

Explaining Urban Recovery after Tropical Cyclones: A Bibliometric-Systematic Review of Research Trends, Drivers, and Future Directions

Shengping Ding ^{1,*}, Lilai Xu ^{2,3} and Alexander V. Prishchepov ¹

¹ Department of Geosciences and Natural Resource Management (IGN), University of Copenhagen, 1350 København, Denmark

² Institute for Disaster Management and Reconstruction, Sichuan University, Chengdu 610065, China

³ Research Center for Integrated Disaster Risk Reduction and Emergency Management, Sichuan University, Chengdu 610065, China

* Correspondence: sdng@ign.ku.dk

How To Cite: Ding, S.; Xu, L.; Prishchepov, A.V. Explaining Urban Recovery after Tropical Cyclones: A Bibliometric-Systematic Review of Research Trends, Drivers, and Future Directions. *Journal of Hazards, Risk and Resilience* **2026**, *1*(1), 20. <https://doi.org/10.53941/jhrr.2026.100020>

Received: 8 March 2026

Revised: 28 July 2026

Accepted: 29 July 2026

Published: 10 August 2026

Abstract: Tropical cyclones increasingly threaten coastal cities, yet why recovery outcomes diverge across places remain poorly synthesized. Here we examine the determinants of post-cyclone urban recovery through a bibliometric-systematic review of 117 peer-reviewed empirical studies published between 2005 and 2025. Combining bibliometric mapping with full-text qualitative synthesis, we assess research trends, recovery drivers, and remaining knowledge gaps. The corpus has grown in visibility and methodological diversity, with increasing use of high-resolution geospatial, mobility and computational approaches to trace recovery across space and time. The synthesis shows that recovery trajectories emerge from interactions between hazard-impact conditions and five capacity-side dimensions: social equity, economic resources, infrastructure vulnerability, institutional capacity and community adaptability. However, the evidence remains geographically concentrated and dominated by single-event designs, fragmented recovery measurement and limited causal inference. We therefore identify three priorities for future research: cross-event and cross-regional comparison, integrated multi-source monitoring, and causal and nonlinear analysis of recovery mechanisms. By linking research trends with a structured framework of recovery determinants, this review advances understanding of why post-cyclone urban recovery diverges across places, while informing more adaptive and equitable resilience planning in cyclone-prone cities.

Keywords: urban recovery; tropical cyclones; recovery drivers; urban resilience; bibliometric-systematic review

1. Introduction

Tropical cyclones are among the most destructive hazards affecting coastal cities, where extreme winds, storm surges, heavy rainfall and compound flooding can trigger cascading disruption across urban systems [1]. These impacts are amplified where urban growth concentrates people and assets in low-lying coastal areas and where exposure intersects with social and infrastructural vulnerability [2]. Continued warming is expected to increase the proportion of intense tropical cyclones and cyclone-related rainfall, even if changes in overall storm frequency remain uncertain [3]. Yet the physical shock alone does not determine what follows, as comparable levels of disruption can produce markedly different recovery trajectories across places and social groups [4]. The



central challenge is therefore not only to document damage and reconstruction, but to explain why recovery is rapid in some urban settings and prolonged in others [5].

Urban recovery is better understood as a trajectory than as a single endpoint [6]. Its speed and completeness reflect not only the restoration of housing, infrastructure and public services, but also the processes through which resources are mobilized, institutions respond and urban functions are reorganized [7,8]. Empirical studies have linked these outcomes to pre-existing vulnerability, access to assistance access, infrastructure disruption, municipal capacity and local networks [9–12]. New forms of evidence have also changed how such relationships can be observed. Remote sensing, social media, and human-mobility records now allow recovery to be traced across neighborhoods and over time [13–17]. Together, these developments have broadened the explanatory scope of recovery research, enabling interactions among social, infrastructural and institutional conditions to be examined across spatial and temporal scales [5].

These explanations, however, do not yet form a cumulative evidence base. Studies are divided across disciplinary traditions and are more commonly organized around particular events, sectors or recovery outcomes, with substantial variation in definitions, indicators and spatial and temporal boundaries [11,14,18,19]. This fragmentation constrains cross-context comparison and obscures which drivers operate consistently across recovery settings [20]. Existing reviews have examined adjacent areas, including community disaster resilience assessment, social media use in disaster recovery, barriers to equitable recovery and multi-risk recovery planning [20–24]. What remains missing is a focused synthesis that traces the development of this explanatory literature and consolidates the empirical evidence on the determinants of post-cyclone urban recovery. Such integration is needed to distinguish context-specific findings from patterns that may be transferable across urban settings.

Here, we conduct a bibliometric-systematic review of 117 peer-reviewed empirical studies published between 2005 and 2025. We focus specifically on studies that examine the determinants of post-cyclone urban recovery. Bibliometric mapping traces the development, collaboration structure and thematic organization of this explanatory literature, whereas full-text qualitative synthesis examines the determinants identified and the relationships among them. The review therefore assesses how explanatory research has evolved, synthesizes the conditions associated with divergent recovery outcomes and identifies priorities for strengthening future evidence. By connecting research trends within this focused corpus with full-text evidence, we provide a structured account of why post-cyclone urban recovery differs across places.

