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REVIEW

Between tradition and comfort: the rural habitat as a livable shelter

Entre tradición y confort: el hábitat rural como refugio habitable

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ABSTRACT

Objective: to analyze the design of rural housing at a global level, focusing on the integration of thermal comfort and habitat characteristics, adapting to local climatic conditions through bioclimatic, vernacular and sustainable approaches. Architectural strategies in different regions are reviewed, highlighting the importance of adaptive solutions that consider cultural, environmental and socioeconomic factors.
Method: this is an exploratory narrative review of the scientific literature between 2021 and 2024, using databases such as Scielo, Google Scholar, Scopus and ScienceDirect. Key terms related to architecture, housing and comfort were applied, and exclusion criteria were applied to obtain a final corpus of 25 relevant articles.
Results: traditional architectural forms are suitable for each local climate and vernacular architecture is a valuable resource for the occurrence of thermal comfort, although it faces challenges in the face of modernization and climate change, and barriers such as lack of awareness, clear policies, accessible financing and technical training to implement sustainable technologies are identified.
Conclusions: rural dwellings face challenges related to thermal comfort, habitability and sustainability, conditioned by climatic, cultural and socioeconomic factors, and that the combination of vernacular and bioclimatic approaches, together with sustainable technologies, is key to improve the quality of life in rural communities.

Keywords: Habitat; Comfort; Rural Housing; Rural Context; Living Spaces.

RESUMEN

Objetivo: analizar el diseño de viviendas rurales a nivel global, enfocándose en la integración del confort térmico y las características del hábitat, adaptándose a las condiciones climáticas locales mediante enfoques bioclimáticos, vernáculos y sostenibles. Se revisan las estrategias arquitectónicas en distintas regiones, destacando la importancia de soluciones adaptativas que consideren factores culturales, ambientales y socioeconómicos.
Método: es una revisión narrativa exploratoria de la literatura científica entre 2021 y 2024, empleando bases de datos como Scielo, Google Académico, Scopus y ScienceDirect. Se aplicaron términos clave relacionados con arquitectura, vivienda y confort, y se aplicaron criterios de exclusión para obtener un corpus final de 25 artículos relevantes.
Resultados: las formas arquitectónicas tradicionales son adecuadas para cada clima local y que la arquitectura vernácula es un recurso valioso para la ocurrencia de confort térmico, aunque enfrenta desafíos frente a la modernización y el cambio climático, además, se identifican barreras como la falta de conciencia, políticas

claras, financiamiento accesible y capacitación técnica para implementar tecnologías sostenibles.
Conclusiones: las viviendas rurales enfrentan retos relacionados con el confort térmico, habitabilidad y sostenibilidad, condicionados por factores climáticos, culturales y socioeconómicos, y que la combinación de enfoques vernáculos y bioclimáticos, junto a tecnologías sostenibles, es clave para mejorar la calidad de vida en comunidades rurales.

Palabras clave: Hábitat; Confort; Vivienda Rural; Contexto Rurales; Espacios de Vida.

INTRODUCTION

The architectural design of rural housing is a specialized field that demands a precise integration of strategies to optimize thermal comfort and habitat characteristics, considering local climatic and contextual particularities. This process involves the development of bioclimatic, sustainable, and vernacular solutions that respond effectively to each region's specific environmental conditions and cultural practices.[1] Incorporating bioclimatic principles improves thermal efficiency and indoor comfort using passive techniques that reduce energy dependence.[2] Furthermore, aspects such as chromatics in rural architecture contribute significantly to its inhabitants' visual and emotional comfort, enhancing spatial quality.[3] The correct siting and orientation of dwellings according to the prevailing climatic conditions are essential to maximize their habitability.[4]

In Africa, vernacular architecture represents a living heritage that synthesizes ancestral knowledge and construction methods adapted to the natural and social environment, constituting an irreplaceable cultural vehicle. However, increasing material modernization, using cement and metal sheeting is gradually replacing the traditional techniques of adobe and green roofs, generating false comfort and affecting the environmental balance of living spaces.[5]

