

REVIEW ARTICLE

A systematic literature review of environmental attributes in traditional village conservation

Yihan Wang¹, Mohd Khairul Azhar Mat Sulaiman^{1,2*}, and Nor Zalina Harun³¹Department of Architecture and Built Environment, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia, Bangi, Selangor, Malaysia²Centre for Innovative Architecture and Built Environment, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia, Bangi, Selangor, Malaysia³Institute of the Malay World and Civilization, Universiti Kebangsaan Malaysia, Bangi, Selangor, Malaysia(This article belongs to the *Special Issue: Rural Settlements Development in the New Era of China*)***Corresponding author:**Mohd Khairul Azhar Mat Sulaiman
(m.khairulazhar@ukm.edu.my)

Citation: Wang, Y., Sulaiman, M.K.A.M., Harun, N. Z. (2026). A systematic literature review of environmental attributes in traditional village conservation. *Journal of Chinese Architecture and Urbanism*, 8(2):025260050. <https://doi.org/10.36922/JCAU025260050>

Received: June 24, 2025**1st revised:** August 16, 2025**2nd revised:** August 24, 2025**3rd revised:** August 28, 2025**Accepted:** August 29, 2025**Published online:** September 24, 2025

Copyright: © 2025 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution-Non-Commercial 4.0 International (CC BY-NC 4.0), which permits all non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Publisher's Note: AccScience Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations. and institutional affiliations.

Abstract

Traditional villages are one of the most valuable assets for cultural heritage protection and have a profound historical and cultural significance. The environmental attributes of these villages are critical not only for cultural preservation but also for ecological balance and the sustainability of their natural surroundings, both of which are integral to effective conservation practices. However, the identification of these attributes remains inadequately addressed in current literature. To bridge this gap, this systematic review analyzed 58 articles sourced from the Web of Science database, following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines, employing bibliometric analysis tools such as VOSviewer and CiteSpace to visualize thematic clusters and citation networks. The results indicate that environmental factors that influence village conservation can be categorized into two main types: (i) Physical attributes, including not only spatial layout and architectural elements but also culturally significant physical structures such as ancestral halls, sacred sites, and ritual spaces; and (ii) natural attributes such as landscape features and ecological characteristics. However, most of the literature fails to consider both types of factors comprehensively. The findings emphasize the need for an integrated approach to conservation that considers both tangible and intangible environmental attributes. Suggestions for future research include interdisciplinary studies and the application of advanced technologies in conservation practices.

Keywords: Traditional villages; Environmental attributes; Conservation; Cultural heritage; Bibliometric analysis

1. Introduction

The concept of traditional villages, or historic villages, is based on the understanding that these settlements possess a rich historical legacy, characterized by well-maintained infrastructure and significant preservation efforts (X. Wang & Zhu, 2022; J. Zhu *et al.*, 2021). Traditional villages are repositories of both tangible (Fu *et al.*, 2021) and intangible

cultural heritage, and they have irreplaceable value in the historical, cultural, architectural, scientific, artistic, social, and economic spheres (Hassan *et al.*, 2020; Xu & Wang, 2021). In accordance with the stipulations outlined in the Granada Convention, these settlements, distinguished by their distinctive architectural, structural, social, or historical characteristics, are deemed to require protection (Katapidi, 2021; Vythoulka *et al.*, 2021). They play a crucial role in protecting cultural heritage.

Despite their profound heritage value, these villages are now facing significant threats that jeopardize their survival due to accelerating urbanization and modernization (Gocer *et al.*, 2024; Harun & Jaffar, 2018; Y. Liu *et al.*, 2022; Lu & Ahmad, 2023; Lu & Qian, 2023; Q. Zhao *et al.*, 2024). Traditional villages confront critical challenges such as environmental degradation (Xiao *et al.*, 2020), cultural losses (Y. Jiang *et al.*, 2023), and unsustainable development (Harun & Jaffar, 2018). These challenges threaten not only the physical structures but also the cultural fabric of these communities (Csurgó & Smith, 2021).

Building on observations from current conservation practice, this review operationalizes “environmental attributes” within a two-layer, six-dimensional framework: a physical layer, comprising natural and built attributes, and an intangible layer, comprising historical-cultural, social, economic, and sensory attributes. The intangible layer is regarded as the environmental attributes due to its capacity to determine the formation, maintenance, utilization, and perception of the physical environment, and it exerts an influence on the outcomes of conservation initiatives (Norberg-Schulz, 1980; Relph, 1976; Rosetia & Harun, 2023; Tuan, 1977; C. Zhang, 2015).

However, the academic literature lacks clarity on the identification, classification, and role of environmental attributes in traditional village conservation. Three gaps motivated this review: First, the field lacks a consolidated typology of environmental attributes. Most studies either listed factors piecemeal or conflated them, thereby obscuring the main traits and how they were represented. Second, the indicators and methodologies employed vary, thus limiting the comparability of data and obscuring the relationship between specific attributes and conservation outcomes. Third, syntheses of environmental resilience and comparisons between China and the rest of the world are underdeveloped, constraining the translation from evidence to practice.

This systematic literature review synthesized existing research by examining 58 academic articles retrieved from the Web of Science (WoS) database to elucidate the role of environmental attributes in shaping traditional village

conservation. This study explored the following research questions (RQs):

- (i) RQ1: What are the primary environmental attributes identified in the conservation of traditional villages?
- (ii) RQ2: How does the existing literature classify environmental attributes in traditional village conservation within a two-layer, six-aspect framework?
- (iii) RQ3: What are the research gaps and future directions regarding the exploration of environmental attributes in traditional village conservation, including environmental resilience and China-international contrasts?

2. Methodology

A systematic literature review provides a more comprehensive opportunity to critically assess the scope, tendencies, aims, and gaps in research on a given topic. The literature analyses used in this study were divided into two parts. Initially, CiteSpace (6.2.R1) was used for a bibliometric analysis (C. Chen, 2004) and VOSviewer (Version 1.6.20) for progressive knowledge domain visualization, thereby enhancing comprehension of prevailing research trends and gaps within the field. Subsequently, a systematic approach was employed, utilizing article coding, statistical methods, and qualitative methods. Multiple criteria were established to categorize the selected literature, allowing for a detailed exploration of specific content. This dual approach provided a nuanced understanding of existing academic gaps and evolving research trajectories.

2.1. Data collection

This literature review used the WoS database, which is the largest comprehensive scholarly information resource around the world, providing a wide range of accessible articles. It comprises publications from a wide range of disciplines, including humanities, social sciences, and natural sciences, covering more than 8,700 core academic journals in all fields. In addition, Science Citation Index Expanded, Social Sciences Citation Index, Arts and Humanities Citation Index, Conference Proceedings Citation Index-Social Science and Humanities, Emerging Sources Citation Index, and Conference Proceedings Citation Index-Science were chosen as data sources for the present research. In this study, “environmental attributes,” “conservation,” and “traditional village” were used as the three main categories of obligatory subject search terms (TS), where each category has a set of keywords related to its associated concept:

- (i) Environmental attributes: $TS_1 = (\text{“environment* attribute*” OR “environment* feature*” OR “environment* character*” OR “environment* element*” OR “environment* aspect*” OR “environment*}$

- parameter*" OR "environment* component*" OR "cultural heritage")
- (ii) Traditional village: $TS_2 =$ ("traditional village*" OR "traditional rural area*" OR "traditional rural settlement*" OR "traditional settlement*" OR "ancient village*" OR "vernacular village*" OR "village*")
- (iii) Conservation: $TS_3 =$ ("preserve*" OR "protect*" OR "safeguard*" OR "conserve*" OR "defend*")
- (iv) Overall: $(TS_1) \text{ AND } (TS_2) \text{ AND } (TS_3)$

Then, three main categories of subject terms were formed: TS_1 , TS_2 , and TS_3 . Matching the three of them and searching the WoS database without a timespan yielded 617 documents.