2. Methodology

2.1. Review Design

We used a focused bibliometric-systematic review design to examine how post-cyclone urban recovery has been explained in empirical literature. The review combined PRISMA-guided study selection with bibliometric mapping and full-text qualitative synthesis [25,26]. Bibliometric mapping characterized the development, collaboration patterns and thematic structures, whereas qualitative synthesis identified recovery determinants and their relationship. Because the retrieval strategy targeted studies that explicitly explain variation in recovery outcomes, the resulting corpus represents the explanatory literature on post-cyclone urban recovery rather than the broader recovery field.

2.2. Data Source

The Web of Science Core Collection was used as the sole bibliographic source to ensure consistency in metadata, citation records, and network analysis. Full records and cited references were exported for each eligible article, including titles, abstracts, authors, publication years, journals, author keywords, Keywords Plus, affiliations, countries, DOIs, cited references and citation counts. Bibliographic metadata for eligible studies identified through backward citation searching were subsequently retrieved from Web of Science and added to the corpus. Full-text information was coded manually in Excel. The coding matrix recorded study location, cyclone event, spatial scale, recovery domain, analytical method and reported recovery determinant and assigned framework dimension.

2.3. Search Strategy and Study Selection

2.3.1. Search Strategy

The topic search combined four concept groups: recovery-related terms, explanatory terms, cyclone-hazard terms and urban-context terms. Recovery-related and explanatory terms were linked using the NEAR/6 operator to prioritize studies that connect recovery outcomes with their determinants while allowing variation in

terminology. Hazard terms captured the regional use of cyclones, typhoon and hurricane, whereas urban-context terms covered cities, towns, municipalities, metropolitan and peri-urban areas, neighborhoods and the built environment. Targeted exclusions removed studies of extratropical cyclones and non-urban ecological recovery.

The final Web of Science query was:

TS = (((“recover*” OR “resilien*” OR “rebuild*” OR “restor*” OR “reconstruct*” OR “rehabilita*” OR “build back better” OR “adaptive capacit*”) NEAR/6 (“factor*” OR “determinant*” OR “driver*” OR “predictor*” OR “mechanism*” OR “barrier*” OR “facilitator*” OR “constraint*” OR “influenc*” OR “shap*” OR “key element*”)))

AND TS = (“tropical cyclone*” OR “tropical storm*” OR “cyclone*” OR “typhoon*” OR “hurricane*” OR “post-typhoon” OR “post-hurricane”)

AND TS = (“urban*” OR “city” OR “cities” OR “town*” OR “municipal*” OR “metropolitan*” OR “suburban*” OR “peri-urban*” OR “periurban*” OR “neighborhood*” OR “neighbourhood*” OR “built environment*”)

NOT TS = (“extratropical cyclone*” OR (“ecosystem*” OR “species*” OR “habitat*”) NEAR/5 (“recover*” OR “restor*” OR “rehabilita*” OR “resilien*” OR “reconstruct*”))).

The asterisk (*) above denotes the standard Web of Science wildcard operator. The search was conducted on 15 June 2026 and returned 182 records.

2.3.2. Inclusion and Exclusion Criteria

Eligibility criteria were defined before screening and applied during both title–abstract screening and full-text assessment (Table 1). The review period began in 2005 to capture two decades of research following Hurricane Katrina and ended in 2025 to retain complete publication years for bibliometric analysis.

Table 1. Inclusion and exclusion criteria.

Dimension	Inclusion	Exclusion
Setting	Urban, peri-urban, metropolitan, municipal, suburban, town or neighbourhood settings affected by tropical cyclones	Isolated rural settings; non-urban ecological systems
Phenomenon	Explicitly analyses determinants shaping post-cyclone recovery trajectories or outcomes	Damage or exposure assessment only; no recovery focus; no explanatory factors
Hazard	Tropical cyclones, tropical storms, typhoons or hurricanes	Extratropical cyclones; non-cyclone hazards
Study type	Peer-reviewed empirical journal articles	Reviews, conference papers, editorials, commentaries and conceptual research
Language	English	Other languages
Period	2005–2025	Outside the review period

2.3.3. PRISMA Selection Process

Study selection followed the PRISMA 2020 flow structure [25] (Figure 1).

(1) Identification. The database search returned 182 records. Because the Web of Science Core Collection was the sole database, no database-level deduplication was required; records were nevertheless checked by title and DOI.

(2) Screening. Restricting the records to English-language journal articles published between 2005 and 2025 removed 35 records. The remaining 147 records underwent title–abstract screening, during which 23 were excluded because they lacked a tropical-cyclone focus, an urban or peri-urban setting, or a recovery component. Full texts were sought for 124 reports, one could not be retrieved. Of the 123 reports assessed in full text, 15 were excluded because they were non-empirical ($n = 2$), did not examine tropical-cyclone events ($n = 4$), fell outside the urban or peri-urban scope ($n = 4$), or lacked explanatory recovery analysis ($n = 5$). The database search therefore yielded 108 eligible articles.

(3) Identification through citation searching. To assess search coverage, we screened the reference lists of the ten most-cited included articles, comprising 616 cited references. After references already captured by the database search were removed, title–abstract screening identified 16 potentially eligible reports. One report could not be retrieved and six were excluded after full-text assessment because they were non-empirical or did not examine recovery determinants. Citation searching therefore added nine articles.

(4) Inclusion. The final corpus comprised 117 articles: 108 identified through the database search and nine through backward citation searching. All were indexed in Web of Science and were included in both bibliometric mapping and qualitative synthesis.

