Nonetheless, its findings provide essential data for anticipatory adaptation and water risk strategies in vulnerable deltaic contexts;
- **King & Gurtner (2017)** draw on post-disaster surveys in Australia to highlight how communication, preparedness, and community education can reduce flood risk. While rich in empirical insight, the chapter focuses more on governance and behavioral aspects than on spatial or design dimensions. Still, it offers relevant contributions to DRR through socially grounded approaches to risk and resilience;
- **King *et al.* (2016)** examine how land-use planning frameworks in post-disaster contexts support or hinder DRR and CCA goals across Australia, Thailand, and Indonesia. Emphasising institutional gaps and development-driven priorities, the article critiques current planning systems for neglecting long-term resilience. While lacking design-specific tools, it offers valuable insights into the governance conditions necessary for embedding risk sensitivity in spatial planning;
- **Klima & Jerolleman (2014)** trace the evolution of hazard mitigation from siloed practices to more integrated, cross-sectoral approaches linking DRR, adaptation, and resilience. Through U.S. based examples, the article advocates for governance reform and professional collaboration. While not spatially grounded, it offers conceptual clarity on institutional barriers and enablers for integrated climate risk planning;
- **Lam & Delina (2024)** review financing strategies for extreme heat adaptation in Southeast Asian cities, emphasising the divide between structural and non-structural measures. While regionally grounded and aligned with the Sendai Framework, the study remains largely descriptive and under-engages with urban design. Still, it offers valuable insights for integrating climate finance, heat governance, and socio-spatial equity in resilience planning;
- **Myers *et al.* (2020)** analyze recent trends in CCA, resilience, and DRR through urban and regional planning policies in Zanzibar, Tanzania. The study highlights the dominance of land use and zoning approaches, critiquing their limited capacity to respond to the

complexities of climate-related risks. It also points to a reliance on externally driven funding and policy frameworks – primarily from non-African actors – which perpetuate top-down models that marginalise local knowledge and participation. While the article engages with DRR, CCM and CCA, it does so without clearly differentiating between these concepts, and without addressing concrete design or implementation practices. Its focus remains on the planning discourse and the early stages of project development, offering critical insights into the structural and governance challenges of resilience-building in postcolonial contexts;

- **Perney & D'Angelo (2023)** examine the integration of DRR and CCA into urban governance through the EU-funded SEACAP 4 SDG project in Naples. Focusing on the implementation of a Living Lab and an updated SECAP, the study documents participatory tools and training sessions involving municipal, academic, and civil society actors. While the article emphasises collaborative methodology and EU alignment, it remains largely descriptive and offers limited critical reflection on power dynamics or spatial negotiation. Nonetheless, it provides a replicable model for advancing climate resilience in urban planning, especially in cities navigating capacity constraints and supranational frameworks;
- **Rani *et al.* (2020)** analyze the incorporation of CCA and DRR into Malaysian urban development plans across governance levels, using policy content analysis. They find stronger integration at the local scale – particularly in the Cameron Highlands – compared to the more sector-specific national frameworks. While the study offers a useful institutional mapping, it lacks engagement with governance dynamics or spatial design practices. Still, it contributes to understanding how national directives translate into localised climate resilience planning, especially in contexts balancing top-down policy coherence with place-based adaptation;
- **Schneider *et al.* (2022)** investigate how urban green infrastructure (UGI) and nature-based solutions can mitigate climate extremes in Holguín, Cuba. Through ecological engineering and spatial mapping, they identify pilot interventions targeting flood and heat risks, especially in vulnerable neighborhoods. While the study offers practical methods for applying NbS in data-poor settings, it remains technocratic, with limited attention to governance or spatial equity. Nonetheless, it contributes to DRR–CCA integration by showcasing how green urbanism can enhance resilience and ecological functionality in Latin American cities;
- **Sethi *et al.* (2025)** provide a longitudinal analysis of interannual climate variability in coastal Odisha, revealing increasing temperature fluctuations and their links to ex-

treme weather events. Drawing on 54 years of station-level data, the study highlights how shifts in seasonal variability exacerbate climate risks for agriculture, infrastructure, and disaster response. While technically rigorous, the article remains within the domain of climate science, offering limited engagement with planning or governance. Nonetheless, it presents valuable insights for regional DRR–CCA strategies and underscores the climatic volatility shaping socio-ecological vulnerability in coastal regions;