In Europe, especially in Spain, building regulations have promoted the development of nearly zero-energy buildings (nZEB), implementing high levels of thermal insulation and airtightness to comply with European standards. However, the uniform application of these standards, designed initially for temperate and cold climates, lacks a comprehensive assessment in Mediterranean and warm regions where intense solar radiation and usage patterns require specific adaptive strategies, such as active solar control and optimized natural ventilation.[6,7] In Portugal, predictive models such as the PTC have effectively analyzed summer thermal comfort in vernacular dwellings with natural air conditioning. However, they have limitations in estimating night-time comfort.[8]

In the Asian context, natural ventilation is still the main passive strategy for thermal conditioning traditional buildings such as shophouses in Vietnam. However, accelerated climate change and urbanization generate indoor thermal imbalances that increase energy demand for mechanical cooling, compromising sustainability.[9]

In North America, particularly in arctic regions such as Alaska, architectural design faces complex challenges related to extreme thermal variability. Building resilience is vital to ensure thermal comfort, minimise energy consumption, and protect occupants from extreme weather conditions. This implies the development of innovative and adaptive building systems and the implementation of integrated passive and active strategies.[10]

In South America, the high Andean rural habitat, as in the Puno region, presents particular challenges due to low temperatures and the precariousness of traditional constructions called Putucos, made of earth blocks (Champa), which require typological interventions that respect cultural knowledge and improve thermal comfort.[11] State programs have promoted housing solutions, but adaptation to specific climatic conditions and cultural appropriation remain areas of opportunity to optimize habitat quality.[12]

In Egypt, adaptive architecture applied to rural design incorporates strategies that allow flexibility and resilience in the face of flooding and water table fluctuations. Integrating vegetation elements such as green roofs and urban gardens improves microclimate, thermal comfort, air quality, and habitability in vulnerable environments.[13]

In India, safe, affordable, and sustainable housing is promoted under the UN Sustainable Development Goals (SDGs), particularly SDG 11. The study of vernacular architecture in the northeast of the country shows how these models can provide solutions aligned with inclusive urbanization and the protection of cultural heritage, thus reinforcing sustainability from a local perspective.[14]

Nigeria's housing deficit and poverty demand low-cost housing development with sustainable criteria that integrate ecological, social, and economic dimensions. Sustainable design approaches seek to improve the quality of life in vulnerable communities by addressing environmental degradation and the lack of adequate infrastructure.[15]

In Australia, in semi-arid tropical regions such as Barkly, thermal comfort is limited during extreme heat events. Lightweight, well-sealed dwellings with ducted evaporative cooling systems are recommended to mitigate these adverse conditions. This also highlights the need to consider poorly studied environmental

hazards, such as dust and fine sand, and to incorporate flexible spaces that support Indigenous socio-cultural practices, facilitating habitability and health in remote contexts.[16]

In summary, this review evidences the imperative need for adaptive and holistic architectural planning incorporating bioclimatic and sustainable principles to improve habitability and thermal comfort in rural dwellings worldwide, with special attention to the climatic and cultural diversity that defines each context.

METHOD

An exploratory narrative review was conducted to examine the available scientific literature. The databases Scielo, Google Scholar, Scopus, and ScienceDirect were consulted. The search was guided by the key terms 'architecture,' "housing," and 'comfort,' applying Boolean operators AND and OR to optimize the precision and scope of the results—the period considered comprised publications between 2021 and 2024, including documents in English and Spanish. Case reports, interviews, letters to the editor, and theses were deliberately excluded due to their lesser empirical rigor or particular focus. Initially, the search yielded 704 documents: 50 from Google Scholar, 530 from ScienceDirect, 47 from Scielo, 34 from Redalyc, and 43 from Dialnet. After eliminating 230 duplicate articles, 340 documents were discarded as they did not fit the study's objective and 364 more as they did not meet the established inclusion criteria. Finally, the selection process resulted in a corpus of 25 articles relevant to the analysis.

