Integrating Disaster Risk Reduction and Adaptation for Urban Climate Resilience: Theoretical Evolution, Analytical Frameworks, and Planning Comparisons

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Abstract
Disaster risk reduction (DRR) and climate change adaptation (CCA) are two major domains through which cities respond to climate-related hazards. Although they share important synergies, their integration is still constrained by differences in paradigms, technical approaches, and institutional arrangements. By comparing the conceptual evolution of DRR and CCA and introducing resilience as an integrative lens, this study develops an analytical framework for urban climate resilience and examines climate-resilience-related plans in 18 coastal megacities. The analysis shows that resilience can bridge DRR and CCA by strengthening urban capacities to maintain essential functions, recover rapidly, and adapt through self-organization, while also enabling spatial reconfiguration and long-term transformation through cross-scale coordination and resource flows. Urban climate resilience is expressed through five mutually connected domains: physical, informational, cognitive, social, and spatial. These domains can be organized across three levels: theoretical foundations, basic principles, and practical applications embedded in the adaptive-cycle model. A comparative review of plans shows that "safety" is the shared goal, while "infrastructure" is the most prominent strategic field. Urban climate resilience planning should therefore balance short-term recovery with long-term adaptive transformation.

Keywords
disaster risk reduction; climate change adaptation; coastal megacities; urban climate resilience

Introduction

Climate change has evolved from a problem of global warming into a climate crisis affecting billions of people. Cities are not only engines of economic prosperity and major contributors to climate change, but also key arenas for climate solutions [1]. In this context, disaster risk reduction, rooted in disaster governance, and climate change adaptation, rooted in climate policy, have become the two principal approaches through which cities respond to climate-related hazard risks [2].

DRR and CCA share clear areas of overlap, but their integration remains difficult. At the policy level, DRR is guided by the Sendai Framework, while the climate agenda has developed mainly through the United Nations Framework Convention on Climate Change and its mitigation-adaptation framework. At the technical level, DRR and CCA differ in risk assessment tools, data systems, and operational language. Even the term "mitigation" carries different meanings: in climate policy it refers to reducing greenhouse-gas emissions, whereas in disaster studies it refers to reducing the adverse impacts of hazards. At the institutional level, the two agendas are often assigned to different administrative systems. Yet both seek to reduce vulnerability, limit losses, and enhance recovery capacity. Resilience therefore offers a possible bridge between them.

This article first reviews the conceptual evolution of DRR and CCA and then explains how resilience can integrate them. It further clarifies the conceptual meaning, process domains, and theoretical hierarchy of urban climate resilience. Finally, it compares relevant plans from 18 coastal megacities in terms of risk types, planning goals and strategies, and action priorities, with the aim of constructing an integrated planning logic for urban climate resilience.

1. Conceptual Evolution of DRR and Adaptation and Their Integration Through Resilience

1.1 Conceptual Evolution of Disaster Risk Reduction

DRR aims to reduce the adverse impacts of hazardous events and to limit losses of life, assets, and social functions [3-4]. Over the past three decades, the outcomes of the World Conferences on Disaster Reduction have shaped its conceptual trajectory. The 1994 Yokohama Strategy called for integrating disaster-prevention, early-warning, and response mechanisms into national policy [5]. The 2005 Hyogo Framework advanced the integration of DRR into governmental strategies and plans and emphasized community resilience [6]. The 2015 Sendai Framework, the current global agenda, further defined measurable targets, strengthened the multidimensional socioeconomic meaning of resilience, and proposed four priorities: understanding disaster risk, strengthening disaster-risk governance, investing in DRR, and "Build Back Better" in recovery, rehabilitation, and reconstruction [7].

Accordingly, the DRR paradigm has shifted from disaster management in the 1990s, which emphasized emergency response during disasters, to risk management in the early twenty-first century, which emphasized prevention before disasters, and then to resilience governance since the 2010s, which stresses systemic capacities for resistance, absorption, recovery, and transformation [8].

1.2 Conceptual Evolution of Adaptation

Adaptation refers to adjustments made by natural or human systems in response to actual or expected climate change and its impacts. Since the 1992 UNFCCC, adaptation has gradually been established as a key response pathway. The early climate agenda focused mainly on mitigation, but after the 2007 Bali Road Map, mitigation and adaptation came to be treated as parallel pillars [8]. The IPCC Special Report on Managing the Risks of Extreme Events and Disasters, published in 2012, established the now classical risk-assessment framework in which risk is shaped by hazard, exposure, and vulnerability [9]. The 2015 Paris Agreement further set a global goal on adaptation, centered on enhancing adaptive capacity, strengthening resilience, and reducing vulnerability [10].

