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Urban Planning for Disaster Risk Reduction and Climate Change Adaptation: A Review at the Crossroads of Research and Practice

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Abstract

This review seeks to understand what urban planning and management can do to reduce disaster risk and help cities adapt to the impacts of climate change. To achieve this, it examines various streams of the literature, as the topic sits at the intersection of several distinct but relevant disciplinary fields. These include urban planning in hazardous areas, recovery planning, disaster risk reduction (an umbrella term encompassing disciplines from engineering to geography and sociology), and, more recently, climate change adaptation. To navigate this vast body of knowledge, a conceptual framework is proposed to guide the selection of the relevant literature, and the strategy for this selection is detailed in the methodological section. This review adopts elements of both critical and theoretical approaches: it does not aim to be comprehensive or to systematically search each disciplinary domain addressed. While acknowledging the limitations and potential biases in the selection of articles and books, the review reflects an evolution in the discourse on urban planning for resilience. The discussion explores how the concept of resilience has emerged as a valuable bridge between disaster risk reduction, sustainability, and climate change adaptation—especially as cities face increasing exposure and vulnerability to stresses that are now more frequently compounded, multi-hazard, and cascading. The conclusion outlines the gaps and challenges that researchers, practitioners, and policy makers need to address moving forward.

Keywords: urban resilience; volcanic hazards; resilient urban development; geospatial data processing; emergency and urban planning coherence

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1. Introduction

1.1. The Review Rationale

Urban planning is intrinsically concerned with the future, as it projects into the future a desired image and configuration of cities, including the provision of services supporting all sorts of activities ranging from economic to educational to recreational [1]. However, the pace of changes in recent decades, the increasingly complex inter-relationships between systems at various levels from local to global, and the exponential growth of the urban population have rendered the exercise of thinking about the future of cities extremely challenging [2]. The intricate connections between humanity and nature, along with political, social, and economic contradictions, are coalescing in crises that often arise unexpectedly and are underestimated in their long-term consequences [3]. Foresight and scenarios [4,5]—tools that are increasingly requested by decision- and policy-makers to support anticipatory and preparedness capacity [6]—have garnered significant attention from urban planners only recently [7,8]. For planners, embracing the high degree of

uncertainty that may potentially undermine projects and visions for the future is a relatively new development [9]. Crises often accelerate processes that are already latent in systems towards new states shaped by the response, and by existing (or absent) capacities, resources, and plans [10].

1.2. The Two Objectives of the Review

This review is aimed at answering two main questions closely related to the context of uncertainties and more frequent crises faced by contemporary cities. First, it aims at understanding what urban planning can do and how to reduce disaster risk and adapt to climate change. Scholars such as Burby [11], Rubin [12], and White [13] have argued that urban- and land-use planning serve as non-structural disaster-risk mitigation measures, in contrast to structural measures and defenses such as levees or landslide consolidation. By breaking the nexus of hazard-exposure and vulnerability, which creates risk conditions and losses once the hazardous event materializes, urban- and land-use planning can yield longer-term benefits than many structural measures alone. In fact, without sound planning, structural measures may even become counterproductive by encouraging increased urbanization in hazardous areas [14]. Second, this review also explores why, despite the significant advancement of knowledge on extreme hazards and on good adaptation and mitigation practices, the integration of these lessons into the everyday activity of planners and city managers is still slow and fragmented. Despite progress, the pace of advancement and dissemination of good practices remains insufficient, as evidenced by the impact of disasters on cities and towns during each extreme event. White et al. [15] identified failures in land-use planning as a key reason why available knowledge about hazards and risks has not been translated into action.

This review is timely, as two factors have become increasingly relevant since the publication of White et al.'s article, creating more favorable conditions for the heightened involvement of urban planners in preventative and adaptation practices. First, sustainability—as both a goal and a practice—has gained momentum in almost every activity connected to urban- and land-use planning [16]. Second, in recent decades, large-scale severe disasters have affected cities, making evident the multiple vulnerabilities that characterize complex urban environments and create the conditions for cascading failures, sometimes with catastrophic outcomes [17]. Climate change creates an additional stress, a hazard on its own, impacting the availability of water, increased heatwaves, and sea level rise, the latter being a significant threat for coastal cities [18]. It also exacerbates hazards that are triggered by extreme weather, such as floods, landslides, avalanches, storms, and forest fires [19].

1.3. The Review Approach

Writing such a review is a challenging task. The proposed approach is explained in the methodological Section 2, which presents a map of the related topics that must be addressed, and the strategy for the literature selection is illustrated. Subsequent sections (from Sections 3–6) tackle each topic following the logical order provided in the map. The topics cover three main areas of reflection:

- The knowledge that supports the identification and assessment of risks to the built environment, settled communities, and infrastructures;
- The tools and the modalities of intervention that urban planning can deploy to reduce and mitigate expected negative impacts and damages;
- The constraints and obstacles in implementing such plans and interventions.

It is important to note that, as indicated by the title, this review draws heavily on long-term research and applications developed across multiple projects with various teams and public administrations in Europe. The topics addressed in the review are informed

by this extensive experience. As such, the review takes a narrative and scoping approach, rather than being systematic or exhaustive. A significant effort has been made to update and extend the literature on the key topics identified, with a particular focus on core references shared by practitioners and scholars in the field. This process has been iterative, aiming to clarify and elucidate what those topics actually are and why they are considered key [20], to respond to the two related review questions. In this respect, the review is closer to what various authors have named as a "critical or integrative" review [21,22] and some others [23] as a "theoretical review".

2. Urban Planning for Reducing Risks and Adapting to Climate Change: The Approach to the Review

Reviewing how urban planning can be considered and used as a measure for disaster risk reduction (DRR) and climate change adaptation (CCA) is inherently interdisciplinary. This review begins by outlining the fields of research and practice that intersect in identifying how urban planning can help create safer, more sustainable, and resilient cities in the face of various stresses and shocks. According to Chaudhary and Piracha [24], twentieth-century research shifted from viewing disasters as purely natural events to understanding them as a "complex nexus of natural, human, social, and economic factors." Complexity is a key concept in this review. Contemporary cities are viewed as complex systems because of their intricate relationships with other cities and regions across different spatial scales [25,26]. Cities share several features with complex systems, as defined by Park et al. [27], including non-linear interactions between urban components, path dependency in locational choices, and the difficulty of predicting responses and recovery after major shocks due to causal-effect loops among multiple factors and dimensions.

2.1. The Review's Guiding Framework

The understanding of systems and the fields considered in this literature review are synthesized in the framework shown in Figure 1. Cities are the target of both local adaptation plans and sectoral plans addressing specific hazards (such as earthquakes, floods, and heatwaves) and their associated exposures and vulnerabilities. Urban resilience is a relatively recent concept that helps bridge and integrate CCA and DRR. A main point illustrated in the figure is that sectoral provisions for DRR and CCA must be integrated into planning throughout the entire disaster timeline, from prevention to reconstruction. Implementation is a critical aspect of any planning process to achieve desired outcomes. However, barriers and obstacles can slow or even prevent the mainstreaming of DRR and CCA into urban development and redevelopment plans.

This framework is the result of long-term research conducted across several projects, mainly funded by the European Commission since the Framework Program 6, and projects conducted with various regional and municipal civil protection authorities, primarily in Italy, and at the European level in working groups promoted by the European Civil Protection and Humanitarian Aid Operations Directorate General (DG ECHO) [28]. The Armonia project, see [29], explored how urban planning in Europe addresses natural hazards and risks, as well as the development of tools tailored to support urban planning. The 7FP Ensure [30] project examined multiple dimensions of vulnerability in multi-risk contexts. The Horizon 2020 Educen (www.educenhandbook.eu, accessed on 20 September 2025) project specifically addressed how to make cities more resilient to crises triggered by large disasters and climate change across multiple time scales. Other projects, such as the 7FP Know4DRR, see [31], Idea [28], and Lode (www.lodeproject.polimi.it) projects funded by DG ECHO, investigated the potential of using damage and loss data to better understand local exposure, vulnerability, and the impacts of climate change. It should also

be emphasized that the construction of the review has been a genuine research effort in itself. The initial rough framework has also been shaped by the results of the search and the consequent reading of the referenced literature. The construction of the guiding framework has to be looked at as the result of a process rather than a predetermined scheme, even though, for clarity, it is positioned at the beginning of this section.

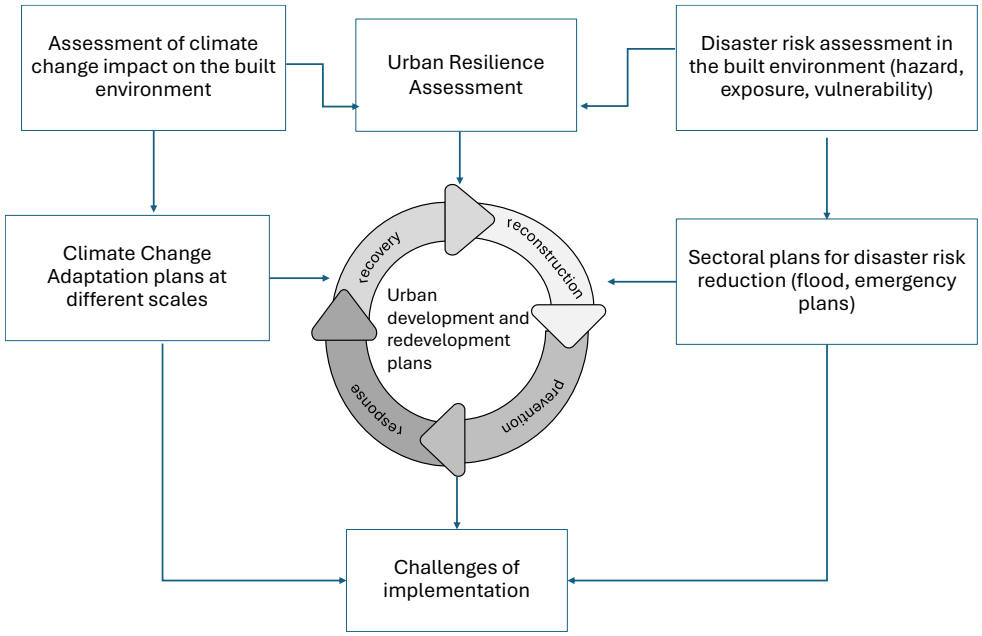

Figure 1. Overall concept framing the review (author's elaboration).

Consistent with the framework illustrated in Figure 1, this review explores the following fields and subfields of study:

- Comprehensive risk assessment in and for urban areas, with particular attention to the risk components of exposure and vulnerability under single- and multi-hazard conditions.
- Resilience—particularly urban resilience—as a concept that can help reconcile previously disconnected policies and provisions for climate change adaptation (CCA) and disaster risk reduction (DRR).
- Urban planning for resilience, examining the role of urban planning across the entire timeline of disasters and crises, and bridging DRR and CCA.
- Challenges in plan implementation arising from governance pitfalls and land property rights.

2.2. The Review Strategy

The review strategy for covering these interconnected but broad fields and sub-fields is summarized in Table 1. The columns list the search categories, a brief explanation of each, the keywords used, the number of references within each category, and the databases selected (Scopus and Google Scholar). In both databases, the search was limited to the first 30 entries.

Columns 2 to 4 correspond to the subfields highlighted above, for which searches were conducted. Column 5 describes how illustrative examples, used in the review to make the arguments more tangible, were selected.

Table 1. Summary of the criteria followed for the review.

Searched Categories	Authoritative References in DRR and CCA Related to Planning	Multi-Risk Exposure and Vulnerability of Urban Areas	Urban Resilience	Planning for DRR and/or CCA, and Linking DRR to CCA	Challenges and Obstacles to Plan Implementation	Illustrative Examples
Explanation	Articles and books that have become authoritative references for researchers and practitioners. Books and articles in this category have recorded more than 1000 citations according to Google Scholar.	Articles, books, and reports on the challenges and the available methodologies for assessing risk and multi-risk in urban areas.	Literature on urban resilience and on resilience more, in general, with implications for urban areas.	Literature on how disaster prevention and management, and on climate impacts adaptation is or can be mainstreamed in land use and urban planning; Literature on the need and opportunities for bridging/linking/connecting CCA and DRR.	Literature on challenges and obstacles to plan implementation, in general, and more specifically on plans for CCA and disaster prevention and management.	Case studies have been mainly drawn from citations of consulted articles and books selected according to the criteria in the previous columns. Some (such as Cologne, Thessaloniki, and Barcelona) have also been found while searching the literature according to the criteria in the previous columns.
Used keywords		Urban vulnerability; vulnerability assessment of cities; exposure to natural hazards/disasters in urban areas/cities; exposed sectors to natural hazards/disasters. Exposed urban areas/functions; multi-hazard/multi-risk conditions; multi-hazard in urban areas/cities; urban exposure/vulnerability to floods, earthquakes, landslides. . .	Urban resilience; resilience of urban systems; communities' resilience; resilience of urban infrastructures; operationalization, measurability of resilience.	Urban planning for DRR; Urban planning for resilience; climate adaptation cities. Linking DRR to CCA hazards and climate impacts assessment. Urban planning in flood/earthquake or seismic/landslide areas.	Implementation of public policies. Implementation obstacles/challenges/failures of CCA in cities. Obstacles/challenges, failures in delivering/implementing urban plans for DRR.	Following the keywords in the previous columns.
n. ref.	19	28	23	30	23	18
	Searched Databases Reports	Google Scholar, Scopus Poljansek, K et al., Science for disaster risk management 2017. Knowing better and losing less, European Commission, DG-JRC [32]; Casajus Valles, A. et al., Science for Disaster Risk Management 2020: acting today, protecting tomorrow, European Commission, DG-JRC [33] European Commission. SWD, Overview of Natural and Man Made Hazards. 2020 [34] UNDRR. 2020. Implementation Guide for Land Use and Urban Planning. Words into Action, UN [35] Fioretti, C.; Pertoldi, M.; Busti, M.; Van Heerden, S. Handbook of Sustainable Urban Development Strategies, 2020 [36]				

Column 1 refers to articles and books that are considered authoritative sources in the fields of DRR and CCA, addressing aspects related to communities' and cities' exposure, vulnerability, and resilience. The covered period extends back sixty years, acknowledging key milestones in disaster studies that either highlight persistent problems or offer interpretations and understandings that remain relevant today. To identify such authoritative references, overviews of research in disaster and climate change adaptation have been considered. For example, Mitchell [37] discussed the advancement of research since the 1940s, grouping topics into four main categories, including "the extent of human occupance of hazardous zones." Alexander, in two contributions [38,39], reviews the period since 1977, identifying major disciplinary contributions to disaster studies from the social sciences and from the hard sciences and engineering. More recently, Kendra and Nigg [40] investigated the interplay between engineering and social sciences, providing a historical overview of disaster studies in the U.S. since the 1970s. Kelman et al. [41] highlight the tension between hazard-centered and vulnerability paradigms, which also characterizes climate change adaptation. Gall et al. [32] present a list of 135 seminal papers identified through a combination of Web of Science's Global Citation Score and keyword searches.

For the remaining columns, a combination of methods was used. Whenever possible, review articles helped identify relevant sources or corroborate previous choices. These reviews were useful in finding additional literature and illustrative examples mentioned in the text. In addition to the literature reviews and extracting relevant articles and cases, specific searches were conducted in databases such as Scopus and Google Scholar using combinations of keywords. The selection of keywords has been an iterative process to include relevant contributions as much as possible, especially when dealing with complex concepts such as integration/synergies between CCA and DRR, which referred to cities and urban planning. Because urban planning is an applied field where the interplay between research and practice is crucial, reports from international organizations were also considered relevant. Notably, two reports published by the European Commission JRC—Science for Disaster Risk Management in 2017 and 2020 [33,42]—were used as state-of-the-art references, given the involvement of around 800 scholars and stakeholders as authors, advisors, and reviewers. It is worth noting that each subchapter in both reports underwent five independent reviews.

2.3. The Selection Rationale

The review follows the recommended 10 steps of the PRISMA ScR Guidelines [43], specifically addressing the needs of scoping/narrative reviews. The 6th step recommends delineating the eligibility criteria of the selected references. A complete list of cited articles and books, classified according to the criteria above, is provided in the table in Appendix A.

Overall, the distribution of references reported for each component of the guiding framework is provided in the graph in Figure 2. For urban resilience and land-use planning as a bridging tool for integrating DRR and CCA, respectively, 23 and 30 papers have been referenced. A total of 19 articles and books have been quoted as authoritative. A total of 28 papers have been referenced for the assessment of exposure and vulnerability including in multi-hazard environment. A total of 23 papers are reported dealing with implementation issues of DRR and CCA policies and measures in cities. 18 articles were selected to provide illustrative examples in the various sections.

All referenced articles and books have been thoroughly read, not selected solely by title or abstract, but based on their relevance within the proposed framework.

As for papers in the first column, it should be noted that authoritative sources also include those forming the common background for most researchers in the field. As the fields of natural hazards, DRR, and CCA are very broad, this group of established and

foundational sources can be quite extensive and depends on the scholar's disciplinary approach. Consequently, the selection of authoritative references is subjective and reflects the interpretations and pathways followed in this review. Although subjective, the relevance of the selected literature is supported by citation counts according to Google Scholar, which provides a plausible, albeit partial, indication of an author's or publication's influence. Articles and books categorized as authoritative references have received an average of more than 1000 citations (and, in many cases, much more). Older publications, especially books [11,12], have not received as many citations but are still considered authoritative, as are [10,13,15], since they are frequently cited in the selected articles and reviews.