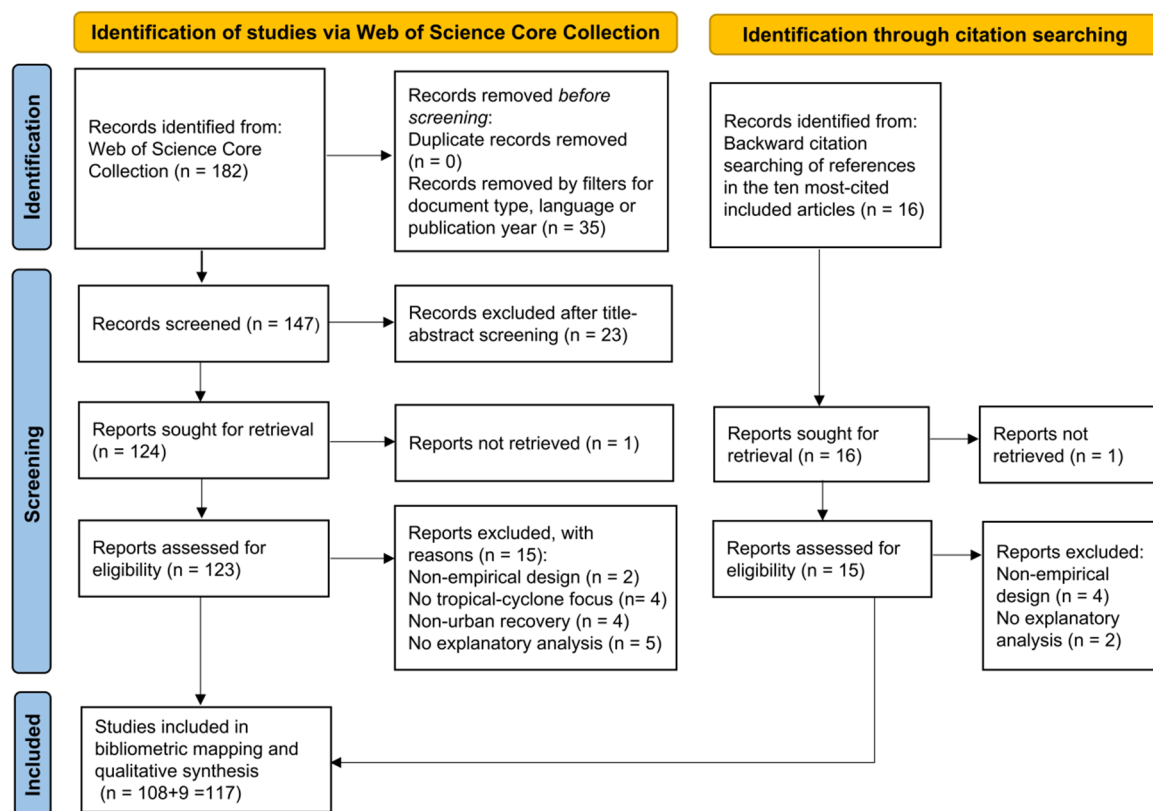


Figure 1. PRISMA 2020 flow diagram for selecting the reviewed corpus. Records were identified through the Web of Science Core Collection and backward citation searching and screened against the prespecified inclusion and exclusion criteria. The final corpus was used for both bibliometric mapping and qualitative synthesis.

2.4. Bibliometric Mapping

Bibliometric mapping described the temporal development, geographical structure and thematic organization of the explanatory corpus. Annual publication counts and citation activity were calculated from Web of Science records retrieved on 15 June 2026. Annual citation values represent citations received by the corpus in each calendar year, rather than citations accumulated by articles published in that year. Citation trends were reported through 2025; incomplete data for 2026 were excluded. A three-year moving average was used to smooth annual fluctuations.

Network maps were generated in VOSviewer version 1.6.20 using association-strength normalization [27]. Unless otherwise stated, the clustering resolution was 1.00 and the minimum cluster size set to five. Country-level co-authorship analysis was used to map international collaboration. Node size represents publication output, and link thickness represents collaboration strength. Country affiliations describe the geography of knowledge production. Keyword co-occurrence analysis was based on author keywords. Keywords occurring at least three times were retained. In the resulting networks, node size represents keyword frequency, link thickness represents co-occurrence strength, and cluster colors indicate thematic groups [27]. In the temporal overlay, node colors represent the average publication years. Cluster interpretation was cross-checked against article titles, abstracts and full-text coding notes.

2.5. Qualitative Synthesis and Recovery-Driver Framework

The recovery-driver framework was developed through hybrid deductive–inductive coding. Initial sensitizing categories were informed by the DROP model and related literature on disaster recovery, social vulnerability and community resilience literature [7,10,28,29]. These sources directed attention to social, economic, infrastructural, institutional, and community conditions within fixing the final structure in advance.

The article was the unit of analysis and could be assigned to multiple dimensions. A factor was coded as a determinant recovery only when it was explicitly linked to variation in recovery duration or completeness. During iterative coding, reported determinants were extracted as first-order codes, compared across studies and merged where they captured the same construct. Recurrent codes were grouped into higher-order dimensions, and categories absent from the initial structure were added inductively. Hazard intensity and realized impacts occurred

as explanatory conditions but were conceptually distinct from settlement capacities, and were therefore retained as a separate shock-side category.

