frontiers | Frontiers in Built Environment

TYPE Mini Review
PUBLISHED 13 October 2025
DOI 10.3389/fbuil.2025.1675897

OPEN ACCESS

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RECEIVED 29 July 2025
ACCEPTED 22 September 2025
PUBLISHED 13 October 2025

CITATION
Cavaco IC and Campello Torres PH (2025) Climate shelters in the Global South: bridging a critical research gap in urban climate adaptation.
Front. Built Environ. 11:1675897.
doi: 10.3389/fbuil.2025.1675897

Climate shelters in the Global South: bridging a critical research gap in urban climate adaptation

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This study investigates how climate shelters are addressed in academic literature, particularly in Global South countries. The research questions whether studies exist on this topic in the Global South and how the concept is discussed globally. It hypothesizes that, while climate shelters are gaining attention due to increasing climate extremes, academic research from the Global South is still limited. The objective is to present a state of the art on climate shelter studies and examine their presence in Southern contexts. A systematic review following the PRISMA protocol was conducted across five databases, emphasizing sources in Portuguese and Spanish. From 59 texts screened, 26 were analyzed. Results show most studies are concentrated in Europe, with few relevant publications from the Global South. This reveals a research gap but also emerging practices in countries like Argentina and Chile. Scientifically, the study updates the literature; socially, it highlights the urgency of context-based adaptation strategies.

KEYWORDS

climate shelters, Global South, climate change, climate adaptation, urban planning

1 Introduction

Extreme heat events are becoming more frequent and intense around the world, posing growing health risks—especially in crowded urban areas. Since cities often worsen heat exposure, particularly in underserved neighborhoods, the idea of climate shelters has gained attention as a crucial way to adapt. These shelters—whether public facilities or community spaces—aim to protect people from extreme heat and provide essential resources during heatwaves, focusing on vulnerable groups like older adults, children, and low-income residents.

Even though the term "climate shelter" is increasingly being used, there's still no clear, shared understanding of what exactly it means. Amorim-Maia et al. (2023) suggest a practical definition that connects climate shelters to social justice and urban adaptation. According to them, these spaces must be carefully planned, inclusive, and sensitive to local contexts—especially in cities of the Global South, where infrastructure challenges combine with socio-environmental vulnerabilities.

Right now, the term climate shelter is often mixed up with concepts like "climate refuge," "disaster shelter," or "refugee shelter," which causes confusion both in research and in practice. Also, most studies come from or focus on the Global North—US, Canada, and parts of Europe—where shelters tend to be seen mainly as temporary cooling centers managed by public health agencies, despite initatives on the Global South (Table 1).

TABLE 1 Climate shelter initiatives identified in the literature and grey sources.

City/Country	Initiative	Description/Approach	Source
Barcelona, Spain	Climate Shelters Network	Municipal network of shelters using schools, libraries and other public facilities to provide safe, cooled spaces during heatwaves.	Ajuntament de Barcelona (2021); García et al. (2022)
Bologna, Italy	TALEA Green Cells (UIA)	Urban innovative actions (UIA) project creating small-scale green infrastructures to provide cooling and improve urban resilience.	Urban Innovative Actions (2019)
Paris, France	Oasis Schoolyards	Transformation of schoolyards into green, permeable and shaded spaces offering shelter during extreme weather events.	Mairie de Paris (2020)
Rosario, Argentina	Climate Refuge Program	Municipal voluntary registry of public and private spaces offering shelter during extreme weather events.	Municipalid de Rosario (2022)
Buenos Aires, Argentina	Climate Shelter Registry	City program enabling any public or private facility to register online as a climate refuge.	Gobierno de la Ciudad de Buenos Aires (2022)
Santiago, Chile	Municipal Climate Shelters	Local government initiative to provide air-conditioned community spaces during heatwaves.	Municipalidad de Santiago (2021)
Valparaíso, Chile	Museo de Historia Natural de Valparaíso	Public museum designated as a climate refuge providing safe indoor cooling spaces.	Municipalidad de Valparaíso (2021)

This mini-review tackles these issues by looking at the gaps and biases in the current literature, paying special attention to decolonial perspectives and a wider regional scope. By searching across multiple academic databases—including those covering Latin America, Africa, and Asia—it goes beyond mainly English-language sources to foster a richer, more diverse conversation about climate shelters.