2.2. Record screening

A scoping review was prepared following the preferred reporting items for systematic reviews and meta-analyses (PRISMA) (Tricco *et al.*, 2018). Initially developed for health research, the PRISMA methodology has become a standard across various scientific fields (Grilli *et al.*, 2024). This review integrated methodologies from the studies by Hale *et al.* (2023) and Barrett *et al.* (2021), applying a five-stage framework: (i) Identifying RQs, (ii) identifying relevant studies, (iii) selecting studies, (iv) charting data, and (v) collating, summarizing, and reporting results. Through thematic analysis, domains were extracted from different articles, and constant comparative analysis was conducted to identify similarities. These results were then categorized under various headings for clustering purposes.

To investigate the environmental attributes of traditional village conservation, this review applied the following inclusion criteria for articles: (i) Articles must be written in English, published in peer-reviewed academic journals, and exclude gray literature (e.g., unpublished reports and conference abstracts). Articles should provide complete data and analysis processes, with a preference for those published within the last 10 years (T. Li *et al.*, 2022); (ii) articles must focus on traditional villages as their primary research subject; (iii) articles must clearly emphasize the conservation of traditional villages; (iv) articles must include specific methods for traditional village conservation; and (v) articles must explicitly address the impact of environmental attributes on the conservation of traditional villages.

According to J. Zhu *et al.* (2023), the first criterion guarantees the inclusion of relevant and high-quality publications with trustworthy data and analytical findings. The time constraint guarantees that the research is current, while the selection of English-written and peer-reviewed publications provides scientific rigor and a wide

readership (Zhou *et al.*, 2024). According to X. Wang & Zhu (2022), the second, third, and fourth requirements guarantee that the articles highlight traditional villages, stress the need for conservation and its approaches, and incorporate particular conservation measures. According to Xia *et al.* (2024), these standards ensure that the included articles have a direct bearing on the preservation of traditional villages and provide useful theoretical support. The systematicity and applicability of the research are enhanced through specific contexts and empirical investigations.

Initially, a total of 617 articles were retrieved from the WoS database. After removing 77 non-English articles, 540 articles underwent initial screening, excluding 11 review articles. In addition, three articles could not be retrieved, leaving 526 articles for the secondary screening phase. In this stage, 198 articles were excluded due to not focusing on traditional villages, 179 articles did not explicitly address conservation, and 91 articles failed to cover environmental attributes. Ultimately, following the approach of Lian *et al.* (2024), the final 58 selected articles were listed in the Appendix for coding and subsequent bibliometric and qualitative analysis (Figure 1).

2.3. Data analysis

First, the selected articles were analyzed using two bibliometric visualization tools, VOSviewer and CiteSpace,

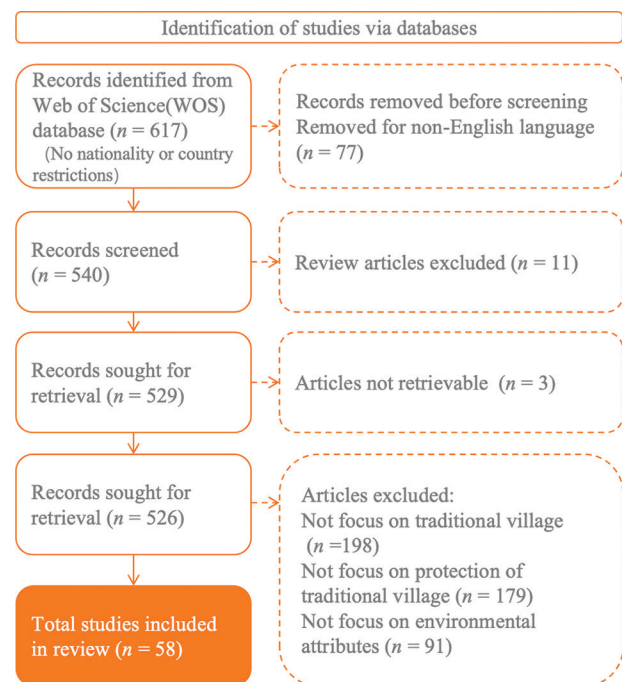


Figure 1. Flow diagram of preferred reporting items for systematic reviews and meta-analyses for article screening
Source: Diagram by the authors.

to identify the thematic clusters, trends, and citation relationships within the literature. VOSviewer is a Java-based application that creates color-coded maps of bibliographic data, providing a visual depiction of the underlying data (Van Eck & Waltman, 2009; Perianes-Rodriguez *et al.*, 2016). Meanwhile, CiteSpace was used to discover co-cited reference clusters and to create co-occurring terminology networks. As explained by C. Chen (2006) and Hou *et al.* (2018), this feature highlights important keywords in articles and pinpoints popular subjects and ideas in the field of study.

The second part of the process involved reviewing and coding the selected articles using a hybrid deductive-inductive approach (Fereday & Muir-Cochrane, 2006), integrating the six environmental attribute categories identified in Section 3.3 with inductive codes emerging from the literature. Units of analysis were defined as passages containing unique conceptual ideas related to environmental attributes (Braun & Clarke, 2006). The initial author was responsible for coding the data, and a second researcher cross-checked this to ensure consistency. Any discrepancies that emerged were resolved through discussion until a consensus was reached (Dwan *et al.*, 2014; Ridder, 2014).

Classification rules were developed to improve replicability. Articles were categorized into one thematic category if they explicitly examined attributes as independent or dependent variables, or as the main descriptive focus of traditional village conservation. Otherwise, articles were assigned to multiple thematic categories if they met the criteria for more than one category. The six thematic categories included:

- (i) Natural attributes, such as environmental setting and landscape ecology, affecting settlement suitability and distribution (L. Chen *et al.*, 2023; Y. Zhou *et al.*, 2024);
 - (ii) Built-environment attributes, focusing on built heritage and vernacular architecture (Cheng *et al.*, 2023; Shi *et al.*, 2023);
 - (iii) Historical and cultural attributes, addressing intangible heritage, local customs, and ritual practices (Lin & Gui, 2024; K. Luo & Wu, 2015);
 - (iv) Social attributes, encompassing community participation, governance, and demographic change (Q. Li *et al.*, 2024; N. Liu & Zhang, 2024);
 - (v) Economic attributes, relating to tourism development, livelihood transition, and market integration (S. Jiang *et al.*, 2023; Kim & Park, 2016); and
 - (vi) Sensory attributes, considering esthetic perceptions, soundscapes, and other multisensory experiences (Cheng *et al.*, 2023; Čurović *et al.*, 2019).
- (vii) These examples were taken directly from the final 58 samples to ensure transparency and traceability.

In addition, through thematic analysis, the various areas of the different articles were extracted, and constant comparative analyses were conducted to identify similarities across them. These findings were then summarized under different headings as group names for the clusters. In this review, environmental attributes were conceptualized as a two-layer construct. The physical dimension comprised nature and the built environment, while the intangible dimensions encompassed historical-cultural, social, economic, and sensory aspects, all of which were analyzed as conditioning factors that influence the performance of the physical environment and its conservation outcomes.

3. Results

3.1. Overview of the literature

The number of articles published by year is represented in a bar chart in Figure 2. There is an upward trend in the quantity of study material pertaining to the preservation of traditional villages and their natural features. From 2013 to 2021, the number of publications remained relatively low, with an average of no more than three articles per year. However, beginning in 2022, there was a notable increase in the volume of studies, with 11 publications, accounting for 17.7% of the total. This upward trajectory peaked in 2023, with 21 articles published, representing 33.9% of the total. Although there was a slight decrease in 2024, with 13 articles (21.0%), the high level of research interest in this field persists. This trend reflects an increasing academic focus on the cultural and environmental significance of traditional villages, providing a robust foundation for future research in this area.