The final framework comprises hazard-impact conditions and five capacity-side dimensions: social equity, economic resources, infrastructure vulnerability, institutional capacity and community adaptability. Hazard-impact conditions capture the magnitude and spatial extent of disruption, including wind intensity, rainfall, storm surge, flood depth and affected areas. The five capacity-side dimensions capture the resources, vulnerabilities and institutional or collective capacities that condition recovery. The dimensions are non-exclusive and represent interacting explanatory pathways rather than discrete causal categories.

3. Results

3.1. Mapping the Explanatory Literature on Post-Cyclone Urban Recovery

3.1.1. Publication Trends and Citation Visibility

The reviewed corpus shows a sustained increase in publication activity and citation visibility over time (Figure 2). Three broad phases are apparent. From 2005 to 2013, Research output was sparse, with only occasional publications and low annual citations counts. Between 2014 and 2019, publication activity became more regular and annual citations rose steadily, suggesting the gradual consolidation of this explanatory literature. Since 2020, annual publication output has remained substantially higher, accompanied by increased citation activity despite year-to-year fluctuations. The three-year moving average confirms a sustained upward trend in citation visibility over this period. These patterns indicate increasing scholarly attention to the determinants of post-cyclone urban recovery within the reviewed corpus.

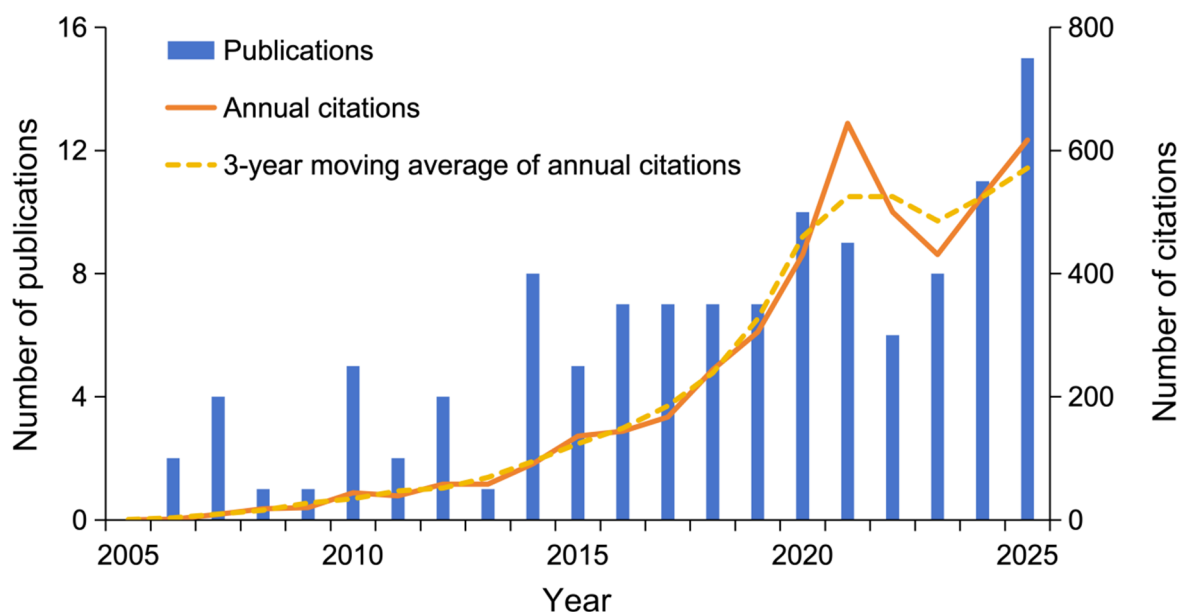


Figure 2. Annual publication output and citation visibility of the reviewed urban recovery corpus, 2005–2025. Blue bars show the number of included publications by year. The orange line shows citations received by the corpus in each calendar year, and the dashed line indicates the three-year moving average of annual citations.

3.1.2. Cyclone Exposure, Research Collaboration and Case-Study Geography

Cyclone exposure, knowledge production and empirical coverage are unevenly aligned (Figure 3). EM-DAT records [30] show high frequencies of severe tropical-cyclone disasters across the western North Pacific, the Caribbean–Gulf region and parts of the Indian Ocean, with the Philippines and China among the most frequently affected countries (Figure 3a). Research collaboration, by contrast, is concentrated in a small number of countries. The United States and China occupy the largest positions in the co-authorship network, with the United States forming its principal collaboration hub (Figure 3b). The concentration is even more pronounced in the geography of empirical case-study locations. Seventy-three case studies focus on the mainland United States, substantially more than in China, Puerto Rico or the Philippines (Figure 3c). Several highly exposed parts of Southeast Asia,

South Asia, Africa and small island regions are represented by few studies. This reviewed evidence therefore reflects only a partial correspondence between cyclone exposure and research attention.

