Research Paper

Practices of Climate Adaptation Actions of Double-Aging Communities in Responding to Heatwaves: A Case Study of Chongqing, China

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Abstract

In the context of urban heatwaves that are occurring with greater frequency and showing a rising temperature trend, "double-aging" communities are rendered more vulnerable as they are caught in a bind of an aged physical environment and population aging. How can "double-aging" communities enhance their capacity to address the risk of heatwaves? This is a crucial topic that China must address as it enters a stage of moderate aging and steps into an era of a stock economy. At present, the methods adopted by communities to deal with heatwaves mainly involve adding cooling and shading facilities in physical spaces, or implementing measures such as distributing cool beverages and advocating for a reduction in the frequency of outdoor activities to alleviate the impacts brought by heatwaves. However, actual research has found that in the context of heatwaves, residents in "double-aging" communities are more willing to engage in outdoor activities due to the comfort of natural outdoor breezes and the need for social interaction. The advocacy for reducing outdoor activities has limited effect. Furthermore, owing to the deterioration of the physical space, "double-aging" communities not only suffer from a shortage of cooling and shading facilities, but also encounter a series of issues, including the piling up of garbage that remains untreated emitting offensive odors; the breeding of mosquitoes in multiple idle spaces; the absence of signage indicating heatwaves; the failure to distribute cooling drinks due to lax property management, and the lack of barrier-free facilities. Evidently, improving the ability of "double-aging" communities to respond to heatwaves has emerged as a systematic endeavor, the current coping strategies remain incomplete. In view of this, this article draws on the existing research on heatwaves response cases in South Korea and the United States, as well as the construction of age-friendly environments in China. It constructs an evaluation system for heatwaves response facilities and governance capabilities in "double-aging" communities. This "double-aging" communities heatwave response capacity evaluation system encompasses six primary indicators, building upon conventional paradigms, this evaluation syste innovatively incorporates botanical mosquito-repellent strategies, environmental sanitation facility configurations (e.g., solid waste treatment), and tailored elderly support infrastructure, which encompasses 28 secondary indicators nested within 6 primary dimensions, namely: smart heatwave prevention measures, shading and cooling facilities, rescue and medical assistance measures, sanitation environment facilities, support facilities for the elderly and community governance. These indicators are further classified into basic-type facilities and improvement-type facilities. Taking this evaluation system as the basis, and integrating on-site surveys, questionnaire surveys, and resident interviews, this paper assesses the heatwaves response capabilities of Wanshou Mountain Community, a "double-aging" community in Chongqing (renowned as a "furnace city"). The study reveals that this community has shortcomings in five primary indicators.

Consequently, seven community heatwaves adaptation action plans tailored for Wanshou Mountain Community are put forward: shading and cooling facilities, environmental sanitation facilities, signage, vegetation, barrier - free facilities, the reuse of idle spaces, and governance measures. Specifically, these actions involve setting up cooling facilities and distribution points for cold beverages, at roads and activity nodes; optimizing the layout of environmental sanitation facilities and promoting the use of buried treatment facilities; setting up signage for heatwaves response; optimizing the layout and selection of vegetation; enhancing the barrier-free facilities at community activity nodes; transforming idle spaces into shaded gardens; and disseminating knowledge about heatwaves response capabilities through public brochures. It is expected that this case can offer a reference for the climate adaptation construction initiatives of "double-aging communities" that are also confronted with the threats of heatwaves.