Additionally, work by Bulkeley et al. (2014) highlights how climate and built environment are deeply intertwined, and infrastructure not only shapes climate risks but also reinforces social inequalities. This strengthens the need to think of climate shelters as part of broader efforts toward fair and resilient cities. To strengthen the conceptual framing, we emphasize that climate shelters should not be seen in isolation, but rather as part of broader agendas on climate justice and urban resilience. Following Fainstein (2010) and Anguelovski. (2016), just cities integrate equity concerns in adaptation, while resilience perspectives (Meerow and Newell, 2019) highlight the capacity of urban systems to absorb shocks and reorganize. In this sense, climate shelters are both adaptation infrastructures and instruments for advancing justice-oriented resilience pathways.

By mapping existing approaches, identifying gaps, and exploring new ideas, this review aims to contribute to academic debates and policy discussions about urban adaptation. More importantly, it pushes for a broader and more grounded understanding of climate shelters—not just as tools for resilience, but as instruments for territorial justice in our cities.

2 Methodology

In this review we operationalize "climate shelters" as physical or institutional infrastructures explicitly designed to provide safe, accessible, and socially inclusive spaces during climate-related hazards, especially heatwaves. This definition builds on Municipalidad de Rosario. (2025) and Amorim-Maia et al. (2023), and guided our screening of academic and grey literature sources. We included only cases where shelters were identified as intentional adaptation measures rather than incidental co-benefits.

This mini-review followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol to ensure transparency and rigor in literature selection (Page et al., 2021). Five databases were used for the search: Google Scholar, Scielo, Scopus, Redalyc, and Web of Science. The inclusion of Google Scholar, Scielo, and Redalyc was strategic, as they tend to index more Global South publications and texts in Portuguese and Spanish, aligning with the review's decolonial perspective.

Over 6 months, various search strings were tested in all five databases using keywords such as *climate shelter*, *climate refuge*, and both terms combined with *Global South*, in English, Portuguese, and Spanish. Supplementary Appendix 1 presents these tests.

Initial tests using only *climate shelter* returned 1,075 results, 859 of which were from Google Scholar. Redalyc and Scielo yielded 150 results combined, and Scopus and Web of Science, 66. When including *Global South*, the total dropped significantly (only 46 results across all databases and 0 from Scielo), most of which were unrelated to our concept of climate shelters. Because of this, we opted not to use *Global South* as a limiting descriptor to avoid excluding studies that met our criteria but did not explicitly use the term.

Instead, we employed a targeted Boolean combination:

> "climate shelter*" AND NOT "refugee" AND ("Brazil" OR "Argentina" OR "Bolivia" OR "Chile" OR "Colombia" OR "Ecuador" OR "Guyana" OR "Paraguay" OR "Peru" OR "Suriname" OR "Uruguay" OR "Venezuela" OR "Africa*" OR "Asia*" OR "small islands" OR "small island nations" OR "small state islands").

This search, conducted in July 2025, returned at least one relevant result per database. These descriptors were then translated into Portuguese and Spanish, totaling 59 texts.

Boolean operators, phrase searching (""), and truncation (*) were adapted to each platform's syntax. Web of Science was excluded from the final analysis due to inflated, imprecise results when multiple descriptors were used.

We excluded the term *climate refuge* after observing that most results referred to displaced human populations or ecosystem refuges (e.g., species loss due to heat or acidification), which diverged from the climate shelter concept as defined by Amorim-Maia et al. (2023).

Inclusion criteria were: (1) studies using the concept of climate shelter per Amorim-Maia et al. (2023); (2) studies discussing solutions for developing climate shelters (e.g., infrastructure, local adaptation, and resilience initiatives). Exclusion criteria included inaccessible texts or texts in languages other than English, Portuguese, or Spanish.