Adaptation strategies have expanded from autonomous and sectoral responses to community-based, ecosystem-based, evolutionary, incremental, and transformational adaptation [11]. In the Anthropocene and under conditions of climate crisis, adaptation is increasingly characterized by contextuality, social learning, and attention to justice.

1.3 Resilience Theory for Integrating DRR and Adaptation

Knowledge-cluster analyses show that DRR and CCA differ in paradigms, methods, and institutions. DRR tends to adopt a positivist understanding of risk as an objective reality, whereas CCA pays greater attention to social construction, knowledge co-production, social context, and climate justice [12-13]. Technically, DRR often relies on quantitative deduction, weighted overlay, and model simulation [14-15], while CCA frequently uses qualitative induction, interviews, surveys, and policy-text analysis [13,16-17]. Institutionally, administrative specialization separates the two fields. In China, for instance, national DRR planning is led by emergency-management authorities, whereas climate adaptation planning is led by ecological and environmental authorities; this parallel structure is reproduced at the urban scale [18-19]. Even so, DRR and CCA overlap in several respects. Both address hazardous impacts, including losses of assets caused by extreme weather; both target short-term shocks and long-term stresses; and both promote social participation within a broader sustainable-development agenda [20]. Since Holling defined resilience in 1973 as the capacity of a system to absorb disturbance and recover while maintaining essential functions [21], the concept has developed through engineering, ecological, and evolutionary interpretations [22]. Its transformative orientation allows it to go beyond the limits of both DRR and CCA [23].

Resilience helps overcome the uncertainty constraints of conventional DRR. Traditional DRR is effective for known and recurring hazards, but it often depends on detailed risk calculation and may leave substantial residual risk when unexpected shocks occur [24]. A resilience approach instead improves overall robustness and recovery capacity without requiring the precise prediction of every possible hazard [25]. Resilience also internalizes and balances adaptive capacity. If adaptation focuses too narrowly on specific hazards, such as intensive intervention against forest fires, it may reduce systemic diversity and flexibility and create negative cross-domain effects [26]. Resilience emphasizes long-term flexibility rather than short-term specialization [27], and requires both social coping capacity and the active shaping of ecosystem dynamics [28]. Collective action enhances resilience; when existing arrangements become unsustainable, transformative capacity supports fundamental system change [29].

2. An Analytical Framework for Urban Climate Resilience

2.1 Conceptual Meaning of Urban Climate Resilience

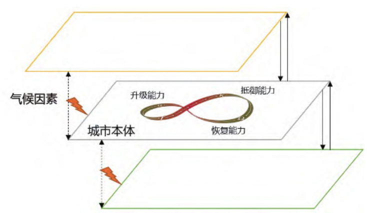
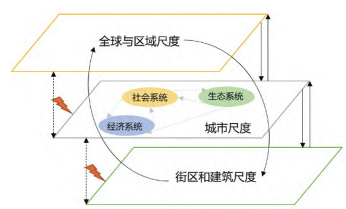
Existing studies use two related perspectives. The first, "urban resilience in climate change," treats climate change as an external disturbance and focuses on the city's overall capacities for resistance, rapid recovery, learning, and upgrading [30]. The second, "climate resilience in cities," treats climate change as a long-term background trend and examines how social, economic, and ecological subsystems within cities respond, reorganize, and transform [31]. The former emphasizes rapid local recovery, whereas the latter stresses long-term transformation and cross-scale interaction.

Urban climate resilience can therefore be understood as the capacity of a city, under the impacts of climate change, to maintain essential functions and recover quickly through self-organization, and to achieve reorganization, transformation, and evolutionary development across spatial scales through coordination among internal subsystems. It is a dynamic rather than static property, marked by long-term transformation and cross-scale interaction.

Table 1. Comparison of Conceptual Frameworks for Urban Climate Resilience

Comparison dimension	Urban resilience in climate change	Climate resilience in cities
Research perspective	External disturbance and rapid recovery: climate change is treated as a disturbance to the city, with attention to how relevant factors affect resistance, recovery, and upgrading.	System adaptation and long-term transformation: climate change is treated as a background trend, with attention to how social, economic, and ecological systems respond within cities.
Capacity focus	Resistance, recovery, and upgrading.	Adaptation, learning, and transformation.

Subject of resilience	The city as a whole.	Subsystems located at the urban scale.
Spatiotemporal dimension	Short-term rapid recovery and local characteristics.	Long-term transformation and scalar interaction.
Essence of resilience	An inherent anti-disturbance property of the city.	Response and reorganization among urban subsystems.