These articles were published in 39 journals, representing various interdisciplinary fields. Table 1 lists the journals that published more than two qualifying articles. From the classification of journal names, common journals included those focused on sustainability, heritage science, architecture, environmental science, and ecology. The research areas primarily involve environmental sciences and ecology, science and technology in other topics, materials science, engineering, chemistry, spectroscopy, arts and humanities in other topics, construction and building technology, and architecture. Most journals span multiple interdisciplinary fields.

3.2. Preliminary bibliometric analysis visualized using VOSviewer and CiteSpace

The links between key phrases linked to “traditional villages,” “conservation,” and “environmental attributes” in the 58 articles from the WoS database are displayed in the co-occurrence network maps created by the VOSviewer program (Figure 3). “Conservation,” “tourism,”

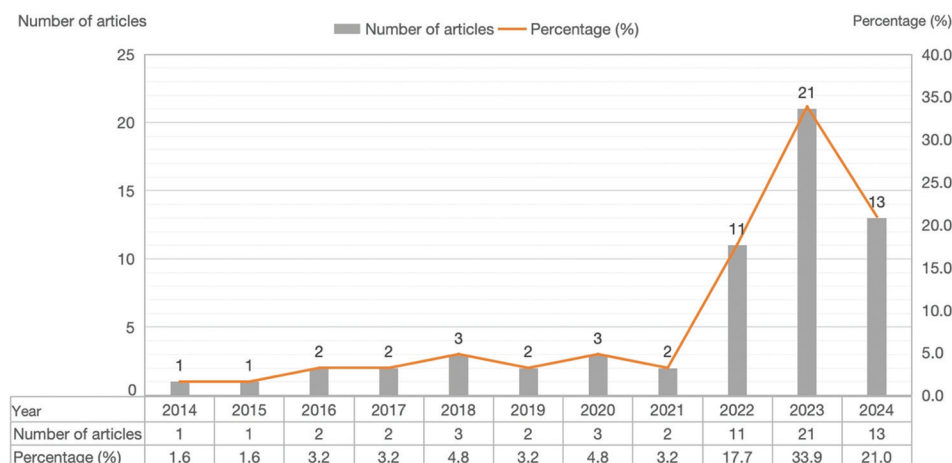


Figure 2. Number of articles issued per year, 2013–2024

Source: Graph by the authors.

Table 1. Journals with more than two articles

Number of articles	Journal titles	Percentage
3	<i>Journal of Asian Architecture and Building Engineering</i>	4.8
4	<i>Buildings</i>	6.4
5	<i>Land</i>	8.1
7	<i>Heritage Science</i>	11.3
13	<i>Sustainability</i>	21.0

and “influencing factor” were the phrases that surfaced most frequently among them (Figure 3A). Furthermore, “environment” was only associated with “landscape,” “spatial structure,” “urbanization,” and “tourism” when it was selected (Figure 3B). In contrast, “environment” was unlinked when “conservation” and “protection” were used to symbolize relevant links. The numerous clusters are represented by different colors, emphasizing the diverse theme areas of the research. This visual depiction clearly summarizes the linkages and research trends in the area (Eck & Waltman, 2009).

The overall connectivity of the keyword co-occurrence network is shown in Figure 4A. The temporal map constructed using CiteSpace showed that the field of traditional villages is the center of studies, with elements such as “environment” and “tourism” (Figure 4C), which are further classified into themes including “community,” “tourism,” and “identity.” Notably, as both the purple and yellow circles showed, “cultural heritage” has been an important subject for a long time. In addition, cluster analysis (Figure 4B) revealed that the two topics of spatial form (Cluster no. 0) and influencing factors (Cluster no. 1)—both of which have attracted a lot of attention

recently—have been the focus of the majority of research on the preservation of traditional villages. Importantly, a common element in linked investigations is the emergence of spatial visualization (Cluster no. 2).

3.3. Identification of the environmental attributes of traditional villages

A review of 58 articles exploring the types of environmental attributes required for traditional village conservation was conducted, and researchers’ definitions of these attributes were summarized according to the predominant classification schemes (Table 2).

To synthesize the 58 articles, the environmental attributes were categorized into six distinct aspects. However, as the same article may address multiple aspects, the total number of records across all categories reached 182. The proportion of each category was calculated based on its frequency relative to the total of 182 occurrences, rather than the total number of articles (58). For example, elements under the “natural” aspect were referenced in 50 articles, accounting for 27.0% of the total number of mentions, while elements under the “built-environment attributes” aspect were mentioned in 34 articles, representing 18.5%.

3.3.1. Nature (A1)

The nature aspect is foundational to the preservation of traditional villages, with 50 articles describing the relevant content, accounting for 27.0%. Such factors include climate, topography, hydrological conditions, vegetation, and biodiversity. These factors form the basis for the layout of traditional villages and influence their spatial organization, ecological resilience, and habitability (L. Chen *et al.*, 2023; Feng *et al.*, 2023; Y. Zhou *et al.*, 2024). In addition, a study emphasized the importance of environmental factors such

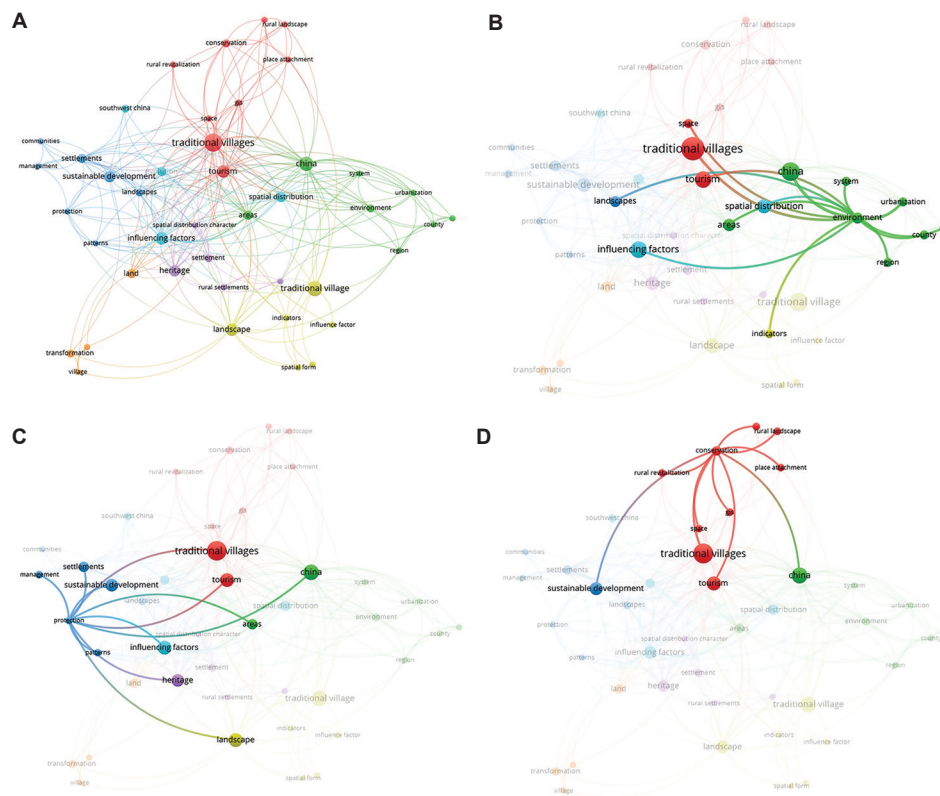


Figure 3. Connectivity of keyword co-occurrence frequency processed in VOSviewer. (A) Keyword co-occurrence clustering. (B) Relevant research links to “environment.” (C) Relevant research links to “protection.” (D) Relevant research links to studies on the conservation of traditional villages. Source: Connectivity maps by the authors.

as water resources, vegetation cover, and biodiversity in maintaining the ecological balance of villages (Q. Zhao & Ren, 2021). Climate, particularly wind and thermal environments, alongside hydrological features, are key factors in village sustainability. Proximity to water supply systems is crucial for the sustainability of these villages (L. Chen *et al.*, 2023; Feng *et al.*, 2023). In the Ganjiang river basin, the presence of multiple suitable environmental elements, including water systems, is necessary for the development and continuity of traditional villages (Y. Zhou *et al.*, 2024).