- **Sharkus *et al.* (2025)** analyze spatial and temporal trends in flood risk across Environmental Justice communities in Massachusetts, revealing that low-income, minority, and limited-English-proficient populations are increasingly concentrated in high-risk zones. Using the Environmental Justice Index and geospatial data from 2010–2020, the study exposes structural inequalities in flood exposure. While grounded in strong spatial analysis, it lacks participatory depth and remains focused on technical risk mapping. Nonetheless, it contributes to DRR and CCA by foregrounding equity in climate adaptation, making a strong case for justice-centered and place-based flood governance;
- **Taramelli *et al.* (2019)** assess the potential of Copernicus Global Land Service data to monitor green infrastructure, particularly natural water retention measures (NWRMs), as nature-based solutions for DRR and CCA. By linking vegetation indices with ecological functions and policy goals, the study provides decision tools to inform spatial planning. Despite limitations in resolution and validation, it offers a practical framework for integrating remote sensing into design and environmental governance, supporting the spatialisation of water retention and biodiversity goals;
- **Tulloch *et al.* (2020)** evaluate global cumulative impacts on marine ecosystems by disaggregating stressors into climate, land, and marine-based categories, and assess the alignment of management tools such as Marine Protected Areas (MPAs), Integrated Coastal Management (ICM), and climate hazard reduction with dominant threats. Their conservation-effectiveness index reveals mismatches between impact sources and policy responses, especially in small island states with high climate vulnerability. By linking impact mapping with governance indicators, the study advances a multi-scalar, spatially grounded approach to DRR and CCA, reinforcing the need for trans-jurisdictional, ecosystem-based, and context-sensitive resilience planning;
- **Wamsler (2013)** discusses the outcomes of the Fourth Global Platform for DRR, arguing for integrated risk governance that bridges global frameworks and local realities. She highlights the importance of including civil

Publications' macro-themes clustering

Tab. 8.a

Macro theme	#
Land Use Planning	2
Global South and Indigenous Perspectives	5
Techniques, modelling and mapping	5
Urban Governance	10
Urban Planning	7
Water Techniques	3

society, personal responsibility, and behavioral change, while challenging the binary between global mitigation and local adaptation. The paper calls for systems thinking and enforceable global targets in shaping the Hyogo Framework for Action (HFA2), aligning with trans-scalar accountability and the systemic nature of risk;

- **Widiati & Irianto (2019)** assess the Multi-Stakeholder Fora (MSF) in Papua Province, eastern Indonesia. It looks at MSF as a participatory platform for climate mitigation and adaptation, focusing on mangrove conservation and local governance. While MSF fosters coordination across sectors, its reliance on external funding and limited institutionalisation of community participation undermine long-term resilience. The case illustrates the promises and fragilities of localised, stakeholder-driven DRR and CCA governance, offering insights into the procedural and structural challenges facing bottom-up adaptation in resource-constrained contexts;
- **Yoshikawa & Koshiyama (2024)** evaluate the potential of Tambo Dams – small, low-cost water regulation devices in paddy fields – as a flood control measure in Japan. Framed within the concept of Eco-DRR, the study highlights a systemic shift in Japanese water governance from centralised river control to integrated basin-level flood management. The research shows that widespread implementation of Tambo Dams can simultaneously reduce flood risks and enhance food security, particularly for vulnerable communities. While the article does not explicitly address CCA, its integrated, ecosystem-based approach aligns with adaptive planning principles. Though rooted in technical water management, the study's recognition of multifunctional landscapes

Risks tackled in the publications

Tab. 8.b

Type of risk	#
Flooding	13
Extreme Heat and Heatwaves	3
Earthquake and Tsunami	1
Biodiversity loss	1
Undefined	14

positions it as relevant to spatial resilience and nature-based planning.