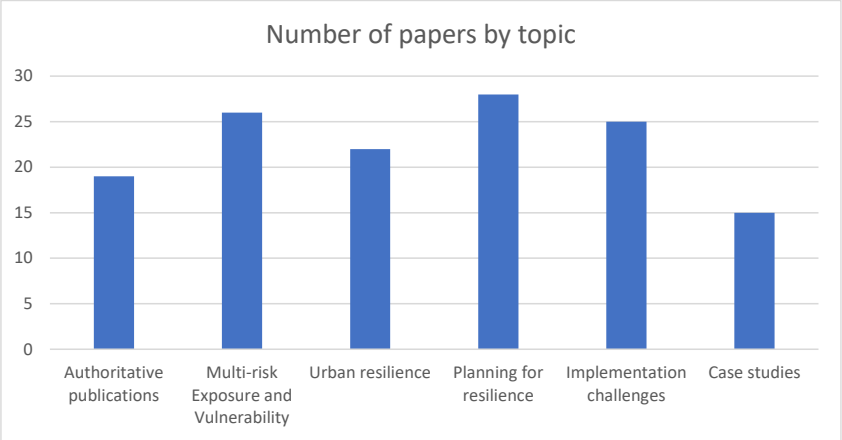

Figure 2. Distribution of the referenced literature across the various components of the guiding framework.

As for papers in the second and third columns, these papers were selected on the basis of pertinence to urban planning and to the theme of cities and urban areas. The selected articles reflect a preference for contributions that enhance the understanding of urban phenomena in hazardous areas and offer solutions and operational tools. By targeting both researchers and practitioners, the review adopts a stance of the pragmatic applicability of concepts and tools [44]. This is especially true for some streams of the literature, such as resilience, which now has an extensive body of work. In other areas, like integration between CCA and DRR policies, implementation challenges, and multi-hazard and multi-risk assessment, the literature is more limited, so most articles were included. Examples, in the last column, were selected on the basis of their pertinence to the argument being discussed. Some, like the cases of the application of risk assessment, including vulnerability to Barcelona and systemic vulnerability to Thessaloniki, were chosen on the basis of the fact that they have been the object of long-term research and, therefore, fit well in the review that does attempt to provide a historical perspective on the rise in concepts and the evolution of understandings.

2.4. The Review Limitations

While synthesizing in a coherent manner what scholars and practitioners from various fields have said about how to make cities more resilient to disasters and climate change is valuable, limitations should be acknowledged. First, the problem's framing is, as stated, subjective, despite being shared by a number of scholars, especially regarding the need for integrating climate change and disaster risk reduction.

More generally, the challenges of providing a transparent and rigorous interdisciplinary review should be highlighted [45]. A significant obstacle to interdisciplinary reviews, including this one, is the reliance on database keyword searches [46]. For narrowly defined topics, keywords are straightforward, but when searching across multiple

disciplines, the combination of keywords significantly influences the results, potentially excluding relevant works. Multiple searches using synonyms and different keyword combinations—including less-common ones—were conducted, but omissions cannot be ruled out.

The strategy followed here can be considered a hybrid of different review types, as classified by Cooper [47], Grant et al. [22], and Paré et al. [23]. By relying on literature reviews where available, this review fits the umbrella review category. Its attempt to develop a new conceptualization of the problem also incorporates elements of mapping, "critical," and/or "theoretical" reviews. As a mapping review, it charts the literature across various disciplines—from engineering to climate change studies—focused on urban resilience and risk prevention. As a theoretical or critical review, as defined by Paré et al. [23] and Snyder [21], it seeks to integrate different streams of the literature into a conceptual framework, recognizing a mature body of knowledge on urban prevention and resilience that would benefit from greater integration and explicit analysis of inter-relationships.

Table 2 summarizes the main choices made for this review according to the criteria proposed by Cooper [47] in his taxonomy of review types. The focus of the review is on practices and applications to urban planning with the aim of identifying and discussing what are subjectively considered central issues. Therefore, it is not targeting only researchers as an audience but also practitioners and policy makers. It does espouse a position related, for example, to the need to better integrate urban policies and measures towards DRR and CCA. It attempts to build on a central core of references that are considered authoritative, with a historic perspective on the evolution and persistence of key concepts and interpretations. It results in a conceptual effort to organize a rather wide body of knowledge, despite providing some examples for clarification.

Table 2. Choices made for the review according to the taxonomy by Cooper [47].

Characteristics of the Review	Categories
Focus	Practices or applications (to urban planning)
Goal	Identification of central issues (according to the proposed framing)
Perspective	Espousal of a position
Coverage	Central or pivotal (considering the authoritative references)
Organization	Conceptual
Audience	Scholars (urban planners and experts in disaster and climate change studies), practitioners, and policy makers

3. Assessing Disasters and Climate Change Impacts in Cities

Assessing the impacts of disasters and climate change in cities requires a comprehensive understanding of the complex interplay between hazards, exposure (both of assets and populations), and vulnerability. Risk assessments are typically conducted before the occurrence of extreme events and aim to forecast potential damage based on the characteristics of these three factors. These factors, in turn, depend on a variety of aspects, ranging from geographical to social and economic conditions. Such assessments often rely on insights gained from ex-post analyses of damage, which help to bring understanding to how impacts materialize in cities. These analyses are not limited to structural evaluations of impacts on buildings and infrastructure but also consider the so-called indirect damage resulting from the interconnections of urban systems.

Forensic investigation, initially proposed by Oliver Smith et al. [48] as a field of study focused on examining the drivers and root causes of damage and losses, has gained increasing interest among geographers and planners. This is because it allows for a better contextualization of damage, considering the locally and regionally relevant factors that

shape social, physical, economic, and institutional vulnerabilities, and their interconnections [49].

The following sections discuss three main areas of investigation, highlighting both achievements and persisting gaps. These areas include the following: (i) the assessment of exposure and vulnerabilities in cities; (ii) advancements in multi-hazard and multi-risk frameworks; and (iii) the development of a typology of cities based on differing combinations of hazards, exposure, and vulnerabilities, which vary according to size and location.

3.1. Open Questions in Assessing Exposure and Vulnerabilities in Cities

Of the three main components of risk assessment, hazard has been the most thoroughly investigated by scientists specializing in different hazardous phenomena. Furthermore, best practices are available regarding how hazard knowledge and information can be supplemented in forms and at scales most appropriate to support urban planning. Fleischhauer et al. [29] reported on the experiences of various European countries and identified the French Risk Prevention Plan as a best practice. Hazard information is crucial for identifying the most-exposed communities and assets.

Exposure is generally defined as a quantitative measure of the number of people or assets located in "harm's way" [50]. Current geospatial technologies, remote satellite imagery, and geographic information systems together provide powerful tools to produce and update maps that show urban areas exposed to hazards [51,52].

Assigning economic value to exposed assets and infrastructure is another key step in understanding which assets would be most costly to repair or replace in the event of an impact [53]. However, monetary assessment of exposure is not straightforward. For residential buildings, databases may provide market values in different areas, which is important for determining the attractiveness of urban zones, particularly during reconstruction. Experience shows that rebuilding in areas that were already losing attractiveness before a disaster often results in an empty and underutilized built stock [54]. For other structures, such as museums, convention centers, or libraries, valuation is more challenging. In the case of modern assets, one would need to know the actual cost of construction, or for historic landmarks, the cost of repair, which is generally high [55]. Additionally, for most public facilities, the value of perishable content is difficult to estimate and certainly not data that can be obtained via remote sensing or satellite images. Lastly, the wide variety of assets, goods, machinery, and workers characterizing industrial and commercial firms makes the standardization of damage to economic activities a rather challenging endeavor [56].

Even though challenges exist in assessing exposure, evaluating urban vulnerability is far more complex [57]. It is not coincidental that most urban risk assessments conducted so far combine hazards and exposure with only limited consideration of vulnerability [58]. This is because vulnerability—defined as the propensity to incur damage—requires much more detailed knowledge of the quality of the exposed assets and systems, as well as the interlinkages between them.

The literature is relatively rich in studies on social vulnerabilities, focusing on the poor and disadvantaged, who are hit hardest by disasters and climate change. The poor often live in precarious conditions, occupy hazardous areas, and lack the resources to seek alternative shelter or recover [59–61]. There is less literature on economic vulnerabilities that examines what makes economies and activities more likely to fail following a disaster, both at the macro and micro levels [62]. The macro level is particularly relevant for cities that have specialized in the competitive globalized economy [63]. Specialization often means relying on a few sectors for success, resulting in a lack of redundancy and alternatives—a factor that some scholars consider a source of economic vulnerability [64]. At the micro level, the

location of economic activities (production and services) in particularly hazardous areas or in places with high physical and systemic vulnerabilities means they will experience significant and long-lasting impacts from disasters [65]. DuPont and Noy [66] analyzed the economic recovery of Kobe, Japan, fifteen years after the severe earthquake of 1995, and found that neither port activities nor certain sectors such as mining and manufacturing had fully returned to pre-disaster levels.

Most frameworks for vulnerability assessment mainly address the physical vulnerability of buildings and, to a lesser extent, networks. Furthermore, the physical vulnerability of a city's urban fabric, or its sections, is rarely considered [67]. Carreño et al. [68] provide an interesting example of how exposure, vulnerability, and hazard can be analyzed and integrated in the seismic risk assessment of Barcelona, Spain. The vulnerability of cities cannot be determined simply by summing the vulnerabilities of individual structures; rather, it depends on the layout, morphology, and types of interactions—both structural and non-structural—between buildings, networks, and natural systems such as water and soil. For instance, railways or elevated roads that run close to buildings are likely to strike them if they collapse, causing a domino effect. Poudel et al. [69] demonstrated how the vulnerability of the healthcare system to seismic risk can be effectively assessed and represented using applications for the city of Thessaloniki, Greece. Their methodology guides the assessment of exposure and vulnerability of each hospital component, the supporting lifelines, and the overall systemic performance of hospitals, given their interconnections and dependencies on lifelines.

While physical vulnerability is a key component, especially for highly destructive hazards such as cyclones and earthquakes, it does not encompass all important vulnerability features relevant to cities. Systemic vulnerabilities—arising from interdependencies within and among systems that prevent continued functioning when parts are compromised—have mostly been studied for critical infrastructure [70]. Systemic vulnerabilities can affect all city flows, including food, mobility, transportation of goods, information, and power. Limongi and Galderisi [71] illustrated the application of a framework for assessing systemic vulnerability in the Phlegraean Fields area of Naples. They evaluated the systemic vulnerability of each homogeneous spatial unit by considering relative accessibility from residential areas to key services and major evacuation routes, as well as distance from train stations and the redundancy of transport routes and strategic services. Finally, they demonstrated how assessing the interlinkages between physical, functional-systemic, social, and economic vulnerabilities can support the prioritization of necessary interventions.

3.2. Towards Multi-Hazard and Multi-Risk Assessment

There is a growing awareness that both large metropolitan areas and small urban centers are often exposed to multi-hazard conditions, particularly when located in mountainous regions or along coastlines—environments where multiple hazards may coexist [72]. In large urban agglomerations, natural extremes can trigger incidents at industrial facilities and critical infrastructures. The acronym "na-tech" was coined by Showalter and Fran Myers [73] to describe such incidents (see [74] for an overview). Alarming examples include Hurricane Katrina triggering an LPG leak in residential areas of New Orleans [75], explosions at petrochemical plants, and the Fukushima nuclear accident caused by the 2011 Tohoku earthquake in Japan. Researchers are already investigating whether climate change may lead to increased occurrences of na-tech events [76].

The term "multi-hazard" refers to the coexistence of natural or man-made threats within the same area, which may also trigger one another [77,78]. Multi-risk assessments require analyzing the combination of hazards, exposure, and vulnerability to various po-

tential threats. However, exposure and vulnerabilities may be hazard-specific, making it challenging to integrate them into a comprehensive multi-risk assessment [79]. Among the few practical examples, Van Westen and Woldai [80] developed a GIS-based training toolkit for assessing multi-hazards in urban environments. Grünthal et al. [81] provided one of the first multi-risk assessments for the city of Cologne, Germany. Lyu and Yin [82] recently provided a multi-risk assessment for floods, muddy water flows, and landslides for Hong Kong, combining multicriteria decision-making techniques with GIS. Boni et al. [83] introduced a methodology for assessing the exposure of built environments and populations to multiple hazards.

3.3. Tailoring Risk and Vulnerability Assessments to Different City Types

The more recent literature has tackled the need to differentiate risk factors for different types of cities. Chang et al. [84] identified ten different types of coastal cities in North America on the basis of a clustering analysis. The indicators considered spanned from geomorphological features of the coastline where cities are located to the stage of development, city size, and economic features such as average real estate values. Hincks et al. [85] applied clustering techniques to identify coastal urban typologies in Europe, considering a range of indicators related to hazards, exposure, and vulnerabilities, including accessibility factors. Sterzel et al. [86] made a clustering analysis for rapidly growing coastal cities with respect to climate change impacts. Tocchi et al. [87] proposed a classification of city archetypes with respect to specific characteristics of exposure and vulnerability to hazards. Menoni and Boni [88] proposed a taxonomy of different types of cities exposed to multi-hazards, ranging from metropolitan areas fully integrated into global flows and networks to inner peripheries that are largely marginalized and experiencing population decline, reduced economic opportunities, and loss of services. Large cities and metropolitan areas generally have significant resources to face crises, such as hospitals and fire departments, and benefit from redundant networks [89]. Those classifications are mainly analytical, aiming at characterizing cities on the basis of factors such as accessibility to resources, including rescue and economic opportunities for recovery. The presence of these resources is a notable strength of megacities compared to more remote places, where access to services is often problematic even under normal conditions. However, these same resources can be vulnerable to a variety of threats [89], and this vulnerability should be better understood not only individually—considering each facility on its own—but also at a more systemic level. Both metropolitan areas and small- to medium-sized cities may be equally exposed to various natural hazards and the potential impacts of climate change. However, their exposure and vulnerability—two key components of risk—may differ significantly, requiring detailed contextual analysis to diagnose actual risk conditions and to identify appropriate prevention and adaptation measures.

4. Resilience as a Bridging Concept Between DRR and CCA

Until recently, natural hazards and disaster risk, climate change, and sustainability have been treated as separate fields of study and practice. However, there are growing calls for greater convergence and cooperation among scientific communities and practitioners in these areas [90–92]. The division of these three fields has posed challenges for public administrations, resulting in fragmented responsibilities that are difficult to justify [93], as well as excessive workloads and fatigue for officials who must comply with multiple legislative requirements related to prevention, adaptation, and sustainability. Integrating the capacities and responsibilities for risk prevention and climate change adaptation would make the work of city managers easier, especially in cities exposed to multiple hazards [94].

Resilience has become an important concept in each of the domains of DRR, CCA, and sustainability. It offers an opportunity to connect these areas both theoretically and practically. Whilst in a citation network analysis published in 2015, Baggio et al. [95] found that resilience could be considered only partly as a bridging concept across disciplinary domains; in a more recent bibliometric analysis, Rana [96] found that "research on integrated resilience, incorporating both disasters and climate change, was a burgeoning topic".

Broadly, resilience can be understood as a set of "networked capacities" [97]—social, operational, informational, cognitive, and economic—that help reduce the catastrophic impacts of extreme events. Originally, resilience was closely linked to its semantic roots, referring to the ability of affected systems to bounce back to their pre-disruption state [98]. However, this "mechanistic" perspective has been challenged. Kosovac and Logan [99] argued that returning to unsustainable pre-event conditions is undesirable. According to Manyena et al. [100], recovery should aim for more sustainable conditions—bouncing forward rather than back.

Numerous definitions of resilience have been proposed and continually refined across different disciplines. These definitions can be roughly categorized as "social" [100,101], engineering [102], ecological [103], and socio-ecological [104]. Rus et al. [105] present a thorough literature review, incorporating concepts like resourcefulness, redundancy, and, especially, robustness, as proposed by Bruneau et al. [102], linking these to ideas from social domains [97,106]. Speranza et al. [107], also drawing from an extensive literature review, propose a framework for socio-ecological resilience. Recent reviews highlight that urban resilience sits at the intersection of physical, socio-economic, and socio-ecological resilience [108,109]. While individual and community capacities are crucial, they depend on a minimum level of functioning in the physical infrastructure that supports city life [110].

Sharifi [106] emphasizes the need to consider both spatial and temporal cross-scale dimensions. Regarding spatial scale, communities cannot be viewed as isolated; their connections to larger scales—from regional to national to global—must be taken into account. Although many land-use and urban-planning decisions are made locally and create local vulnerabilities [111], their consequences can be felt much more broadly. Conversely, decisions made at larger scales can have significant local impacts. For instance, the 2011 flood in Thailand damaged hard-disk manufacturers, causing substantial indirect effects worldwide [112]. Likewise, damage to transportation systems, which are often designed at regional, national, or international levels, can leave cities isolated after an extreme event. Inter-relationships across scales also exist between natural and built environments. For riverine or mountain floods, the entire catchment area must be considered to assess the potential impact on a particular urban section. Deforestation and even the replacement of plant species can destabilize slopes, leading to debris flows that affect settlements downhill, as occurred in Sarno, Italy, in 1998 [113].

Regarding temporal cross-scale dimensions, the literature increasingly ties resilience to the full disaster cycle—from the capacity to anticipate and prepare for events, to absorbing, responding, and recovering from them [27,114,115]. In this view, anticipation and forward-looking approaches are essential for preparedness and the ability to manage future changes.