Therefore, nature is seen as the backdrop of the landscape and a factor that influences the conservation of settlements, the exposure to risk, and the visual and ecological context of the built environment.

3.3.2. Built environment (A2)

The built-environment aspect is the second most described after the natural aspect, totaling 34 articles (18.5%). Built-environment attributes denote the physical fabric built and maintained through human activity, reflecting the ways in which human societies have adapted to the natural environment over time. They include traditional architectural styles, spatial layouts, and infrastructure systems such as

roads, wells, and irrigation canals. Architectural features, including ancestral halls, residential buildings, and public spaces, reflect the cultural values and historical narratives of the village (Cao, 2023; G. Chen *et al.*, 2022). Spatial layouts that organize homes, streets, and public areas are often influenced by geographical and cultural factors to ensure functional and esthetic harmony (H. Wang *et al.*, 2024; Zhu *et al.*, 2023). At the same time, infrastructure supports the daily needs of villagers and facilitates agricultural production (X. Wang & Zhu, 2022; Zheng *et al.*, 2021; Z. Zhou *et al.*, 2022). This approach highlights the resilience of traditional practices in the face of environmental challenges, emphasizing the importance of maintaining these unique layouts amid the pressures of modernization.

3.3.3. Historical culture (B1)

Historical culture is an aspect of the environmental attributes of the village, mentioned by 32 articles (17.5%). Historical and cultural attributes represent the intangible heritage that is deeply rooted in traditional village communities (Lin & Gui, 2024; Lu & Ahmad, 2023; L. Zhang *et al.*, 2023). These attributes include rituals, customs, religious beliefs, and social practices, all of which have been passed down



Figure 4. Keyword co-occurrence analysis processed using CiteSpace. (A) Connectivity of keyword co-occurrence frequency. (B) Keyword cluster ranking. (C) Chronological distribution of keyword co-occurrence frequencies.
Source: Network maps by the authors.

across generations. Folklore, oral traditions, and belief systems are also integral to the cultural fabric of the village, maintaining a sense of community identity and continuity over time (Yao, 2016; H. Zhang *et al.*, 2024; L. Zhang *et al.*, 2023). In addition to these intangible elements, historical landmarks and culturally significant spaces in a village contribute to its overall heritage value (Lu & Ahmad, 2023; Shi *et al.*, 2023; M. Zhang *et al.*, 2023). The reviewed studies (32 articles) emphasize the importance of conserving these historical and cultural attributes as part of a comprehensive conservation strategy (Lin & Gui, 2024; Yu, 2013; H. Zhang, 2022). Connecting tangible and intangible heritage in conservation efforts ensures that the cultural heritage of traditional villages is maintained along with their physical structures.

3.3.4. Social networks and interactions (B2)

In the context of environmental studies, the term “environment” extends beyond its biophysical dimensions to encompass the social environment – defined as the network of relationships, norms, and collective practices embedded within a place (Pretty *et al.*, 2005; Stokols,

1992). Social attributes relate to both community dynamics and demographics, affecting the sustainability of traditional villages (Feng *et al.*, 2023; Lei *et al.*, 2022; B. Li *et al.*, 2022; Lin & Gui, 2024; Z. Nie *et al.*, 2023; X. Wang & Zhu, 2022). These attributes include social networks, demographic dynamics, and institutional infrastructure. Social networks comprise relationships and interactions among village inhabitants, promoting social cohesion and collective resilience. These are crucial for sustaining village stability and vitality, as they reflect the daily behaviors and activity needs of the inhabitants (Gong *et al.*, 2023; Kim & Park, 2016; Peng *et al.*, 2024; Shi *et al.*, 2023; T. Wang *et al.*, 2017; Yang *et al.*, 2023). Understanding these networks is essential for comprehending the human-environment relationships and spatial characteristics of the village. Population dynamics, including changes in population size and structure, directly affect a village’s ability to sustain its cultural and economic activities (X. Wang & Zhu, 2022; Yao, 2016; X. Yu, 2019; Y. Yu, 2013). Meanwhile, institutional infrastructure, including education, healthcare, and governance systems, supports the social and economic continuity of villages (C. Liu *et al.*, 2020; T. Wang *et al.*,

Table 2. The summary of previous studies on selected environmental attributes of traditional villages

Aspects	Elements	Indicators	Studies (total records=182) (%)	References (article coding in appendix)
A1 Nature	A1-1 Climate	Weather, wind, rain, humidity, precipitation, temperature	50 (27.0)	2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 24, 25, 26, 27, 28, 29, 30, 32, 33, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50, 51, 53, 54, 55, 57, 58
	A1-2 Topography	Soil, slope, land, mountain, altitude, elevation, terrain		
	A1-3 Hydrology	Stream, pond, bay, river, spring, etc.		
	A1-4 Vegetation	Vegetation, greening		
	A1-5 Biodiversity	Animals, plants, fruit trees, forests		
A2 Built environment	A2-1 Architecture	Ancestral halls, residential buildings, public spaces, building density, style, form	34 (18.5)	1, 2, 3, 4, 5, 8, 9, 10, 14, 15, 16, 19, 20, 22, 24, 25, 26, 29, 32, 33, 35, 37, 41, 45, 46, 48, 49, 50, 51, 52, 54, 55, 56, 57
	A2-2 Layout	Site selection		
	A2-3 Landform	Dwellings, streets, farmlands, fishponds, other artificially constructed areas, grassland, cultivated land, artificial surface forest, shrubs, water, bare land		
	A2-4 Infrastructure	Transportation, wells, irrigation systems, electricity, road network density, building facilities, telecommunications, railway stations, bus stops, roads		
	A2-5 Handcraft	Monuments, edifices		
B1 Historical culture	B1-1 Behavior and mentality	Rituals, folklore, customs, beliefs, festivals, and clan inheritance	32 (17.5)	1, 2, 8, 9, 10, 11, 14, 15, 16, 17, 18, 19, 20, 22, 24, 28, 30, 31, 32, 35, 36, 40, 41, 44, 45, 46, 47, 48, 51, 52, 53, 57
	B1-2 Languages	-		
	B1-3 Toponyms	-		
	B1-4 Rural landscapes	Habitability, accessibility, compatibility, sensitivity, beauty		
	B1-5 Ethnic minorities	Ethnic diversity		
B2 Social networks and interactions	B2-1 Institution	Government, education, healthcare, and social-service infrastructure	29 (16.3)	1, 6, 7, 8, 9, 11, 13, 14, 15, 16, 19, 20, 30, 31, 32, 35, 37, 40, 41, 43, 44, 45, 47, 48, 49, 52, 54, 55, 58
	B2-2 Interaction	Public space, behaviors, activity, interrelationship, social connections		
	B2-3 Population	Density, population structure		
	B2-4 Living space	Lifestyle, function		
B3 Economics	B3-1 Tourism	-	28 (15.2)	6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 18, 19, 20, 24, 28, 32, 37, 40, 41, 42, 43, 44, 45, 47, 48, 49, 55, 58
	B3-2 Industry	Major industry categories, industrial structure		
	B3-3 Production	Cultivated land area, crop, grain-aquaculture function		
	B3-4 Traffic	Types of highways, village roads		
	B3-5 Income	GDP per capita, collective income		
B4 Sensory aspect	B4-1 Visual	Visual coherence, visual focus, visual complexity, and visual cognition	9 (5.4)	4, 11, 17, 23, 30, 34, 49, 50, 52
	B4-2 Esthetics	Landscape, visual quality		
	B4-3 Auditory	Acoustic environment, shaping the continuity, spatial sequence experience		

Abbreviation: GDP: Gross domestic product.