All the analysed publications show a wide range of thematic orientations. In order to offer a systematic understanding of the contents of the contributions, in **Table 8a** seven macro-themes within each article have been categorised.The themes are: 'Land Use Planning', 'Global South and Indigenous Perspectives', 'Techniques, modelling and mapping', 'Urban Governance', 'Urban Planning' and 'Water Techniques'. 'Land Use Planning' refers to those works which interrogate the classic territorial instruments (e.g. zoning) and their inclusion in DRR. Attolico (2014) and King *et al.* (2016) argue how land use planning is constrained and rigid in comparison with the need for flexibility and understanding of uncertainty that climate related risks ask for. The contributions which take into account the 'Global South and Indigenous Perspectives' put in the foreground the (higher) climate vulnerability in postcolonial and resource-lacking contexts. These articles prioritise cultural, socio-political and epistemic dimensions. In the case of Ajibade (2017), Myers *et al.* (2020), Islam *et al.* (2025), Indal & Arriola (2024) and Chandra *et al*. (2023), place-based knowledge are institutional fragilities are highlighted: Global South territories are often excluded or subordinated in the adaptation process and dialogue. As it was noticed throughout this review, technical and technocratic approaches seems to be at the forefront of DRR, CCA and CCM, it was crucial to notice which contributions are purely focused on these techno-oriented themes. 'Techniques, modelling and mapping' macro-theme integrates quantitative, technical or model-driven approaches and methods to hazard and risk prediction and assessment. Cadiz (2018) and Sethi *et al.* (2025) focus on GIS techniques for risk identification, Taramelli *et al.* (2019) use remote sensing for mapping ecological resilience and Schneider *et al.* (2022) use mapping for implementation of NbSs. Then there is the 'Urban Governance' and 'Urban Planning' themes that together count almost half of the total contri-

butions. The first cluster contains how institutions and policies shape CCA, Articles such as Wamsler (2013), Devès *et al*. (2018), and Djalante & Lassa (2019) critically assess the global picture of climate governance, drawing attention to the limitations of top-down, expert-driven frameworks in fostering locally grounded action. In contrast, studies like Cottar & Wandel (2024), Perney & D'Angelo (2023), and Hanna *et al.* (2025) delve into municipal-level responses. Yoshikawa & Koshiyama (2024) and Lam & Delina (2024) expand this theme by highlighting how hydrological regimes, flood control, and urban heat management are increasingly entangled with administrative and planning systems. The second cluster brings together the contributions that focus on spatial practice, participation and co-design techniques and procedural explorations. Biancifiori *et al*. (2020) explores the use of gamified co-design to support Nature-Based Solutions (NbS); Galderisi (2014) and Carlone & Mannocchi (2024) engage with scenario-based tools; Rani *et al.* (2020) and Banwell *et al.* (2020) further expand this perspective by examining how planning hierarchies, local capacities, and community knowledge systems influence the integration of CCA and DRR across governance levels. Finally the 'Water Techniques' include technical infrastructures and spatial tools addressing water-related risks. Articles like the one of Bogaard *et al.* (2016) on Coastal Early Warning Systems (CEWS), Tulloch *et al*. (2020) on marine stressor mapping, and Sharkus *et al.* (2025) on spatial injustice in flood exposure exemplify this approach.