The 59 results were screened by title, abstract, and keywords. Duplicates and unrelated studies (e.g., focused on refugees or fauna/flora refuges) were removed. We then conducted a full-text screening of the remaining articles. To assess relevance, we searched for the term *shelter* within each text and performed diagonal reading to verify its conceptual alignment and the depth of discussion.

The final selected studies were analyzed by (1) geographic focus, (2) research themes and methods, (3) opportunities for future studies on climate shelters in the Global South, and (4) patterns in authorship and journal disciplines.

3 Results

26 out of the 59 studies were included, from the four databases that we were able to work with (Google Scholar, Redalyc, Scielo and Scopus) and other sources (indication from author Amorim-Maia, and cross referencing). That already shows how the topic is unexplored and an opportunity for new research. The PRISMA flow diagram (Supplementary Appendix 2) shows the process from search to inclusion.

A total of 22 results did not pass the first screening of titles because they referred to climate refugees, climate shelters for humanity in the case of a volcanic eruption that would leave Earth sunless; or shelters for fauna and flora because of climate change effects on their natural habitats. Additionally, we excluded 8 duplicates and 1 text that had not the file available online.

The one text returned by Scielo studied heat islands in a small city of São Paulo state, Brazil (Teixeira; Amorim, 2018), and was initially downloaded for a second full text screening. Similarly, the one text from Redalyc focused on schools adapted in boats due to floods, in Madhyapara, Bangladesh (Veiga and de Assis Garcia, 2017). 22 of the 30 texts from Scopus were downloaded after the screening of titles. 2 texts were identified via other methods.

The texts that cited "climate shelter" but focused on shelters for humanitarian emergencies (catastrophic events, like wars or tsunamis), were excluded mainly for the temporary characteristic of the shelters. The climate shelters we discuss are durable, long-term, and ideally located in existing, community-integrated spaces (e.g., schools, libraries). We do not consider climate shelters something new that is only built during extreme events and then dismantled.

We acknowledge the value of studies on temporary shelters, as they offer insights on the best and most viable materials tested and resistant to heatwaves, coldwaves, mass movement, and heavy rain. Their process and political considerations of implementation in vulnerable communities that just went through a destructive event can offer lessons to our topic, however, due to significant contextual differences, such studies were excluded from the final analysis.

Another result was identifying new relevant descriptors used, such as "climatic shelter", "urban climate shelter", and "climate resilient shelter". Their inclusion can help future studies. Finally, 24 database results and 2 from other sources were included for analysis (Supplementary Appendix 4).

10 texts have the topic "climate shelters" in their own titles (Amorim-Maia et al., 2023; Cantos et al., 2025; Estévez et al., 2025; Lopes et al., 2025; Maccabiani et al., 2025; Montero-Gutiérrez et al., 2023; Plazas et al., 2023; Pede, 2024; Sanz-Mas et al., 2025; Vasconcelos et al., 2024). Also, 10 texts have the word "urban" in the titles (Amorim-Maia et al. (2023); Baró et al., 2022; Cantos et al., 2025; Estévez et al., 2025; Lenzi et al., 2025; Lopes et al., 2025; Maccabiani et al., 2025; Montero-Gutiérrez et al., 2023; Pede, 2024; Vasconcelos et al., 2024). And a total of 7 texts cite "school/s" in the title (Baró et al., 2022; Gisotti and., Masiani, 2024; Plazas et al., 2023; Sevilla and Aguinaco, 2025; Ruiz-Mallén et al., 2023; Sanz-Mas et al., 2024; 2025).

4 studies have variations of the concept of nature-based solutions (NbS) in the titles (Baró et al., 2022; Sevilla and Aguinaco, 2025; Ruiz-Mallén et al., 2023; Vasconcelos et al., 2024). "Cool/ing" is another relevant word present in 5 of the titles (Barnat et al., 2024; Montero-Gutiérrez et al., 2023; Montero-Gutiérrez et al., 2024; Montero-Gutiérrez et al., 2025; Vasconcelos et al., 2024).

