

HEAT VULNERABILITY, EVERYDAY THERMAL EXPOSURE, AND LOCAL ADAPTATION PLANNING IN A MEDITERRANEAN MASS-TOURISM MUNICIPALITY

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Extreme heat in Mediterranean tourist municipalities is not only a climatic problem but also a planning and management problem, because the spaces that sustain tourism and those that sustain everyday resident life are not governed in the same way. This article examines how economically vulnerable households experience heat in Lloret de Mar, Catalonia, and uses that evidence to clarify priorities for local adaptation planning. The study is framed as an exploratory mixed-method case study combining semi-structured interviews and participatory mapping with 28 households (77 household members) recruited through the Food Distribution Center of C'aritas Lloret de Mar. Triangulation across closed-response items, open-ended accounts, and mapped locations shows a pronounced gap between the tourist image of summer comfort and the lived thermal reality of low-income residents. More than half of participants reported summer thermal discomfort at home, half reported difficulty bearing cooling-related utility costs, and electricity bills emerged as the most problematic household expense. Coping depended primarily on low-cost domestic strategies, especially fans, cross-ventilation, and persianas, while air conditioning was present in some homes but rarely used because operating costs were prohibitive. Participatory mapping revealed concentrated exposure along main roads, service routes, and dense central areas, alongside an emergent reliance on informal cool refuges such as the public library. The article argues that local adaptation planning should move from generic heat messaging toward place-based, socially targeted interventions: formal climate shelters, shaded everyday mobility corridors, and publicly managed cool commons, while recognizing that the findings are intentionally case-specific rather than statistically generalizable.

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INTRODUCTION

Heatwaves are becoming more frequent, more intense, and more prolonged across the Mediterranean, turning extreme heat from an occasional emergency into a recurrent condition of urban life [14, 15, 25]. In Spain, the summer of 2022 alone brought 41 heatwave days and elevated heat-attributable mortality, underscoring that extreme heat is no longer a marginal seasonal issue [1, 2, 29]. Yet in coastal tourism-dependent municipalities, heat remains politically under-recognized because warm weather is also a core economic asset. This tension is especially visible in destinations where public space, mobility systems, and investment priorities are shaped by visitor comfort and tourist competitiveness, while vulnerable residents experience the same urban environment as exhausting, unaffordable, and difficult to navigate.

This article examines that tension through the case of Lloret de Mar, a major mass-tourism municipality on the Catalan coast. It focuses on households living in conditions of socio-economic vulnerability and asks what their lived experiences of heat reveal for municipal planning and management. Rather than treating heat as a purely meteorological phenomenon, the analysis examines how exposure is produced through housing, mobility, public-space design, and institutional prioritization. This framing places the article squarely within the concerns of management and planning research by linking resident vulnerability to local governance choices and to the practical design of municipal adaptation.

The article makes three focused contributions. First, it documents the intersection of heat vulnerability and summer energy poverty in a mass-tourism setting, showing that the ability to keep cool is constrained by income, housing conditions, and utility cost burdens [28, 30]. Second, it uses participatory mapping to connect household-level experience to specific urban locations, demonstrating that thermal exposure is distributed across everyday routes rather than confined to the dwelling alone [3, 8]. Third, it translates those convergent findings into a planning-oriented interpretation, identifying concrete municipal priorities in climate shelter provision, shaded route design, and public cooling governance. The contribution is therefore not a claim to statistical generalization, but an analytically rich case that clarifies how heat risk becomes embedded in ordinary urban systems in tourism-dependent places.

STUDY CONTEXT AND METHODOLOGICAL DESIGN

Lloret de Mar as a planning context

Lloret de Mar is a coastal municipality with just over forty-one thousand residents and more than one million annual tourists, attracting roughly 40% of tourists visiting the Costa Brava [13]. Tourism-related sectors account for approximately 89% of the working population registered during the high season, which makes the local economy strongly dependent on a highly seasonal and precarious labor structure [16]. This economic profile has clear planning consequences: the same central spaces that are most intensively managed for tourism are also the spaces where many low-income residents live, circulate, and work.