Operationalization is crucial to making resilience a usable concept. Various metrics and frameworks have been developed to assess how closely a system approaches a resilient state. Some frameworks have been proposed by international organizations such as Arup [116], the World Bank, and GFDRR [117]. Other scholars—Henry and Ramirez-Marquez [118], and Gonzales-Quintero and Avila-Foucat [119]—have identified indicators for measuring the resilience performance of cities, institutions, and communities.

Models by Linkov et al. [120], Park et al. [27], and Harrison and Williams [108] have been designed for evaluating the resilience of complex systems in cities. Fox-Lent et al. [121]

applied Linkov et al.'s [120] framework to the Rockaway Peninsula in New York after Hurricane Sandy, highlighting factors and areas to target for future resilience planning and investment.

Most operational tools use GIS to map and visualize risk and resilience indicators. Brandt et al. [122] suggested representing the uncertainty that is intrinsic in any model used to assess the different components of risk using GIS. Focusing on flood hazard, they mapped the uncertainty inherent in risk models as a buffer zone that planners should consider for zoning and allocation of appropriate uses. The use of GIS is also useful in participatory approaches to urban planning for resilience, and co-mapping exercises with local communities are an increasingly adopted practice [123]. Arvidsson et al. [124], in a systematic cross-field review, found that GIS enables a better appraisal of the geographic interactions between critical infrastructures. However, large amounts of data on critical infrastructures are needed, which often are not provided by managing companies [125]. In addition, the systemic nature of resilience lying at the interconnection between different systems and the processual dimension inherent in the concept cannot be easily captured with GIS [123].

When designing resilience assessment frameworks, it is important to clarify exactly what is being measured: the outcome of policies and strategies designed to strengthen system resilience, or the process leading to those outcomes. This distinction matters because a system may be resilient to one type of hazard but not others [109]. Some authors [126,127] emphasize the importance of processes that can unlock resilience capacities and improve system performance. Da Silva [110] notes that resilience results from a combination of interconnected actions and measures carried out jointly by individuals and institutions.

Another key issue is whether resilience assessment frameworks should be normative/prescriptive or descriptive. Descriptive frameworks can be used to evaluate the current situation and progress achieved through new initiatives, while normative frameworks define the conditions required for a system to be considered resilient or on a resilient pathway. Hybrid models are also possible [107]. Strunz [128] offers an interesting semantic perspective, suggesting that the ambiguity and uncertainty of "resilience thinking" enables the convergence of different disciplinary approaches [129] for addressing the complex challenges of urban resilience—a view shared by Graveline and Germaine [98]. However, Strunz [128] cautions that mixing descriptive and normative aspects of resilience is problematic. He recommends distinguishing between the following: i. tools for assessing resilience; ii. "sustainability" targets that must be achieved; and iii. the transformative, dynamic trajectory required to reach sustainability goals. In this way, sustainability and resilience are seen as linked, rather than divergent concepts, as noted by Godschalk [130].

5. Urban Planning for Resilience

Urban planning plays a role in every phase of the so-called disaster cycle, from prevention to emergency response, recovery, and reconstruction. Prevention has traditionally been the main arena for urban planning, through the use of land-use restrictions and guidance for the built environment to reduce the potential for both physical and systemic damage in the future [131]. Building codes for earthquake resistance, and increasingly for floodproofing, are important legal tools that must be adopted in all areas considered at risk. Although legislation is often passed or revised after a disaster has occurred, it must also be applied in areas that have not recently experienced an event. Guidelines on how to use urban planning tools to prevent disasters are available in the literature and in several reports produced by international organizations [35,132]. However, more often than not, such provisions and tools are adopted only after a severe event occurs [133].

In the last decade, a steeply growing interest in blue and green infrastructures able to reduce the intensity of some hazards, especially floods and heat waves, has been observed in the literature [134]. Green infrastructures, such as green roofs, open-area design, and parking lots permitting improved water drainage, and blue infrastructures related to water, such as maintenance or restoration of humid areas in estuaries and deltas, and recreation of natural ponds as retainment basins, have been planned and realized in different pilot cities in many parts of the world [135,136]. Whilst the concept of urban ecosystem service has been there for a long time, as well as engineering approaches adopting natural materials to produce structural defenses, nature-based solutions are a more recent term, mainly introduced by international organizations and, to a large extent, tested in Europe [137]. The overall idea is that by also restoring natural ecosystems in urban areas, different advantages can be achieved at the same time, coupling the well being exercised by natural elements with adaptation to climate change (i.e., cooling effect) and DRR. A review on the effectiveness of NBS for flood-risk reduction [138] found mixed results and concluded that the combination of different measures, hybrid gray traditional measures and green and blue measures, is more likely to achieve a tangible reduction in impacts. This is a conclusion that is shared by Depietri and McPhearson [137].

Decisions made during recovery and reconstruction have significant long-term implications for the future resilience of cities. The "window" of opportunity opened by disasters can make it easier to adopt preventative measures. Recovery, defined here as the period between the end of the emergency and the completion of reconstruction, is when the most important decisions are made about the location and construction of shelters, the fate of construction material waste, and the provisional placement of vital services and infrastructure [139]. Often, the temporary city quickly built in the aftermath of disasters to meet the immediate needs of affected populations becomes a new part of future development—for better or worse [140].

The years required for full reconstruction after a disaster, especially when many structures and infrastructures have been destroyed, make it challenging to ensure that the initial vision and momentum for resilience can withstand administrative and financial hurdles. Additionally, Vale and Campanella [141] remind us that reconstruction involves many layers, from tangible to fully immaterial and intangible, including the healing of the community that has suffered trauma. This is why the rehabilitation of cultural heritage is often considered an important milestone by affected communities [142].

CCA has prompted some cities to reconsider their development and redevelopment programs and projects with the goal of reducing future damage [143,144]. The changes in urban planning and management that took place in New York following the damage and losses caused by Hurricane Sandy have been documented in the literature [145–147]. Perhaps the most important aspect of the Special Initiative for Rebuilding and Resiliency was the incorporation of climate change as a key criterion for design and planning during recovery. This initiative combined short-term rehabilitation through infrastructural defense measures, including nature-based solutions, with longer-term flexible planning. Rather than focusing solely on the "worst case scenario," alternative solutions for a range of scenarios were considered to develop a long-term plan adaptable to changing hazard conditions.

The response phase is the least considered. Still, only a small portion of the literature supports the idea of stronger interconnections between urban and emergency planning [148,149]. There are three distinct domains where urban planning offers important elements for improved emergency planning. First, the full inclusion of a spatial perspective in emergency plans, meaning these plans should be viewed as territorial constructs, not just administrative tools for coordinating responders. Second, the increased reliance on scenarios in emergency planning requires greater attention to the spatial context, as sce-

narios unfold within a city characterized by particular topography, patterns, and fabric. A notable example is the CLE tool required in Italy as part of seismic emergency plans [150], with CLE standing for Emergency Limit Conditions (in Italian, Condizioni Limite per l'Emergenza). This tool allows for the assessment of critical components and networks whose failure would compromise the effectiveness of emergency plans [151]. Third, urban and regional planning is vital for ensuring the feasibility of measures that will be required from either the population or rescuers. For example, the pre-positioning of rescue materials (from snowcats to generators) requires that free areas be available and designated for that purpose in the urban master plan. More broadly, urban planning can provide important insights into how cities and regions function from the perspective of residents and users. This knowledge is crucial for identifying critical issues, setting priorities, and planning the logistics of emergency plans.

The various phases are interconnected: better prevention results in less damage and reduces the effort needed for recovery and reconstruction. Recovery and reconstruction are closely linked, as recent research has shown [152]. These phases fundamentally influence outcomes if new extreme events occur in the future [153]. Not all recoveries are the same. In some cases, cities achieve better conditions with reduced vulnerabilities; in others, decline and degradation hinder full reconstruction and community healing [141].

During recovery and reconstruction, there is often a pressure to revisit ideas that have been discussed for a long time but never implemented, such as building a new highway to improve connectivity or a new airport to make the city more globally central, as happened after the 1995 Kobe earthquake in Japan [154]. There is no clear line separating reconstruction from development. In fact, it has often been suggested that they should be pursued together, especially when aiming for more sustainable conditions [155]. Some scholars [156,157] argue that recovery should be planned in advance, just as emergency preparedness is, in order to ensure that resources, legal provisions, and clear procedures are in place to ease the burden on public administrations and provide a vision to guide desired outcomes.

6. Challenges to Implement Plans for Resilience

Despite the strong emphasis in current urban studies on sustainability and adaptation, the reality on the ground remains grim, as significant gaps persist along the pathway to resilience. Recent events echo similar scenes, from the July 2021 floods in Belgium, Germany, and the Netherlands [158] to those in Italy in May 2023. Poor decisions in land use and urban planning can explain much of the damage, often independently of climate change [159,160]. According to Correa et al. [117], "land use and occupation reflect the development model that has prevailed in a given country," making disaster risk "the cumulative result of historical deficiencies in development planning." The EU Commission [34] identifies ineffective urbanism as a major cause of damage resulting from natural disasters and extreme events that are induced or intensified by climate change, and also highlights, among other factors, the growth of sprawl across all member states. Despite well-intentioned legislation, urban expansion continues in the most hazardous areas, as Rentschler et al. [161] note.

Authors such as Shamsuddin [162] and Kosovac et al. [99] have examined obstacles in the implementation of urban resilience from a more general perspective. Among the obstacles, there is a need to deal with a wide range of threats, including emerging and unexpected ones, and that the materialization of these threats is characterized by high uncertainties is pointed out as critical. Complacency and overconfidence are two conditions that may undermine efforts towards the type of processual investment in measures and interventions that are required. Complacency refers to the fact that administrations overstate

their actual preparedness and absorption capabilities, whilst overconfidence implies too large expectations regarding what has already been performed, neglecting the changing landscape of threats and risks.

Focusing more specifically on obstacles to effective urban planning for resilience, three main aspects are considered, namely the need to achieve implementation at scale, cross-sectoral governance, and careful consideration of land tenure/property right regimes.

6.1. Challenges to Achieving Implementation at Scale

In a review on the implementation of climate action policies in European cities, Correa do Lago et al. [163] highlighted that even in the best pioneering cases, interventions struggle to achieve the scale and the diffusion that is needed for a transformational change. Achieving implementation at scale requires a truly transformative approach involving the entire chain of stakeholders—from planners and designers to developers, global real estate entrepreneurs, owners, administrations, and citizens [164].

Differences in implementation challenges between large metropolitan areas and medium-sized cities must also be accounted for. In large metropolitan areas, the need to coordinate interventions across various areas, neighborhoods, and sub-jurisdictions—each with unique characteristics—remains problematic. Through analyses and interviews related to three large-scale EU-funded projects proposing nature-based adaptation solutions, O'Sullivan et al. [165] found that implementation is often too restricted to limited urban zones to really be a game changer at the city level. Olazabal et al. [166], who examined the adaptation policies of 59 coastal cities with populations over one million, found that comprehensive action on the ground is still rather limited. Most of the climate adaptation plans and documents analyzed lack adequate detail regarding funding and prioritization of actions, with only a few exceptions. According to this analysis, cities that have integrated their CCA and DRR plans have achieved more concrete proposed interventions.

Small- and medium-sized cities lag behind large cities and metropolitan areas in developing programs for DRR and CCA. Reckien et al. [167] found significant disparities between large and medium–small European cities in planning for adaptation out of the 885 cities of their sample. Medium- and small-sized cities often struggle to find adequate human and financial resources for developing and implementing such programs. In addition, they often rely much more than metropolitan areas and large cities on occasional projects that are often difficult to transform into longer-term structural policy [168].

6.2. Governance for Urban Resilience

The implementation of plans for urban resilience necessitates robust governance, defined as "the system of institutions, mechanisms, policy and legal frameworks, and other arrangements to guide, coordinate, and oversee DRR and related areas of policy" (UNDRR, Glossary). Platt [169] proposed a framework in which societal efforts towards risk management are instigated by the impact of a recent disaster, heightened perception of hazards, and risk assessments. Building upon this, a modified framework is suggested to illustrate the elements of urban resilience governance in Figure 3.

At the center, the political and governance system is often driven either by increased costs resulting from the impact of natural hazards on the built environment or by a heightened sense of urgency as threats become, or are perceived to become, more severe or frequent. This can lead to new legislation and the allocation of more resources for prevention and adaptation. For example, new laws may be enacted, such as the European Flood Directive issued in 2007—five years after the severe 2002 flood that affected Central Europe. Alternatively, existing laws may be revised in response to updated risk assessments. Finan-

cial and human resources must be identified to enforce these laws and to implement risk reduction and mitigation plans and measures.

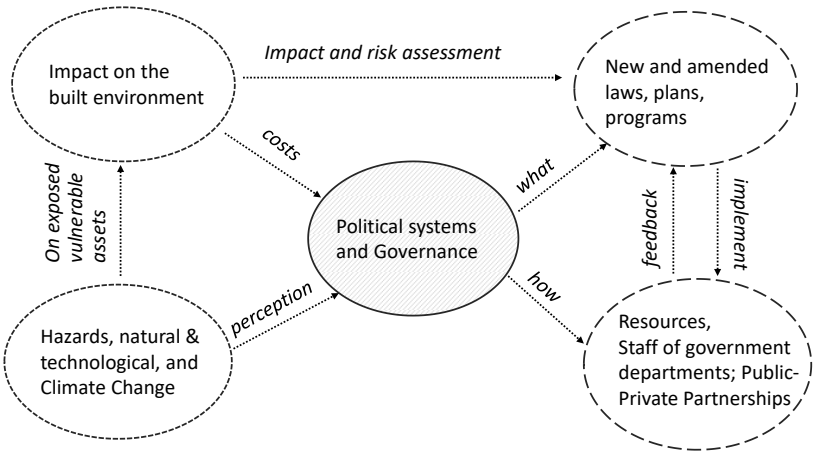

Figure 3. Risk and climate adaptation governance framework (author's modification of Platt's figure).

Because urban resilience sits at the intersection of various systems—some local, like the built environment, and others on a larger scale, such as supply chains, transport systems, and lifelines—solutions must also be cross-sectoral. This requires both vertical and horizontal collaboration among government sectors [170]. Cross-sectoral governance involves horizontal integration (among departments and organizations dealing with different aspects of a city's functioning) and vertical integration (linking municipal levels with higher levels of government). Understanding hazards, impacts, and the measures and tools for viable implementation—the "what" and "how"—requires diverse expertise. Moreover, identifying and selecting solutions requires the engagement and participation of multiple stakeholders [171,172]. The need for cross-sectoral policies and arrangements that transcend siloed initiatives to make Australian cities better prepared for and more resilient to natural hazards was already noted by Handmer [90]. The EC-JRC Handbook on Sustainable Urban Planning [36] explicitly calls for cross-sectoral governance to address, in a coordinated way, the multiple social, economic, spatial, and environmental dimensions of cities. According to the EC-JRC Handbook, cross-sectoral governance "produces added value from the joint consideration of multiple policies, building on governance capacity, funding, and implementation instruments." Fiorino et al. [173], based on a literature review, proposed an exploratory framework for integrated DRR and CCA governance, putting at the center three types of actors: state, market, and social.

The role of civil society in achieving a broad consensus on the need for certain interventions or limitations on land use should not be overlooked in governance schemes. In a systematic review on coastal urban flood risk management, Aziz et al. [174] pointed to the need for multistakeholder collaboration, including among different levels of government, and public participation as key. Public participation in plan-making and implementation is essential to successfully supporting ambitious sustainability and adaptation objectives [175]. However, as warned by Reckien et al. [166], public participation should not be merely "tokenistic" but must offer genuine opportunities for citizens and associations to influence risk-related decisions, which are ultimately social rather than purely technical matters [176]. The available literature on participatory approaches to urban planning for resilience [177,178] discusses both the challenges and opportunities of working with local stakeholders. Warner et al. [179] examined the controversies surrounding the Dutch "Making Space for the Rivers" plan, particularly in areas where residents and economic activities had to be relocated. Such measures inevitably create "winners"—those who bene-

fit from increased safety and reduced flood risk—and "losers"—those who must relocate. Wamsler et al. [180] caution that current organizational and power structures often hinder genuine citizen involvement and grassroots participation in decisions about adaptation and nature-based solutions.

6.3. The Relevance of Land Property Rights Management for Enforcing Urban Plans for Resilience

Existing legal and juridical norms and systems that define property rights on land, as well as established rules and conditions for land use in the name of the public good [181], have a significant impact on the enforcement of climate adaptation and disaster risk-reduction projects and on the concrete measures necessary to achieve resilience [182,183]. The issue of land tenure is an important obstacle in developing countries, both to the implementation of preventative measures and to resilient recovery. In a study on Trinidad and Tobago, Daniel et al. [184] verified that in the absence of documentation attesting to the right on the land, victims are not eligible for recovery funding.

Whilst a significant part of the literature on developing countries focuses on issues of inequality and the inequity of the disadvantaged who are more exposed to tenure security issues [182], the literature in Western countries also focuses on the impact that hazard knowledge and disasters may have on land values. Hazard maps have been contested due to their presumed effects on the economic value of properties. An illustrative case, reported by Handmer [185], involved the withdrawal of flood hazard maps issued as part of innovative floodplain management policies in New South Wales, Australia, following strong opposition from resident groups and the adoption of their cause by political parties just before elections. Failure to fully enforce the Stafford Act's provisions on natural hazard risk management—particularly those related to urban development control—has been identified as a key reason for increased exposure and urban vulnerability to floods in the United States [186]. U.S. Supreme Court rulings that counteracted preventative measures taken by jurisdictions to protect coastal and riverine communities from large-scale flood and storm impacts were discussed by Platt and Dawson [187]. More recently, Raska et al. [188] have indicated that the legal framework and constitution of property rights for both agricultural and urban land represent significant barriers to implementing nature-based solutions in various European countries.