Among the reviewed contributions, water-related climate risks emerge as the most dominant concern, with 38% of the publications addressing flooding in its various forms (**Table 8b**). Within the total addressing floods, 25% are about coastal inundation and 17% about riverine or pluvial events. These threats are not only environmental but also deeply urban and political, intersecting with themes of speculative development (Ajibade, 2017), spatial injustice (Sharkus *et al.*, 2025), and institutional reform (Yoshikawa & Koshiyama, 2024). This prevalence confirms the centrality of water in shaping both vulnerabilities and adaptive strategies within climate-resilient urbanism. Nature-Based Solutions (NbS) feature in 16% of the contributions, signaling their rising role as mediators between design, governance, and ecosystemic processes. From ecological engineering in Latin American cities (Schneider *et al.*, 2022) to participatory co-design in Italy (Biancifiori *et al.,* 2020), and governance critiques (Carlone & Mannocchi, 2024), NbS emerge as both tool and paradigm in rethinking resilience. Additionally, 9% of the articles specifically engage with heat-related risks, especially in urban contexts with rising energy demand and unequal exposure (Lam & Delina, 2024; Schneider *et al*., 2022). While less represented than flooding, heat adaptation appears increasingly relevant in discussions of urban equity and infrastructural planning.

3.9. Publications' cross reading: a fragmented landscape of spatial engagement and practice

The critical reading of the literature resulting from the set query, reveals a fragmented and non-homogenous incorporation of DRR, CCA and CCM within spatial practices. DRR, CCA and CCM are often involved in the arguments of the articles as "components" of *resilient strategies* but seldom translated into spatial operative frameworks or design processes. Many contributions look at resilience under a technological or institutional lens, detaching it from spatial design and planning or from socio-political-environmental ecologies that might emerge from resilient urban adaptation strategies. The analysis of the Eko Atlantic City in Nigeria, demonstrates how urban projects that have been called "resilient" might perpetuate instead "maladaptation": favoring vulnerability and displacement of already at risk communities, legitimising private capital accumulation and economic growth, and creating socio-ecological hazards under the disguise of heavy-engineered coastal protection projects (Ajibade, 2017). This case underlines how there might be an assumption that resilience is only beneficial and neutral, while in reality spatial interventions can reinforce existing inequalities. Similarly, Banwell *et al.* (2020), with the case study of the Araucania Region of Chile, show the exclusion of local community engagement and knowledge from policy frameworks and implementations. This aspect produces gaps between state and community actors. Local communities, often overlooked and forgotten by resilience strategies, are in fact aware of climate related risks and are prepared in their adaptive day to day practices.

Other contributions highlight more explicitly how planning perspectives are yet only descriptive and technocratic. Attolico (2014) describes DRR integration in the territorial planning of the Potenza province in Italy, yet, fails to to interrogate the spatial consequences of the planning decisions. In the case of Naples studied by Perney and D'Angelo (2023), the effort is to align local governance tools to the EU governance frameworks, but overlook the spatial and socio-political reconfigurations necessary for long-term adaptation. Technical tools like GIS and Geoinformatics are also taken into account in the literature (e.g. Cadiz, 2018; Taramelli *et al.* (2019; Cervelli *et al.* (2020)). The use of these tools is often in service of risk identification, prediction and management rather than an integrated component of a participatory spatial design and planning practice. These tools are powerful in revealing exposure and infrastructural fragility, yet they frequently bypass the relational and cultural dimensions that define how space is inhabited, claimed, and governed. As seen in Cervelli *et al*. (2020), land use scenarios are generated to support ecosystem service optimisation, but the resulting "resilience" is tied more to energy productivity than to social or ecological needs. A relevant amount of the selected literature (16%) attempts to in-

tegrate Nature based Solutions into urban and spatial planning. For instance, Carlone & Mannocchi (2024) focus their research on NBSs – defined by the European Commission in 2022 – as solutions that are locally adapted, systemic interventions that enhance resilience by integrating natural elements and processes into urban, rural, and coastal environments (UNEP, 2022). As it is noted in the article, NBSs are gaining traction in DRR strategies and regional planning, but reluctance in institutions and disciplinary conservatisms limit their application and transformative potential. Yoshikawa & Koshiyama (2024), for example, highlight how relatively low-tech Eco-DRR measures such as tambo dams can provide both flood mitigation and food security, particularly when supported by state-led decentralisation efforts, but their scalability and integration into planning systems remain uneven.