Keywords

Double-Aging Communities, Climate Adaptation Action, Heatwave Response, Urban Renewal, Aging Society

1. Introduction

"Double-aging" communities have become a crucial subject for China to address in the context of climate change response, urban renewal, and an aging society. The number of double-aging communities in Chinese cities is enormous, Gu et al. has found that 178 out of 967 communities in the central urban area of Wuhan City met the "double-aging" standard(Gu et al., 2025). These communities typically exhibit aging physical environments, characterized by outdated municipal infrastructure, a lack of community services, and insufficient daily maintenance, making them highly vulnerable to increasingly frequent heat waves and high temperatures(Mason et al., 2022). Furthermore, the large elderly population within these communities makes their health extremely susceptible to the threats posed by heatwaves. Research data shows a higher proportion of non-accidental deaths among people aged 65 and above during heat waves (Zhang et al., 2018), a fact corroborated by historical events such as the 1995 Chicago heat wave and the 2003 Central European heat wave(Vecellio et al., 2021). Because of the increased temperature and humidity during heat waves accelerate the functional decline of older adults(Wang et al., 2020), directly leading to fatal symptoms such as dehydration, hyperthermia, and heatstroke(Wang et al., 2020), and exacerbating underlying chronic diseases such as cardiovascular and respiratory illnesses(Xu et al., 2019). Therefore, as China enters a moderately aging stage and an era of urban renewal, improving double-aging communities response capacity of to cope with heat waves has become a vital topic.

Currently, China lacks policies to guide double-aging communities in responding to heatwaves. Existing guidelines such as the Technical Guidelines for Community Living Circle Planning, the Guidelines for Improving Residential Community Construction, and the "15-Minute Convenient Living Circle" framework do not provide guidance on building climate adaptability. Current research do not offer specific guidance for double-aging communities, but have proposed suggestions on how communities can cope with heatwaves, including physical interventions (e.g., introducing shading facilities, adopting building density indicators, constructing medical facilities, green spaces, installing air conditioning, reducing impermeable surfaces, and increasing canopy coverage) and behavioral management (e.g., distributing cold drinks and advocating for reduced outdoor activities) (Hass et al., 2021). However, through surveys and interviews, we found that such measures had minimal effect on improving the heatwave coping capacity of double-aging communities. For example, during heatwaves elderly residents in double-aging communities would like to go outside activities because they need necessary social interaction and enjoy the comfort of natural

breezes rather than air conditioning, suggestions to reduce outdoor activities for elderly residents during heatwaves have limited impact. Furthermore, despite of the lack of physical interventions for cooling facilities, double-aging communities also suffer from problems such as unmanaged garbage accumulating and emitting foul odors during heatwave, affecting the environmental quality of the whole community; unmanaged and unmaintained spaces are overgrown with weeds, breeding mosquitoes and snakes, indirectly affecting the health of the elderly; outdoor spaces lack guidance signs for the elderly dealing with heatwave and high temperature; poor property management renders community public cooling facilities ineffective; and a lack of accessibility facilities restricts the outdoor activities of the elderly. Consequently, the prevailing heatwave coping strategies for double-aging communities are fundamentally incomplete, necessitating a systematic and integrated undertaking to bolster their climate resilience. All above problems reflect that coping with heatwave in double-aging communities cannot rely solely on cooling and humidification facilities, a systematic and comprehensive planning strategy is needed to enhance their capabilities.

Worldwide countries and cities have developed systematic community-based heatwave response plans to prevent or mitigate the impact of heatwave on public health. These plans encompass elements such as community development, urban greening, housing renovation, and financial support. related follow-up studies tracking the implementation effectiveness of these plans confirm that systematic community heat response measures can effectively reduce mortality during heatwaves. Khatana et al. demonstrated that after implementing systematic heatwave response measures, the heatwave-related mortality rate in Montreal in 2018 significantly decreased compared to 2010(Khatana et al., 2022), highlighting the effectiveness of systematic heatwave response plans. These international cases and studies not only provide valuable references for enhancing the heat resilience of double-aging communities but also indicate that adopting a systematic community heat response plan will strongly bolster the resilience of this specific demographic. Crucially, a comprehensive and scientific assessment of the double-aging community's current heat response capacity is the prerequisite for developing effective response measures. Therefore, this study will first construct a double-aging community heatwave response capacity evaluation system based on existing domestic and international community planning tools and relevant foundational research. Subsequently, this evaluation system will be applied to Wanshou Mountain Community in Chongqing (a typical aging community) to formulate a systematic and targeted set of heat mitigation strategies, with the aim that this systematic approach can provide a reference for other communities facing the challenges of double-aging to enhance their climate adaptability.