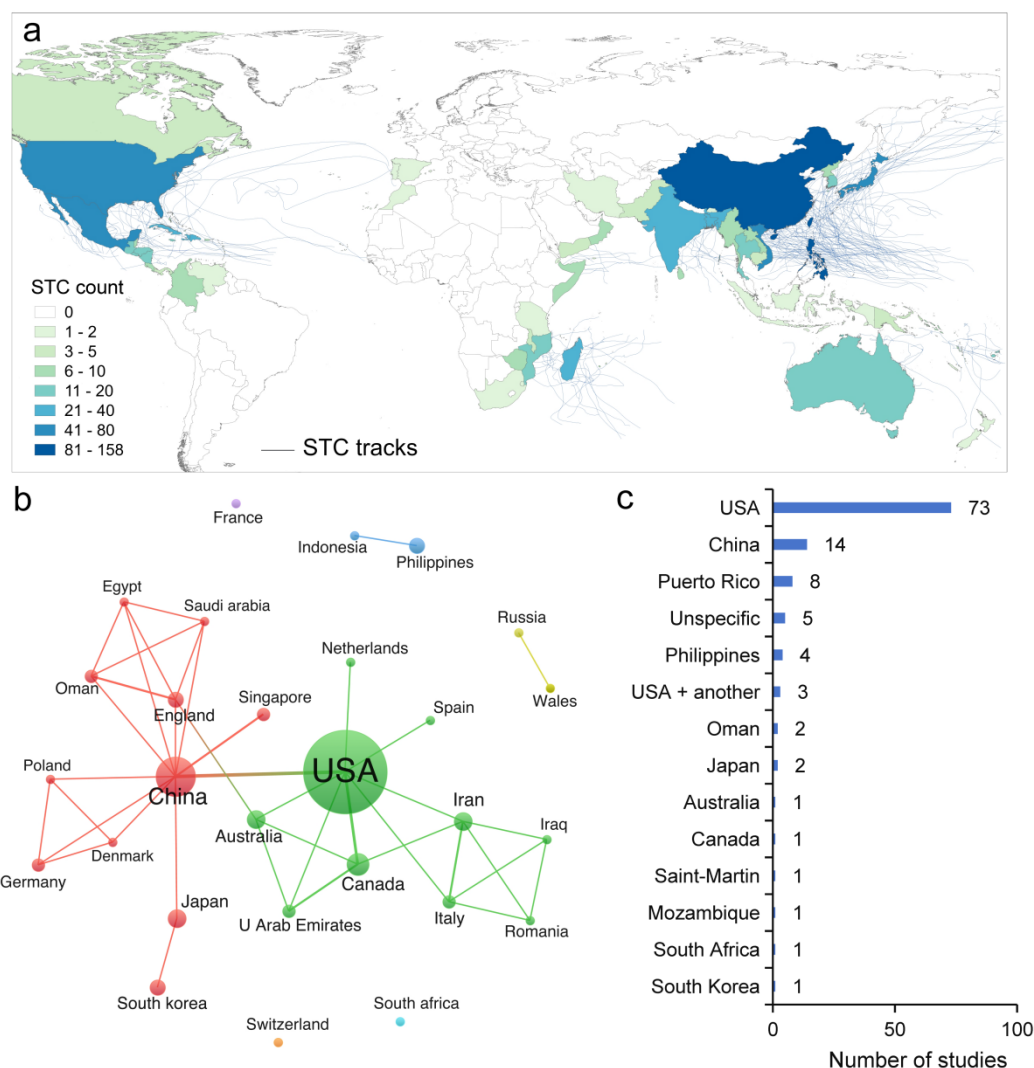
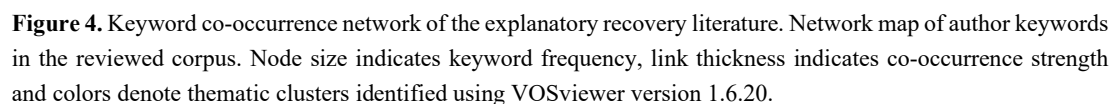


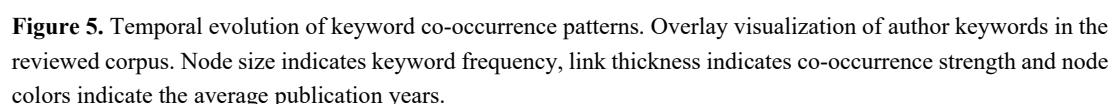
Figure 3. National exposure, research collaboration and case-study distribution. **(a)** Country-level frequency of Severe Tropical-cyclone (STC) disasters in EM-DAT during 2005–2024; light blue lines indicate storm tracks for STC using data from the International Best Track Archive for Climate Stewardship [31]. **(b)** Country-level co-authorship network in the reviewed literature. Node size represents publication output, link thickness represents collaboration strength and colors denote collaboration clusters. **(c)** Geographic distribution of empirical case studies included in the review. Puerto Rico is reported separately and is not included in the "USA" category.

3.1.3. Keyword Structure and Thematic Evolution

Keyword co-occurrence analysis reveals both dominant research themes and evolving scholarly priorities over time (Figures 4 and 5). From a total of 31 keywords appearing at least three times, five terms emerged as the most frequent: “resilience” (18), “disaster(s)” (12), “recovery” (10), “disaster recovery” (8) and “New Orleans” (8). The network is separated into four thematic clusters (Figure 4). We interpret the red cluster as event-specific reconstruction and housing recovery, anchored by New Orleans, Hurricane Katrina and housing recovery. The green cluster links resilience with infrastructure, transportation, climate change and policy. The blue cluster connects community recovery and social vulnerability with human mobility and big data, highlighting the growing use of data-intensive approaches to assess recovery dynamic at community scale. The yellow cluster brings together urban resilience, social capital, vulnerability, disaster planning and Puerto Rico, pointing to the critical role of social capital in post-disaster urban recovery.



3.2 examines how these emerging analytical perspectives have been used to explain recovery determinants.