内涵比较	气候变化中的城市韧性	城市中的气候韧性
研究视角	外部干扰与快速复原——将气候变化视为对城市韧性的外部扰动因素，关注这些因素如何影响城市	系统适应与长期转型——将气候变化视为背景趋势，关注社会、经济和生态系统在城市中如何应对气候变化
能力侧重	抵御、恢复和升级能力	适应、学习和转型能力
韧性主体	城市整体	位于城市尺度中的子系统
时空维度	短期快速复原和地方特性	长期转型和尺度交互
韧性本质	城市自身固有的抗扰动属性	各子系统在城市中的响应与重组
概念图示		

2.2 Process Domains of Urban Climate Resilience That Internalize DRR and Adaptation

Resilience is not itself a normative objective; as a systemic property, it can be expressed in different process domains [32]. Process domains are functional subsystems through which resilience is transmitted and realized. Internalization means that temporary external policy instructions are transformed into endogenous properties of urban subsystems.

The process domains of urban climate resilience are therefore the functional spaces in which DRR and CCA can operate synergistically. Once embedded in these domains, cities acquire dynamic capacities to respond to climate-related hazards. When destructive weather events occur, different domains may face similar impacts but follow different pathways toward resilience. An integrated process-domain analysis can therefore maximize whole-system resilience [33].

Five domains are particularly important. The physical domain concerns infrastructure and lifeline systems. The informational domain concerns data creation, processing, and storage. The cognitive domain concerns psychological preparedness, risk perception, and values. The social domain concerns interaction, collaboration, and self-synchronization among individuals and organizations. The spatial domain concerns multifunctional mixing, flexible zoning, and the reconfiguration of urban form.

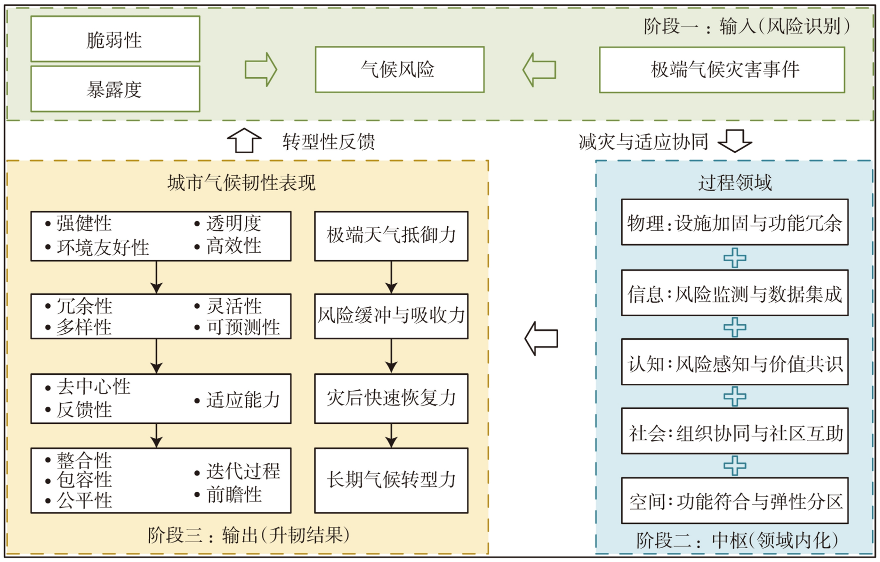


Figure 1. Process-Domain Framework of Urban Climate Resilience

The framework begins with input and risk identification, including climate risks, extreme climate-hazard events, hazards, vulnerability, and exposure. It then moves through domain internalization: physical reinforcement and functional redundancy; information-based risk monitoring and data integration; cognitive risk perception and value consensus; social organizational coordination and community mutual aid; and spatial multifunctionality and flexible zoning. The output is resilience enhancement, expressed as resistance to extreme weather, buffering and absorption of risk, rapid post-disaster recovery, and long-term climate transformation. These outcomes depend on robustness, environmental friendliness, redundancy, diversity, decentralization, feedback, integration, inclusion, equity, transparency, efficiency, flexibility, predictability, adaptability, and foresight. Through the evolutionary pathway of resistance, absorption, recovery, and transformation, social networks and cognitive domains produce social learning through feedback mechanisms, drive institutional change, and enable cities to respond dynamically to both short-term shocks and long-term stresses [34].