2. Existing Relevant Research and Construction of "Double-aging" Communities Heatwave Capacity Evaluation System

2.1. Existing relevant research concerning heatwave response cases

Developed countries such as the United States and South Korea have formulated community-based heatwave adaptation planning policies, which mainly include community heatwave vulnerability assessment, heatwave response measures, weather warning systems, and public climate response education(Stone Jr et al., 2014). Among them, the United States, as one of the countries most severely affected by heatwaves, has the most representative heatwave response plan named Cool Neighborhoods NYC. This plan focuses on four core areas: constructing a community heatwave vulnerability index to identify high-risk communities; mitigating the urban heat island effect by improving the physical environment; establishing a heatwave data collection and monitoring system to achieve real-time

monitoring of community temperatures; and creating a health service map with online information on public health facilities. Meanwhile, South Korea has pronounced the National Climate Change Adaptation Strategy (NCCAS), which emphasizes increasing various cooling facilities such as green spaces and air-conditioned buildings within communities. Most notably, this strategy encourages the government to facilitate the opening of air-conditioned public buildings as "Community Cooling Centers" to the public. This approach successfully achieves the dual goals of enhancing energy efficiency while simultaneously meeting the urgent cooling demands of the community during high-temperature heatwave events(Kim et al., 2023).

Although China has not yet issued specific plans and guidelines for heatwave response at the community scale, some urban-level measures to address high temperatures have already been implemented. For instance, the Wuhan Urban Cooling Action Plan proposed five major action guidelines at the urban scale, covering aspects such as ventilation, water body activation, greening, permeability, and carbon reduction, which aimed to reduce the area of strong heat islands, limit contiguous heat islands to within 30 square kilometers, decrease the static wind speed, and significantly improve the urban living environment by 2025. Similarly, the Guangzhou Cool City Action also proposes corresponding strategies covering four levels: city as a whole, unit, block, and community. At the community level, the action mainly outlines specific strategies for cool communities, including strengthening community ventilation and increasing shading facilities and misting cooling infrastructure.

2.2. Construct heatwave response capacity evaluation system for double-aging communities

Through integrating heatwave response measures from the United States and South Korea, and existing urban-scale practices from China, this paper constructed a comprehensive evaluation system to assess the capacity of double-aging communities responding to heatwaves. First, this paper defines that the double-aging communities applicable to this evaluation system are those located in urban centers, built before 2005, with aging environmental facilities and a population aged 60 and above exceeding 14%. the evaluation framework addresses two core dimensions: the daily living needs of the elderly and the heatwave mitigation demands of aging built environments. This two-dimensional approach is firmly grounded in empirical literature. For instance, heat injury is a major cause of death among the elderly, so outdoor sun protection and shade for the elderly must be given high priority(Yuan et al., 2022); the number of ambulance calls and emergency room visits increases during heat waves(Ghirardi et al., 2015), and the key to heatstroke intervention is the golden half hour, so corresponding medical service facilities need to be set up within this service area(Holstein et al., 2005); it is necessary to comprehensively improve the heat adaptation capacity of the elderly population by considering factors such as temperature, humidity, wind, and radiation(Nazarian et al., 2022). Building on these foundations, this study constructed a heatwave response capacity evaluation system for double-aging communities, which comprises six primary indicators(including smart heatwave prevention measures, shading and cooling facilities, rescue and medical assistance measures, sanitation environment facilities, support facilities for the elderly, community governance) and 28 secondary indicators. These indicators are classified into "basic facilities," which represent immediate and essential short-term response measures, and "improvement facilities," which denote components to be implemented as future conditions permit. In order to provide a straightforward representation of the capacity of double-aging communities responding to heatwaves, this evaluation system utilizes a binary "presence-or-absence" approach. A value of "1" is assigned if a

community possesses the corresponding facility, and "0" otherwise, thereby directly reflecting the actual conditions of the community.