In a comparative study on the implementation of regulatory coastal management across different countries, Alterman and Pellach [189] highlight the need to consider the inevitably contested impacts of measures such as setbacks, relocation, and other adaptations to sea-level rise and more frequent extreme storms on land property rights—an issue they argue has not been sufficiently addressed so far.

Hartmann [164] proposed a complex policy framework, which he calls "clumsy," combining different land-management approaches to address the equally "clumsy" pressures from various stakeholders seeking to concentrate urban functions—from residential to transportation and commercial uses—in floodplains. Figure 4 attempts to summarize some of the most relevant challenges that must be addressed to fully account for land ownership regimes when implementing urban plans for DRR and climate change adaptation (CCA). The figure first distinguishes between public and private land. For public land, rules and plans to reduce risks based on available knowledge of hazards and vulnerabilities are easier to implement from a juridical perspective. For private land, urban and land use plans have the power to dramatically increase land value by designating it as suitable for development, or to reduce its value when land is excluded from such development [190]. As a result, the separation between land ownership and land use is particularly problematic in urban areas; in some countries, there has been strong support for compensating not only for the taking of land but also for restrictions on development and building [191,192].

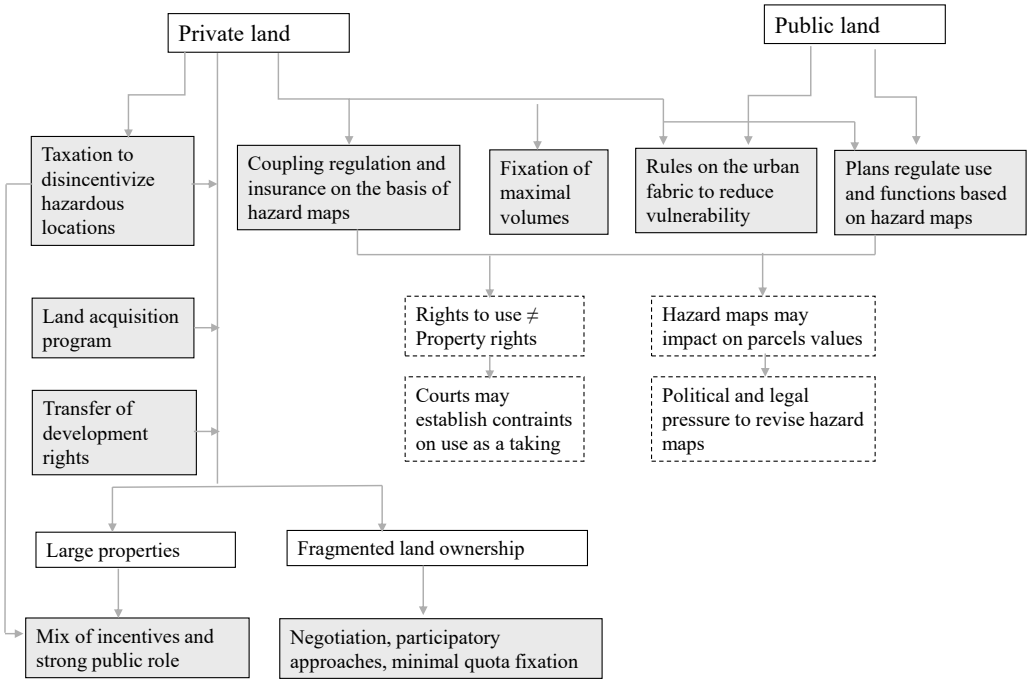

Figure 4. Managing land ownership and tenure arrangements explicitly for DRR and CCA (author's elaboration).

Tools available to planners for achieving resilience goals on privately owned land are shown in the gray boxes. Although acquisition programs can, in principle, remove the most hazardous areas from the market, this approach is very costly for local administrations. A system of incentives and disincentives based on taxation and insurance may be more effective than strict regulation. The transfer of development rights has also been proposed as a viable instrument. However, practical implementation has revealed numerous obstacles and challenges, especially when a large number of properties are involved. Hills and Schleicher [193] provide a useful overview of the challenges and potential benefits associated with the transfer of development rights.

The last four boxes at the bottom of the figure address the challenges posed by large versus fragmented small properties. Since taxation related to new development or redevelopment is often a vital source of revenue for local governments, leveraging development permits to foster resilience and prevention capacity can backfire by reducing the availability of services. Large developers have the resources and influence to oppose local governments and push for outcomes that benefit them in the real estate market. These developers are often international companies capable of enduring long disputes and seizing political opportunities, such as local elections, to advance their plans. Conversely, highly fragmented properties pose a significant obstacle to efforts to rationalize urban conditions and development patterns [194]. Projects involving partial relocation from areas most exposed to natural hazards, or efforts aimed at reducing vulnerabilities that are resisted even by a minority of owners, are likely to fail. Success would require a comprehensive, coherent transformation of entire urban areas [195].

7. Conclusions

This article has provided a review of some of the main challenges of integrating DRR and CCA goals to be pursued by urban planners, and the way forward that has been indicated by scholars and practitioners in recent decades. The framework presented in Figure 1, which has guided this review, represents the author's main contribution,

providing an underlying understanding of the aspects that must be considered from risk and resilience assessment to implementation.

The main findings of the review are synthesized in Table 3. The first column reports the major topics that have been evidenced. Such topics are broken into arguments that are relevant for different types of stakeholders. In the third column, gaps to be covered by future research are highlighted.

Table 3. Synthesis of the review's main findings.

Key Findings	Relevance for Different Stakeholders	Possible Future Directions for Research
Assessment of exposure and urban vulnerability to multi-hazard conditions as a basis for urban planning.	- Researchers have been struggling to develop convincing and usable methodologies and models for assessing risks to multiple threats in the same environment. - Practitioners need usable tools that can be applied to different contexts and different types of cities. - Policy makers may consider adopting legislation with a wider scope than existing ones to take a more comprehensive approach of DRR and CCA, considering multiple threats either cascading or co-existing.	- Exposure and vulnerability assessments to multiple hazards require further research efforts, even though the fundamental concepts and frameworks have been already provided by research and practice. - Cascading impacts in cities require more systematic analytical and interpretative efforts. - Forensic investigation of damage can become an important source of knowledge on urban vulnerability factors (physical, systemic, social, and economic).
The need for bridging between DRR, CCA, and sustainability in urban planning.	- There are growing calls by researchers to bridge between the three fields, particularly when it comes to providing a coherent set of measures at the city level. - Practitioners are already struggling with multiple mandates and requirements deriving from different legislations and regulations. They would certainly benefit from a framework highlighting converging pathways to prevention and adaptation, and showing in what cases contradictions between provisions may take place. - Policy makers are asked to create closer collaboration and coordination between administrations in charge of implementing DRR, CCA, and sustainability policies in cities	- The different time horizon of, in particular, disaster and climate change analyses and scenarios has often been raised as an obstacle to bridging between the two. Further research effort is needed to identify potential convergence and identify useful synergies between researchers and projects that may benefit from improved understanding of concepts in the different domains.
Urban resilience as a candidate for bridging between the fields of DRR and CCA.	- Research on resilience as a concept, as a new paradigm complementing risk assessment and management, has been growing in recent years. Literature reviews on urban resilience have shown that the positive connotation of resilience fits well with the need to provide cities with tools to cope, but in the meantime, create opportunities for more livable places. - Practitioners are particularly interested in operationalizing the concept, and in having metrics and frameworks helping them to translate resilience into urban plans and interventions that work. - In recent policy documents, resilience is understood as a concept encompassing the entire disaster cycle from prevention and preparedness to emergency management and recovery.	- The review process has shown that there has been a growing body of literature calling for resilience as a bridging concept between different fields. Resilience is still attracting significant research interest, providing a more nuanced understanding and interpretation. There is still room for further developing usable operational frameworks on the basis of such a more nuanced understanding.
Different cities require context-sensitive planning and implementation of measures aimed at resilience.	- The available literature deals with the need to differentiate between large cities, metropolitan areas, and medium-to-small cities as for the challenges they face in DRR and CCA. Typologies have been proposed, highlighting what aspects make different cities differently vulnerable, exposed, and equipped with resources and coping capacity. - It is reasonable to expect that different types of intervention and policies have to be implemented in large metropolitan areas and in small, medium-sized cities. Also, it is reasonable to expect that other elements considered in classifications, like the type of hazards, and social and economic characteristics, as well as the role played by cities at the regional, national, and international level, have to be considered in tailoring and choosing among alternative measures.	- Efforts of developing typologies have been mainly descriptive and analytical so far. There is a need for empirical research to assess how vulnerabilities play differently in the various categories of available classifications. - There are attempts at classification of different types of tools, policies, and measures. Future research may try to combine classifications of tools and measures with classifications of city typologies.

Table 3. *Cont.*

Key Findings	Relevance for Different Stakeholders	Possible Future Directions for Research
DRR and CCA governance require overcoming siloed types of intervention.	- The need to overcome siloed approaches requires that researchers with different disciplinary backgrounds, notably experts in social sciences and engineers, and "natural" science will collaborate together in truly interdisciplinary efforts. - Practitioners and, especially, policy makers may need to find new types of cross-sectoral arrangements to facilitate the integration of DRR and CCA with sustainability policies, easing the tasks falling on local public administrations, but may also need to seek stronger coherence and convergence between different types of planning and intervention.	- This is mainly a field of study related to public policies and administrations. However, there are many implications for urban planners who must be taken on board to assess what kind of cross-sectoral arrangements have worked better, given different types of cities and in different social, economic, political, and cultural contexts.
Land tenure arrangements are crucial in achieving the implementation of preventative policies for damage reduction and climate adaptation.	- Land tenure and property rights are crucial to consider when aiming to implement DRR and CCA at scale. There are significant differences in legislation, types of arrangements from one country to another, even when limiting the analysis to Western countries or to developing ones. For example, large illegal settlements can be found in developing countries, but also in some regions of developed ones. This means that caution should be taken in attempts to generalize findings. - In the meantime, for policy makers, it is important to understand how different types of ownership and real estate agents play in limiting the potential of implementation of DRR and CCA.	- This is a field that has gained differential attention in developing countries and in developed ones. Also, the type of issues that have been at the core of research are rather diverse. Research is needed in this field to be able to draw some common aspects and identify specifics that are tied to contexts and must, therefore, be treated with ad hoc measures and tools. - More empirical studies on how land property has played against preventative measures, or instead positive agreements have been found between public and private stakeholders, would be very helpful, also to shed light on several aspects that have not been talked about sufficiently so far.

Considering the audience, useful contributions and relevant gaps have been identified as takeaways for different users of this review. Researchers from various disciplinary fields may find the proposed conceptualization valuable for understanding how their specific domain relates to others, thereby supporting improved risk assessments and providing scientific guidance for integrated DRR and CCA measures in complex urban environments. Significant gaps persist in current research, particularly regarding multi-risk assessment and the integration of methods that have so far been developed separately by the "climate change" and "disasters" scientific communities. The aspects related to implementation also require further interdisciplinary research, especially in the field of cross-sectoral governance for urban resilience, and on the important role that land tenure arrangements have on the possibility of enforcing different types of measures and interventions at the necessary scale and diffusion. Further studies are needed to dig into the differences and commonalities regarding risks and challenges of DRR and CCA between different types of cities. As suggested by Cross [89], there is in fact a continuum between megacities, large cities, and medium-sized and small-sized cities. Their role globally and regionally must be understood as it has implications for systemic vulnerability and resilience of communities.

Practitioners may benefit from the operationalization of urban resilience, which can help to streamline efforts towards adaptation, sustainability, and disaster prevention through more integrated planning. Frameworks for assessing urban resilience have been proposed by international organizations and researchers, among which cities may choose, taking into consideration the availability of data and skilled personnel. More applications are needed, and studies that aim to compare methods to provide guidance on the more suitable ones that are able to inform policies and measures. Although assessing the quality and effectiveness of adaptation [195] and DRR policies prior to their testing by extreme events is challenging, comparative analysis and post-disaster forensic investigation [48,49] can help to identify prevention measures and interventions that have proven more or less successful in past cases. This area merits further research and analytical effort. DRR and CCA policies should inform not only visions and large master plans, but also smaller-scale

decisions such as granting building permits, selecting locations for new infrastructure, and regenerating neighborhoods.

Policy makers may find value, despite the challenges posed by current governance arrangements, in pursuing cross-sectoral frameworks to overcome siloed interventions that often undermine each other rather than achieving the desired outcomes in risk reduction and adaptation capacity. While policy implementation and enforcement of legislation are broad issues, the review specifically addresses how to implement measures for city and community resilience, emphasizing spatial and temporal factors. On one hand, there is a need for large-scale implementation that considers differences in city typologies, including extent, specialization, and urban fabric, as shaped by geographical and morphological constraints. Whilst the review showed that there is growing interest in this type of analysis, there is a need to improve the understanding of how such classifications can inform more tailored approaches to develop urban resilience. It would be relevant to explore how planning can support policies for self capacities in more remote places, such as mountain areas or islands. On the other hand, legislation must explicitly consider the timing of interventions across the "disaster cycle." Timely intervention should be a central consideration in future planning: a plan or project that is relevant and potentially beneficial at one time may become obsolete or even counterproductive years later. This applies even to structural mitigation measures such as levees, as rivers may change course or urban development may encroach on areas originally set aside for such measures [195].

Finally, for more successful implementation, professional intervention by local governments and officials must be complemented by initiatives aimed at raising risk awareness and preparedness within communities [11], in order to garner support even for interventions that may conflict with short-term economic interests.

Those are some of the most relevant conclusions that can be drawn from the review that has taken a hybrid approach, combining mapping, umbrella, and theoretical review strategies, given the challenges to provide a review at the crossroads of different disciplinary domains, and that involves, by its very nature, a large number of stakeholders with different knowledge, expertise, and objectives. By opting for applicability and usability over strict systematicity, and making specific choices accordingly, the review is admittedly "vulnerable on the ground of subjectivity" [23]. However, every effort has been made to ensure that the reasoning behind these selections is as transparent and explainable as possible. Future efforts may try to systematize the proposed guiding framework and shed light on specific aspects that have been presented as neglected or insufficiently covered by the currently available literature.

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Appendix A. Table with the References Retrieved According to the Criteria in Table 1