2.3 An Urban Climate Resilience Framework Embedded in the Adaptive Cycle

The adaptive-cycle model describes the dynamic evolution of complex systems through four recurring stages: exploitation or development (r), conservation (K), release (Ω), and reorganization (α). Embedding this model into urban climate resilience provides a unified temporal logic for DRR and adaptation. DRR primarily operates in the anti-disturbance transition from conservation to release, whereas adaptation focuses on the transition from release to reorganization and into a new phase of exploitation or development.

This framework is realized through three nested levels. The first is the theoretical-foundation level. It differentiates the core concepts, analytical methods, and temporal frameworks of DRR and CCA, and establishes the adaptive cycle as a temporal framework for integrating fragmented actions. In this view, DRR and CCA are not isolated events but coordinated responses across different evolutionary stages. Urban climate resilience is not merely static defensive capacity; it is a dynamic evolutionary property realized through continuous social learning [35].

The second is the basic-principles level. It organizes the multidisciplinary foundations of urban climate resilience, including complex-systems theory, risk-society theory, system dynamics, environmental science, ecology, emergency management, and urban disaster-prevention planning. These theoretical foundations support the operation of the adaptive cycle in complex urban environments and provide principles for constructing technical pathways.

The third is the practical-application level. Centered on the "urban resilience-enhancement cycle for climate change," it uses scenario simulation, risk identification, process mechanisms, and resilience strategies to formulate action pathways for responding to climate-hazard risks. Risk identification detects the possibility of accumulated climate hazards in urban systems. Resilience-mechanism analysis identifies structural barriers in the conservation phase. Scenario simulation predicts possible release-stage risks under different carbon-emission and urban-development scenarios. Resilience strategies then drive the system through reorganization and into a higher level of development, producing a spiral enhancement of urban climate resilience through spatial-governance tools.