Remarkably, 21 texts discuss climate shelters exclusively in European cities: Barcelona (Amorim-Maia et al., 2023; Amorim-Maia et al., 2022; Baró et al., 2022; Cantos et al., 2025; Estévez et al., 2025; Plazas et al., 2023; Cárdenas and Gravante, 2023; Pede, 2024; Sanz-Mas et al., 2024; 2025; Vasconcelos et al., 2024), Bologna (Maccabiani et al., 2025; Roversi and Longo, 2025), Braga (Lopes et al., 2025), Madrid (Baró et al., 2022; Heredia et al., 2023; Torrego-Gómez et al., 2024), Paris (Baró et al., 2022), Rzeszow (Barnat et al., 2024), Sevilla (Montero-Gutiérrez et al., 2023; Montero-Gutiérrez et al., 2024; Montero-Gutiérrez et al., 2025), and Vitoria-Gasteiz (Sevilla and Aguinaco, 2025).

15 texts focus solely on Spain, and 9 of the total are centered on Barcelona's climate shelter network. We note that no studies from the Global South appeared in the results, except from 2 different studies that focus on Bangladesh (Haque, 2019; Veiga and de Assis Garcia, 2017). Other texts discuss case studies from other places but it's not their focus (Gisotti and Masiani, 2024), or do not discuss case studies at all (Lenzi et al., 2025; Ruiz-Mallén et al., 2023).

The need to understand what are the existing methodologies for the implementation and evaluation of climate shelters in urban areas was a centerpiece in 4 studies, with a focus on what is best and what to avoid (Amorim-Maia et al., 2022; Amorim-Maia et al., 2023; Torrego-Gómez et al., 2024; Sanz-Mas et al., 2024). Our analysis revealed three main thematic clusters connecting climate shelters and urban adaptation: (i) heat–health protection (cooling centers, early warning systems); (ii) social inclusion and equity (targeting vulnerable groups, accessibility criteria); and (iii) multifunctional green and blue infrastructure (parks, shading, water retention). Common keywords included "resilience," "vulnerability," "equity," "green infrastructure," and "public health." These patterns indicate that shelters are emerging at the intersection of social policy and environmental planning.

Apart from the Barcelona climate shelters network, the "TALEA Green Cells" in Bologna, Italy, and "Oasis" from Paris, France are cited. All three of those projects were financed by the Urban Innovative Actions (UIA), of the European Union. Initiatives in schools, mainly their naturalization, are found in a significant number of studies: Baró et al. (2022), Gisotti and Masiani (2024), Plazas et al. (2023), Sevilla and Aguinaco, 2025, Ruiz-Mallén et al. (2023), Sanz-Mas et al. (2025) Sanz-Mas et al. (2024) and Veiga and de Assis Garcia, 2017.

Some authors are present in more than one text, in total they are responsible for 10 studies, which could indicate a small (and recently growing) grid of researchers on the topic. Highlighting Francesc Baró, who participates in 3 studies (Baró et al., 2022; Ruiz-Mallén et al., 2023; Vasconcelos et al., 2024) and Paz Montero-Gutiérrez in 3 studies too (Montero-Gutiérrez et al., 2023; Montero-Gutiérrez et al., 2024; Montero-Gutiérrez et al., 2025). Two other authors appear in 2 texts each as first authors, Ana Terra Amorim-Maia (Amorim-Maia et al., 2023; Amorim-Maia et al., 2022) and Marta Sanz-Mas (Sanz-Mas et al., 2024; 2025).

Here, the oldest year of publication is 2017, by Adriana Veiga and Joe Garcia. Almost all studies (24 of them) were published after 2020, and 9 texts were published this current year of 2025. This could show the growing concern for more urban climate shelters globally.

As seen in Supplementary Appendix 4, the predominant methodologies are qualitative (17 of the texts), but there are quantitative studies (4 of them), and mixed-methods (also 4 studies). The focus of the studies were implementation and evaluation of climate shelters projects, schools as strategic for urban climate resilience, approaches to climate planning and adaptation, and different structures used as shelters (schools, bus stops, boats). Extreme heat and heatwaves are also a focus to bring up climate shelters (Maccabiani et al., 2025; Montero-Gutiérrez et al., 2023; Montero-Gutiérrez et al., 2024; Montero-Gutiérrez et al., 2025; Pede, 2024; Vasconcelos et al., 2024).