Table 1. Evaluation system to check the heatwave response ability of "double-aging" communities. Source: Created by the author.

Num	Primary indicators	Secondary indicators	Descriptions	Evaluation method	Type
1	Smart heatwave prevention measures	Early warning information system	Includes early warning notifications delivered via SMS, television, and other media platforms	1 is yes, 0 is none	basic-type
2		Monitoring system	Refers to environmental monitoring equipment, such as air/humidity sensors and localized community weather stations	1 is yes, 0 is none	basic-type
3		Intelligent pedestrian route recommendation system	A digital pedestrian route recommendation engine optimized for safe travel	1 is yes, 0 is none	basic-type
4	Shading and cooling facilities	Neighborhood wind corridor	Major ventilation pathways that align with prevailing wind directions and remain unobstructed by built structures	1 is yes, 0 is none	improvement-type
5		Shaded community green space	Provides open spaces, gardens, and courtyards that offer high-canopy shade and cooling benefits	1 is yes, 0 is none	basic-type
6		Outdoor Shading facilities	Comprises built structures designed to provide physical sun blocking and optimal shading	1 is yes, 0 is none	basic-type
7		Outdoor misting facilities	Features outdoor spraying and misting installations that distribute water droplets or fine mist for localized cooling	1 is yes, 0 is none	improvement-type
8		Community cooling center	Refers to compact public buildings that are universally accessible, open to the public, and equipped with indoor air conditioning systems	1 is yes, 0 is none	basic-type
9		Exterior wall materials	Specifies building facade materials that effectively lower indoor ambient temperatures when integrated with external shading designs	1 is yes, 0 is none	improvement-type
10		Cool pavements	Denotes ground paving materials capable of accelerating water evaporation to reduce surface and ambient temperatures	1 is yes, 0 is none	improvement-type
11		Green roof	Roof structures integrated with structural shading designs and live vegetative plantings	1 is yes, 0 is none	improvement-type
12	Rescue and medical assistance measures	Community Health Service Centers	Medical service facilities equipped to provide high-temperature preventative care, routine treatments, and rehabilitation	1 is yes, 0 is none	basic-type
13		Emergency Vehicle Access Lane	Transportation corridors designed and maintained to facilitate the unhindered access and maneuvering of ambulances	1 is yes, 0 is none	basic-type
14		Temporary Cooling Center	Mobile or deployable cooling service points providing drinking water, heat shelter, and emergent heat relief	1 is yes, 0 is none	basic-type
15	Sanitation environment facilities	Waste Collection Station/ Garbage Collection Station	Odorless and visually integrated waste disposal containers that eliminate environmental and visual pollution	1 is yes, 0 is none	basic-type
16		Material Recovery Facility	Reutilization and recycling hubs engineered to operate without emitting odors or creating visual pollution	1 is yes, 0 is none	improvement-type
17		Conversion of Idle Spaces	The systematic transformation of unmanaged, underutilized, and pest-prone areas into highly utilized, easily maintained, and mosquito-free public assets	1 is yes, 0 is none	basic-type
18		Botanical Insect Repellent Materials	The implementation of dual-purpose plants (combining ornamental value with natural insect-repelling properties) to construct a multi-dimensional botanical shield against vector-borne hazards	1 is yes, 0 is none	basic-type
19	Support facilities for the elderly	Accessibility in Public Spaces	Public domains intentionally designed with appropriate slopes, widths, and handrails to ensure fluid entry and exit for elderly residents using wheelchairs, walkers, or facing gait instability	1 is yes, 0 is none	basic-type