Authoritative References in the Field of DRR and CCA Related to Urban Planning	Multi-Hazard/Multi-Risk Exposure and Vulnerability of Urban Environments	Urban Resilience	Planning for DRR and/or CCA, and Linking DRR to CCA	Challenges and Obstacles to Plans Implementation	Illustrative Examples
Blaikie, P., Cannon, T., Davis, I., & Wisner, B. (2014). *At risk: natural hazards, people's vulnerability and disasters*. Routledge. [61] Bruneau, M., Chang, S. E., Eguchi, R. T., Lee, G. C., O'Rourke, T. D., Reinhorn, A. M., . . . & Von Winterfeldt, D. (2003). A framework to quantitatively assess and enhance the seismic resilience of communities. Earthquake spectra, 19(4), 733–752. [102] Burby R. (ed.) (1998). Cooperating with nature. Confronting natural hazards with land-use planning for sustainable communities, Joseph Henry Press, Washington D.C. [11] Carpenter, S., Walker, B., Anderies, J. M., & Abel, N. (2001). From metaphor to measurement: resilience of what to what?. Ecosystems, 4, 765–781. [103] Davoudi, S., Shaw, K., Haider, L. J., Quinlan, A. E., Peterson, G. D., Wilkinson, C., . . . & Davoudi, S. (2012). Resilience: a bridging concept or a dead end?"Reframing" resilience: challenges for planning theory and practice interacting traps: resilience assessment of a pasture management system in Northern Afghanistan urban resilience: what does it mean in planning practice? Resilience as a useful concept for climate change adaptation? The politics of resilience for planning: a cautionary note: edited by Simin Davoudi and Libby Porter. Planning theory & practice, 13(2), 299–333. [95]	Arvidsson, B., Guldåker, N., & Johansson, J. (2021). Critical Infrastructures, geoscience and risk governance: a literature review of synergistic research opportunities, Reliability Engineering and System Safety 213. [124] Birkmann, J.; Welle, T.(2015) Assessing the risk of loss and damage: Exposure, vulnerability and risk to climate-related hazards for different country classifications. Int. J. Glob. Warm 8, 191–212. [50] Boni, M.P., Faiella, A., Gazzola, V., Pergalani, F. (2025) A multi-hazard and multi-risk assessment methodological approach to support Civil Protection planning in wide areas. Int. J. Disaster Risk Reduct., 119. [83] Chang, S. E., Yip, J. Z., Conger, T., Oulahen, G., & Marteleira, M. (2018). Community vulnerability to coastal hazards: Developing a typology for disaster risk reduction. Applied Geography, 91, 81–88. [84] Corbane, C.; Gamba, P.; Pesaresi, M.; Pittore, M.; Wieland, M. Current and innovative methods to define exposure. In Science for Disaster Risk Management 2017: Knowing Better and Losing Less; Poljansek, K., Ed.; European Commission, DG-JRC: Brussels, Belgium, 2017; pp. 59–69. [51] Cross, J. A. (2001). Megacities and small towns: different perspectives on hazard vulnerability. Global Environmental Change Part B: Environmental Hazards, 3(2). [89]	Béné, C. (2013). Towards a quantifiable measure of resilience. IDS Working Papers, 2013(434). [114] Bhreasai, A., N. & Persson, E. (2023). Measuring Resilience. A Guide to Tracking Progress, ARUP available at https://www.arup.com (last acc. July 2024) [116] Chen, C., Xu, L., Zhao, D., Xu, T., & Lei, P. (2020). A new model for describing the urban resilience considering adaptability, resistance and recovery, Safety science, 128. [115] Cariolet, J. M., Vuillet, M., & Diab, Y. (2019). Mapping urban resilience to disasters–A review. Sustainable Cities and Society, 51. [123] Curt C. and Tacnet J. M. (2018), Resilience of critical infrastructures: Review and analysis of current approaches. Risk Analysis, 38(11). [70] De Bono M., Mora M.G. (2014), A global exposure model for disaster risk assessment, International Journal of Disaster Risk Reduction, 10. [53] Galderisi, A., & Altay-Kaya, D. (2021). A New Framework for a Resilience-Based Disaster Risk Management. In Handbook of Disaster Risk Reduction for Resilience: New Frameworks for Building Resilience to Disasters. Cham: Springer International Publishing. [126] Harrison, C. G., & Williams, P. R. (2016). A systems approach to natural disaster resilience. Simulation Modelling Practice and Theory, 65. [108]	Baggio, J. A., Brown, K., & Hellebrandt, D. (2015). Boundary object or bridging concept? A citation network analysis of resilience. Ecology and society, 20(2). [95] Burby, R. J. and Dalton, L. C. (1994). Plans can matter! The role of land use plans and state planning mandates in limiting the development of hazardous areas. Public administration review. [192] Chmutina, K., Bosher, L., Coaffee, J., & Rowlands, R. (2014). Towards integrated security and resilience framework: a tool for decision-makers. Procedia Economics and Finance, 18. [131] Fünfgeld, H., Fila, D., Dahlmann, H. (2023) Upscaling climate change adaptation in small-and medium-sized municipalities: Current barriers and future potentials. Curr. Opin. Environ. Sustain. [168] Galderisi A., Colucci A. (2019) Smart, Resilient and Transition Cities: Emerging Approaches and Tools for A Climate-Sensitive Urban Development, Elsevier. [71] Clemente, M., & Salvati, L. (2017). 'Interrupted' landscapes: post-earthquake reconstruction in between Urban renewal and social identity of local communities. Sustainability, 9(11). [142] Cloutier, G., Joerin, F., Dubois, C., Labarthe, M., Legay, C., & Viens, D. (2015). Planning adaptation based on local actors' knowledge and participation: a climate governance experiment. Climate Policy, 15(4). [178]	Alterman, R., & Pellach, C. (2021). Regulating coastal zones: International perspectives on land management instruments. Taylor & Francis. [189] Aziz, F., Wang, X., Mahmood, M. Q., Awais, M., & Trenouth, B. (2024). Coastal urban flood risk management: Challenges and opportunities– A systematic review. Journal of Hydrology, 645. [174] Booth, L., Schueller, L. A., Scolobig, A., & Marx, S. (2020). Stakeholder solutions for building interdisciplinary and international synergies between climate change adaptation and disaster risk reduction. International journal of disaster risk reduction, 46. [172] Coaffee, J., Therrien, M. C., Chelleri, L., Henstra, D., Aldrich, D. P., Mitchell, C. L.,et al. (2018). Urban resilience implementation: A policy challenge and research agenda for the 21st century. Journal of Contingencies and Crisis Management, 26(3). [170] Djalante, R. (2012) Adaptive governance and resilience: The role of multi-stakeholder platforms in DRR. Nat. Hazards Earth Syst. Sci., 12. [175] Forino, G., von Meding, J., & Brewer, G. J. (2015). A conceptual governance framework for climate change adaptation and disaster risk reduction integration. International Journal of Disaster Risk Science, 6(4). [173] Hartmann, T. (2016). Clumsy floodplains: Responsive land policy for extreme floods. Routledge. [164]	Carreño M. L., Cardona O. D., Barbat A. (2007), Urban seismic risk evaluation: a holistic approach. Natural Hazards, 40. [68] Daniel, D., Sutherland, M., & Speranza, C. I. (2019). The role of tenure documents for livelihood resilience in Trinidad and Tobago. Land Use Policy, 87. [184] Depietri, Y., & McPhearson, T. (2018). Changing urban risk: 140 years of climatic hazards in New York City. Climatic Change, 148(1). [17] duPont, W., IV.; Noy, I. (2015) What happened to Kobe? A reassessment of the impact of the 1995 earthquake in Japan. Econ. Dev. Cult. Change, 63. [66] Edgington, D.W. (2016) Reflections on the Hanshin Earthquake of 1995 and the Reconstruction of Kobe, Japan; Daly, P., Feener, R.M., Eds.; Cambridge University Press: Cambridge, UK. [154] Finn, D., Chandrasekhar, D., & Xiao, Y. (2023). A region recovers: Planning for resilience after superstorm Sandy. Journal of Planning Education and Research, 43(1). [146] Fox-Lent, C., & Linkov, I. (2018). Resilience matrix for comprehensive urban resilience planning. Resilience-Oriented Urban Planning: Theoretical and Empirical Insights. [121]

Authoritative References in the Field of DRR and CCA Related to Urban Planning	**Multi-Hazard/Multi-Risk Exposure and Vulnerability of Urban Environments**	**Urban Resilience**	**Planning for DRR and/or CCA, and Linking DRR to CCA**	**Challenges and Obstacles to Plans Implementation**	**Illustrative Examples**
Godschalk, D. R. (2003). Urban hazard mitigation: Creating resilient cities. Natural hazards review, 4(3), 136–143. [130] Gunderson, L. H., & Holling, C. S. (Eds.). (2002). Panarchy: understanding transformations in human and natural systems. Island press. [104] Jabareen, Y., & Jabareen, Y. (2015). The risk city resilience trajectory. The Risk City: Cities Countering Climate Change: Emerging Planning Theories and Practices around the World, 137–159. [127] Mitchell, J. (Ed) (1999) Crucibles of hazard: mega-cities and disasters in transition. UN University Press, Tokyo, New York, Paris. [90] Manyena, S. B. (2006). The concept of resilience revisited. Disasters, 30(4), 434–450. [100] Norris F., Stevens S., Pfefferbaum B., Wyche K., Pfefferbaum R. (2008), "Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness". American Journal of Community Psychology 41(1–2). [97] Quarantelli, E. L. (1996). The future is not the past repeated: Projecting disasters in the 21st century from current trends. Journal of contingencies and crisis management, 4(4), 228–240. [10] Rose, A. (2007). Economic resilience to natural and man-made disasters: Multidisciplinary origins and contextual dimensions. Environmental hazards, 7(4), 383–398. [62]	Cruz, A. M., and Okada, N. (2008). Methodology for preliminary assessment of Natech risk in urban areas. Natural Hazards, 46. [74] Diaz-Sarachaga, J. M., & Jato-Espino, D. (2020). Analysis of vulnerability assessment frameworks and methodologies in urban areas. Natural Hazards, 100(1), 437–457. [57] Duy, P, Tight, M, Chapman, L, Linh, P & Thuong, L 2017, Increasing vulnerability to floods in new development areas: evidence from Ho Chi Minh City', International Journal of Climate Change Strategies and Management, 10(1). [195] Forzieri, G., Feyen, L., Russo, S., Vousdoukas, M., Alfieri, L., Outten, S., . . . & Cid, A. (2016). Multi-hazard assessment in Europe under climate change. Climatic Change, 137. [18] Gill, J. C., & Malamud, B. D. (2014). Reviewing and visualizing the interactions of natural hazards. Reviews of geophysics, 52(4). [77] Gill, J. C., & Malamud, B. D. (2016). Hazard interactions and interaction networks (cascades) within multi-hazard methodologies. Earth System Dynamics, 7(3). [78] Gunasekera R., Ishizawa O., Aubrecht C., Blankespoor B., Murray S., Pomonis A., Daniell J. (2015). Developing an adaptive global exposure model to support the generation of country disaster risk profiles. Earth-Science Reviews, 150. [52]	Gonzalez-Quintero, C., and Avila-Foucat, V. S. (2019). Operationalization and measurement of social-ecological resilience: a systematic review. Sustainability, 11(21). [119] Graveline, M. H., & Germain, D. (2022). Disaster risk resilience: Conceptual evolution, key issues, and opportunities. International Journal of Disaster Risk Science, 13(3). [98] Horney, J., Dwyer, C., Aminto, M., Berke, P., & Smith, G. (2017). Developing indicators to measure post-disaster community recovery in the United States. Disasters, 41(1). [156] Hutton, M. (2018). Neither passive nor powerless: reframing economic vulnerability via resilient pathways. In Consumer Vulnerability, Routledge, UK. [64] Kim, K., & Olshansky, R. B. (2014). The theory and practice of building back better. Journal of the American Planning Association, 80(4). [157] Kosovac, A. & Logan, T. M. (2021). Resilience: lessons to be learned from safety and acceptable risk. Journal of safety science and resilience, 2(4). [99] Linkov, I., Eisenberg, D. A., Bates, M. E., Chang, D., Convertino, M., Allen, J. H., . . . & Seager, T. P. (2013). Measurable resilience for actionable policy. [120] Jha, A. K., Miner, T. W., & Stanton-Geddes, Z. (Eds.). (2013). Building urban resilience: principles, tools, and practice. World Bank Publications. [132]	Corrêa do Lago, A., Sánchez Chaparro, T., & Lumbreras, J. (2023). A Decade of Climate Action and the Mission towards Climate Neutrality and Adaptation in European Cities: Delivering Urban Transformations?. Sustainability, 15(24). [163] Correa, E., with F. Ramírez and H. Sanahuja (2011). Populations at Risk of Disaster: A Resettlement Guide–Washington, DC: The World Bank: GFDRR. [117] Daly, P., Mahdi, S., McCaughey, J., Mundzir, I., Halim, A., & Srimulyani, E. (2020). Rethinking relief, reconstruction and development: Evaluating the effectiveness and sustainability of post-disaster livelihood aid. International Journal of Disaster Risk Reduction, 49. [155] Da Silva, J., Kernaghan, S., & Luque, A. (2012). A systems approach to meeting the challenges of urban climate change. International Journal of Urban Sustainable Development, 4(2). [110] Depietri, Y:, McPhearsib, T. (2017). Integrating the gray, green, and blue in cities:nature based solutions for climatechange adaptation and risk reduction. In Nature based solutions to climate change adaptation in urban areas: linkages between science, policy and practice, Cham: Springer international. [137] Finucane, M. L., Acosta, J., Wicker, A., & Whipkey, K. (2020). Short-term solutions to a long-term challenge: Rethinking disaster recovery planning to reduce vulnerabilities and inequities. International journal of environmental research and public health, 17(2). [153]	Hepperle E., Dixon-Gough R., Mansberger R., Paulsson J., Hernik J., Kalbro T. (eds.). (2009). Land Development Strategies: Patterns, Risks, and Responsibilities Publisher: vdf Hochschulverlag AGEditor: Erwin Hepperle, Hans Lenk. [183] Hills Jr R. M., Schleicher D. (2020), Building Coalitions Out of Thin Air: Transferable Development Rights and "Constituency Effects" in Land Use Law, Journal of Legal Analysis, 12. [193] Lahsen, M., & Ribot, J. (2022). Politics of attributing extreme events and disasters to climate change. Wiley Interdisciplinary Reviews: Climate Change, 13(1). [160] Mitchell D., Myers M., Grant D. (2014), Land Valuation: Key Tool for Disaster Risk Management, Land Tenure Journal, 1. [190] Olazabal, M., & De Gopegui, M. R. (2021). Adaptation planning in large cities is unlikely to be effective. Landscape and Urban Planning, 206. [166] Orr A. M., Stewart J. L., Jackson C., White J. T. (2023), Ownership diversity and fragmentation: A barrier to urban centre resilience, Environment and Planning B: Urban Analytics and City Science, 50:3. [194] O'Sullivan, F., Mell, I., & Clement, S. (2020). Novel solutions or rebranded approaches: evaluating the use of nature-based solutions (NBS) in Europe. Frontiers in Sustainable Cities, 2, 572527. [165]	Galderisi, A.; Limongi, G. (2021) A comprehensive assessment of exposure and vulnerabilities in multi-hazard urban environments: A key tool for risk-informed planning strategies. Sustainability, 13. [71] Grove, K., Rickards, L., Wakefield, S. (2023) Becoming non-commensurable: Synthesis, design, and the politics of urban experimentation in post-Superstorm Sandy New York. Sustain. Sci. Pract. Policy, 19- [147] Grünthal, G., Thieken, A. H., Schwarz, J., Radtke, K. S., Smolka, A., & Merz, B. (2006). Comparative risk assessments for the city of Cologne–storms, floods, earthquakes. Natural Hazards, 38. [81] Handmer, J.W. (1985) Flood policy reversal in Australia. Disasters, 9. [185] Hölscher, K.; Frantzeskaki, N.; McPhearson, T.; Loorbach, D. (2019) Tales of Transforming Cities: Transformative Climate Gov-ernance Capacities in New York City, U.S. and Rotterdam, Netherlands. J. Environ. Manag., 231. [171] Klijn, F.; Pedroli, G.B.M.; Van Os, A.G. (2004) Towards sustainable flood risk management in the Rhine and Meuse river basins: Synopsis of the findings of IRMA-SPONGE. River Res. Appl., 20. [191]

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Rubin C., Saperstein M., Barbee D. (1985). Community recovery from a major natural disaster. FMHI Publications, 87. [12] Thomalla, F., Downing, T., Spanger-Siegfried, E., Han, G., & Rockström, J. (2006). Reducing hazard vulnerability: towards a common approach between disaster risk reduction and climate adaptation. Disasters, 30(1), 39–48. [94] Vale L.J., Campanella T.J. (2005). The Resilient City. How modern city recover form disaster, Oxford University Press, NY. White, G. F., Kates, R. W., & Burton, I. (2001). [141] Knowing better and losing even more: the use of knowledge in hazards management. Global Environmental Change Part B: Environmental Hazards, 3(3), 81–92. [15] White, G. F. (1960). Strategic aspects of urban flood-plain occupance. Journal of the Hydraulics Division, 86:2, 89–102. [13]	Hart, D.E.; Pitman, S.J.; Byun, D.S. (2020) Earthquakes, coasts. . . and climate change? Multi-hazard opportunities, challenges and approaches for coastal cities. J. Coast. Res., 95. [72] Henry, D., & Ramirez-Jurgilevich, A., Räsänen, A., Groundstroem, F., & Juhola, S. (2017). A systematic review of dynamics in climate risk and vulnerability assessments. Environmental Research Letters, 12(1). [58] Hincks, S., Carter, J., & Connelly, A. (2023). A new typology of climate change risk for European cities and regions: Principles and applications. Global Environmental Change, 83. [85] Luo, X.; Cruz, A.M.; Tzioutzios, D. (2020) Extracting Natech reports from large databases: Development of a semi-intelligent Natech identification framework. Int. J. Disaster Risk Sci., 11. [76] Mili, R. R., Hosseini, K. A., & Izadkhah, Y. O. (2018). Developing a holistic model for earthquake risk assessment and disaster management interventions in urban fabrics. International journal of disaster risk reduction, 27. [67] Noy, I., & Yonson, R. (2018). Economic vulnerability and resilience to natural hazards: A survey of concepts and measurements. Sustainability, 10(8). [65]	Park, J., Seager, T. P., Rao, P. S. C., Convertino, M., & Linkov, I. (2013). Integrating risk and resilience approaches to catastrophe management in engineering systems. Risk analysis, 33(3). [27] Raju, E., Boyd, E., & Otto, F. (2022). Stop blaming the climate for disasters. Communications Earth & Environment, 3(1). [159] Rana, I. A. (2020). Disaster and climate change resilience: A bibliometric analysis. International journal of disaster risk reduction, 50. [96] Ribeiro, P. J. G., and Gonçalves, L. A. P. J. (2019). Urban resilience: A conceptual framework. Sustainable Cities and Society, 50. [109] Sharifi, A. (2016). A critical review of selected tools for assessing community resilience. Ecological indicators, 69. [106] Speranza, C. I., Wiesmann, U., & Rist, S. (2014). An indicator framework for assessing livelihood resilience in the context of social–ecological dynamics. Global Environmental Change, 28. [107] Strunz, S. (2012) Is conceptual vagueness an asset? Arguments from philosophy of science applied to the concept of resilience. Ecol. Econ., 76. [128]	Esraz-Ul-Zannat, M., Dedekorkut-Howes, A., & Morgan, E. A. (2024). A review of nature-based infrastructures and their effectiveness for urban flood risk mitigation. Wiley Interdisciplinary Reviews: Climate Change, 15(5). [138] Fang, X., Li, J., & Ma, Q. (2023). Integrating green infrastructure, ecosystem services and nature-based solutions for urban sustainability: A comprehensive literature review. Sustainable Cities and Society, 98. [134] Francini, M., Gaudio S., Palermo A., Viapiana M. F. (2020). A performance-based approach for innovative emergency planning, Sustainable Cities and Society, 53. [148] Francini M., Palermo A., Viapiana M. F. (2020), Il piano di emergenza nell'uso e nella gestione del territorio: atti del convegno scientifico Società italiana degli urbanisti-Università della Calabria, Rende (CS), 22–23 novembre 2019. [150] Glaas E., Jonsson A., Hjerpe M. and Andersson-Skold Y. (2010), Managing climate change vulnerabilities: formal institutions and knowledge use as determinants of adaptive capacity at the local level in Sweden, Local Environment: The International Journal of Justice and Sustainability, 15(6). [93] Gonzalez-Mathiesen C., Ruane S., March A. (2021), Integrating wildfire risk management and spatial planning–A historical review of two Australian planning systems, International Journal of Disaster Risk Reduction, 53. [149]	Platt R., A. Dawson, The taking issue and the regulation of hazardous areas, Natural Hazards Research Working Paper n. 95, Natural Hazards Research and Applications Information Center, Institute of Behavioral Science, University of Colorado, Boulder, June 1997. [187] Platt, R. H. (2012). Disasters and democracy: The politics of extreme natural events. Island Press. [169] Platt, R. H. (2014). Land Use and Society: Fundamentals and Issues. Land Use and Society: Geography, Law, and Public Policy. [181] Raška P., Bezak N., Ferreira C. S., Kalantari Z., Banasik K., Bertola M., . . . Hartmann T. (2022). Identifying barriers for nature-based solutions in flood risk management: An interdisciplinary overview using expert community approach. Journal of environmental management, 310. [188] Reale, A., & Handmer, J. (2011). Land tenure, disasters and vulnerability. Disasters, 35(1). [182] Reckien, D., Salvia, M., Heidrich, O., Church, J. M., Pietrapertosa, F., De Gregorio-Hurtado, S., . . . & Dawson, R. (2018). How are cities planning to respond to climate change? Assessment of local climate plans from 885 cities in the EU-28. Journal of cleaner production, 191. [167]	Kwok, A.O. (1018) Natural Disasters and Supply Chain Disruption in Southeast Asia; Neilson Journals Publishing: Edinburgh, UK. [112] Lyu, H. M., & Yin, Z. Y. (2023). An improved MCDM combined with GIS for risk assessment of multi-hazards in Hong Kong. Sustainable Cities and Society, 91. [82] Poudel, A., Argyroudis, S., & Pitilakis, K. (2024). Systemic seismic risk assessment of urban healthcare system considering interdependencies to critical infrastructures. International Journal of DRR, 103. [69] Rosenzweig, C.; Solecki, W. (2014) Hurricane Sandy and adaptation pathways in New York: Lessons from a first-responder city. Glob. Environ. Change, 28, 395–408. [145] Santella, N.; Steinberg, L.J.; Sengul, H. (2010) Petroleum and hazardous material releases from industrial facilities associated with Hurricane Katrina. Risk Anal.: Int. J., 30. [75]