Table 1. Cases studied

	Number of studies
Year of publication	
2021	5
2024	7
Design	
Place of study	
Germany	4
United States	3
Spain	3
Peru	5
China	3
Alaska	1
Australia	1
Colombia	3
Nigeria	1
Study population (N) >570	25

RESULTS

Table 2. Studies consulted

Title	Year	Link	Abstract
Thermal environments of vernacular dwellings and the adjacent alley in summer: An experimental study in Southwest China	2024	10.1016/j.buildenv.2024.111634	This study examines how vernacular dwellings achieve summer thermal comfort with passive strategies. It identifies that 34 % of heat enters through walls, 26 % through roofs and 40 % through ventilation. Dwellings near alleyways achieve comfort on 95 % of days; improvements in airtightness and night ventilation are recommended.
The Right to Comfort in Social Housing: Energy and Thermal Performances as Parameters of a Systemic Analysis	2023	10.3390/buildings13051173	This article critically analyses the interventions of the Porto Improvement Plan, highlighting advances in quality of life and energy efficiency, but pointing out the persistence of energy poverty and difficulties in domestic comfort. It evaluates strategies, legal and financial constraints, and proposes to optimise future social housing and thermal efficiency policies.
Identifying bioclimatic techniques for sustainable low-rise high-density residential units: Comparative analysis on the ventilation performance of vernacular dwellings in China	2023	10.1016/j.jobe.2023.108008	This study evaluates vernacular Asian dwellings using bioclimatic techniques to create sustainable and dense residences. It focuses on natural ventilation to improve thermal comfort. Through simulations and studies in China, it identifies six parameters that influence ventilation efficiency, demonstrating their effectiveness in sustainable design.

Climate change and thermal comfort in colombian social housing	2023	10.22320/07190700.2023.13.01.06	The study analyses the thermal performance of social housing in Colombia in the face of climate change, simulating future scenarios in Bogotá, Medellín and Cali. Only 18,9 % of 576 scenarios comply with adequate thermal comfort (>70 %), showing that most of the dwellings do not guarantee optimal conditions.
Thermal Comfort, Solar Exposure, Energy Production, and Carbon Reduction of Court-Yarded Clustered Sustainable Housing in Arid Regions	2024	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85193628571&doi=10.1007%2f978-3-031-54394-4_13&partnerID=40&md5=c6f94ff432193f7aa9a1a3724782e961	This study challenges conventional urban housing design in Egypt, proposing typologies adapted to the arid microclimate. Based on a decade of research in New Aswan, it assesses thermal comfort, energy consumption and decarbonisation, highlighting the use of compressed earth walls and the importance of geometric design and vegetation for energy efficiency.
Systemized Modular Approach for Electric Drive Unit Family Development	2023	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85174729852&doi=10.51202%2f9783181024201-89&partnerID=40&md5=2707f593f36e6f6259ec48851cd34a79	This article introduces InfiMotion, which uses Systems Engineering to design modular Electric Drive Units (EDUs), integrating comfort, safety and efficiency. The approach reduces cost and complexity, optimising launch time and improving performance through innovations in design, cooling and control.
A Study on the Visual Comfort of Urban Building Colors under Overcast and Rainy Weather	2024	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85197272656&doi=10.3390%2fbuildings14061552&partnerID=40&md5=911c4c7774a5a31e5923de2ffd3d04ae	This study examines how colour influences visual comfort in Hangzhou, China, in cloudy weather. Based on 60 architectural samples and surveys of 40 people, significant correlations between colour value contrast and comfort were identified, establishing thresholds for residential and commercial buildings.
Bioclimatic design of middle housing in the times of the oil boom in tampico, Mexico (1912-1930)	2023	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85181918901&doi=10.22320%2f07190700.2023.13.02.07&partnerID=40&md5=c8d9edd4f8767adc98669e183484e2f2	This study identifies bioclimatic strategies in middle-class housing in Tampico, built during the oil boom. Through climate analysis, literature review and user interviews, it confirms that these dwellings incorporate techniques that improve indoor comfort and reduce energy dependence, optimising current costs.
Optimizing Air Movement for Thermal Comfort: Spatial Adaptations and Occupant Satisfaction in Residential Activity Spaces	2023	10.1007/s11277-023-10717-5	This study analyses how air movement generated by ceiling fans affects thermal comfort in bedrooms, living rooms, kitchens and dining rooms. By measuring air velocity and factors such as windows and screens, it provides recommendations for architects to optimise comfort and user satisfaction in future designs.
The impact of architecturally qualified data in deep learning methods for the automatic generation of social housing layouts	2024	10.1016/j.autcon.2023.105238	This study examines the impact of colour on visual comfort in Hangzhou, China, cloudy weather. It analysed 60 architectural samples and surveyed 40 participants, revealing that colour value contrast significantly influences visual comfort, establishing thresholds for residential and commercial buildings.
Investigation of Thermal Comfort for A Naturally Ventilated House: Correlation between Climatic Design Strategy and Thermal Data Analysis	2023	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85185334614&doi=10.30880%2fijscet.2023.14.05.013&partnerID=40&md5=50cc1d1090e2e125ff84ec221a851a92	This study evaluates the Traditional Malaysian House as a sustainable model in the face of climate change. Through predictive thermal analysis, it shows that 62 % of its interior temperatures are within comfort, highlighting its natural ventilation and adaptive design for hot and humid climates in Malaysia.
Transformation of the concept of comfort of the residential and urban environment in the modern conditions of the Almaty City	2022	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85165048536&doi=10.15649%2f2346075X.2974&partnerID=40&md5=96d4b5ac27d6a88e61a878c76936f0f3	This article analyses living comfort in Almaty, Kazakhstan, integrating natural, historical and urban factors. It stresses that urban housing is part of an interconnected system and that architectural design must respond to social and individual needs, developing a regional style linked to its environment.
Tajudeen O. Ajayi*, Olasunmbo O. Adhuze, Opeyemi T. Daramola	2023	https://www.researchgate.net/publication/382794708	This article reviews the literature on sustainable architecture for low-income housing in Nigeria, highlighting bioclimatic design, vernacular architecture and passive solar as key approaches. It analyses typologies, challenges and research gaps, proposing recommendations for policy and future studies in a context of high housing deficit and poverty.