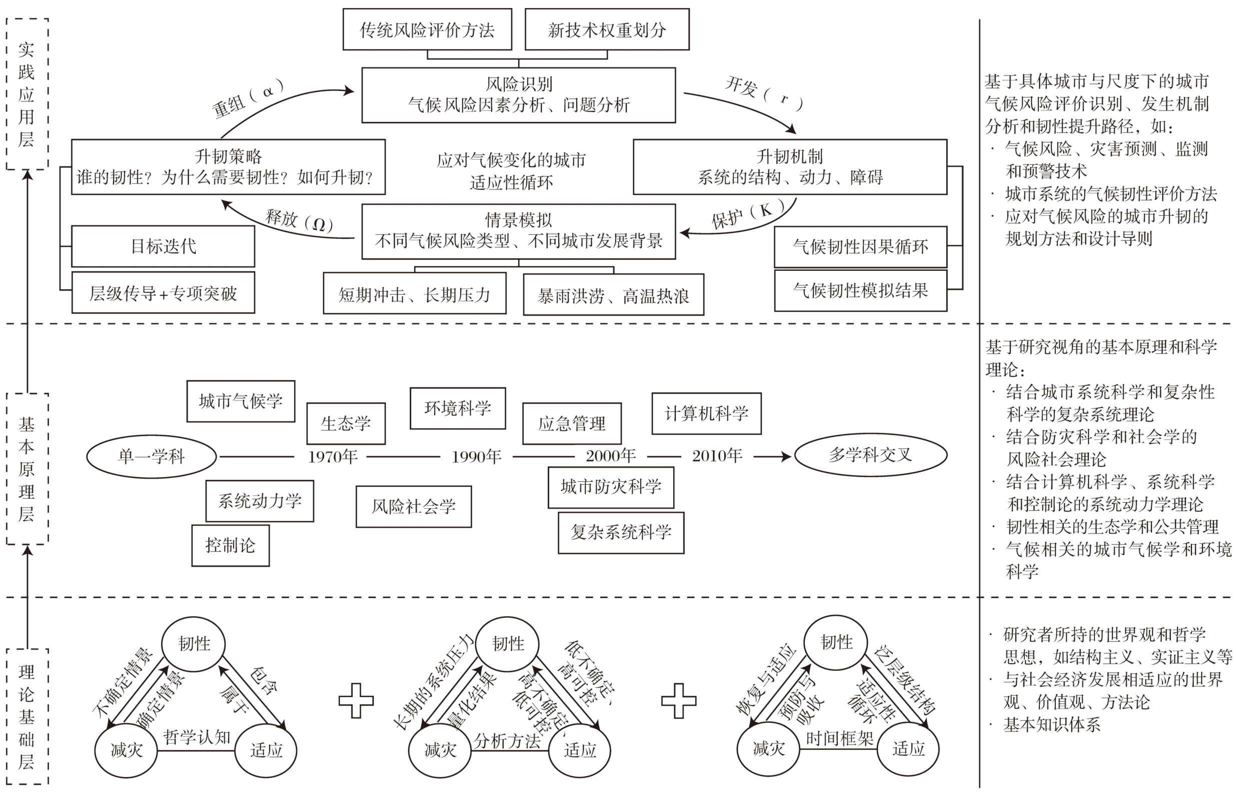


Figure 2. Hierarchical Theoretical Framework of Urban Climate Resilience

The framework links risk identification, problem analysis, scenario simulation, and resilience strategies within the adaptive cycle. It clarifies why resilience is needed, whose resilience is being strengthened, and how resilience can be enhanced. It also connects traditional risk assessment, new technological capacities, territorial spatial governance, and urban climate science, thereby translating theoretical cognition into planning practice.

3. Comparative Analysis of Urban Climate Resilience Plans: Evidence from 18 Coastal Megacities

Coastal location and megacity scale reinforce each other, increasing exposure and vulnerability and making coastal megacities front-line spaces for the adverse impacts of climate change [11]. Based on

Statista's list of global megacities [36], this study identified 18 coastal megacities through city-by-city geographic screening. Sixty-one percent of them are located in Asia, including Shanghai, Guangzhou, Tianjin, and Shenzhen in China. The study selected 42 climate-resilience-related planning documents from these cities, including 16 master plans, 12 DRR plans, and 14 CCA plans, published mainly between 2010 and 2022. The following sections compare risk types, planning goals and strategies, and action priorities.

Table 2. Planning Documents for Climate Resilience in Coastal Megacities

City (country)	Planning types	Number of documents	Publication years
Tokyo (Japan)	Master plan; DRR plan; CCA plan	3	2017-2021
Shanghai (China)	Master plan; DRR plan	3	2018-2022
Mumbai (India)	DRR plan; CCA plan	2	2021-2022
Osaka (Japan)	Master plan; DRR plan; CCA plan	3	2017-2022
New York (United States)	Master plan; DRR plan; CCA plan	3	2013-2019
Guangzhou (China)	Master plan; DRR plan	2	2019-2022
Karachi (Pakistan)	CCA plan	1	2025
Lagos (Nigeria)	Master plan; CCA plan	2	2020-2022
Istanbul (Türkiye)	Master plan; CCA plan	2	2014-2018
Buenos Aires (Argentina)	Master plan; CCA plan	2	2018-2020
Manila (Philippines)	Master plan; DRR plan	2	2014-2020
Rio de Janeiro (Brazil)	Master plan; DRR plan; CCA plan	3	2010-2016
Tianjin (China)	Master plan; DRR plan; CCA plan	3	2021-2022
Los Angeles (United States)	Master plan; DRR plan; CCA plan	3	2018-2021
Jakarta (Indonesia)	Master plan; DRR plan; CCA plan	3	2012-2019

Lima (Peru)	Master plan	1	2022
Bangkok (Thailand)	Master plan; CCA plan	2	2013
Shenzhen (China)	Master plan; DRR plan; CCA plan	3	2021-2022

Note: Master plan refers to a comprehensive urban plan; DRR plan refers to an urban disaster-prevention or disaster-risk-reduction plan; CCA plan refers to an urban climate-change-adaptation plan.

3.1 Climate-Hazard Risk Types in Plans

The plans reveal the hazard types prioritized by coastal megacities during the 2010s and early 2020s. Flooding appears in all cases and is the most widely recognized risk. Heat waves, rainstorms, landslides, tropical storms, storm surges, and sea-level rise also appear frequently. This distribution shows a clear risk gradient: high-frequency flooding is combined with compound risks such as heat waves, rainstorms, and landslides, while long-term stresses such as sea-level rise continue to intensify pressure on coastal cities.

Flooding is often linked with rainstorms, storm surges, land subsidence, and sea-level rise. Coastal megacities therefore face both short-term extreme-weather shocks, such as rainstorm-induced waterlogging and tide-related disasters, and chronic pressures, including sea-level rise and salinization. Heat waves are the second most frequently cited risk, reflecting the combined effects of the urban heat-island effect and global warming on public health and socioeconomic systems. Risk profiles also vary by region. Los Angeles gives particular attention to wildfire because of its Mediterranean climate, vegetation conditions, and urban expansion, while Shenzhen identifies fog as a risk, reflecting the need to manage low-visibility hazards that affect navigation and urban operations.