Most studies are published in Urban Studies journals (Amorim-Maia et al., 2023; Baró et al., 2022; Cantos et al., 2025; Estévez et al., 2025; Lenzi et al., 2025; Sevilla and Aguinaco, 2025; Maccabiani et al., 2025; Pede, 2024), followed by Energy (Barnat et al., 2024; Heredia et al., 2023; Montero-Gutiérrez et al., 2023; Montero-Gutiérrez et al., 2024; Montero-Gutiérrez et al., 2025; Torrego-Gómez et al., 2024; Vasconcelos et al., 2024), and then Environment/Sustainability (Haque, 2019; Plazas et al., 2023; Cárdenas and Gravante, 2023; Roversi and Longo, 2025; Ruiz-Mallén et al., 2023). A minority of articles are in the areas of Health (Sanz-Mas et al., 2024; 2025), Project Management (Lopes et al., 2025), and Education (Veiga and de Assis Garcia, 2017).

Some limitations identified through the screening of the texts range from institutional and political barriers to implement climate shelters, and engineering limits for projects that aim to change infrastructures. These topics show opportunities for further research and practice regarding climate shelters planning and implementation globally.

4 Discussion

The findings of this systematic review confirm that the concept of climate shelters is still emerging in academic literature[1], with a significant concentration of studies focusing on urban climate shelter networks in Europe, particularly Barcelona (Amorim-Maia et al., 2023; Baró et al., 2022; Cantos et al., 2025; Estévez et al., 2025; Plazas et al., 2023; Sanz-Mas et al., 2024; Vasconcelos et al., 2024). This regional concentration highlights a clear bias in scholarly production, revealing a substantial gap in representation from the Global South, where available literature remains scarce or indirect (Haque, 2019; Veiga and de Assis Garcia, 2017). Generally, amongst Global North and South, the results mix with studies about shelters for fauna and flora, or even refugia, another perspective that focuses on the conservation of biodiversity facing climate extremes (Morelli et al., 2020; Keppel et al., 2012).

This regional disparity reflects structural, political, and financial differences between the Global North and South, an aspect that demands further investigation. The near absence of academic research from the Global South—despite practical initiatives in cities like Buenos Aires, Santiago, and Valparaíso (Municipalidad de Rosario., 2025; Programa de Refugio Climático Urbano, 2025)—underscores the urgency to expand research beyond predominantly Anglophone and European databases, aligning with decolonial perspectives that recognize plural and diverse urban climate adaptation responses (Amorim-Maia et al., 2023).

We found two cities with climate shelters established in Chile, Santiago and Valparaíso[2]. In Santiago, the climate shelters are open from 12:00p.m. to 18:00p.m., and they offer places to rest and hydrate. In Valparaíso, it seems like one museum is characterized as a climate shelter since the summer of 2023, the "Museo de Historia Natural de Valparaíso", and this museum launched the program "Programa de Refugio Climático Urbano 2025" for this current year, to offer physical protection during climate extremes but also to raise awareness about climate change. In Buenos Aires and Rosario anyplace can become a climate shelter by filling an online form to the secretariat responsible, therefore, it's a volunteer initiative. In Santiago and Valparaíso it's not clear what's the process of places becoming climate shelters.

1 We note other types of production such as news articles and governmental documents found in simple Google searches, listed in Supplementary Appendix 3.

2 See more: https://www.munistgo.cl/refugios-climaticos-2024/; https://www.mhnv.gob.cl/noticias/refugio-climatico-urbano-una-iniciativa-pionera-en-museos-de-la-region.

Results also indicate that current literature prioritizes permanent shelters integrated into existing urban infrastructures, such as schools and libraries (Baró et al., 2022; Veiga and de Assis Garcia, 2017; Plazas et al., 2023; Sanz-Mas et al., 2024), mainly focused on protection against heatwaves (Maccabiani et al., 2025; Montero-Gutiérrez et al., 2023; Vasconcelos et al., 2024). This focus is consistent with the increasing frequency and severity of extreme heat events in Europe, as demonstrated by the included studies (Vasconcelos et al., 2024). Nonetheless, there is a clear research gap regarding shelter functionality in contexts of extreme cold or intense rainfall, which are equally important in many Global South countries with tropical or temperate climates.