20		Unobstructed Passage	Outdoor pathways systematically retrofitted with suitable slopes, widths, and handrails to allow older adults with assistive mobility devices or unsteady gaits to pass through smoothly	1 is yes, 0 is none	basic-type
21		Accessible Facilities	Vertical and sloped accessibility infrastructure, such as elevators and ramps, that meet the fundamental mobility and daily living requirements of elderly and disabled residents	1 is yes, 0 is none	basic-type
22		Accessible Cooling	Designated heat shelters and cooling amenities equipped with wheelchair-accessible ramps for barrier-free entry	1 is yes, 0 is none	basic-type
23		Barrier-Free Signage	High-legibility signs and wayfinding elements tailored for easy physical and cognitive recognition by older adults	1 is yes, 0 is none	basic-type
24		Accessible Intelligent Systems	Age-friendly smart assistance and digital monitoring platforms designed for senior residents	1 is yes, 0 is none	improvement-type
25	Community governance	Facility Management Governance & Regular Inspection	Institutional and operational frameworks that dynamically adjust the operating schedules of cooling centers, ensuring specific zones remain open during off-work days under extreme heat conditions to fulfill residents' cooling needs	1 is yes, 0 is none	basic-type
26		Public Participation	Community engagement activities, including participatory workshops, exhibitions, and educational outreach campaigns, aimed at enhancing public climate awareness	1 is yes, 0 is none	basic-type
27		Community Heat Response Services	A community-based mutual aid and response network that delivers essential cooling products (e.g., cooling balms, insect-repellent water, electric fans, and traditional heat-relief medicines) to vulnerable elderly households during extreme heatwaves	1 is yes, 0 is none	basic-type
28		High Temperature Warning Sign	Outdoor warning and navigational signage that provides high-temperature alerts, behavioral coping strategies, medical rescue details, and orientation guides	1 is yes, 0 is none	basic-type

3. Evaluation System Application and Practice of Heatwave Response in Double-Aging Communities: Wanshou Mountain Community in Chongqing

3.1. Wanshou Mountain Community basic context

This study applies the developed evaluation framework to Wanshou Mountain Community, located in Chongqing, one of China's "Furnace Cities." According to the gathered community profile data, Wanshou Mountain Community is situated within the central urban area of Chongqing, spanning 0.4 square kilometers and accommodating a permanent population that exceeds 6,500 residents across 2,600 households. Developed in April 2002, the community suffers from acute infrastructure degradation; furthermore, as of 2024, its elderly population (aged 60 and above) exceeded 2,000 individuals, rendering it a textbook case of a "double-aging" community. As regional heatwaves grow increasingly frequent and severe, the community confronts intensifying heat stress, necessitating an initial capacity evaluation to inform targeted efforts toward enhancing local climate resilience.



Figure 1. Images of the Built Environment within Wanshou Mountain Community, The top-left image illustrates the current state of spatial aging and structural deterioration within the community, characterized by narrow building intervals, a deficiency in green infrastructure, and a severe lack of maintenance, repair, and management. The top-right image demonstrates the extreme narrowness of existing pedestrian sidewalks, vehicular roadways, and roadside greenery, while highlighting the pronounced deficiency in shaded resting amenities and universal barrier-free infrastructure beneath the tree canopy. The bottom-left image captures the current conditions of unutilized idle spaces within the neighborhood; these areas remain completely unmanaged, with overgrown neglected vegetation entirely obscuring the original stone pavements, alongside piles of abandoned construction materials that facilitate the breeding and harborage of mosquitoes and snakes. The bottom-right image depicts elderly residents gathering and conversing outdoors during the extreme heat of the "Sanfu" period, empirically evidencing that senior citizens maintain a resilient and intensive demand for outdoor social interaction even under high-temperature stress; notably, the elderly residents featured in this panel also served as the primary subjects for the field questionnaires and in-depth interviews. Source: Created by the author