The municipality's old town and beach-adjacent central areas are both socially and climatically significant. Around 29.0% of the local population lives at risk of relative poverty, with average income per person reported at Euro 11,436 [13]. The built environment is also energy inefficient: around 70% of the housing stock in the central area lacks insulation, and large shares of the stock predate current thermal standards [12]. These conditions heighten the domestic burden of cooling. At the same time, local urban heat island effects intensify heat exposure in the dense central zone, with prior local studies reporting substantial summer temperature differentials in the very areas where tourism is concentrated [19, 22].

Data and fieldwork

The study uses an exploratory mixed-method design based on semi-structured interviews and participatory mapping conducted with 28 households representing 77 household members. All participants were users of the Food Distribution Center run by C'aritas Lloret de Mar, the municipality's principal organization serving households with severe financial difficulties [7]. Data collection took place face-to-face between 30 June and 21 July 2022, during a period in which several heat episodes affected the municipality. During fieldwork, the maximum recorded temperature was 34.1°C, and the maximum THSW index reached 41.1°C.

The interview instrument combined closed questions derived from EU-SILC living-conditions measures with open-ended questions on thermal comfort, housing, utilities, work, and everyday heat experience [11]. Participation was voluntary, verbal informed consent was obtained before each interview, and identifying details were removed at transcription. Interviews were audio-recorded, transcribed, and coded iteratively using a focused thematic scheme covering housing conditions, utility burden, mobility exposure, coping practices, and perceived refuges. Themes were retained when they recurred across closed-response summaries, open-ended narratives, and the mapping exercise, so that the interpretation relied on convergence across sources rather than on isolated statements.

The participatory mapping exercise followed the interview. Each participant worked with a paper base map (A0 format, 1:5,000 scale) covering central Lloret de Mar, the main beach, and nearby Fenals beach. Participants first located their home, then marked:

- hot places (red dots),
- cool places (blue dots), and
- places with potential for improvement (green dots).

This design was intended not only to document existing discomfort and refuge, but also to capture residents' spatial imagination of adaptation priorities. The mapped points were interpreted descriptively by reviewing recurring clusters and repeated route-based markings across participants rather than by formal spatial-statistical modeling. Because participants were recruited purposively through C'aritas, the findings should be read as analytically focused evidence about vulnerable households rather than as population-wide estimates for the municipality.

RESULTS

Participant profile and household structure

The sample was predominantly feminized: 20 of 28 participants were women. Participants ranged from 19 to 78 years of age, with an average age of 44. The sample also reflected long-term as well as recent residence in the municipality: 13 participants had lived in Lloret de Mar for more than ten years, while 5 had been in the municipality for less than one year. The average household size was approximately 2.75 persons.

Table 1 summarizes the core sample profile and family composition. The largest single category consisted of people living alone, followed by households classified as "other," principally extended-family arrangements. The sample also included four single-mother households and multiple households with dependent minors, older adults, or persons with disabilities. In labor-market terms, formal stable employment was rare; unemployment

Table 1: Participant and household profile

Indicator	Reported value
Total interviewed households	28
Total household members represented	77
Female participants	20 of 28 (71.4%)
Age range / mean age	19–78 years / 44 years
Residence in Lloret de Mar >10 years	13 participants
Residence in Lloret de Mar 5–10 years	3 participants
Residence in Lloret de Mar 1–5 years	7 participants
Residence in Lloret de Mar <1 year	5 participants
Average household size	Approximately 2.75 persons
Lives alone	9 households (32.1%)
Couple with children	4 households (14.3%)
Couple without children	2 households (7.1%)
Single mother	4 households (14.3%)
Shared flat without family relation	2 households (7.1%)
Other / extended arrangements	7 households (25.0%)
Unemployed without allowance or benefit	7 participants (25.0%)
Unemployed with allowance or benefit	3 participants (10.7%)
Temporary worker with contract	3 participants (10.7%)
Retired (including early retirement)	6 participants (21.4%)

without benefits was the most frequent single category, reinforcing the extent to which heat exposure in this setting is inseparable from economic insecurity.