Meanwhile, Bogaard *et al*. (2016) propose generic early warning and decision support tools for coastal resilience, but these approaches, while scientifically grounded, often operate independently of spatial governance or urban design perspectives. Devès *et al*. (2018) critically reflect on the IPCC's (Intergovernmental Panel on Climate Change) disciplinary biases and call for more inclusive, multi-actor perspectives – emphasising the need to bridge the gap between scientific expertise and situated decision-making. This resonates with Djalante & Lassa's (2019) argument that complexity and governance failures – particularly the lack of integration across sectors and scales – undermine the effectiveness of the Sendai Framework and delay the structural shift toward adaptive governance.

Moreover, systemic ecological and political perspectives remain marginal across the sample of literature. The absence of references to urban political ecology (with the notable exception of Ajibade, 2017) and the underuse of frameworks such as territorial metabolism or socio-natural assemblages indicate a gap in the research and integration of these essential approaches to DRR and CCA. While keywords such as "resilience", "adaptation", and "urban planning" appear frequently, their presence in titles or abstracts is not consistently matched by critical engagement in content. As noted in the content analysis, key terms like "land use" and "governance" are underrepresented relative to their importance in shaping risk and response dynamics.

Discussion

The results of this systematic literature review confirm a persistent gap in how Disaster Risk Reduction (DRR) and Climate Mitigation and Adaptation (CMA) are jointly conceptualised and operationalised within the spatial disciplines. Our results triangulate discipline–outlet–lexicon to evidence a structural technocentrism: this three-way convergence is a stronger claim than any single indicator alone.

Although "resilience" emerges as a recurring term across the reviewed literature, its articula-

tion is predominantly embedded in technological or institutional frameworks. These framings tend to overlook non-technocratic approaches to spatial governance – such as participatory planning, place-based design, and landscape or ecosystemic strategies – that are essential for integrating DRR and CCA in context-sensitive ways.

As Nadin et al. (2021) argue, spatial planning should evolve beyond its traditional technocratic rationality towards adaptive and participatory modes capable of negotiating uncertainty and contextual diversity.

The inclusion of DRR and CMA as core components of spatial thinking remains the exception rather than the rule. Even when both frameworks are addressed, they are typically treated as parallel technical objectives, rather than as interrelated, territorially situated practices that require coordinated, long-term engagement. This fragmentation is clearly reflected in the disciplinary distribution of the selected publications: a strong dominance of engineering, environmental modelling, and geosciences is observed, with urban planning, spatial design, environmental humanities, and political ecology significantly underrepresented.

These disciplinary imbalances are mirrored in the limited engagement with governance complexity. Many of the contributions fail to address how institutional fragmentation, lack of cross-sectoral coordination, and insufficient attention to local agency constrain the transformative potential of spatial strategies. Planning remains largely instrumental: a vehicle for implementing externally defined goals, rather than a situated practice of negotiation, cultural meaning-making, and ecological attunement. The review highlights how such blind spots lead to maladaptive outcomes – spatial interventions that inadvertently deepen socio-ecological inequalities, reproduce vulnerability, or privilege private interest under the guise of resilience.

Technical tools such as GIS, remote sensing, or early warning systems, though widely adopted in planning and design practices, are predominantly deployed for risk mapping and hazard prediction. While they are indispensable for identifying exposure and fragility, they rarely contribute to participatory spatial storytelling or collective imaginaries of climate futures. As shown by Cadiz (2018), Cervelli *et al.* (2020), and Taramelli *et al*. (2019), the reliance on modelling and remote-sensing tools often confines resilience to a technical exercise of measurement and control. Devès *et al.* (2018) and Djalante and Lassa (2019) similarly note that expert-driven and data-centred frameworks, while valuable for policy coordination, tend to marginalise contextual and co-produced knowledge. As a result, design and planning often appear as passive recipients of scientific data, rather than as active, generative processes capable of framing alternative responses and fostering embedded resilience.