3.2. Synthesis of Recovery Drivers

The reviewed studies explain post-cyclone urban recovery through complementary forms of evidence. Qualitative case studies show how local politics, institutional arrangements and social relations condition recovery [18,32], whereas geospatial, network and simulation approaches make spatial, temporal and cross-system dynamics more visible [13,14,33,34]. We synthesize this evidence into a recovery-driver framework comprising one shock-side category and five capacity-side dimensions (Figure 6).

This framework distinguishes the external disturbance from the capacities through which urban systems absorb, respond to and recover from that disturbance [7,19]. Hazard-impact conditions describe the magnitude and spatial pattern of the cyclone shock. The five capacity-side dimensions, namely social equity, economic resources, infrastructure vulnerability, institutional capacity and community adaptability, capture complementary aspects of recovery capacity [7]. These dimensions are conceptually distinct but operate as a coupled system. Social disadvantage limits access to finance, assistance and decision-making [10]; infrastructure disruption increases household and business losses [35,36]; institutions influence the timing and distribution of assistance [12]; and community networks may bridge, but cannot fully compensate for, weaknesses in formal systems [37]. The framework therefore organizes interacting explanatory pathways rather than independent or mutually exclusive causes.

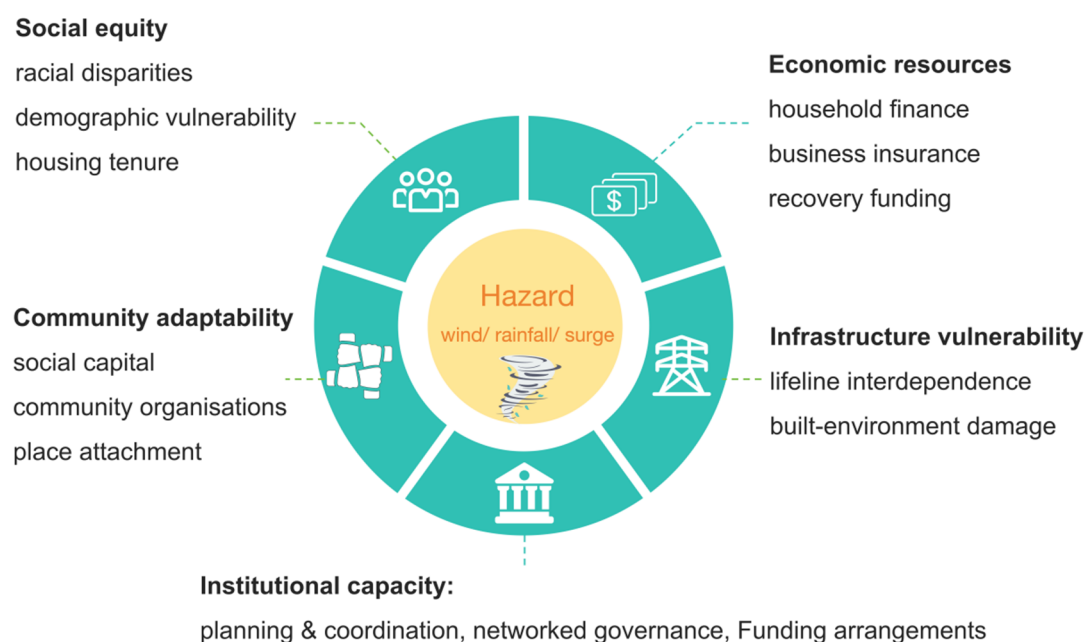


Figure 6. Framework for explaining post-cyclone urban recovery. The framework distinguishes one shock-side category from five interdependent capacity-side dimensions.

a. Hazard-impact conditions

Hazard-impact conditions establish the initial scale and geography of disruption [16]. Across the reviewed studies, recovery trajectories varied with storm intensity, including wind speed, rainfall, storm surge, flood depth and damage severity [33,38]. The hazard processes rarely occurred independently: wind, rainfall and floods interacted to produce uneven damage and cascading failures across urban systems [39,40]. The synthesis nevertheless distinguishes impact severity from recovery capacity. Hazard-impact conditions define the disturbance that an urban system must absorb, but their consequences depend on the social, economic, infrastructural and institutional capacities of the affected city [9].

b. Social equity

Social equity concerns how opportunities to rebuild and the burdens of displacement are distributed across social groups and urban territories [28]. It encompasses social inclusion, together with inequalities related to socioeconomic position, race, ethnicity, migratory background and place of origin [41,42]. Because social disadvantage is often spatially concentrated, these inequalities also generate socio-territorial differences in exposure and access to recovery resources [8]. In New Orleans, predominantly Black and low-income neighborhoods recovered more slowly after Hurricane Katrina, reflecting the structural inequalities before the disaster [43,44]. Studies of Puerto Rico similarly identify racialized and colonial relations as influences on

emergency and recovery responses [45]. Migrants, public-housing residents, renters and other marginalized groups often face weaker access to assistance and less influence over recovery decisions [46,47]. Age, health and intersecting identities further shape exposure to service disruption and perceptions of recovery [48,49]. Recovery programs can mitigate these inequalities, but may also reproduce them when administrative burdens, eligibility rules or market-based mechanisms favour households with greater resources and institutional access [50,51]. Social equity therefore concerns not only how resources are distributed, but also whose needs are recognized in recovery governance [8].