The sample included 14 nationalities, including participants from Spain, several Latin American countries, Belarus, India, Gambia, Hungary, Morocco, Romania, Russia, and Ukraine. This heterogeneity matters analytically: while the economic condition of the households was similar, thermal expectations and prior experiences of heat varied. The descriptive percentages reported below therefore function as sample characteristics that clarify this case rather than as representative prevalence estimates for Lloret de Mar as a whole.

Economic strain and domestic thermal stress

Economic strain was a central finding. When asked how they made their ends meet by the end of the month, 8 participants (28.6%) reported doing so with many difficulties, 5 (17.9%) with difficulties, and another 8 (28.6%) with some difficulties. Only 7 participants reported reaching the end of the month with some degree of ease.

The thermal consequences of this economic pressure were direct. Half of participants reported feeling burdened by the utility bills required for cooling. More than half (57.1%) reported difficulty maintaining their homes sufficiently cool in summer, a rate substantially higher than the corresponding general-population benchmark referenced in the study. Winter thermal discomfort was also present, but at a lower level (35.7%). Five households reported both summer and winter thermal discomfort, indicating not a seasonal inconvenience but persistent energy vulnerability across the year.

Table 2 presents the core indicators of financial strain, cooling burden, and utility stress.

Qualitative accounts deepened these figures. Participants linked summer to more showers, more laundry, and

Table 2: Economic strain, thermal discomfort, and utility burden

Indicator	Reported value
Reached end of month with many difficulties	8 (28.6%)
Reached end of month with difficulties	5 (17.9%)
Reached end of month with some difficulties	8 (28.6%)
Felt burdened by cooling-related utility costs	14 (50.0%)
Reported summer thermal discomfort at home	16 (57.1%)
Reported winter thermal discomfort at home	10 (35.7%)
Reported both summer and winter thermal discomfort	5 (17.9%)
Electricity bill difficulties (among 25 reporting)	9 (36%)
Electricity cut-offs (among 25 reporting)	2 (8%)
Electricity debt accumulation (among 25 reporting)	7 (28%)
Water bill difficulties (among 25 reporting)	2 (8%)
Water cut-offs (among 25 reporting)	1 (4%)
Water debt accumulation (among 25 reporting)	2 (8%)

Note: Utility indicators are reported only for participants who answered the utility-specific questions in the source study.

therefore higher water costs; electricity was especially stressful because missed payments were associated with cut-offs and enduring debt. This burden affected not only those who already reported thermal discomfort, but also households that tried to maintain minimum cooling while sacrificing other aspects of their budget.

Heat perception and the geography of everyday exposure

The social image of Lloret de Mar as a desirable summer destination contrasted sharply with resident experience. When asked how they perceived summer in the city, 61% of participants described it as *very hot* and another 14% as *hot*. Participants repeatedly described humidity as a key amplifying factor, using terms such as sultriness, stickiness, and vapor. Importantly, discomfort was not limited to the home: participants also described hot workplaces, transit routes, and daily errands.

Participatory mapping made this spatially visible. Participants placed more than 400 hot-area dots, suggesting both the salience and the routineness of thermal discomfort in everyday life. The marked hotspots clustered around:

- main roads used for work, shopping, school, and public services,
- playgrounds and stopping points along daily trips,
- the beachfront corridor, especially Passeig d'Agust'i Font near the city hall,
- dense central streets such as Carrer de Sant Pere, and
- sloped routes that magnified physical load.

These findings are highly relevant for planning. They show that exposure is embedded in ordinary mobility, not only in exceptional outdoor stays. For local authorities, this means that heat adaptation cannot be limited to iconic open spaces or symbolic greening projects; it must address the corridors of compulsory movement that structure everyday resident life.