3.2. Evaluation system application and outcome

Based on the established evaluation system, this study assessed the heatwave response capacity of Wanshou Mountain Community. Guided by detailed on-site field investigations and conducted with the informed consent of both the local neighborhood committee and its residents, the assessment was purposefully executed during the "Sanfu" period (the dog days of summer)—the hottest interval of the year that best reflects a community's peak high-temperature coping capacity. By analyzing empirical data collected from the on-site distribution of 86 physical questionnaires and in-depth interviews with 15 residents, and utilizing mean score calculations of the questionnaire responses, the evaluation reveals that the community scored relatively high only in the primary indicator of " Rescue and medical assistance measures ". In marked contrast, it exhibits varying degrees of systemic deficiencies across the remaining five primary indicators, detailed as follows: Regarding Smart heatwave prevention measures, although the meteorological authority disseminates high-temperature warnings via mobile text messages, the community lacks its own climate sensing capability, resulting in insufficient fine-grained monitoring and response capacity. Within the Shading and cooling facilities, outdoor activity spaces and seating areas lack

critical shading provisions, with shaded spaces being restricted to inaccessible vegetation thickets and beneath street trees, and the community is devoid of cooling features such as misting or fountain facilities. Sanitation environment facilities is compromised as the community relies on scattered waste bins instead of specialized collection and transport facilities, while numerous underutilized idle spaces with neglected vegetation facilitate mosquito breeding, posing a significant health concern for elderly residents. For Support facilities for the elderly, despite the fact that key public facilities—including convenience service centers, family doctor stations, and elderly care service facilities—are equipped with ramps and handrails, the overall community suffers from severe shortcomings in accessibility throughout its circulation and outdoor spaces; road infrastructure features mixed pedestrian-vehicular traffic and narrow sidewalks, making passage highly inconvenient for seniors relying on wheelchairs. Finally, Community Governance exhibits inadequate management flexibility, evidenced by public facilities being operational during weekdays when the elderly are often unavailable due to childcare responsibilities, yet closed on weekends when the elderly have leisure time; concurrently, the community lacks participatory heat response education mechanisms and clear heat response signage. Collectively, these findings confirm that Wanshou Mountain Community possesses a low overall level of heatwave response capability.

Table 2. Evaluation result of the Wanshou Mountain Community heatwave ability. Source: Created by the author.

	Primary Indicators	Secondary indicators	Average Score	Residents Comments	Type
1	Smart heatwave prevention measures	**Early warning information system**	**1.00**	**The meteorological authority issues high-temperature alerts via mobile text messages.**	**basic-type**
2		**Monitoring system**	**0.00**	**the community lacks micro-meteorological stations or similar facilities**	**basic-type**
3		**Intelligent pedestrian route recommendation system**	**0.00**	**Route maps are absent from common commercial mapping platforms.**	**basic-type**
4	Shading and cooling facilities	Neighborhood wind corridor	0.13	Due to its age and high population density, the community lacks adequate space for ventilation corridors.	improvement-type
5		**Shaded community green space**	**0.20**	**Current community outdoor activity spaces are primarily plazas with insufficient shading; effective shade is mainly confined to street trees and inaccessible vegetation thickets.**	**basic-type**
6		**Outdoor Shading facilities**	**0.60**	**Most community outdoor recreational facilities are designed without consideration for shading.**	**basic-type**
7		Outdoor misting facilities	0.00	The community is devoid of cooling features such as misting systems or fountains.	improvement-type
8		**Community cooling center**	**1.00**	**While the community lacks a dedicated cooling center, a convenience service center is available for temporary use as a heat refuge.**	**basic-type**
9		Exterior wall materials	0.00	Due to the community's early construction period, these facilities are currently absent.	improvement-type
10		Cool pavements	0.00	Due to the community's early construction period, these facilities are currently absent.	improvement-type
11		Green roof	0.13	Some rooftops feature privately constructed gardens lacking regulatory control over photovoltaic integration or greening metrics.	improvement-type
12	Rescue and medical assistance measures	**Community Health Service Centers**	**1.00**	**The community is equipped with convenience service centers, family doctor stations, and elderly care service facilities.**	**basic-type**
13		**Emergency Vehicle Access Lane**	**0.67**	**Although a family doctor station is currently operational within the community, the adequacy of its passage clearance cannot be verified due to the absence of designated ground markings.**	**basic-type**
14		**Temporary Cooling Center**	**0.67**	**Some ground-floor residents spontaneously open their living rooms, creating informal, temporary heat-sheltering spaces.**	**basic-type**