2017; X. Wang & Zhu, 2022; Z. Zhou *et al.*, 2022; Z. Zhou *et al.*, 2018; Q. Zhu & Liu, 2023).

3.3.5. Economics (B3)

Economic factors were conceptualized as part of the anthropogenic environment, given their direct role

in shaping the spatial form, material conditions, and ecological sustainability of traditional villages (Kawabe *et al.*, 2009; J. Liu *et al.*, 2007). The economic aspect of conserving the environmental attributes of traditional villages was studied in 28 of the 58 articles reviewed, accounting for 15% of the total number of reports (182). Economic attributes focus on the financial and industrial activities that support the sustainable development of traditional villages (S. Jiang *et al.*, 2023; Kim & Park, 2016; Lu & Ahmad, 2023; X. Wang & Zhu, 2022). Tourism, local industries, the growth of urbanization rates, and population density are critical for providing the financial sustainability necessary to support preservation efforts (Curovic *et al.*, 2019; S. Jiang *et al.*, 2023; Kim & Park, 2016; M. Li *et al.*, 2024; Yin *et al.*, 2024). Tourism has a dual role as an income source for conservation efforts and as a potential threat to the cultural and environmental integrity of villages. Local industries, such as handicrafts and small-scale agriculture, provide an economic base for village life and are critical to supporting conservation activities (Lu & Ahmad, 2023; Michalka & Siláci, 2017). Income levels and economic diversity are important indicators of the ability of villages to sustain long-term conservation efforts (X. Wang & Zhu, 2022; Yang *et al.*, 2023; Yao, 2016). Economic factors are essential to ensure that conservation efforts are economically sustainable and bring tangible benefits to communities while reducing negative impacts such as over-tourism. These factors are critical for understanding the economic sustainability, living standards, and long-term development of communities within these areas (K. Wu *et al.*, 2023; Yang *et al.*, 2023).

3.3.6. Sensory aspect (B4)

The environmental attributes of traditional villages include a sensory aspect, forming an intangible environment that is essential for shaping the senses and values of both residents and visitors (Curovic *et al.*, 2019; M. Li *et al.*, 2024; K. Luo & Wu, 2015; Xiao & Fang, 2023; X. Yu *et al.*, 2019). The sensory dimension draws on insights from sensory geography and environmental perception theory, recognizing sensory experiences as an integral part of

the lived environment (Porteous, 1990; Rodaway, 2002). These include visual esthetics, auditory experiences, and emotional connections to the landscape (S. Jiang *et al.*, 2023; Q. Wang *et al.*, 2022; S. Zhang *et al.*, 2018). Visual attributes include the overall landscape esthetics of the village, architectural harmony, and landscape quality (X. Chen *et al.*, 2020; Q. Wang *et al.*, 2022; S. Zhang *et al.*, 2018).

Auditory attributes include the natural sounds of water, wind, and village life that make up the community's unique acoustic environment (Q. Zhao & Ren, 2021; Zheng *et al.*, 2021). Emotional connections arise when residents and visitors interact with a village, fostering a sense of place and cultural belonging (S. Jiang *et al.*, 2023; Q. Li *et al.*, 2024; Z. Nie *et al.*, 2023).

Sensory attributes, although poorly researched (nine articles), are increasingly recognized as an important component in the overall conservation of traditional villages (X. Chen *et al.*, 2020; Long *et al.*, 2024; Z. Nie *et al.*, 2023). Attributes play an important role in enhancing the cultural and experiential value of villages, particularly in the context of tourism and heritage conservation. These strategies can effectively engage local communities and external stakeholders, creating a reinforcing feedback loop that enhances the effectiveness of conservation efforts in traditional villages.

3.3.7. Classifying the environmental attributes of traditional villages

The environmental attributes defined by the complex interactions with people that are unique to each village were summarized into two-layer framework: The physical environment (Group A), which forms the basis of traditional villages with conservation value; and the intangible environment (Group B), which guides and drives developmental values and is capable of shaping, maintaining, and constituting traditional village spaces (Figure 5). Group B attributes were included only when they have a demonstrable and operational link to the physical environment, such as influencing its formation,

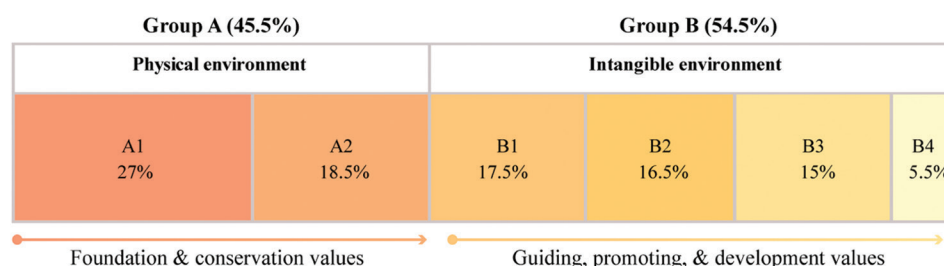


Figure 5. The environmental attribute dimension relationship
Source: Chart created by the authors.

maintenance, utilization, or perception. This ensured that even intangible factors have direct relevance to conservation outcomes.

The six aspects include: Natural attributes, built-environment attributes, social attributes (e.g., community networks that maintain shared spaces), economic attributes (e.g., tourism revenue sustaining traditional building materials), historical and cultural, and sensory attributes (e.g., visual and auditory qualities influencing design decisions). These attributes are essential for the conservation of traditional villages, and careful consideration of both natural and anthropogenic impacts is required to preserve their unique cultural and environmental heritage.

Taken together, the review consolidated environmental attributes into six aspects under two higher-order groups—the physical environment (A1: Nature; A2: Man-made architecture, layout, and infrastructure) and the

intangible environment (B1: Historical-cultural attributes; B2: Social networks and interactions; B3: Economics; B4: Sensory attributes). Grounded in recurrent co-occurrence patterns across 58 studies, this transparent taxonomy remains analytically separable yet practically recombinable through the strategy map in Table 3. This directly addressed RQ1 by linking each attribute to concrete spatial levers, delivery pathways, and lean monitoring indicators.

4. Discussion

Environmental attributes provide an approach to the conservation of traditional villages, and academic interest in this approach is growing rapidly. The findings of this systematic literature review illuminate the important role of environmental attributes in the conservation of traditional villages. By examining these attributes, including natural, built-environment, historical-cultural, social, economic, and sensory aspects, this section explores the broader implications

Table 3. International-domestic comparison: attribute-linked strategies and indicators