c. Economic resources

Economic resources determine whether households, businesses and public institutions can absorb losses and mobilize recovery [52]. At the household level, income, tenure and access to finance influence whether damage leads to timely repair or prolonged displacement [10,53]. Insurance can support rebuilding and adaptation, whereas uninsured losses delay neighbourhood recovery and compound existing inequalities [54,55]. Business recovery is similarly conditioned by customer demand and the restoration of local economic activity [11,56]. Public funding depends not only on the amount available, but also on its timing and accessibility. Louisiana's Road Home program and post-Katrina Community Development Block Grant allocations show how eligibility requirements and payment mechanisms can delay rebuilding or distribute assistance unevenly [51,57].

d. Infrastructure vulnerability

Infrastructure vulnerability encompasses two interconnected classes of physical systems. Critical lifeline infrastructure comprises electricity, transport, water and telecommunications, which sustain essential urban functions and govern service continuity [58]. Built-environment assets include housing, commercial buildings and public facilities, whose conditions affect service access and physical reconstruction [59]. Lifeline systems are strongly interdependent. Failure in one system can delay restoration in others and alter the sequence of urban recovery [34,36]. Prolonged power disruption, for example, constrains household recovery, business activity and access to critical facilities [35,60]. Damage to housing and commercial buildings also slows neighborhood and functional recovery, while disparities in built-environment quality amplify differences between places [55,59,61]. Conversely, network diversity, redundancy and transport connectivity can support mobility and functional continuity [62,63]. Infrastructure vulnerability therefore captures both susceptibility to cascading failure and the system properties that enable restoration [64].

e. Institutional capacity

Institutional capacity determines how recovery priorities are established, resources are coordinated and policy decisions are translated into action [8]. Public institutions shape recovery through damage assessment, funding allocation, housing programs and infrastructure restoration [6]. Following Hurricane Katrina, differences in planning capacity and intergovernmental coordination influenced both the pace and distribution of recovery [65,66]. Recovery also depends on horizontal coordination among agencies and organizations and vertical coordination across levels of government. Collaboration among public agencies, non-governmental organizations and affected communities can facilitate collective action, whereas fragmented authority can delay implementation [67,68]. National and international funding arrangements further reshape local reconstruction priorities [69]. In Beira, Mozambique, contested "build back better" governance produced spatially uneven outcomes after Cyclone Idai [70]. Several cases also emphasize the value of incorporating local knowledge into formal planning and connecting multiple levels of governance [71].

f. Community adaptability

Community adaptability captures the capacity of residents and local organizations to respond when formal systems are delayed [72]. Social capital is the most prominent mechanism in this dimension. Networks of trust and mutual aid can accelerate information exchange, resource mobilization and collective recovery [32]. Digital networks can extend these functions through needs reporting, aid coordination and public communication [22]. Community-based organizations can translate social ties into organized action, helping residents navigate recovery programs and advocate for local investments [73], while place attachment shapes decisions to return, rebuild or relocate [74,75]. Across these mechanisms, adaptability depends on whether social relationships can be converted into information, resources and coordinated action [72]. Yet this capacity is itself unevenly distributed: households differ in mobility, political access and material resources, so the communities better able to self-organize are often those that were already better resourced before landfall [53,76].

Taken together, the shock-side category and five capacity-side dimensions show that recovery is jointly shaped by the magnitude of disruption and the capacities available to absorb it. These relationships are conditional rather than additive: the effect of any one determinant depends on the presence and operation of others. The

framework does not rank determinants by importance or imply a universal causal sequence. Rather, it organizes the interacting pathways through which cyclone impacts are translated into divergent recovery trajectories.

4. Discussion

This review synthesizes the explanatory literature on urban recovery after tropical cyclones. The corpus has grown in visibility and methodological diversity, but remains geographically uneven in explanatory depth. Its central finding is that recovery trajectories emerge from interaction between hazard-impact conditions and five capacity-side dimensions. This interactional perspective shifts attention from recovery as a technical sequence of repairs to a process through which unequal resource, infrastructures, institutions and collective capacities filter disruption.

4.1. Progress in Explaining Recovery Determinants

The reviewed literature shows a clear shift from documenting post-cyclone recovery outcomes to explaining why recovery differs across urban contexts. Publication and citation activity increased from the mid-2010s and remained at substantially higher levels after 2020. Qualitative studies have clarified how local institutions, social capital and governance arrangements shape recovery. In contrast, geospatial, mobility, social-media and computational approaches have made recovery dynamics visible at finer spatial and temporal scales [56,77,78]. Together, these developments have widened both the range of determinants examined and the scales at which their effects can be observed.

The main conceptual advance is a shift from isolated-factor accounts towards interactional explanations. Comparable levels of disruption can produce different recovery trajectories where urban settlements differ in pre-existing social disadvantage, resource access, infrastructure redundancy, institutional responsiveness or community organization. Conversely, strong capacity in one dimension may have limited effect when another remains severely constrained. The contribution of this literature is therefore not the identification of isolated factors, but the gradual movement towards explaining recovery as an interaction between disruption and recovery capacity.

4.2. Gaps Limiting Explanatory Power

Despite methodological progress, three gaps limit the explanatory power of the literature. First, evidence remains concentrated in a small number of national contexts, with single-event and single-location studies still predominant. These studies provide localized insights but make it difficult to distinguish local contingencies from determinants that operate across hazard, governance and urban settings.