15	Sanitation environment facilities	**Waste Collection Station/ Garbage Collection Station**	**0.40**	**The community primarily relies on scattered waste bins and lacks specialized refuse collection and transportation facilities.**	**basic-type**
16		Material Recovery Facility	0.00	These types of facilities are absent.	improvement-type
17		**Conversion of Idle Spaces**	**0.00**	**A significant number of underutilized idle spaces within the community, characterized by neglected vegetation, facilitate mosquito breeding.**	**basic-type**
18		**Botanical Insect Repellent Materials**	**0.00**	**Community vegetation planning does not adequately integrate pest control (mosquitoes, insects, snakes) requirements alongside shading and heat prevention.**	**basic-type**
19	Support facilities for the elderly	**Accessibility in Public Spaces**	**0.13**	**Due to the community's early construction date, there is a notable scarcity of barrier-free accessibility facilities.**	**basic-type**
20		**Unobstructed Passage**	**0.40**	**Community roads feature mixed pedestrian and vehicular traffic, narrow sidewalks, and a lack of accessibility infrastructure (e.g., ramps, handrails, wheelchair access), leading to difficult passage.**	**basic-type**
21		**Accessible Facilities**	**0.67**	**Key public facilities, including the convenience service center, family doctor station, and elderly care service station, are equipped with accessibility ramps and handrails.**	**basic-type**
22		**Accessible Cooling**	**1.00**	**Given that the convenience service center is equipped with accessibility ramps and handrails and can temporarily function as a cooling center, this indicator is considered present.**	**basic-type**
23		**Barrier-Free Signage**	**0.47**	**The community lacks an adequate internal signage system.**	**basic-type**
24		Accessible Intelligent Systems	0.00	These are lacking.	improvement-type
25	**Community governance**	**Facility Management Governance & Regular Inspection**	**0.13**	**Facility management is inadequate; residents report that public facilities are operational only on weekdays, when the elderly are often unavailable due to childcare responsibilities, but are closed on weekends when the elderly have leisure time.**	**basic-type**
26		**Public Participation**	**0.00**	**Community participation remains insufficient.**	**basic-type**
27		**Community Heat Response Services**	**0.00**	**These are lacking.**	**basic-type**
28		**High Temperature Warning Sign**	**0.00**	**These are lacking.**	**basic-type**

3.3. Improvement strategies for Wanshou Mountain Community

Based on the aforementioned evaluation results, this paper proposes tailored heatwave adaptation action planning strategies for Wanshou Mountain Community. Given that basic-type facilities constitute the most critical pillar of a community's heatwave response capacity, the plan formulates seven action strategies aimed at rectifying these fundamental shortcomings: First, target the deployment of shading, cooling facilities, and cold beverage distribution points at critical roadways and activity nodes. It is recommended to establish mobile booths equipped with shading awnings, portable air conditioners/fans, and water dispensers at 500-meter intervals along major community roads. This deployment mode not only alleviates the community's construction and financial operational burdens, but also enables residents to swiftly escape scorching sunlight during outdoor activities while facilitating small-scale social interactions. Second, optimize the layout of environmental sanitation facilities. The plan suggests employing containerized waste treatment units integrated with the transit capacity of front-end collection vehicles to improve waste compression and transfer efficiency. Concurrently, the promotion of buried waste treatment systems is recommended to mitigate odor emissions and pest/mosquito breeding induced by the accumulation of domestic waste. Third, install dedicated signage systems for high-temperature response and directional guidance. Drawing on the precedence of the "Heat Kills" warning signs implemented in Boulder, Nevada, USA, these visual elements are designed to elevate residents' vigilance and coping efficacy regarding