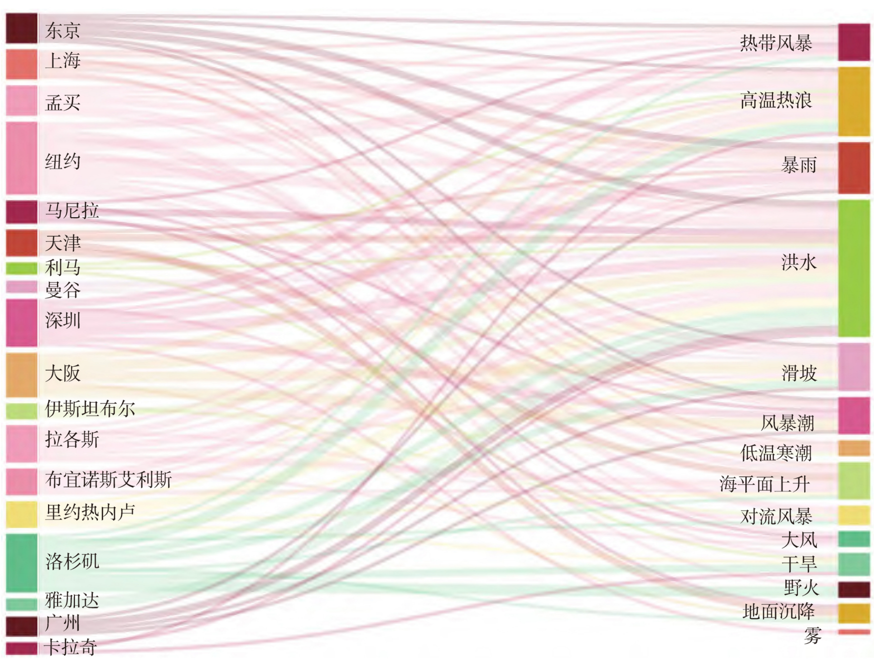


Figure 3. Correspondence Between Coastal Megacities and Climate-Hazard Risks in Planning Documents

The figure links the 18 coastal megacities with hazard types including tropical storms, heat waves, rainstorms, flooding, landslides, storm surges, cold waves, sea-level rise, convective storms, strong winds, drought, wildfire, land subsidence, and fog.

3.2 Planning Goals and Strategic Directions

The frequency statistics for planning goals and strategic directions show that "safety" is the primary goal in coastal megacity climate-resilience planning, followed by "equity," "efficiency," "resilience," and "sustainability." Different plan types have different emphases. Master plans also include goals such as adequacy, robustness, reliability, and livability. DRR plans further stress health and intelligence. CCA plans have a more diverse goal structure, including affordability, advancement, inclusion, flexibility, and autonomy. Master plans and DRR plans prioritize safety, whereas CCA plans place greater emphasis on sustainability.

Strategic directions can be grouped into 11 categories, ranked by frequency as follows: infrastructure, ecological environment, community cooperation, health, pre-disaster warning, urban economy, urban energy, post-disaster recovery, social governance, urban buildings, and urban transport. Infrastructure is a central concern across all three types of plans. Master plans also emphasize social governance; DRR plans give additional weight to community cooperation and pre-disaster warning; and CCA plans treat the ecological environment as equally important as infrastructure.