Second, recovery is often measured through fragmented approaches. Administrative records, surveys, remote sensing, mobility data and social media each capture only part of the recovery process and are rarely integrated. Aggregated measures can obscure intra-urban disparities [9,10]; night-time lights offer spatially continuous proxies for electricity restoration and economic activity but are affected by cloud contamination [13,79]; and mobile-phone and social media data remain limited by uneven access, demographic bias and temporal discontinuity [56,77].

Third, recovery mechanisms remain weakly specified. Many quantitative studies identify associations rather than causal pathways, whereas qualitative insights into governance, social cohesion and local adaptation are rarely incorporated into comparative or predictive models [80]. The evidence base can therefore identify many conditions associated with recovery, but is less able to establish the mechanisms by which those conditions alter recovery trajectories.

4.3. Future Research Directions

Future research should move from identifying recovery determinants to explaining how they operate across contexts. Three priorities follow directly from the limitations above.

Large-scale comparative designs. Cross-event and cross-city comparisons should complement single-event studies. Comparing recovery under different cyclone intensities, governance arrangements, infrastructure systems and socioeconomic conditions would help separate place-specific observations from more transferable recovery determinants. Comparisons should also extend beyond the small group of well-studied North American cases.

Integrated spatiotemporal measurement. Recovery should be monitored as a dynamic, multi-domain process through the integration of complementary data sources [8]. Combining administrative records and surveys with remote sensing, social media or mobility data can reveal how infrastructure restoration, economic activity, population return and social recovery diverge across space and time [81]. Common outcome definitions would further improve comparability between studies [23].

Causal and nonlinear explanation. Stronger designs are needed to move beyond association. Quasi-experimental methods can estimate the effects of aid, relocation and institutional delay, whereas system-dynamics, agent-based and machine-learning approaches can identify thresholds, nonlinear feedback and path dependencies. These methods should complement, rather than replace, contextual evidence on institutions and social relations.

4.4. Implications for Recovery Governance

The findings imply that urban recovery should be governed as a problem of uneven capacity, not only as a task of physical reconstruction. Place-based recovery policies should assess both the spatial pattern of cyclone impacts and the capacities available to absorb them. Planning and resource allocation should identify which neighborhoods and social groups are likely to recover slowly and why [82]. Equity-sensitive indicators can then direct assistance towards households and communities facing the greatest financial, infrastructural and institutional constraints.

The recovery-driver framework also shows that physical reconstruction alone is insufficient. Infrastructure restoration, aid delivery and housing recovery need to be coordinated because delays in one system can slow progress across others [64]. Multi-source monitoring that links satellite indicators, service-restoration records, administrative data and local reporting can identify lagging areas and unmet needs [83]. Recovery policy should therefore be evaluated not only by rebuilding speed, but by whether it reduces the conditions that generate uneven recovery and avoids reproducing pre-disaster vulnerability [84].

4.5. Limitations

This review has several limitations. First, it was restricted to English-language, peer-reviewed publications indexed in Web of Science. This choice ensured consistent metadata for bibliometric mapping, but may have introduced language, database and publication bias. It may also reinforce the geographic concentration of the corpus because research from highly exposed regions is often published in local languages, regional outlets or grey literature. Second, the bibliometric component is based on a focused corpus of 117 studies. The co-occurrence and collaboration maps should therefore be read as indicative of broad thematic and structural patterns, rather than as precise field-level measurements.

5. Conclusions

This bibliometric-systematic review synthesizes 117 empirical studies examining the determinants of urban recovery after tropical cyclones. Literature has become more visible and methodologically diverse, with increasing use of geospatial, mobility and computational evidence to trace recovery across space and time. The central insight is that recovery cannot be explained by hazard severity or urban capacity alone, but by their interaction.

The principal conceptual contribution is a shock–capacity framework that distinguishes hazard-impact conditions from five interdependent capacity-side dimensions: social equity, economic resources, infrastructure vulnerability, institutional capacity and community adaptability. By organizing these determinants as connected pathways rather than isolated factors, the framework helps explain why comparable cyclone shocks can produce divergent urban recovery trajectories.

The evidence nevertheless remains geographically concentrated, dominated by single-event designs, fragmented recovery measurement and limited causal inference. Future research should therefore prioritize cross-event and cross-regional comparison, integrated multi-source monitoring, and causal and nonlinear analysis. For urban policy, recovery strategies should respond to spatially differentiated impacts and capacities, rather than physical damage alone. The goal is not simply to restore urban functions more quickly, but to reduce the conditions that make recovery persistently uneven.

Author Contributions

S.D.: Conceptualization, Methodology, Software, Visualization, Formal analysis, Investigation, Data curation, Writing—original draft, Writing—review & editing, Funding acquisition. L.X.: Funding acquisition, Writing—review & editing. A.V.P.: Conceptualization, Validation, Supervision, Resources, Writing—review & editing. All authors have read and agreed to the published version of the manuscript.

Funding

This research was funded by the China Scholarship Council (CSC) (202004910409) and the International Innovation Cooperation Project of the Department of Science and Technology of Sichuan Province (2024YFHZ0241).

Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Not applicable.

Data Availability Statement

The bibliographic data supporting this study were retrieved from the Web of Science Core Collection. All data analyzed in this review are derived from publicly available published literature.

Conflicts of Interest

The authors declare no conflict of interest.

Use of AI and AI-Assisted Technologies

During the preparation of this manuscript, the authors used ChatGPT (OpenAI) to improve the language and readability of the manuscript. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

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