Housing Design for Health in a Changing Climate for Remote Indigenous Communities in Semi-Arid Australia	2024	https://www.mdpi.com/2673-8945/4/3/41	This article examines the influence of architecture on health and wellbeing in arid regions, focusing on indigenous communities in northern Central Australia. It highlights the impacts of climate change on housing and health, underlining the need to incorporate indigenous beliefs and practices into design to improve resilience.
Climate adaptation in traditional dwelling typologies: the case of Southern Anhui, China	2023	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85181193060&doi=10.1080%2f17452007.2023.2295362&partnerID=40&md5=e92d9d74ba9e5bf7aa9073388a4dce5f	This study analyses the climate adaptation of traditional dwellings in southern Anhui, classifying bioclimatic solutions into built form, spatial gradients and adaptive interface. Through field study and simulations, it confirms that traditional forms optimise thermal comfort, providing foundations for contemporary sustainable architectural practices.
Passive Cooling Strategies for Thriving in a Changing Climate	2023	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85178994509&partnerID=40&md5=7c604c4c361fbaa8c77423ef10d90cef	This study assesses the thermal performance of 288 flats in south-eastern Cyprus, with a semi-arid subtropical climate, in line with SDG 7. Using thermal data and energy bills, high indoor temperatures and a gap of +5°C between actual and predicted values were identified, showing deficiencies in comfort and efficiency.

CONCLUSIONS

The architectural design of rural housing globally faces complex challenges related to thermal comfort, habitability, and sustainability, conditioned by climatic, cultural, and socio-economic variables specific to each region. Integrating vernacular and bioclimatic strategies with sustainable technologies and appropriate local materials is fundamental to optimizing rural communities' environmental performance and well-being. From Africa to South America, architecture must respond to both the demands of the climatic context and its inhabitants' cultural and economic particularities, promoting adaptive design that harmonizes with the natural and social environment.

Sustainable architecture in rural areas is positioned as an essential tool to mitigate the effects of climate change and the pressure of modernization. It promotes constructive solutions that respect the landscape and foster thermal and energy resilience. However, significant barriers remain, such as a lack of awareness of the benefits of sustainable design, the absence of clear regulatory frameworks, and a lack of specialized technical training.

One of the biggest obstacles lies in the limited availability of accessible financing and support mechanisms for sustainable housing projects, which restricts the implementation of innovative technologies and efficient materials. This economic insufficiency makes it difficult for developers and communities to adopt responsible and efficient construction practices, slowing progress toward a more sustainable, comfortable, and just rural habitat. It is, therefore, essential to strengthen public policies, promote technical education, and facilitate access to financial resources to consolidate resilient and environmentally responsible rural housing models

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