Entrapment, household lock-in, and limited adaptive capacity

The study identified what it described as different degrees of household *entrapment* or lock-in. These lock-ins included:

- absence of cooling devices,
- inability to use available cooling devices because of cost,
- lack of effective ventilation,
- humidity problems,
- utility-payment difficulties and debt accumulation,
- severe end-of-month financial strain, and
- self-reported thermal discomfort.

Households did not experience these in isolation. Some reported only one such difficulty, but others reported combinations reaching as many as seven concurrent constraints, with an average of about four categories. This result is crucial because it demonstrates that household vulnerability is cumulative rather than singular. In planning terms, it means that a one-dimensional response (for example, generic heat advice) is unlikely to be effective when households face overlapping financial, physical, and environmental barriers.

Participants also emphasized their inability to use vacation as a relief mechanism. Summer was described not as a season of leisure but as a period of intensified work pressure or, paradoxically, impending seasonal unemployment. This reinforced the sense that vulnerable residents were spatially and economically locked into the municipality during precisely the period of maximum heat exposure.

Coping strategies and the informal cooling system

Coping strategies were dominated by low-cost domestic practices. Most participants described taking frequent showers, using fans, adding frozen bottles or cold water near fans, seeking cooler places within the dwelling, and carefully managing windows and *persianas* according to sun and time of day. These practices show substantial practical knowledge and behavioral adaptation, but they also underscore the absence of stronger structural support.

One of the most important findings was that 64% of participants reported excessive outdoor or neighbor noise that prevented them from leaving windows open at night. In other cases, street-facing layouts made open doors or windows feel unsafe or too intrusive. Thus, even the most accessible low-cost strategy—cross-ventilation—was often constrained by building configuration and neighborhood conditions.

Table 3 presents the main coping tools reported by participants.

The gap between installation and use of air conditioning is particularly significant. One quarter of households had air conditioning, but only one household reported occasional actual use. This indicates that infrastructure ownership alone is not a valid proxy for cooling access when operating costs are prohibitive.

Table 3: Common coping tools used by participants

Coping tool	Reported use
Community swimming pool	21%
Air conditioning installed	25%
Actual use of air conditioning	4%
Dehumidifier	14%
Fans	79%
Cross ventilation	71%
Persianas	79%

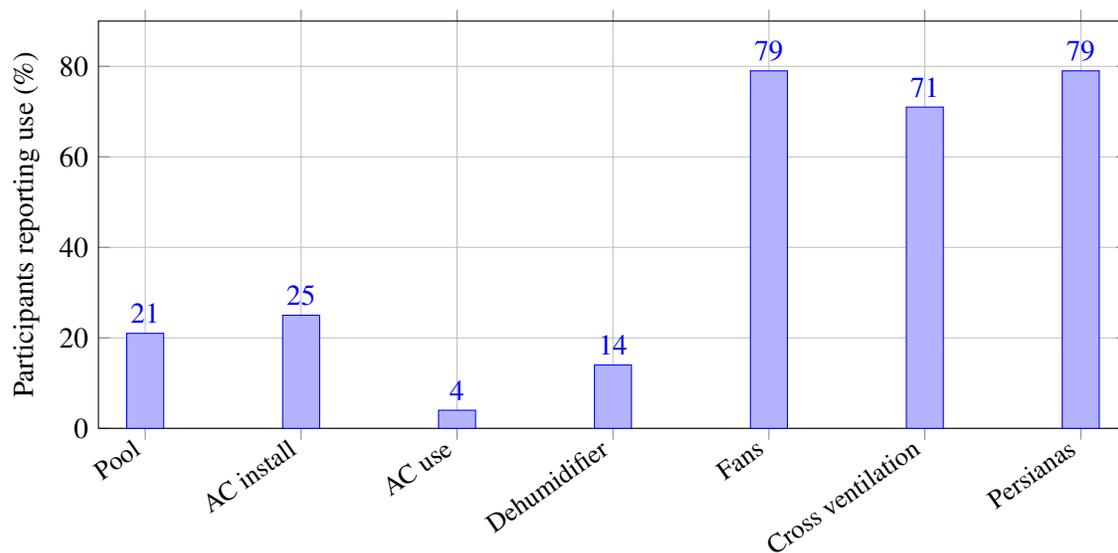


Figure 1: Reported coping tools for dealing with summer heat. The strongest dependence is on low-cost domestic strategies, while air conditioning is infrequently used despite being present in some homes.