Authoritative References in the Field of DRR and CCA Related to Urban Planning	Multi-Hazard/Multi-Risk Exposure and Vulnerability of Urban Environments	Urban Resilience	Planning for DRR and/or CCA, and Linking DRR to CCA	Challenges and Obstacles to Plans Implementation	Illustrative Examples
	Oliver-Smith, A., Alcántara-Ayala, I., Burton, I., Lavell, A. (2016) Forensic Investigations of Disasters (FORIN): A Conceptual Framework and Guide to Research; Integrated Research on Disaster Risk: Beijing, China. [48] Mendoza, M.T., Schwarze, R. (2019) Sequential Disaster Forensics: A case study on direct and socio-economic impacts. Sustainability 11. [49] Rentschler, J., Avner, P., Marconcini, M., Su, R., Strano, E., Vousdoukas, M., & Hallegatte, S. (2023). Global evidence of rapid urban growth in flood zones since 1985. Nature, 622(7981). [161] Rus, K., Kilar, V., & Koren, D. (2018). Resilience assessment of complex urban systems to natural disasters: A new literature review. International journal of disaster risk reduction, 31. [105] Singh S. R.; Eghdami M. R.; Singh S. (2014). The concept of social vulnerability: A review from disasters perspectives. International Journal of Interdisciplinary and Multidisciplinary Studies, 1(6). [60] Sterzel, T.; Lüdecke, M.K.; Walther, C.; Kok, M.T.; Sietz, D.; Lucas, P.L. (2020) Typology of coastal urban vulnerability under rapid urbanization. PLOS one., 15(1). [86]		King D., Gurtner Y., Firdaus A., Harwood S., Cottrell A. (2016), Land use planning for disaster risk reduction and climate change adaptation: Operationalizing policy and legislation at local levels, International journal of disaster resilience in the built environment, 7(2). [111] March A., Kornakova M. (eds) (2017), Urban planning for disaster recovery. Butterworth Heinemann, Elsevier. [140] Meerow, S., & Mitchell, C. L. (2017). Weathering the storm: The politics of urban climate change adaptation planning. Environment and Planning A: Economy and Space, 49(11). [144] Peek, L., Tobin, J., Adams, R.M., Wu, H., Mathews, M.C. (2020) A framework for convergence research in the hazards and disaster field: The natural hazards engineering research infrastructure CONVERGE facility. Front. Built Environ., 6. [129] Saunders W., Kilvington M. (2016) Innovative land use planning for natural hazard risk reduction: A consequence-driven approach from New Zealand, International Journal of Disaster Risk Reduction, 18. [9] Shamsuddin, S. (2020). Resilience resistance: The challenges and implications of urban resilience implementation. Cities, 103. [162] Van Aalst, M. K. (2006). The impacts of climate change on the risk of natural disasters. Disasters, 30(1). [19]	Shaw, R. (2014). Post disaster recovery: Issues and challenges. Disaster recovery: Used or misused development opportunity, in Shaw (ed) Post disaster recovery: Issues and challenges, Springer. [139] Soltesova, K.; Brown, A.; Dayal, A.; Dodman, D. (2014) Community participation in urban adaptation to climate change: Potential and limits for community-based adaptation approaches. In Community-Based Adaptation to Climate Change, Routledge: Abingdon, UK. [177] Warner J., Edelenbos J., van Buuren A. (2012), Space for the River Governance experiences with multifunctional river flood management in the US and Europe, IWA Publishing. [179]	

Authoritative References in the Field of DRR and CCA Related to Urban Planning	Multi-Hazard/Multi-Risk Exposure and Vulnerability of Urban Environments	Urban Resilience	Planning for DRR and/or CCA, and Linking DRR to CCA	Challenges and Obstacles to Plans Implementation	Illustrative Examples
	Tapsell S., McCarthy S., Faulkner H., Alexander M. (2010). Social vulnerability to natural hazards. State of the art report from CapHaz-Net's WP4. London. [59] Tocchi G., Pittore, M., Polese, M. (2025). Identifying urban and rural settlement archetypes: clustering for enhanced risk-oriented exposure and vulnerability analysis, Natural Hazards and Earth System Sciences. [87]		Vogel, C., Susanne, C. M., Roger, E. K., & Geoffrey, D. D. (2012). Linking vulnerability, adaptation, and resilience science to practice: pathways, players and partnerships. In Integrating science and policy, Routledge. [92] Wamsler, C., Alkan-Olsson, J., Björn, H., Falck, H., Hanson, H., Oskarsson, T., . . . & Zelmerlow, F. (2020). Beyond participation: when citizen engagement leads to undesirable outcomes for nature-based solutions and climate change adaptation. Climatic Change, 158. [180] Wamsler, C. (2008). 'Planning ahead': Adapting settlements before disasters strike. In Hazards and the Built Environment (pp. 318–354). Routledge. [133] Wamsler, C., Brink, E., Rivera, C. (2013) Planning for climate change in urban areas: From theory to practice. J. Clean. Prod. 50. [143]		

References

1. Ratcliffe, J.; Krawczyk, E. Imagineering city futures: The use of prospective through scenarios in urban planning. *Futures* **2011**, *43*, 642–653. [CrossRef]
2. Wilkinson, A.; Kupers, R.; Mangalagiu, D. How plausibility-based scenario practices are grappling with complexity to appreciate and address 21st century challenges. *Technol. Forecast. Soc. Change* **2013**, *80*, 699–710.
3. Ramírez, R.; Selin, C. Plausibility and probability in scenario planning. *Foresight* **2014**, *16*, 54–74. [CrossRef]
4. Ringland, G. *Scenario Planning: Managing for the Future*; John Wiley & Sons Ltd.: Hoboken, NJ, USA, 1999.
5. Wibeck, V.; Eliasson, K.; Neset, T.S. Co-creation research for transformative times: Facilitating foresight capacity in view of global sustainability challenges. *Environ. Sci. Policy* **2022**, *128*, 290–298. [CrossRef]
6. Wayland, R. Strategic foresight in a changing world. *Foresight* **2015**, *17*, 444–459. [CrossRef]
7. Daffara, P. Rethinking tomorrow's cities: Emerging issues on city foresight. *Futures* **2011**, *43*, 680–689. [CrossRef]
8. Tjark, G.; Allam, Z. Strategic Foresight and Futures Thinking in Urban Development: Reframing Planning Perspectives and Decolonising Urban Futures. In *Future Cities Series: Practical Guidance for Innovative, Resilient and Inclusive Cities of the Future*; UN-Habitat: Nairobi, Kenya; ISOCARP: The Hague, The Netherlands, 2022.
9. Saunders, W.; Kilvington, M. Innovative land use planning for natural hazard risk reduction: A consequence-driven approach from New Zealand. *Int. J. Disaster Risk Reduct.* **2016**, *18*, 244–255. [CrossRef]
10. Quarantelli, E.L. The future is not the past repeated: Projecting disasters in the 21st century from current trends. *J. Contingencies Crisis Manag.* **1996**, *4*, 228–240. [CrossRef]
11. Burby, R. Cooperating with Nature. In *Confronting Natural Hazards with Land-Use Planning for Sustainable Communities*; Joseph Henry Press: Washington, DC, USA, 1998.
12. Rubin, C.; Saperstein, M.; Barbee, D. *Community Recovery from a Major Natural Disaster*; FMHI Publications: Chesterfield, MO, USA, 1985; p. 87.
13. White, G.F. Strategic aspects of urban flood-plain occupance. *J. Hydraul. Div.* **1960**, *86*, 89–102. [CrossRef]
14. Breen, M.J.; Kebede, A.S.; König, C.S. The safe development paradox in flood risk management: A critical review. *Sustainability* **2022**, *14*, 16955. [CrossRef]
15. White, G.F.; Kates, R.W.; Burton, I. Knowing better and losing even more: The use of knowledge in hazards management. *Glob. Environ. Change Part B Environ. Hazards* **2001**, *3*, 81–92. [CrossRef]
16. Petit-Boix, A.; Leipold, S. Circular economy in cities: Reviewing how environmental research aligns with local practices. *J. Clean. Prod.* **2018**, *195*, 1270–1281. [CrossRef]
17. Depietri, Y.; McPhearson, T. Changing urban risk: 140 years of climatic hazards in New York City. *Clim. Change* **2018**, *148*, 95–108. [CrossRef]
18. Forzieri, G.; Feyen, L.; Russo, S.; Vousdoukas, M.; Alfieri, L.; Outten, S.; Migliavacca, M.; Bianchi, A.; Rojas, R.; Cid, A. Multi-hazard assessment in Europe under climate change. *Clim. Change* **2016**, 137. [CrossRef]
19. Van Aalst, M.K. The impacts of climate change on the risk of natural disasters. *Disasters* **2006**, *30*, 5–18. [CrossRef] [PubMed]
20. McDougall, R. Reviewing literature in bioethics research: Increasing rigour in non-systematic reviews. *Bioethics* **2015**, *29*, 523–528. [CrossRef] [PubMed]
21. Snyder, H. Literature review as a research methodology: An overview and guidelines. *J. Bus. Res.* **2019**, *104*, 333–339. [CrossRef]
22. Grant, M.J.; Booth, A. A typology of reviews: An analysis of 14 review types and associated methodologies. *Health Inf. Libr. J.* **2009**, *26*, 91–108. [CrossRef]
23. Paré, G.; Trudel, M.C.; Jaana, M.; Kitsiou, S. Synthesizing information systems knowledge: A typology of literature reviews. *Inf. Manag.* **2015**, *52*, 183–199. [CrossRef]
24. Chaudhary, M.T.; Piracha, A. Natural Disasters—Origins, Impacts, Management. *Encyclopedia* **2021**, *1*, 1101–1131. [CrossRef]
25. McPhearson, T.; Haasea, D.; Kabischa, N. Advancing understanding of the complex nature of urban systems. *Editor. Ecol. Indic.* **2016**, *70*, 566–573.
26. Bai, X.; Surveyer, A.; Elmqvist, T.; Gatzweiler, F.W.; Güneralp, B.; Parnell, S.; Prieur-Richard, A.H.; Shrivastava, P.; Siri, J.G.; Stafford-Smith, M.; et al. Defining and advancing a systems approach for sustainable cities. *Curr. Opin. Environ. Sustain.* **2016**, *23*, 69–78. [CrossRef]
27. Park, J.; Seager, T.P.; Rao, P.S.C.; Convertino, M.; Linkov, I. Integrating risk and resilience approaches to catastrophe management in engineering systems. *Risk Anal.* **2013**, *33*, 356–367. [PubMed]
28. Molinari, D.; Menoni, S.; Aronica, G.T.; Ballio, F.; Berni, N.; Pandolfo, C.; Stelluti, M.; Minucci, G. Ex post damage assessment: An Italian experience. *Nat. Hazards Earth Syst. Sci.* **2014**, *14*, 901–916. [CrossRef]
29. Fleischhauer, M.; Greiving, S.; Wanczura, S. Natural hazards and spatial planning in Europe. *J. Environ. Plan. Manag.* **2006**, *49*, 739–757.
30. Menoni, S.; Molinari, D.; Parker, D.; Ballio, F.; Tapsell, S. Assessing multifaceted vulnerability and resilience in order to design risk-mitigation strategies. *Natural hazards* **2012**, *64*, 2057–2082. [CrossRef]

31. Weichselgartner, J.; Pigeon, P. The role of knowledge in disaster risk reduction. *Int. J. Disaster Risk Sci.* **2015**, *6*, 107–116. [CrossRef]
32. Gall, M.; Nguyen, K.H.; Cutter, S.L. Integrated research on disaster risk: Is it really integrated? *Int. J. Disaster Risk Reduct.* **2015**, *12*, 255–267. [CrossRef]
33. Poljansek, K.; Marín Ferrer, M.; De Groeve, T.; Clarck, I. *Science for Disaster Risk Management 2017: Knowing Better and Losing Less*; Publications Office of the European Union: Luxembourg, 2017.
34. European Commission. SWD, Overview of Natural and Man Made Hazards. 2020. Available online: https://op.europa.eu/en/publication-detail/-/publication/89fcf0fc-edb9-11eb-a71c-01aa75ed71a1 (accessed on 20 September 2025).
35. UNDRR. Implementation Guide for Land Use and Urban Planning. Words into Action, UN. 2020. Available online: https://www.undrr.org/words-into-action/implementation-guide-land-use-and-urban-planning (accessed on 1 June 2025).
36. Fioretti, C.; Pertoldi, M.; Busti, M.; Van Heerden, S. *Handbook of Sustainable Urban Development Strategies*; EUR 29990 EN; Publications Office of the European Union: Luxembourg, 2020; JRC118841.
37. Mitchell, J.K. Natural hazards research. In *Perspectives on Environment*; Manners, I.R., Mikesell, M.W., Eds.; Association of American Geographers: Washington, DC, USA, 1974; pp. 311–341.
38. Alexander, D.E. A survey of the field of natural hazards and disaster studies. In *Geographical Information Systems in Assessing Natural Hazards*; Carrara, A., Guzzetti, F., Eds.; Springer: Dordrecht, The Netherlands, 1995; pp. 1–19.
39. Alexander, D. The study of natural disasters, 1977–1997: Some reflections on a changing field of knowledge. *Disasters* **1997**, *21*, 284–304.
40. Kendra, J.; Nigg, J. Engineering and the social sciences: Historical evolution of interdisciplinary approaches to hazard and disaster. *Eng. Stud.* **2014**, *6*, 134–158. [CrossRef]
41. Kelman, I.; Gaillard, J.C.; Lewis, J.; Mercer, J. Learning from the history of disaster vulnerability and resilience research and practice for climate change. *Nat. Hazards* **2016**, *82*, 129–143. [CrossRef]
42. Casajus Valles, A.; Marin Ferrer, M.; Poljanšek, K.; Clark, I. (Eds.) *Science for Disaster Risk Management 2020: Acting Today, Protecting Tomorrow*; Publications Office of the European Union: Luxembourg, 2020.
43. Tricco, A.C.; Lillie, E.; Zarin, W.; O'Brien, K.K.; Colquhoun, H.; Levac, D.; Moher, D.; Peters, M.D.J.; Horsley, T.; Weeks, L.; et al. PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. *Ann. Intern. Med.* **2018**, *169*, 467–473. [CrossRef]
44. Cornish, F. Evidence synthesis in international development: A critique of systematic reviews and a pragmatist alternative. *Anthropol. Med.* **2015**, *22*, 263–277. [CrossRef]
45. Montuori, A. The complexity of transdisciplinary literature reviews. *Complicity Int. J. Complex. Educ.* **2013**, *10*, 45–55. [CrossRef]
46. Polonioli, A. In search of better science: On the epistemic costs of systematic reviews and the need for a pluralistic stance to literature search. *Scientometrics* **2020**, *122*, 1267–1274. [CrossRef]
47. Cooper, H.M. Organizing knowledge syntheses: A taxonomy of literature reviews. *Knowl. Soc.* **1988**, *1*, 104. [CrossRef]
48. Oliver-Smith, A.; Alcántara-Ayala, I.; Burton, I.; Lavell, A. *Forensic Investigations of Disasters (FORIN): A Conceptual Framework and Guide to Research*; Integrated Research on Disaster Risk: Beijing, China, 2016; p. 56.
49. Mendoza, M.T.; Schwarze, R. Sequential Disaster Forensics: A case study on direct and socio-economic impacts. *Sustainability* **2019**, *11*, 5898. [CrossRef]
50. Birkmann, J.; Welle, T. Assessing the risk of loss and damage: Exposure, vulnerability and risk to climate-related hazards for different country classifications. *Int. J. Glob. Warm.* **2015**, *8*, 191–212. [CrossRef]
51. Corbane, C.; Gamba, P.; Pesaresi, M.; Pittore, M.; Wieland, M. Current and innovative methods to define exposure. In *Science for Disaster Risk Management 2017: Knowing Better and Losing Less*; Poljansek, K., Ed.; European Commission, DG-JRC: Brussels, Belgium, 2017; pp. 59–69.
52. Gunasekera, R.; Ishizawa, O.; Aubrecht, C.; Blankespoor, B.; Murray, S.; Pomonis, A.; Daniell, J. Developing an adaptive global exposure model to support the generation of country disaster risk profiles. *Earth-Sci. Rev.* **2015**, *150*, 594–608.
53. De Bono, M.; Mora, M.G. A global exposure model for disaster risk assessment. *Int. J. DRR* **2014**, *10*, 442–451. [CrossRef]
54. Carbonara, S.; Stefano, D. Recupero edilizio, valori immobiliari e declino demografico nell'Abruzzo post-sisma 2009. In Proceedings of the 2nd International Forum of Architecture and Urbanism, Pescara, Italy, 8–10 November 2018.
55. Romao, X.; Pauperio, E. An indicator for post-disaster economic loss valuation of impacts on cultural heritage. *Int. J. Archit. Herit.* **2021**, *15*, 678–697. [CrossRef]
56. Pesaro, G. The Contribution of the Economic Thinking to Innovate DRR Policies and Action. In *Smart, Resilient and Transition Cities: Emerging Approaches and Tools for A Climate-Sensitive Urban Development*; Galderisi, A., Colucci, A., Eds.; Springer: Berlin/Heidelberg, Germany, 2018.
57. Diaz-Sarachaga, J.M.; Jato-Espino, D. Analysis of vulnerability assessment frameworks and methodologies in urban areas. *Nat. Hazards* **2020**, *100*, 437–457. [CrossRef]
58. Jurgilevich, A.; Räsänen, A.; Groundstroem, F.; Juhola, S. A systematic review of dynamics in climate risk and vulnerability assessments. *Environ. Res. Lett.* **2017**, *12*, 013002. [CrossRef]