Comparative feature	China-based studies	International cases	Attribute-linked action & indicators
Governance and policy	Coupled to national/provincial designation; rural revitalization; funds to listed villages; priority on architectural integrity and landscape settings (Lu & Ahmad, 2023; Yao, 2016; Z. Zhou <i>et al.</i> , 2018; Z. Zhou & Zheng, 2022)	Municipal/heritage-trust frameworks; project finance; design codes; context-sensitive public-realm upgrades and adaptive reuse (Curovic <i>et al.</i> , 2019; Michalka & Siláci, 2017)	A2: minimum-intervention adaptive reuse; indicators: percentage reused buildings/year; façade/plot continuity index (Cheng <i>et al.</i> , 2023; Curovic <i>et al.</i> , 2019)
Technical toolkits	GIS, Geodetector, and remote sensing for regional pattern detection/siting; rising use of CFD and micro-climate tests for ventilation/drainage (K. Wu <i>et al.</i> , 2023; H. Zhang, 2022; M. Zhang <i>et al.</i> , 2023; Y. Zhou <i>et al.</i> , 2024; Z. Zhou <i>et al.</i> , 2022)	Community mapping and landscape assessment at site scale, complementing regional analytics (Curovic <i>et al.</i> , 2019; Michalka & Siláci, 2017)	A1+A2: CFD-guided ventilation corridors; permeable paving; graded surface-subsurface drainage; indicators: mean lane wind speed; lane permeability ratio; storm-peak flow (L. Chen <i>et al.</i> , 2023; K. Wu <i>et al.</i> , 2023; Zheng <i>et al.</i> , 2021; Z. Zhou <i>et al.</i> , 2022; Z. Zhou <i>et al.</i> , 2018)
Participation	Village committees/campaigns; growing attention to social networks, place-making, and tourism preferences (S. Jiang <i>et al.</i> , 2023; Q. Li <i>et al.</i> , 2024; N. Liu & Zhang, 2024; Yin <i>et al.</i> , 2024)	Institutionalized co-design and stewardship in small public-realm retrofits (Curovic <i>et al.</i> , 2019; Michalka & Siláci, 2017)	B2: co-design charrettes; stewardship agreements; indicators: participation rate; number of active steward groups; volunteer hours; on-time maintenance ratio (Curovic <i>et al.</i> , 2019; Michalka & Siláci, 2017; Q. Li <i>et al.</i> , 2024; N. Liu & Zhang, 2024)
Tourism management	Scenic-route planning and selective upgrading; risk of over-commercialization and peak pressure	Capacity control, visitor routing, and reuse frameworks to balance access and conservation	B3: routing and capacity control; indicators: peak density in core squares (people/sqm); resident satisfaction; shop-mix diversity (Curovic <i>et al.</i> , 2019; Michalka & Siláci, 2017)
Evidence-led monitoring	UAV, LiDAR, and GIS for mapping and pattern analysis (C. Liu <i>et al.</i> , 2020; K. Wu <i>et al.</i> , 2023)	Outcome-oriented appraisal and post-occupancy checks, including perceptual evaluation (H. Zhang <i>et al.</i> , 2024)	B4: UAV/LiDAR+GIS+VR eye-tracking for perceptual quality; indicators: number of protected view corridors; night-sky brightness; gaze-hotspot stability (C. Liu <i>et al.</i> , 2020; K. Wu <i>et al.</i> , 2023; H. Zhang <i>et al.</i> , 2024)

Abbreviations: CFD: Computational fluid dynamics; GIS: Geographic information system; LiDAR: Light detection and ranging; UAV: Unmanned aerial vehicle; VR: Virtual reality.

of the findings and integrates important perspectives that contribute to the existing body of knowledge. The discussion also highlights the limitations of current research and makes recommendations for future research.

4.1. Trending themes in current research and research frontiers

The CiteSpace-generated data findings correspond with typical research paradigms. The majority of the early studies on traditional villages in China focused on the sustainable development of the “built environment.” However, since 2015, there has been a shift in the focus, highlighted by the emergence of popular studies on subjects such as “space environment,” “tourism,” “cultural heritage,” “conservation,” “influencing factors,” and “spatial distribution.” According to this change, village conservation does not only encompass the surrounding buildings. The importance of environmental factors that affect traditional villages has been stressed by scholars who have begun to examine the reasons behind their preservation.

Since 2020, there has been increased attention on terms such as “city,” “county,” and “environment,” emphasizing the integration of traditional villages into broader urban and environmental contexts. The consistent focus on “cultural heritage” underscores its continued importance in the field, indicating that while the research focus may have broadened, the preservation of cultural identity remains central to traditional village conservation.

4.2. Significance of the identified environmental attributes

This systematic literature review identified several key environmental attributes that are critical to the conservation of traditional villages. These attributes are classified into natural, built-environment, historical-cultural, social, economic, and sensory categories, each playing a unique role in sustaining the integrity and continuity of traditional villages. In this section, the significance of each attribute in the conservation of traditional villages is described.

4.2.1. Natural aspect as a foundation for conservation

The natural environment is foundational for traditional village conservation. It provides the material basis and cultural context essential for safeguarding both tangible and intangible heritage (Curovic *et al.*, 2019; X. Nie *et al.*, 2023; H. Wang *et al.*, 2024). As demonstrated by L. Chen *et al.* (2023) and X. Chen *et al.* (2020), the geographical environment is a determining factor in village organization. Topographical features such as elevation, mountain undulation, and slope significantly influence the spatial distribution and clustering of traditional villages. The natural environment serves as the material support

for rural life and production, and its protection is crucial for maintaining the distinct identity of villages under the pressures of urbanization (Y. Jiang *et al.*, 2023; H. Wu *et al.*, 2023). For example, in the Miao Frontier Corridor, these natural characteristics have led to a “single nucleated structure with multiple sub-nuclei,” demonstrating the profound impact of the physical landscape on village organization (W. Zhao *et al.*, 2024). The quality of human settlement suitability in traditional villages is also influenced by vegetation factors, which can contribute to spatial changes and affect the overall living environment (L. Chen *et al.*, 2023). The integration of mountains, rivers, trees, and buildings creates a harmonious living environment that reflects the historical and cultural significance of rural heritage (H. Zhang *et al.*, 2024). In addition, the cultural-ecological framework emphasizes the dynamic interaction between the natural environment and the spatial organization of traditional villages, driving spatial evolution processes and reflecting the ecological wisdom of historic Chinese people in creating sustainable living environments (X. Chen *et al.*, 2020).

Measuring the natural environment of traditional villages involves a multifaceted approach that integrates various methods to capture the intricate details of these spaces. For example, 3D laser scanning technology can precisely quantify spatial morphological features (G. Chen *et al.*, 2022). The concept of landscape genes further emphasizes the importance of natural elements in defining the spatial characteristics and heritage values of traditional villages, as demonstrated in the studies of Huizhou traditional villages (H. Wu *et al.*, 2023). The analytic hierarchy process assesses the integrity of traditional areas and the proportion of traditional buildings, as well as the integrity of the natural ecological environment (N. Liu & Zhang, 2024). In addition, geographic information system (GIS) tools provide detailed insights into environmental factors surrounding the villages, including their relationship with rivers and land use distribution (Y. Zhou *et al.*, 2024).

From the perspective of environmental resilience, the characteristics of the natural environment directly determine the level of disaster risk and the behavior of the microclimate. Topographic gradients and soil conditions influence the likelihood of landslides and surface runoff, while hydrological characteristics determine the layout of drainage systems and the need for riparian buffer zones. Furthermore, vegetation cover mitigates the effects of high temperatures and heatwaves while also trapping surface water. Therefore, protective measures must be tailored to the site's topography to design effective drainage systems, protect riparian zones, and establish slope buffers and plant shelterbelts (L. Chen *et al.*, 2023; Y. Zhou *et al.*, 2024;

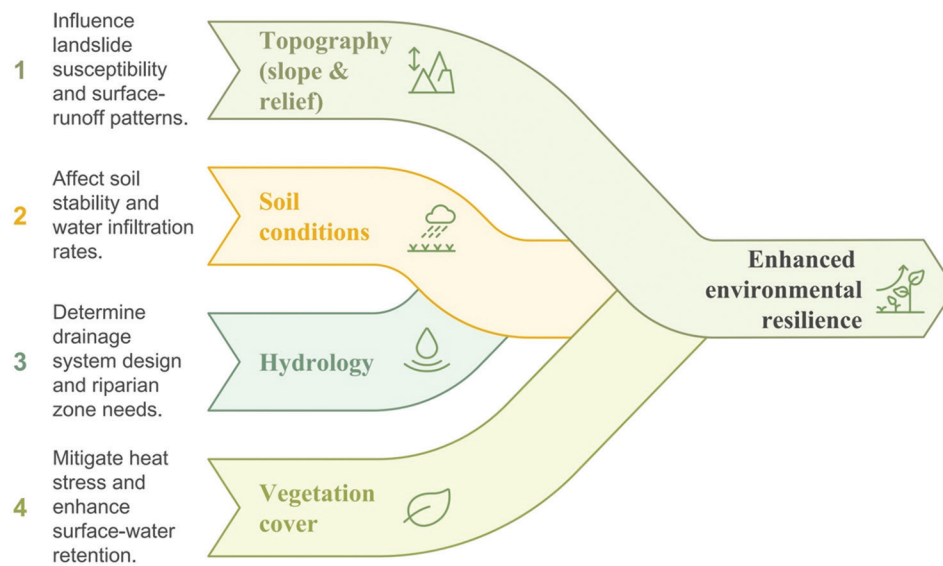


Figure 6. Natural-context drivers of environmental resilience in traditional villages
Source: Diagram by the authors.