A fundamental shift is thus required: from resil-

ience as a technical or managerial goal to resilience as a socio-spatial and political process. This shift entails more than the integration of DRR and CMA into planning frameworks – it requires a radical rethinking of how resilience is conceived, governed, and enacted. It calls for crossing disciplinary boundaries, foregrounding ecological interdependencies, and valorising local knowledge systems. Crucially, it demands that we design *with* communities and ecosystems, not merely *for* them. As the climate emergency accelerates and planetary boundaries are increasingly breached, the urgency of such a reorientation becomes both evident and inescapable. In synthesis, and drawing upon the foregoing discussion, the following concluding considerations may be advanced:

- The reviewed corpus delineates a terrain wherein Disaster Risk Reduction (DRR) and Climate Change Mitigation (CCM) and Adaptation (CMA) gain progressive salience, yet persist largely inscribed within paradigms of technocratic and hierarchical governance;
- Planning emerges, in the majority of contributions, as a mere vehicle for external objectives, rather than as a forum of contention, deliberation, or co-creational agency;
- The domain of design is seldom articulated as an epistemic practice that might mediate between ecological thresholds and socio-cultural needs;
- This critical reading discloses the necessity for a more profound confluence of ecological sensitivity, political contestation, and spatial praxis – not solely to render resilience operational, but to redefine it through the lenses of justice, vital conditions, and relational place-making.

While the review provides a structured and cross-disciplinary overview, several methodological boundaries must be acknowledged. First, the exclusive use of Scopus as the research engine inevitably restricts the corpus to indexed, peer-reviewed publications, excluding grey literature and certain practice-oriented planning and design journals not captured by the database (Gavel & Iselid, 2008). Nevertheless, Scopus remains the most comprehensive and transparent platform for cross-sectoral analyses of academic production. Second, the inclusion of English-language publications only reflects both a pragmatic and methodological necessity, as English constitutes the lingua franca of international research and ensures the comparability of keywords and metadata across disciplines. This choice, however, may contribute to the underrepresentation of locally grounded or Global South perspectives more frequently published in other languages. Third, the temporal frame (2013–2025) does not represent a restriction but rather the effective onset of the debate: systematic intersections between Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) within spatial and planning literature begin to appear on-

ly after the Sendai Framework (2015) and the Paris Agreement (2015). Earlier publications, therefore, do not constitute a meaningful reference set.

Taken together, these methodological boundaries do not undermine the validity of the analysis but delineate its epistemic perimeter, pointing to the need for future reviews to broaden linguistic and source diversity while deepening the comparative reading of practice-based and policy-oriented knowledge.

Conclusion

In the light of the increasing number of catastrophic events and the ongoing climate crisis, a novel systematic literature review has been conducted to understand how Disaster Risk Reduction (DRR) and Climate Mitigation and Adaptation (CMA) approaches are dealt with in urban and regional spatial governance strategies, planning, and design. Inherent search terms for titles, abstracts, and keywords have been used in Scopus, resulting in the selection of 34 publications. This is a limited number and can be read as an important information *per se*, since more scientific interest may be expected for addressing spatially and altogether two relevant approaches dealt with by the United Nations in the presence of a globally increasing urbanisation; as a consequence, the first result can be seen as the existence of some margin for further scientific work on CMA and DRR, jointly addressed in terms of spatial planning, governance, and design. Also, particular attention has been paid to understand their common features for climate-related spatial resilience and to critically detect possible biases and/or margins for improvements. The main findings may be summarised as follows:

- Most publications (84%) have been published in scientific journals, and almost all of them authored by scholars;
- The time distribution ranges from 2013 to 2025, with a majority of contributions (65%) being published between 2016 and 2020, i.e. in the lustrum immediately following the Paris Agreement on climate emissions (UNFCCC, 2015) and the Sendai Framework for Disaster Risk Reduction 2015-2030 (UNDRR, 2015; 2020);
- Most of the authors are based in Europe (30%) and Asia (28%), followed by North America and Oceania with fewer affiliations in Africa and South America; a strong majority (72%) works in the Global North;
- Half of the authors (50%) are affiliated with disciplines in the Physical Sciences and Engineering (PE macro-sector: ERC, 2020), including earth sciences, engineering, hydrology and environmental sciences. Social Sciences and Humanities (SH) account for 45%, primarily in planning, geography, governance and policy. Only 5% belong to Life Sciences (LS), focused on molecular or structural biology;
- The editorial collocations are also oriented

towards physical sciences and engineering, in addition to life sciences; only two book series explicitly address city planning, urban studies, communities and human settlements, and urban development, while no scientific journal is primarily concerned with such subjects and topics; one journal covers urban studies together with engineering and with earth and environmental sciences;

- The disciplinary distribution of authors and editorial contexts, with a predominance of hard and technically applied sciences, suggests that a technocentric approach may exist, partly supported by the content analysis, also highlighting some business orientation; surprisingly, no author has a hard science background on climate studies;
- Except for Ajibade (2017), no specific research or professional interest has been found in urban political ecology, which has been recently confirmed as a crucial way to address the climate emergency (Kaika *et al.*, 2023); technology-centered and de-politicised discourses on climate change have been already highlighted by Swyngedouw (2010), an author who is considered to unpick "the dissonance between the need for urgent action on climate change on the one hand, and the failing attempts to deflect the trajectory of the climate future on the other" and, "in a situation where we are already living the apocalypse", to call for "a new temporality and spatiality around a democratising re-politisation of the current socio-ecological state of affairs" (Haarstad *et al.*, 2023, p. 7);
- Keywords and recurring contents are significantly affected by the search terms, yet a mismatch can be found between the occurrence of concepts from the urban and regional studies and the actual presence of authors from those disciplines; it seems pleas are made by technicians and hard and life scientists to spatially manage their knowledge, but a margin for improvement and further development is detected for a proper integration of DRR and CMA into spatial governance, planning, and design;
- Albeit 29 of the 34 selected works were published from 2016 on, only 15% of those mention the Paris Agreement (UNFCCC, 2015), and none refer to the seminal works by the United Nations Office for Disaster Risk Reduction (UNDRR, 2015; 2020);
- On top of cultural aspects and proper climate- and risk-oriented spatial planning, governance, and design, underrepresented topics include environmental studies and sustainability science, despite their demonstrated relevance in DRR and CMA; systemic and ecosystemic approaches seem therefore deserving higher attention, including foci on such a crucial trigger of disasters as land use.

Among the possible future actions to possible make up for some of the lacks that have been

found in the present literature review, some paths are here envisioned to integrate DRR and CMA into best practices for urban and regional governance, planning, and design: in order to avoid fragmented research, missing key knowledge from key disciplines, one may consider some larger integration of ecology, environmental studies, and sustainability science, together with cultural, social, economic, political, and political ecological aspects. Some currently neglected aspects may be addressed too, e.g. this century promising to be very different from the previous one, in terms of expected disasters, changing climate, and overall resource availability to reduce disaster risk and climate effects also in the presence of changing and not always predictable events, available technologies, economies, priorities, etc. Factors and stressors emerging from that larger involvement and transdisciplinary dialogue may be therefore tested in a given context (e.g. at the city level, the country level, etc.), also through the local cultural realm (Pisano, 2023). The review also highlights that spatial design, planning, and governance are underrepresented, and – when present – often treated as passive recipients of technical knowledge, rather than as active, place-based practices capable of shaping climate and disaster responses. This technocratic orientation risks reproducing fragmented or decontextualised responses to climate risks.
Some indicators may be identified to follow this path, and existing guidelines for policies and/or planning – anyway deserving further development, as emerged from the present review – may be reinforced and complemented by informed and tailored small-scale design solutions.

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