Cool places, de facto shelters, and participatory demand for change

Participants identified cool places very differently from hot places. Hot spaces were easier and more numerous to map. Cool places were fewer, more contingent, and often socially qualified. Participants described seeking cooler conditions in shaded breezy areas, near the shore, behind the theatre, and on the route to the municipal pool. Some bars, caf'es, and shops were also mentioned as temporary refuges.

Two findings stand out. First, the public library already functioned as a de facto cool refuge, even in the absence of an official climate-shelter program. Second, several participants marked *home* as a cool place. This cannot be read as straightforward domestic comfort. Among the 9 participants who named home as a cool refuge, 6 also reported being burdened by cooling costs, and 3 reported humidity problems and difficulty maintaining indoor coolness. In other words, retreating home often reflected reduced mobility or lack of alternatives rather than genuine thermal adequacy.

The participatory mapping exercise also captured a clear planning demand. Participants most often called for:

- more tree cover or artificial shade along roads,
- better-shaded playgrounds,

Table 4: Source-grounded planning priorities for municipal adaptation

Observed condition	Planning significance	Municipal priority
Main roads to work, schools, shops, and services were repeatedly mapped as hot.	Everyday thermal exposure is concentrated in compulsory mobility corridors, not only in leisure spaces.	Prioritize shade canopies, trees, benches, and drinking water at key service corridors and waiting points.
Beachfront corridors and central tourist streets were mapped as hot despite their symbolic value.	Visitor-facing public space does not necessarily function as resident-supportive space.	Rebalance central-area public-space management toward thermal comfort for routine resident use.
The public library already operated as a perceived cool refuge.	Existing municipal infrastructure can be upgraded faster than building new facilities.	Formalize the library as an official climate shelter with clear signage, opening-hour policy, and outreach.
Home was frequently named as a refuge despite cooling-cost burden and humidity.	Domestic retreat may indicate entrapment rather than comfort.	Combine public cooling provision with home-focused bill relief, ventilation support, and targeted retrofit programs.
Residents most often requested more cover on roads and playgrounds and identified specific areas for improvement.	Participatory evidence offers place-specific design priorities.	Integrate resident-mapped priorities into annual public works, parks planning, and local heat-action plans.

- greener main routes,
- visible water-based cooling elements such as ground fountains, and
- more usable public places during peak heat.

These are not abstract preferences; they are operational design cues for municipal action.

PLANNING AND MANAGEMENT IMPLICATIONS

The empirical findings point to a set of concrete, context-specific planning and management priorities. Table 4 translates the reported results into a municipal action framework grounded in the observed conditions of Lloret de Mar.

Three context-sensitive implications follow.

First, local climate adaptation should be managed as an *everyday infrastructure* issue. The critical spaces in this study were not exceptional emergency sites but roads, playgrounds, public buildings, and routine service routes. This shifts the planning focus from isolated refuge provision to networked urban comfort.

Second, municipal heat governance should distinguish between *existing cool assets* and *symbolic adaptation*. The public library's role as an informal refuge shows that some cooling capacity already exists within the municipal estate. Formal designation, communication, and accessibility management may therefore yield faster and more equitable benefits than highly visible but socially narrow tourism-oriented projects.

Third, adaptation in a mass-tourism setting requires stronger integration between social policy and spatial planning. A household that cannot pay for air conditioning, cannot safely ventilate at night, and cannot afford

leisure escape is not helped by generic awareness campaigns alone. In such settings, climate adaptation must be coordinated with anti-poverty policy, utility support, and inclusive public-space management [18, 21, 26].