Z. Zhou *et al.*, 2022), as shown in Figure 6.

4.2.2. Importance of built-environment structure

Built-environment attributes, including architecture, spatial layouts, and infrastructure, are the second most significant identified category. They are essential components of the cultural heritage and historical continuity of traditional villages, reflecting how human societies have historically adapted to environments.

Architecture reflects cultural heritage and adapts to the environment, influencing the village's historical continuity and its ability to withstand environmental changes. In the Demirel Complex in Türkiye, local architecture reflects the balance between cultural heritage and environmental sustainability. The adaptive reuse of traditional dwellings demonstrates how architectural practice can bridge the past and present, adapting to modern needs while ensuring the continuity of cultural identity (Durukan *et al.*, 2021). In addition, the emphasis on architectural styles and spatial organization aligns with the principles of *genius loci* (Norberg-Schulz, 1980), where the physical environment is seen as embodying the spirit of a place. This underlines the importance of preserving the built environment to maintain cultural identity and historical continuity in traditional villages. The strong representation of built-environment attributes in the literature suggests that these physical elements are central to conservation efforts, serving as tangible links to the past.

Infrastructure enables functionality, supporting daily activities and ensuring that the village can thrive

economically and socially. Infrastructure such as roads, bridges, and irrigation systems ensures that a village remains functional and sustainable in supporting daily life and agricultural activities. In addition, infrastructure comprises a variety of types, each of which plays a role in facilitating mobility, communication, and storage, all of which are essential for economic activity and social interaction (Wilkinson, 2019). Land use patterns optimize land for agriculture and living, ensuring sustainable development in relation to the natural environment. Asadi *et al.* (2012) found that land use and topography severely affected soil properties and agronomic productivity in the semi-arid regions of Iran.

Across the included studies, built-environment attributes were found to be associated with conservation effectiveness through resilience mechanisms. For example, continuity of texture and elevation helps maintain heritage integrity and authenticity (G. Chen *et al.*, 2022; Cheng *et al.*, 2023) while carefully managed accessibility, avoiding over-hardening and inhibiting increases in surface runoff (K. Wu *et al.*, 2023; Zheng *et al.*, 2021). Furthermore, ventilation corridors and surface-subsurface drainage reduce heat and humidity stress, as well as mitigating flood damage (L. Chen *et al.*, 2023; Z. Zhou *et al.*, 2022; Z. Zhou *et al.*, 2018), as shown in Figure 7.

In short, this set of measures is essential for maintaining historical continuity, preserving cultural values, and sustaining vitality under modernization and environmental change.

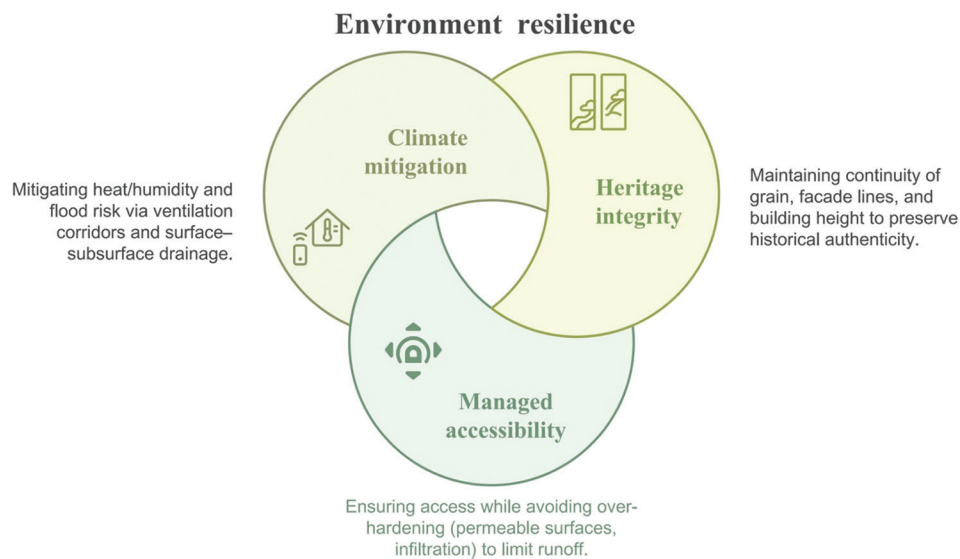


Figure 7. Built-environment pathways to village environmental resilience
Source: Diagram by the authors.

4.3. International-domestic contrasts and practice-oriented strategies

Research data show clear differences between China-based studies and international cases in governance models, implementation toolkits, and participation.

In terms of governance and policy, Chinese studies are tightly coupled to national and provincial designation systems and the rural revitalization program, channeling earmarked funds to listed villages and prioritizing architectural integrity and landscape settings (Lu & Ahmad, 2023; Yao, 2016; Z. Zhou *et al.*, 2018; Z. Zhou & Zheng, 2022). In contrast, international cases often operate through municipal planning frameworks or heritage trusts with project-based finance and design codes, emphasizing context-sensitive public-realm upgrades and adaptive reuse (Curovic *et al.*, 2019; Michalka & Siláci, 2017).

In terms of technical toolkits, China-based research frequently applies GIS, Geodetector, and remote sensing for pattern detection and siting (K. Wu *et al.*, 2023; H. Zhang, 2022; M. Zhang *et al.*, 2023; Y. Zhou *et al.*, 2024). In addition, these studies increasingly use computational fluid dynamics (CFD) and micro-climate analysis to test ventilation and drainage performance (Z. Zhou *et al.*, 2022). International cases have reported site-scale documentation and evaluation through community mapping and landscape assessment that complement China's regional analytics (Curovic *et al.*, 2019; Michalka & Siláci, 2017).

In terms of participation and tourism management, recent Chinese studies foreground social networks,

place-making, and tourism preferences (S. Jiang *et al.*, 2023; Q. Li *et al.*, 2024; N. Liu & Zhang, 2024; Yin *et al.*, 2024), while international practice tends to institutionalize co-design in small public-realm retrofits and stewardship arrangements (Curovic *et al.*, 2019; Michalka & Siláci, 2017).

In terms of practice-oriented synthesis, Table 3 links each strategy to the targeted attribute and built element, clarifies the spatial mechanism, specifies the delivery pathway, and adds lean indicators for follow-up. Priority actions include heritage-sensitive infrastructure that reduces heat-moisture and flood risks while preserving settlement grain (e.g., CFD-informed ventilation corridors, permeable paving, and graded surface-subsurface drainage) (L. Chen *et al.*, 2023; Z. Zhou *et al.*, 2022; Z. Zhou *et al.*, 2018); managed accessibility so that road and parking upgrades do not harden surfaces or increase runoff (K. Wu *et al.*, 2023; Zheng *et al.*, 2021); minimum-intervention adaptive reuse to maintain façade continuity and plot rhythm (G. Chen *et al.*, 2022; Cheng *et al.*, 2023); and participatory place-making informed by social-network analysis and co-design (Q. Li *et al.*, 2024; N. Liu & Zhang, 2024). Evidence-led monitoring that combines unmanned aerial vehicle (UAV) and light detection and ranging (LiDAR) mapping with GIS analytics and virtual-reality (VR)-based eye-tracking aligns design choices with perceived landscape quality and enables outcome tracking over time (C. Liu *et al.*, 2020; K. Wu *et al.*, 2023; H. Zhang *et al.*, 2024).