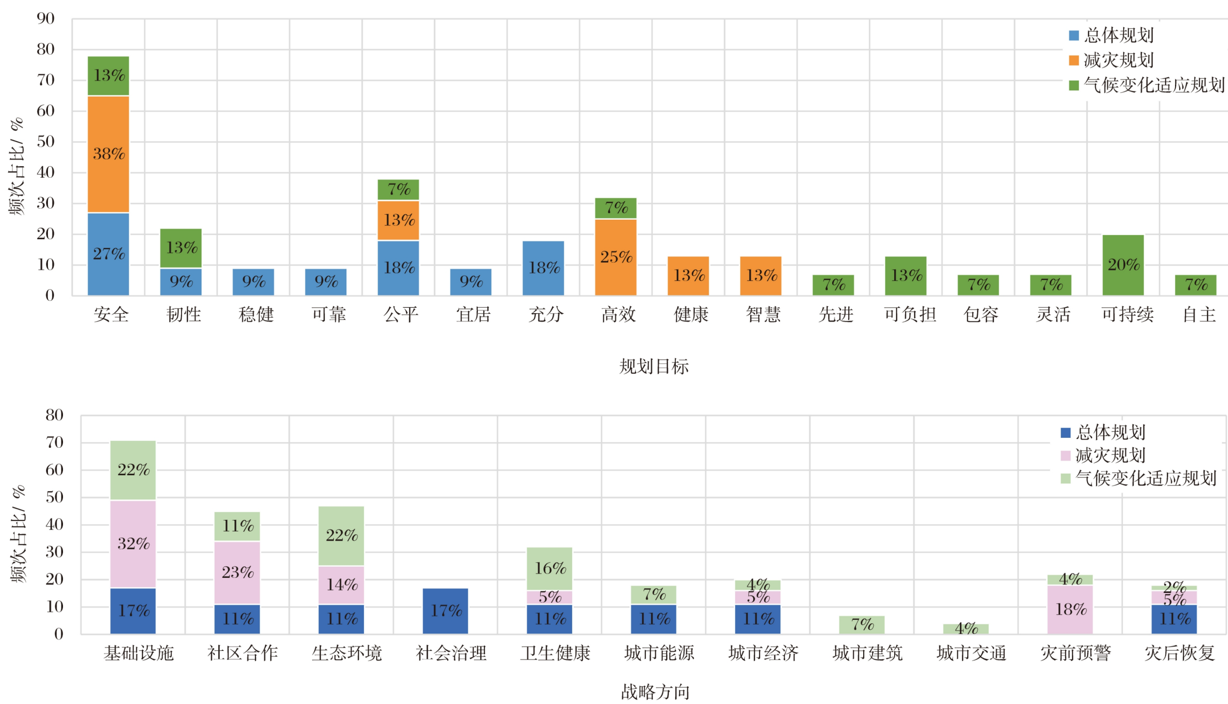


Figure 4. Frequency Distribution of Goals and Strategic Directions in Climate Resilience Planning for Coastal Megacities

The figure compares master plans, DRR plans, and CCA plans in terms of goal frequencies and strategic-direction frequencies.

3.3 Action Priorities in Plans

A horizontal comparison of concrete measures in DRR and CCA plans shows how different starting points shape planning responses to climate-hazard risks.

First, in infrastructure, both types of plans emphasize improving flood-control and drainage systems and the reliability of urban lifeline infrastructure. DRR plans additionally stress the safety of underground facilities, emergency shelters, and agricultural irrigation facilities.

Second, in community cooperation, DRR plans emphasize emergency-evacuation capacity, while CCA plans stress education and training in disaster-prevention awareness and long-term, locally tailored climate-adaptation guidance.

Third, in the ecological environment, DRR plans focus on the flood-control functions of urban green infrastructure, whereas CCA plans pay more attention to integrated regional ecological benefits and environmental-pollution control.

Fourth, in social governance, both types of plans identify efficient emergency rescue mechanisms, sound public-private partnerships, cross-sectoral and cross-regional decision-making capacity, and the incorporation of climate change into administrative decision-making as important for responding to climate-hazard risks.

Fifth, in health, DRR plans emphasize identifying vulnerable groups, while CCA plans focus more on systemic public-health risks, safe drinking water, sanitation facilities, and medical-support plans.

Sixth, in urban energy, DRR plans involve the installation of emergency power supplies, whereas CCA plans propose measures that coordinate adaptation with emissions reduction and the use of clean energy.

Seventh, in the urban economy, DRR plans emphasize innovation in business models and disaster-prevention financing, while CCA plans stress government-led financial support and the incorporation of climate impacts into investment decisions.

Eighth, in urban buildings, both plan types focus on updating building technologies, standards, and planning rules. DRR plans particularly stress the protection of historic buildings, while CCA plans propose passive low-carbon design strategies and updates to building codes and zoning ordinances.

Ninth, in urban transport, DRR plans do not give explicit attention to transport, whereas CCA plans focus on reducing emissions in public transport.

Tenth, in pre-disaster warning, both types of plans focus on collecting disaster-risk data and predicting future trends. CCA plans further propose differentiated early-warning measures for specific climate hazards, such as heat waves, infectious diseases, storm surges, landslides, and disaster-risk observation systems.

Eleventh, in post-disaster recovery, DRR plans focus on rapid recovery of essential public services, whereas CCA plans emphasize economic subsidies and medical assistance after disasters.

Overall, DRR plans in coastal megacities focus on the rapid recovery of basic urban functions, while CCA plans emphasize longer-term and sustained measures as well as synergies with climate mitigation, such as reductions in greenhouse-gas emissions. Despite these differences, the two types of plans converge in infrastructure, community cooperation, social governance, urban buildings, and pre-disaster warning. Both seek to reduce disaster risk while strengthening adaptive capacity and thereby enhancing urban climate resilience.