extreme heat stress. Fourth, strategically optimize vegetation spatial layouts and species selection. The plan recommends the scientifically guided utilization of small trees such as Cinnamomum burmannii (Indonesian cinnamon), Cinnamomum camphora (Camphor tree), and Citrus limon (Lemon tree); hedgerows including Aglaia odorata (Chinese perfume plant), Gendarussa vulgaris (Warmer), and Zanthoxylum beecheyanum (Beechey's prickly ash); and herbaceous flora possessing both mosquito-repelling properties and ornamental/shading value, such as Mentha (Mint) and Murraya paniculata (Orange jessamine). This multi-layered botanical configuration constructs a three-dimensional mosquito-repellent defense shield while maximizing microclimate cooling efficacy. Fifth, enhance barrier-free infrastructure at community activity nodes to systematically improve the spatial mobility and accessibility of the elderly population. Sixth, advance the transformative reuse of underutilized idle spaces, retrofitting these areas into shaded community gardens that function as effective micro-cooling hubs. Seventh, strengthen institutional governance measures through the compilation and distribution of public awareness brochures alongside the introduction of participatory governance mechanisms, thereby enhancing community residents' heat-resilience awareness and response capabilities. Furthermore, specific retrofitting guidelines are presented for localized scenarios where the community's heat response capacity is acutely deficient, with the recommendation that improvement-type facilities be progressively upgraded through a gradient approach as financial appropriations become available in the future.



Figure 2. Wanshou Mountain Community heatwave ability improvement strategies. Source: Created by the author.

4. Conclusion and Future Development

This paper introduces a Heatwave Response Capacity Evaluation System for "double-aging" communities, which was subsequently applied to Wanshou Mountain Community—a typical case in Chongqing—to execute an empirical evaluation and propose tailored planning strategies. Based on localized insights gained during the extreme heat of the "Sanfu" period via 86 physical questionnaires and 15 in-depth interviews, this study formulated seven targeted action strategies. The primary novelty of this research lies

in its departure from traditional heatwave adaptation paradigms—which typically prioritize macro-level cooling and generic health protections—by centering strictly on the spatial and demographic nuances of "double-aging" communities; it enriches the existing literature by introducing hyper-specific, actionable interventions, including containerized waste management, elderly-centric barrier-free infrastructure, and botanical multi-layered configurations with mosquito-repellent properties. Ultimately, this study offers a replicable blueprint for climate adaptation construction in similar heatwave-threatened "double-aging" neighborhoods. To further validate the applicability and scalability of this evaluation system and its prescriptive strategies, the following research actions will be progressively undertaken:

First, the research scope will expand its regional focus from Southwestern China to the Southern and Southeastern regions. This cross-regional expansion aims to ensure broader geographical representativeness and to continuously test how different climatic contexts affect community-level heatwave vulnerability and response mechanisms.

Second, the research team will actively pursue the spatial translation and materialization of the proposed strategies. By seeking opportunities for on-site micro-renovation implementations (e.g., the suggested mobile booths, containerized waste facilities, and multi-layered mosquito-repellent cooling gardens), alongside public exhibitions and policy dialogues, we aim to bridge the gap between planning theory and grassroots governance.

Third, we will advance from qualitative and baseline evaluation to rigorous multi-disciplinary empirical testing. Recognizing that the scientific efficacy of the proposed botanical configurations (e.g., Cinnamomum burmannii and Murraya paniculata) and imported signage models (e.g., Boulder's "Heat Kills" precedence) requires quantitative verification, we plan to collaborate with scholars in meteorology and ecology. Together, we will utilize microclimate simulation and empirical environmental sensing to precisely measure the actual cooling and ecological impacts of these heat adaptation strategies.

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