59. Tapsell, S.; McCarthy, S.; Faulkner, H.; Alexander, M. *Social Vulnerability to Natural Hazards*; State of the Art Report from CapHaz-Net's WP4: London, UK, 2010.
60. Singh, S.R.; Eghdami, M.R.; Singh, S. The concept of social vulnerability: A review from disasters perspectives. *Int. J. Interdiscip. Multidiscip. Stud.* **2014**, *1*, 71–82.
61. Blaikie, P.; Cannon, T.; Davis, I.; Wisner, B. *At Risk: Natural Hazards, People's Vulnerability and Disasters*; Routledge: Abingdon, UK, 2014.
62. Rose, A. Economic resilience to natural and man-made disasters: Multidisciplinary origins and contextual dimensions. *Environ. Hazards* **2007**, *7*, 383–398. [CrossRef]
63. Sassen, S. *Global Networks, Linked Cities*; Routledge: Abingdon, UK, 2016.
64. Hutton, M. Neither passive nor powerless: Reframing economic vulnerability via resilient pathways. In *Consumer Vulnerability*; Routledge: Abingdon, UK, 2018; pp. 46–68.
65. Noy, I.; Yonson, R. Economic vulnerability and resilience to natural hazards: A survey of concepts and measurements. *Sustainability* **2018**, *10*, 2850. [CrossRef]
66. duPont, W., IV.; Noy, I. What happened to Kobe? A reassessment of the impact of the 1995 earthquake in Japan. *Econ. Dev. Cult. Change* **2015**, *63*, 777–812. [CrossRef]
67. Mili, R.R.; Hosseini, K.A.; Izadkhah, Y.O. Developing a holistic model for earthquake risk assessment and disaster management interventions in urban fabrics. *Int. J. DRR* **2018**, *27*, 355–365.
68. Carreño, M.L.; Cardona, O.D.; Barbat, A. Urban seismic risk evaluation: A holistic approach. *Nat. Hazards* **2007**, *40*, 137–172. [CrossRef]
69. Poudel, A.; Argyroudis, S.; Pitilakis, K. Systemic seismic risk assessment of urban healthcare system considering interdependencies to critical infrastructures. *Int. J. DRR* **2024**, *103*, 104304. [CrossRef]
70. Curt, C.; Tacnet, J.M. Resilience of critical infrastructures: Review and analysis of current approaches. *Risk Anal.* **2018**, *38*, 2441–2458. [CrossRef]
71. Galderisi, A.; Limongi, G. A comprehensive assessment of exposure and vulnerabilities in multi-hazard urban environments: A key tool for risk-informed planning strategies. *Sustainability* **2021**, *13*, 9055. [CrossRef]
72. Hart, D.E.; Pitman, S.J.; Byun, D.S. Earthquakes, coasts… and climate change? Multi-hazard opportunities, challenges and approaches for coastal cities. *J. Coast. Res.* **2020**, *95*, 819–823. [CrossRef]
73. Showalter, P.; Fran Myers, M. *Natural Disasters as the Cause of Technological Emergencies: A Review of the Decade 1980–1989*; Natural Hazard Research and Applications Center, University of Colorado: Boulder, CO, USA, 1992.
74. Cruz, A.M.; Okada, N. Methodology for preliminary assessment of Natech risk in urban areas. *Nat. Hazards* **2008**, *46*, 199–220. [CrossRef]
75. Santella, N.; Steinberg, L.J.; Sengul, H. Petroleum and hazardous material releases from industrial facilities associated with Hurricane Katrina. *Risk Anal. Int. J.* **2010**, *30*, 635–649. [CrossRef]
76. Luo, X.; Cruz, A.M.; Tzioutzios, D. Extracting Natech reports from large databases: Development of a semi-intelligent Natech identification framework. *Int. J. Disaster Risk Sci.* **2020**, *11*, 735–750. [CrossRef]
77. Gill, J.C.; Malamud, B.D. Reviewing and visualizing the interactions of natural hazards. *Rev. Geophys.* **2014**, *52*, 680–722. [CrossRef]
78. Gill, J.C.; Malamud, B.D. Hazard interactions and interaction networks (cascades) within multi-hazard methodologies. *Earth Syst. Dyn.* **2016**, *7*, 659–679. [CrossRef]
79. Zschau, J. 2.5 Where are we with multihazards, multirisks assessment capacities? Qualitative and quantitative approaches to risk assessment. In *Science for Disaster Risk Management 2017: Knowing Better and Losing Less*; Poljansek, K., Marín Ferrer, M., De Groeve, T., Clark, I., Eds.; European Commission, DG-JRC: Brussels, Belgium, 2017.
80. van Westen, C.; Woldai, T. The Riskcity training package on multi-hazard risk assessment. *Int. J. Appl. Geospat. Res.* **2012**, *3*, 41–52. [CrossRef]
81. Grünthal, G.; Thieken, A.H.; Schwarz, J.; Radtke, K.S.; Smolka, A.; Merz, B. Comparative risk assessments for the city of Cologne–storms, floods, earthquakes. *Nat. Hazards* **2006**, *38*, 21–44. [CrossRef]
82. Lyu, H.M.; Yin, Z.Y. An improved MCDM combined with GIS for risk assessment of multi-hazards in Hong Kong. *Sustain. Cities Soc.* **2023**, *91*, 104427. [CrossRef]
83. Boni, M.P.; Faiella, A.; Gazzola, V.; Pergalani, F. A multi-hazard and multi-risk assessment methodological approach to support Civil Protection planning in wide areas. *Int. J. Disaster Risk Reduct.* **2025**, *119*, 105343. [CrossRef]
84. Chang, S.E.; Yip, J.Z.; Conger, T.; Oulahen, G.; Marteleira, M. Community vulnerability to coastal hazards: Developing a typology for disaster risk reduction. *Appl. Geogr.* **2018**, *91*, 81–88. [CrossRef]
85. Hincks, S.; Carter, J.; Connelly, A. A new typology of climate risk for European cities and regions: Principles and applications. *Glob. Environ. Change* **2023**, *83*, 102767.

86. Sterzel, T.; Lüdecke, M.K.; Walther, C.; Kok, M.T.; Sietz, D.; Lucas, P.L. Typology of coastal urban vulnerability under rapid urbanization. *PLoS ONE* **2020**, *15*, e0220936. [CrossRef]
87. Tocchi, G.; Pittore, M.; Polese, M. Identifying urban and rural settlement archetypes: Clustering for enhanced risk-oriented exposure and vulnerability analysis. *NHESS* **2025**, 25. [CrossRef]
88. Menoni, S.; Boni, M.P. A systemic approach for dealing with chained damages triggered by natural hazards in complex human settlements. *Int. J. DRR* **2020**, *51*, 101751. [CrossRef]
89. Cross, J.A. Megacities and small towns: Different perspectives on hazard vulnerability. *Glob. Environ. Change Part B Environ. Hazards* **2001**, *3*, 63–80. [CrossRef]
90. Handmer, J. Natural and anthropogenic hazards in the Sydney sprawl: Is the city sustainable? In *Crucibles of Hazard: Mega-Cities and Disasters in Transition*; Mitchell, J., Ed.; UN University Press: Tokyo, Japan, 1999.
91. Galderisi, A.; Colucci, A. *Smart, Resilient and Transition Cities: Emerging Approaches and Tools for a Climate-Sensitive Urban Development*; Elsevier: Amsterdam, The Netherlands, 2019.
92. Vogel, C.; Susanne, C.M.; Roger, E.K.; Geoffrey, D.D. Linking vulnerability, adaptation, and resilience science to practice: Pathways, players and partnerships 1. In *Integrating Science and Policy*; Routledge: Abingdon, UK, 2012; pp. 97–127.
93. Glaas, E.; Jonsson, A.; Hjerpe, M.; Andersson-Skold, Y. Managing climate change vulnerabilities: Formal institutions and knowledge use as determinants of adaptive capacity at the local level in Sweden, Local Environment. *Int. J. Justice Sustain.* **2010**, *15*, 525–539. [CrossRef]
94. Thomalla, F.; Downing, T.; Spanger-Siegfried, E.; Han, G.; Rockström, J. Reducing hazard vulnerability: Towards a common approach between DRR and climate adaptation. *Disasters* **2006**, *30*, 39–48. [CrossRef]
95. Baggio, J.A.; Brown, K.; Hellebrandt, D. Boundary object or bridging concept? A citation network analysis of resilience. *Ecol. Soc.* **2015**, 20. [CrossRef]
96. Rana, I.A. Disaster and climate change resili-ence: A bibliometric analysis. *Int. J. Disaster Risk Reduct.* **2020**, *50*, 101839. [CrossRef]
97. Norris, F.; Stevens, S.; Pfefferbaum, B.; Wyche, K.; Pfefferbaum, R. Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness. *Am. J. Community Psychol.* **2008**, *41*, 127–150. [CrossRef]
98. Graveline, M.H.; Germain, D. Disaster risk resilience: Conceptual evolution, key issues, and opportunities. *Int. J. Disaster Risk Sci.* **2022**, *13*, 330–341. [CrossRef]
99. Kosovac, A.; Logan, T.M. Resilience: Lessons to be learned from safety and acceptable risk. *J. Saf. Sci. Resil.* **2021**, *2*, 253–257. [CrossRef]
100. Manyena, S.B. The concept of resilience revisited. *Disasters* **2006**, *30*, 434–450. [CrossRef]
101. Davoudi, S.; Shaw, K.; Haider, L.J.; Quinlan, A.E.; Peterson, G.D.; Wilkinson, C.; Fünfgeld, H.; McEvoy, D.; Porter, L.; Davoudi, S. Resilience: A bridging concept or a dead end? Reframing resilience: Challenges for planning theory and practice interacting traps: Resilience assessment of a pasture management system in Northern Afghanistan urban resilience: What does it mean in planning practice? Resilience as a useful concept for CCA? The politics of resilience for planning: A cautionary note: Edited by Simin Davoudi and Libby Porter. *Plan. Theory Pract.* **2012**, *13*, 299–333.
102. Bruneau, M.; Chang, S.E.; Eguchi, R.T.; Lee, G.C.; O'Rourke, T.D.; Reinhorn, A.M.; Shinozuka, M.; Tierney, K.; Wallace, W.A.; Von Winterfeldt, D. A framework to quantitatively assess and enhance the seismic resilience of communities. *Earthq. Spectra* **2003**, *19*, 733–752. [CrossRef]
103. Carpenter, S.; Walker, B.; Anderies, J.M.; Abel, N. From metaphor to measurement: Resilience of what to what? *Ecosystems* **2001**, *4*, 765–781. [CrossRef]
104. Gunderson, L.H.; Holling, C.S. *Panarchy: Understanding Transformations in Human and Natural Systems*; Island Press: Washington, DC, USA, 2002.
105. Rus, K.; Kilar, V.; Koren, D. Resilience assessment of complex urban systems to natural disasters: A new literature review. *Int. J. DRR* **2018**, *31*, 311–330. [CrossRef]
106. Sharifi, A. A critical review of selected tools for assessing community resilience. *Ecol. Indic.* **2016**, *69*, 629–647. [CrossRef]
107. Speranza, C.I.; Wiesmann, U.; Rist, S. An indicator framework for assessing livelihood resilience in the context of social–ecological dynamics. *Glob. Environ. Change* **2014**, *28*, 109–119. [CrossRef]
108. Harrison, C.G.; Williams, P.R. A systems approach to natural disaster resilience. *Simul. Model. Pract. Theory* **2016**, *65*, 11–31. [CrossRef]
109. Ribeiro, P.J.; Gonçalves, L.A. Urban resilience: A conceptual framework. *Sustain. Cities Soc.* **2019**, *50*, 101625. [CrossRef]
110. Da Silva, J.; Kernaghan, S.; Luque, A. A systems approach to meeting the challenges of urban climate change. *Int. J. Urban Sustain. Dev.* **2012**, *4*, 125–145. [CrossRef]
111. King, D.; Gurtner, Y.; Firdaus, A.; Harwood, S.; Cottrell, A. Land use planning for DRR and CCA: Operationalizing policy and legislation at local levels. *Int. J. Disaster Resil. Built Environ.* **2016**, *7*, 158–172. [CrossRef]
112. Kwok, A.O. *Natural Disasters and Supply Chain Disruption in Southeast Asia*; Neilson Journals Publishing: Edinburgh, UK, 2018.