Table 3. Comparison of Action Priorities Between Disaster Risk Reduction and Climate Change Adaptation Planning

Strategic direction	DRR planning	Share (%)	CCA planning	Share (%)

	priorities		priorities	
Infrastructure	Maintenance and upgrading of rainwater systems, including infiltration wells, sluices, and multifunctional manhole covers; safety protection for underground facilities such as waterway bridges, culverts, and tunnels; safety and management of emergency shelters; renovation of river and coastal defenses; reinforcement of reservoirs and agricultural irrigation facilities; improvement of lifeline reliability.	44.4	Improvement of basic flood-control and drainage systems; higher standards for lifeline infrastructure.	61.1
Community cooperation	Inspection of community emergency evacuation; training in residents' disaster-prevention capacity; grassroots climate and disaster-prevention education by	33.3	Dissemination and training in public disaster-prevention awareness; community customization of climate-adaptation guidelines.	100.0

	private, nonprofit, and community organizations.			
Ecological environment	Control of land subsidence; nature-based solutions such as sponge-city measures; equitable distribution of green open space; development of flood-control functions of street trees, trunk rivers, and secondary rivers; systematic sponge-city flood control.	33.3	Restoration of biodiversity; protection and expansion of natural coasts; mitigation design for the urban heat-island effect; reduction of water pollution; upstream improvements in waste treatment.	72.2
Social governance	Rapid-response rescue systems; emergency evacuation from large underground shopping malls and metro stations; governmental assistance for small businesses in emergencies; interdepartmental platforms for disaster-prevention decision-making; administrative control of construction in	44.4	Adaptive adjustment of tourism, commercial, and sociocultural regulations; inclusion of climate science in government decision-making; cross-sectoral and cross-regional adaptive capacity.	33.3

	hazardous areas; cooperation among government, private sectors, social organizations, and higher-education institutions to improve disaster-prevention methods.			
Health	Identification of health and safety risks among vulnerable groups during natural disasters.	5.6	Mitigation of public-health risks induced by climate change; provision of safe drinking water; accessible sanitation facilities; medical-support plans for adaptation capacity.	38.9
Urban energy	Installation of emergency power supplies.	5.6	Use of clean energy.	5.6
Urban economy	Innovation in disaster-prevention financing mechanisms; business practices in partnership with the private sector.	16.7	Flood insurance and renovation funding; consideration of climate impacts in public investment decisions; use of climate adaptation to increase economic opportunities.	16.7
Urban buildings	Standardized	16.7	Passive low-	38.9

	application of disaster-resistant building technologies, codes, and guidelines; protection of important historic buildings and renewal of other buildings.		carbon building design; updates to building codes and zoning ordinances.	
Urban transport	Not specified.	-	Low-carbon public transport.	11.1
Pre-disaster warning	Efficient dissemination of natural-disaster alerts; survey and assessment of urban DRR capacity; census of basic climate-hazard risk data.	55.6	Strengthened heat-wave prevention; prevention and monitoring of infectious diseases; information sharing on storm surges; integrated prevention of landslides; improved efficiency of disaster-risk observation and early-warning systems.	50.0
Post-disaster recovery	Rapid recovery of key public services.	11.1	Post-disaster economic subsidies and medical assistance.	5.6

4. Conclusion

By comparing DRR and adaptation and integrating them through the lens of resilience, this study has examined the conceptual meaning, process domains, and theoretical levels of urban climate resilience.

The analysis of planning documents from 18 coastal megacities shows that DRR and CCA plans differ significantly in risk types, goals and strategies, and action priorities. Clarifying these differences can support future coordination and integration in urban climate resilience planning. Two further issues deserve attention.

First, because DRR planning and adaptation planning have long operated as relatively independent parallel systems, integrating them through a resilience lens can help mainstream urban climate resilience actions that are currently dispersed across different types of plans [37-38]. The "sponge city" initiative launched in China in 2014, for example, has evolved from a specialized action into principles and indicators incorporated into urban plans at multiple levels. In practice, climate-resilience objectives can be embedded across territorial spatial plans through both hierarchical transmission and targeted breakthroughs.

Second, as China's "dual carbon" goals deepen, the meaning of urban climate resilience will continue to expand. Future research and planning should incorporate low-carbon and green urban development into the urban climate resilience framework. This means organically integrating DRR pathways that reduce climate-hazard risks, adaptation pathways that address adverse climate impacts, and low-carbon pathways that fundamentally control greenhouse-gas emissions, so as to jointly advance sustainable urban development.

Notes

[1] The author used bibliometric analysis and literature knowledge mapping to classify and summarize 852 Chinese- and English-language publications on "disaster risk reduction" and "adaptation." Because of space limitations, the detailed results are not presented in this article.

[2] In this article, coastal megacities refer to cities whose municipal centers are within 100 km of the mean high-water coastline, whose land elevation is below 100 m, and whose permanent population exceeds 10 million.

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