Institutional, political, and technical barriers identified in some studies emphasize that implementing climate shelters in urban environments faces multifaceted challenges, which future applied research must address (Amorim-Maia et al., 2022; Amorim-Maia et al., 2023; Sanz-Mas et al., 2024). Integrating these dimensions is crucial for advancing knowledge in the field of Built Environment, as urban infrastructure planning and management are central to ensuring the functionality, accessibility, and sustainability of climate shelters (Baró et al., 2022; Ruiz-Mallén et al., 2023).

The methodological diversity observed—predominantly qualitative but including quantitative and mixed methods—reflects a growing interdisciplinarity desire for understanding the complexity of climate shelters, their use, and social impacts. However, the concentration of studies around a small group of authors and pilot projects indicates that the field is still nascent and requires greater diversification and depth, particularly in terms of replicability across varied contexts (Montero-Gutiérrez et al., 2023; Montero-Gutiérrez et al., 2023).

Given the journal's focus on Built Environment, this review highlights the importance of conceptualizing climate shelters not merely as temporary responses to extreme events but as integrated components of urban space that foster territorial resilience and socio-environmental justice (Amorim-Maia et al., 2023; Anguelovski et al., 2016). Advancing understanding of planning, implementation, and evaluation mechanisms for climate shelters in diverse contexts is essential to broaden their adaptive and inclusive potential in future cities.

5 Final remarks

In conclusion, climate shelters can play a strategic role in addressing local challenges such as recurrent heatwaves, flooding, and energy vulnerability. Their long-term relevance depends on integration with urban planning, maintenance of facilities, and institutionalization within climate adaptation policies. Strengthening this link between shelters and broader adaptation pathways is crucial to ensure that they evolve from isolated interventions into enduring instruments of just and resilient urban futures. The state of the art of the research on climate shelters shows how this topic is growing especially from 2022 on. Although the Global South is not yet appropriating the discussion academically, there is political interest and practices in Argentina and Chile. But research and practice, from proposals to implementations, is still a gap in the region, considering its different vulnerabilities to climate extremes.

The studies found here focus on the growing need of climate shelters in urban spaces, and on how vulnerable populations are or are not served by them. Even though the two studies from the South analyzed do not formulate a definition of climate shelter, they focus on local climate problems and adaptation solutions that can be long term.

Globally, studies are focused on climate shelters in Europe, Barcelona's network, and their integration with other urban planning policies. Research on the Global South can be deepened in future studies focusing on Argentina, Chile, and others, or maybe including grey literature such as reports and legislations.

This article shows a new and growing topic, an updated state of the art of it, and presents gaps in academic production from the Global South regarding the subject. It also summarizes the limitations of existing climate shelters and need for further research in the cities implementing them other than Barcelona, notwithstanding the importance of the pilot developed there.

This mini-review advances the field by systematically highlighting the geographic and conceptual gaps in current climate shelter research, emphasizing the urgent need for more inclusive, context-sensitive frameworks—particularly in Global South urban environments. By broadening the scholarly dialogue beyond predominantly Anglophone and Global North perspectives, this work contributes to fostering a more equitable and decolonial approach to climate adaptation infrastructure, offering critical insights for both academic inquiry and policy development.

Author contributions

IC: Investigation, Methodology, Writing – original draft. PC: Conceptualization, Funding acquisition, Methodology, Project administration, Supervision, Writing – review and editing.

Funding

The author(s) declare that financial support was received for the research and/or publication of this article. This research was funded by Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Projeto Universal processo 407457/2023-2. This study was financed, in part, by the São Paulo Research Foundation (FAPESP), Brasil. Process Number 2024/00949-5 and 2025/01741-1.

Acknowledgments

We thank Ana Terra Amorim-Maia for kindly contributing additional references that enhanced the comprehensiveness of our review.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fbuil.2025.1675897/full#supplementary-material

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