113. Crosta, G.B.; Dal Negro, P.J.N.H. Observations and modelling of soil slip-debris flow initiation processes in pyroclastic deposits: The Sarno 1998 event. *Nat. Hazards Earth Syst. Sci.* **2003**, *3*, 53–69. [CrossRef]
114. Béné, C. Towards a Quantifiable Measure of Resilience. *IDS Work. Pap.* **2013**, *2013*, 1–27. [CrossRef]
115. Chen, C.; Xu, L.; Zhao, D.; Xu, T.; Lei, P. A new model for describing the urban resilience considering adaptability, resistance and recovery. *Saf. Sci.* **2020**, *128*, 104756. [CrossRef]
116. Bhreasai, A.N.; Persson, E. Measuring Resilience. A Guide to Tracking Progress. 2023. Available online: https://www.arup.com (accessed on 1 July 2024).
117. Correa, E.; Ramírez, F.; Sanahuja, H. *Populations at Risk of Disaster: A Resettlement Guide*; The World Bank, GFDRR: Washington, DC, USA, 2011.
118. Henry, D.; Ramirez-Marquez, J.E. Generic metrics and quantitative approaches for system resilience as a function of time. *Reliab. Eng. Syst. Saf.* **2012**, *99*, 114–122. [CrossRef]
119. Gonzalez-Quintero, C.; Avila-Foucat, V.S. Operationalization and measurement of social-ecological resilience: A systematic review. *Sustainability* **2019**, *11*, 6073. [CrossRef]
120. Linkov, I.; Eisenberg, D.A.; Bates, M.E.; Chang, D.; Convertino, M.; Allen, J.H.; Flynn, S.E.; Seager, T.P. *Measurable Resilience for Actionable Policy*; ACS Publications: Washington, DC, USA, 2013.
121. Fox-Lent, C.; Linkov, I. Resilience matrix for comprehensive urban resilience planning. In *Resilience-Oriented Urban Planning: Theoretical and Empirical Insights*; Springer: Berlin/Heidelberg, Germany, 2018; pp. 29–47.
122. Brandt, S.A.; Lim, N.J.; Colding, J.; Barthel, S. Mapping flood risk uncertainty zones in support of urban resilience planning. *Urban Plan.* **2021**, *6*, 258–271. [CrossRef]
123. Cariolet, J.M.; Vuillet, M.; Diab, Y. Mapping urban resilience to disasters–A review. *Sustain. Cities Soc.* **2019**, *51*, 101746.
124. Arvidsson, B.; Johansson, J.; Guldåker, N. Critical infrastructures, geographical information science and risk governance: A systematic cross-field review. *Reliab. Eng. Syst. Saf.* **2021**, *213*, 107741. [CrossRef]
125. Schotten, R.; Mühlhofer, E.; Chatzistefanou, G.A.; Bachmann, D.; Chen, A.S.; Koks, E.E. Data for critical infrastructure network modelling of natural hazard impacts: Needs and influence on model characteristics. *Resilient Cities Struct.* **2024**, *3*, 55–65. [CrossRef]
126. Galderisi, A.; Altay-Kaya, D. A New Framework for a Resilience-Based Disaster Risk Management. In *Handbook of DRR for Resilience: New Frameworks for Building Resilience to Disasters*; Springer International Publishing: Cham, Switzerland, 2021; pp. 131–156.
127. Jabareen, Y.; Jabareen, Y. The risk city resilience trajectory. In *The Risk City: Cities Countering Climate Change: Emerging Planning Theories and Practices around the World*; Springer: Berlin/Heidelberg, Germany, 2015; pp. 137–159.
128. Strunz, S. Is conceptual vagueness an asset? Arguments from philosophy of science applied to the concept of resilience. *Ecol. Econ.* **2012**, *76*, 112–118. [CrossRef]
129. Peek, L.; Tobin, J.; Adams, R.M.; Wu, H.; Mathews, M.C. A framework for convergence research in the hazards and disaster field: The natural hazards engineering research infrastructure CONVERGE facility. *Front. Built Environ.* **2020**, *6*, 110. [CrossRef]
130. Godschalk, D.R. Urban hazard mitigation: Creating resilient cities. *Nat. Hazards Rev.* **2003**, *4*, 136–143. [CrossRef]
131. Chmutina, K.; Bosher, L.; Coaffee, J.; Rowlands, R. Towards integrated security and resilience framework: A tool for decision-makers. *Procedia Econ. Financ.* **2014**, *18*, 25–32.
132. Jha, A.K.; Miner, T.W.; Stanton-Geddes, Z. *Building Urban Resilience: Principles, Tools, and Practice*; World Bank Publications: Washington, DC, USA, 2013.
133. Wamsler, C. Planning ahead: Adapting settlements before disasters strike. In *Hazards and the Built Environment*; Routledge: Abingdon, UK, 2008; pp. 318–354.
134. Fang, X.; Li, J.; Ma, Q. Integrating green infrastructure, ecosystem services and nature-based solutions for urban sustainability: A comprehensive literature review. *Sustain. Cities Soc.* **2023**, *98*, 104843. [CrossRef]
135. Oral, H.V.; Carvalho, P.; Gajewska, M.; Ursino, N.; Masi, F.; van Hullebusch, E.D.; Kazak, J.K.; Exposito, A.; Cipolletta, G.; Andersen, T.R.; et al. A review of nature-based solutions for urban water management in European circular cities: A critical assessment based on case studies and literature. *Blue-Green Syst.* **2020**, *2*, 112–136. [CrossRef]
136. Dhyani, S.; Singh, S.; Basu, M.; Dasgupta, R.; Santhanam, H. Blue-green infrastructure for addressing urban resilience and sustainability in the warming world. In *Blue-Green Infrastructure Across Asian Countries: Improving Urban Resilience and Sustainability*; Springer: Singapore, 2022; pp. 1–22.
137. Depietri, Y.; McPhearson, T. Integrating the grey, green, and blue in cities: Nature-based solutions for climate change adaptation and risk reduction. In *Nature-Based Solutions to Climate Change Adaptation in Urban Areas: Linkages Between Science, Policy and Practice*; Springer: Cham, Switzerland, 2017; pp. 91–109.
138. Esraz-Ul-Zannat, M.; Dedekorkut-Howes, A.; Morgan, E.A. A review of nature-based infrastructures and their effectiveness for urban flood risk mitigation. *Wiley Interdiscip. Rev. Clim. Change* **2024**, *15*, e889. [CrossRef]

139. Shaw, R. Post disaster recovery: Issues and challenges. In *Disaster Recovery: Used or Misused Development Opportunity*; Springer: Berlin/Heidelberg, Germany, 2014; pp. 1–13.
140. March, A.; Kornakova, M. *Urban Planning for Disaster Recovery*; Butterworth Heinemann, Elsevier: Amsterdam, The Netherlands, 2017.
141. Vale, L.J.; Campanella, T.J. *The Resilient City: How Modern Cities Recover from Disaster*; Oxford University Press: New York, NY, USA, 2005.
142. Clemente, M.; Salvati, L. Interrupted landscapes: Post-earthquake reconstruction in between Urban renewal and social identity of local communities. *Sustainability* **2017**, *9*, 2015. [CrossRef]
143. Wamsler, C.; Brink, E.; Rivera, C. Planning for climate change in urban areas: From theory to practice. *J. Clean. Prod.* **2013**, *50*, 68–81. [CrossRef]
144. Meerow, S.; Mitchell, C.L. Weathering the storm: The politics of urban CCA planning. *Environ. Plan. A Econ. Space* **2017**, *49*, 2619–2627. [CrossRef]
145. Rosenzweig, C.; Solecki, W. Hurricane Sandy and adaptation pathways in New York: Lessons from a first-responder city. *Glob. Environ. Change* **2014**, *28*, 395–408. [CrossRef]
146. Finn, D.; Chandrasekhar, D.; Xiao, Y. A region recovers: Planning for resilience after superstorm Sandy. *J. Plan. Educ. Res.* **2023**, *43*, 136–149. [CrossRef]
147. Grove, K.; Rickards, L.; Wakefield, S. Becoming non-commensurable: Synthesis, design, and the politics of urban experimentation in post-Superstorm Sandy New York. *Sustain. Sci. Pract. Policy* **2023**, *19*, 2225339. [CrossRef]
148. Francini, M.; Gaudio, S.; Palermo, A.; Viapiana, M.F. A performance-based approach for innovative emergency planning. *Sustain. Cities Soc.* **2020**, *53*, 101906. [CrossRef]
149. Gonzalez-Mathiesen, C.; Ruane, S.; March, A. Integrating wildfire risk management and spatial planning–A historical review of two Australian planning systems. *Int. J. DRR* **2021**, *53*, 101984. [CrossRef]
150. Francini, M.; Palermo, A.; Viapiana, M.F. Il piano di emergenza nell'uso e nella gestione del territorio. In Proceedings of the Convegno Scientifico Società Italiana Degli Urbanisti-Università Della Calabria, Rende, Italy, 22–23 November 2019.
151. Dolce, M.; Speranza, E.; Bocchi, F.; Conte, C. The method I. OPà. CLE for the formulation and calculation of structural operational efficiency indices for the assessment of emergency limit conditions. In Proceedings of the ANIDIS Pistoia Conference, Pistoia, Italy, 17–21 September 2017; pp. 2–13.
152. Galderisi, A.; Menoni, S.; Setti, G.; Tognon, A. Disaster Recovery Reform and Resilience. In *DRR for Resilience: Disaster and Social Aspects*; Springer International Publishing: Cham, Switzerland, 2022; pp. 25–54.
153. Finucane, M.L.; Acosta, J.; Wicker, A.; Whipkey, K. Short-term solutions to a long-term challenge: Rethinking disaster recovery planning to reduce vulnerabilities and inequities. *Int. J. Environ. Res. Public Health* **2020**, *17*, 482. [CrossRef] [PubMed]
154. Edgington, D.W. *Reflections on the Hanshin Earthquake of 1995 and the Reconstruction of Kobe, Japan*; Daly, P., Feener, R.M., Eds.; Cambridge University Press: Cambridge, UK, 2016; pp. 108–140.
155. Daly, P.; Mahdi, S.; McCaughey, J.; Mundzir, I.; Halim, A.; Srimulyani, E. Rethinking relief, reconstruction and development: Evaluating the effectiveness and sustainability of post-disaster livelihood aid. *Int. J. DRR* **2020**, *49*, 101650. [CrossRef]
156. Horney, J.; Dwyer, C.; Aminto, M.; Berke, P.; Smith, G. Developing indicators to measure post-disaster community recovery in the United States. *Disasters* **2017**, *41*, 124–149. [CrossRef]
157. Kim, K.; Olshansky, R.B. The theory and practice of building back better. *J. Am. Plan. Assoc.* **2014**, *80*, 289–292. [CrossRef]
158. Hemmati, M.; Kornhuber, K.; Kruczkiewicz, A. Enhanced urban adaptation efforts needed to counter rising extreme rainfall risks. *NPJ Urban Sustain.* **2022**, *2*, 16. [CrossRef]
159. Raju, E.; Boyd, E.; Otto, F. Stop blaming the climate for disasters. *Commun. Earth Environ.* **2022**, *3*, 1. [CrossRef]
160. Lahsen, M.; Ribot, J. Politics of attributing extreme events and disasters to climate change. *Wiley Interdiscip. Rev. Clim. Change* **2022**, *13*, e750. [CrossRef]
161. Rentschler, J.; Avner, P.; Marconcini, M.; Su, R.; Strano, E.; Vousdoukas, M.; Hallegatte, S. Global evidence of rapid urban growth in flood zones since 1985. *Nature* **2023**, *622*, 87–92. [CrossRef]
162. Shamsuddin, S. Resilience resistance: The challenges and implications of urban resilience implementation. *Cities* **2020**, *103*, 102763. [CrossRef]
163. Corrêa do Lago, A.; Sánchez Chaparro, T.; Lumbreras, J. A Decade of Climate Action and the Mission towards Climate Neutrality and Adaptation in European Cities: Delivering Urban Transformations? *Sustainability* **2023**, *15*, 16665. [CrossRef]
164. Hartmann, T. *Clumsy Floodplains: Responsive Land Policy for Extreme Floods*; Routledge: Abingdon, UK, 2016.
165. O'Sullivan, F.; Mell, I.; Clement, S. Novel solutions or rebranded approaches: Evaluating the use of nature-based solutions (NBS) in Europe. *Front. Sustain. Cities* **2020**, *2*, 572527. [CrossRef]
166. Olazabal, M.; De Gopegui, M.R. Adaptation planning in large cities is unlikely to be effective. *Landsc. Urban Plan.* **2021**, *206*, 103974. [CrossRef]

167. Reckien, D.; Salvia, M.; Heidrich, O.; Church, J.M.; Pietrapertosa, F.; De Gregorio-Hurtado, S.; d'Alonzo, V.; Foley, A.; Simoes, S.G.; Lorencová, E.K.; et al. How are cities planning to respond to climate change? Assessment of local climate plans from 885 cities in the EU-28. *J. Clean. Prod.* **2018**, *191*, 207–219. [CrossRef]
168. Fünfgeld, H.; Fila, D.; Dahlmann, H. Upscaling climate change adaptation in small-and medium-sized municipalities: Current barriers and future potentials. *Curr. Opin. Environ. Sustain.* **2023**, *61*, 101263. [CrossRef]
169. Platt, R.H. *Disasters and Democracy: The Politics of Extreme Natural Events*; Island Press: Washington, DC, USA, 2012.
170. Coaffee, J.; Therrien, M.C.; Chelleri, L.; Henstra, D.; Aldrich, D.P.; Mitchell, C.L. Urban resilience implementation: A policy challenge and research agenda for the 21st century. *J. Contingencies Crisis Manag.* **2018**, *26*, 403–410. [CrossRef]
171. Hölscher, K.; Frantzeskaki, N.; McPhearson, T.; Loorbach, D. Tales of Transforming Cities: Transformative Climate Governance Capacities in New York City, U.S. and Rotterdam, Netherlands. *J. Environ. Manag.* **2019**, *231*, 843–857. [CrossRef]
172. Booth, L.; Schueller, L.A.; Scolobig, A.; Marx, S. Stakeholder solutions for building interdisciplinary and international synergies between CCA and DRR. *Int. J. DRR* **2020**, *46*, 101616.
173. Forino, G.; von Meding, J.; Brewer, G.J. A conceptual governance framework for climate change adaptation and disaster risk reduction integration. *Int. J. Disaster Risk Sci.* **2015**, *6*, 372–384. [CrossRef]
174. Aziz, F.; Wang, X.; Mahmood, M.Q.; Awais, M.; Trenouth, B. Coastal urban flood risk management: Challenges and opportunities—A systematic review. *J. Hydrol.* **2024**, *645*, 132271. [CrossRef]
175. Djalante, R. Adaptive governance and resilience: The role of multi-stakeholder platforms in DRR. *Nat. Hazards Earth Syst. Sci.* **2012**, *12*, 2923–2942. [CrossRef]
176. Calabresi, G.; Bobbitt, P. *Tragic Choices*; WW Norton & Co: New York, NY, USA, 1978.
177. Soltesova, K.; Brown, A.; Dayal, A.; Dodman, D. Community participation in urban adaptation to climate change: Potential and limits for community-based adaptation approaches. In *Community-Based Adaptation to Climate Change*; Routledge: Abingdon, UK, 2014; pp. 214–225.
178. Cloutier, G.; Joerin, F.; Dubois, C.; Labarthe, M.; Legay, C.; Viens, D. Planning adaptation based on local actors' knowledge and participation: A climate governance experiment. *Clim. Policy* **2015**, *15*, 458–474.
179. Warner, J.; Edelenbos, J.; van Buuren, A. *Space for the River Governance Experiences with Multifunctional River Flood Management in the US and Europe*; IWA Publishing: London, UK, 2012.
180. Wamsler, C.; Alkan-Olsson, J.; Björn, H.; Falck, H.; Hanson, H.; Oskarsson, T.; Simonsson, E.; Zelmerlow, F. Beyond participation: When citizen engagement leads to undesirable outcomes for nature-based solutions and CCA. *Clim. Change* **2020**, *158*, 235–254. [CrossRef]
181. Platt, R.H. Land Use and Society: Fundamentals and Issues. In *Land Use and Society: Geography, Law, and Public Policy*; Island Press: Washington, DC, USA, 2014; pp. 13–39.
182. Reale, A.; Handmer, J. Land tenure, disasters and vulnerability. *Disasters* **2011**, *35*, 160–182. [CrossRef]
183. Hepperle, E.; Dixon-Gough, R.; Mansberger, R.; Paulsson, J.; Hernik, J.; Kalbro, T. *Land Development Strategies: Patterns, Risks, and Responsibilities*; Hepperle, E., Lenk, H., Eds.; Vdf Hochschulverlag: Zollikon, Switzerland, 2009.
184. Daniel, D.; Sutherland, M.; Soeranza, C.I. The role of tenure documents for livelihood resilience in Trinidad and Tobago. *Land Use Policy* **2019**, *87*, 104008. [CrossRef]
185. Handmer, J.W. Flood policy reversal in Australia. *Disasters* **1985**, *9*, 279–285. [CrossRef] [PubMed]
186. May, P.J.; Deyle, R.E. Governing land use in hazardous areas with a patchwork system. In *Cooperating with Nature: Confronting Natural Hazards with Land-Use Planning for Sustainable Communities*; Burby, R.J., Ed.; Joseph Henry Press: Washington, DC, USA, 1998; pp. 57–82.
187. Platt, R.H.; Dawson, A.D. *The Taking Issue and the Regulation of Hazardous Areas*; Natural Hazards Research Working Paper n. 95; Natural Hazards Research and Applications Information Center, Institute of Behavioral Science, University of Colorado: Boulder, CO, USA, 1997.
188. Raška, P.; Bezak, N.; Ferreira, C.S.; Kalantari, Z.; Banasik, K.; Bertola, M.; Bourke, M.; Cerdà, A.; Davids, P.; de Brito, M.M.; et al. Identifying barriers for nature-based solutions in flood risk management: An interdisciplinary overview using expert community approach. *J. Environ. Manag.* **2022**, *310*, 114725. [CrossRef] [PubMed]
189. Alterman, R.; Pellach, C. *Regulating Coastal Zones: International Perspectives on Land Management Instruments*; Taylor & Francis: Abingdon, UK, 2021; p. 456.
190. Mitchell, D.; Myers, M.; Grant, D. Land Valuation: Key Tool for Disaster Risk Management. *Land Tenure J.* **2014**, *1*.
191. Hooijer, A.; Klijn, F.; Pedroli, G.B.M.; Van Os, A.G. Towards sustainable flood risk management in the Rhine and Meuse river basins: Synopsis of the findings of IRMA-SPONGE. *River Res. Appl.* **2004**, *20*, 343–357. [CrossRef]
192. Burby, R.J.; Dalton, L.C. Plans can matter! The role of land use plans and state planning mandates in limiting the development of hazardous areas. *Public Adm. Rev.* **1994**, *54*, 229–238. [CrossRef]
193. Hills, R.M., Jr.; Schleicher, D. Building Coalitions Out of Thin Air: Transferable Development Rights and Constituency Effects in Land Use Law. *J. Leg. Anal.* **2020**, *12*, 79–135. [CrossRef]

194. Orr, A.M.; Stewart, J.L.; Jackson, C.; White, J.T. Ownership diversity and fragmentation: A barrier to urban centre resilience. *Environ. Plan. B: Urban Anal. City Sci.* **2023**, *50*, 660–677. [CrossRef]
195. Duy, P.; Tight, M.; Chapman, L.; Linh, P.; Thuong, L. Increasing vulnerability to floods in new development areas: Evidence from Ho Chi Minh City. *Int. J. Clim. Change Strateg. Manag.* **2017**, *10*, 197–212. [CrossRef]