DISCUSSION

This study shows that heat vulnerability in coastal tourist municipalities is best interpreted as a problem of unequal access to cooling, unequal exposure across everyday space, and uneven institutional attention. The findings align with broader work on summer energy poverty, especially the argument that domestic thermal comfort cannot be understood only through appliance ownership or indoor conditions [23, 28, 30]. In Lloret de Mar, the relevant question is not simply whether cooling technologies exist, but whether vulnerable residents can afford to use them and whether the urban environment offers meaningful alternatives.

The study also supports the idea that household boundaries are permeable in heat governance. Exposure is distributed across the home, the walk to the supermarket, the route to school, the playground, the workplace, and the public building. This has important consequences for local planning because it means that thermal risk is embedded in the organization of everyday urban systems rather than in one isolated location [3]. Participatory mapping was especially valuable in making these spatial dynamics legible to planners because it corroborated interview accounts and identified recurring hotspots along compulsory routes rather than only in amenity spaces.

A further contribution lies in the identification of *informal cooling infrastructures*. The public library, the route to the municipal pool, certain breezy shaded areas, and even selected commercial interiors formed an ad hoc cooling system in the absence of a formal municipal one. From a management perspective, this is a critical insight: municipal adaptation does not start from zero. It starts from already-used places that can be recognized, stabilized, and made more equitable. In this sense, the manuscript's originality lies less in proposing a new theory of heat vulnerability than in showing, through a tightly bounded case, how an existing body of climate-justice and energy-poverty research can be translated into specific municipal action in a tourism-dependent setting.

The findings also expose a limitation in current tourism-led sustainability agendas. Investments framed around greener hotels, upgraded tourism services, or destination competitiveness may improve environmental performance without meaningfully reducing the heat burden experienced by low-income residents. Where tourism remains the dominant development lens, adaptation risks being spatially visible but socially exclusionary. This is precisely why planning research must pay close attention to whose comfort is being managed, where, and for what purpose.

At the same time, the study should be read within the limits of its design. The sample was intentionally recruited through C'aritas and therefore captures households already facing economic strain; the resulting percentages are not intended as representative prevalence estimates for the wider municipality. The value of the case instead lies in analytical depth, cross-source triangulation, and the way it reveals mechanisms of cumulative disadvantage that can inform subsequent comparative and policy-oriented work.

CONCLUSION

Heat adaptation in coastal tourist municipalities cannot be treated as a generic public-information exercise or as a purely technical matter of urban greening. The evidence from Lloret de Mar shows that vulnerable households face a double challenge: they contend with domestic thermal stress under conditions of economic hardship, and they navigate a public realm where routine routes and central spaces remain intensely exposed.

Their coping strategies are practical and disciplined, but largely individualized and low-cost, which means that resilience is being produced under constraint rather than through supportive institutional design.

For management and planning practice, the implications are direct. Municipal authorities should formalize already-used cool refuges, especially public buildings such as libraries; redesign everyday mobility corridors for thermal safety; prioritize shaded and accessible playgrounds and service routes; and connect heat adaptation with social support for households facing cooling-cost burdens. Participatory mapping is especially valuable because it reveals where residents actually experience heat, where they already seek relief, and which interventions are most immediately legible to local users.

In municipalities shaped by tourism, effective adaptation depends on moving from destination-centered thermal management to resident-centered climate planning. The present case does not claim universal coverage, but it does show that a planning framework recognizing vulnerable households, everyday exposure, and the need for publicly governed *cool commons* is more equitable and more operationally aligned with how heat is actually lived.

DATA AVAILABILITY

The underlying source study reports that de-identified data are available on request. Because the material concerns vulnerable households and includes sensitive lived-experience accounts, any reuse should follow the original consent conditions and appropriate confidentiality safeguards.

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