4.4. The dominance of physical attributes in

conservation efforts

The findings from this review indicate that physical attributes—comprising natural and built-environment elements—dominate the literature on traditional village conservation. This focus on physical attributes is not surprising, given their tangible nature and the ease with which they can be observed, measured, and preserved. Physical attributes are often seen as the most immediate and visible markers of a village's heritage, making them the primary targets of conservation efforts (Bai & Wang, 2019; Olğun & Karatosun, 2019).

However, the emphasis on physical attributes may also reflect a gap in the literature concerning the conservation of intangible cultural heritage. While physical elements are crucial, the historical-cultural and social aspects of traditional villages—such as rituals, customs, and social networks—are equally important for maintaining the identity and continuity of these communities (Ali, 2021; Koster *et al.*, 2019). Theories such as place identity (Proshansky *et al.*, 1983) and cultural landscape suggest that a place's identity is not solely defined by its physical characteristics but also by the meanings and practices associated with it (Blumer, 2009). This underscores the need for a more holistic approach to conservation that includes both tangible and intangible elements (Ashworth & Graham, 2018).

4.5. Integrating intangible attributes in conservation strategies

The relatively lower representation of both the historical culture and social networks and interactions attributes in the reviewed literature points to an opportunity for more integrated conservation approaches (S. Chen, 2024; Y. Luo *et al.*, 2024). Intangible attributes, such as rituals, customs, and social practices, play a key role in sustaining the cultural fabric of traditional villages (Shah Khaidzir & Ahmad Kamal, 2023). These attributes contribute to a sense of community and belonging, both of which are essential for the long-term viability of these villages.

Theories such as symbolic interactionism (Blumer, 2009) support the idea that the meanings attached to physical spaces are socially constructed and continuously negotiated through cultural practices. Therefore, conservation strategies should not only focus on preserving physical structures but also on fostering the cultural practices that give these structures their significance. This approach ensures that traditional villages remain living communities rather than static museum pieces. The concept of community resilience is also of great importance in the context of the protection of traditional villages, both in terms of their social and cultural aspects (Wilson *et al.*,

2018; L. Liu *et al.*, 2023; Gocer *et al.*, 2024).

In place theory, Tuan (1977) and Relph (1976) emphasized how place attachment and identity are deeply cognitive processes that influence people's emotional and psychological connection to their environments. Tuan discussed how places become meaningful through cognitive processes of memory and emotion, suggesting that perceptions of beauty are deeply intertwined with these processes. It is frequently observed that traditional villages are characterized by a high degree of social cohesion, whereby residents evince a profound sense of attachment to the village, manifested in enhanced levels of daily, residential, and digital mobility (Y. Luo *et al.*, 2024; Roslan *et al.*, 2021). In addition, perceiving the environment and protecting it from a human perspective is environmental social psychology (Reicher *et al.*, 2006). It emphasizes the bidirectional influence where not only do physical settings affect human behavior, but individuals also actively shape their environment. This understanding is crucial for developing predispositions that appreciate the interdependence of person-environment relationships, which are essential for adopting sustainable lifestyles (Pérez Ibarra *et al.*, 2020).

4.6. The role of economic and perceptual attributes

4.6.1. Economic attributes

Economic aspects are critical in providing the financial sustainability necessary to support preservation efforts (X. Chen *et al.*, 2020; Kim & Park, 2016; Shi *et al.*, 2023; Q. Wang *et al.*, 2022; Yang *et al.*, 2023). The initial development of traditional villages relied heavily on agricultural production and industrial economic growth; however, the primary economic factors now influencing these villages include production activities and tourism, with economic development serving as a key driver of spatial evolution in these communities (K. Luo & Wu, 2015; Y. Wang *et al.*, 2023). In southwest China, the economic environment of traditional villages is shaped by factors such as population, urbanization rates, and gross domestic product per capita, all of which are crucial for their sustainable development and growth (Z. Nie *et al.*, 2023; Yang *et al.*, 2023).

Economic factors often exert a greater influence on the spatial distribution of villages than natural environmental factors do. For example, L. Chen *et al.* (2023) confirmed that economically underdeveloped regions, such as Xiangxi province, Huaihua city, and Shaoyang city, exhibit lower levels of economic development, leading to insufficient investment in the protection and renovation of traditional villages and resulting in lower liveability scores. Conversely, while rapid economic growth and high urbanization levels

in some regions place additional pressures on traditional villages, they also heighten the necessity and awareness of preservation efforts.

Furthermore, traditional villages with better transportation access generally experience higher levels of economic development, while those with limited access tend to retain their unique cultural identities due to reduced external influences (J. Zhu *et al.*, 2023). For example, K. Wu *et al.* (2023) employed methods such as average nearest neighbor analysis, Thiessen polygon analysis, kernel density analysis, and Geodetector to analyze data from 724 traditional villages in Guizhou, China. Their research demonstrated how transportation conditions significantly impact the spatial distribution and accessibility of these sites, underscoring the critical relationship between transportation and traditional villages.

4.6.2. Sensory attributes

Perception is defined as a psychological experience reflecting the impact of village development on inhabitants' lives, influencing the way residents and tourists interact with the environment. It encompasses the dimensions of emotional attachment, functional dependence, and developmental cognition. Focusing on residents' emotional factors is critical for enhancing rural revitalization strategies that encourage positive behaviors, ensuring the healthy and sustainable development of traditional villages. Vegetation greening rates in rural areas with high visual esthetic quality have been found to promote physical activity and evoke positive emotions. In addition, visually unique and esthetically pleasing natural landscapes can help to reduce the mental stress of work or study and can facilitate social interaction.

Yin *et al.* (2024) analyzed the dimensions of sensory perception in rural tourism contexts, including atmospheric perception, spatial perception, place perception, and visual perception, mainly through the use of qualitative grounded theory. They found that spatial and visual perception were the most significant factors influencing tourists' overall experiences. In addition, human visual perception can focus on the composition and organization of material elements, textures, and colors in traditional villages, while auditory perception, represented by the acoustic environment, can reflect the spatial sequence changes within these villages (Cheng *et al.*, 2023). As S. Jiang *et al.* (2023) and M. Li *et al.* (2024) explained, a comprehensive understanding of these perception factors is crucial for formulating sustainable conservation strategies.

The psychological environment profoundly influences conservation behavior by shaping the attitudes, beliefs, and behaviors of community members (Brown & Raymond,

2007; Stedman, 2002). When research focuses on the relationship between people and village development, the emotional cognition of residents is seen as a resource that has the same value as material heritage in terms of conservation and utilization (Devine-Wright, 2009; Manzo, 2005). Despite its significance, the existing literature offers limited insights into how cognitive and emotional factors are applied in traditional village conservation (C.-F. Chen & Chen, 2010; Salleh *et al.*, 2024). As rural tourism continues to grow and generate economic benefits, the perceived impacts on individuals have become a critical perspective in understanding the driving forces behind traditional village development (Kastenholz *et al.*, 2013; Pai *et al.*, 2023). Emotional perceptions of the inhabitants, similar to physical heritage, are now seen as vital resources for both conserving and utilizing traditional villages (Lewicka, 2011).

Framed by the objective of resilience and long-term sustainability, the review indicates that conservation outcomes are more durable when the classified attributes are tied to implementable strategies and a light-touch monitoring routine. For the physical environment (A1 & A2), CFD-guided ventilation corridors, permeable paving, and graded surface-subsurface drainage reduce heat and moisture stress, as well as attenuate flood peaks while preserving settlement grain (L. Chen *et al.*, 2023; Z. Zhou *et al.*, 2022; Z. Zhou *et al.*, 2018). In addition, managed accessibility prevents surface hardening and excessive runoff from access and parking upgrades (K. Wu *et al.*, 2023; Zheng *et al.*, 2021). For the intangible environment (B1–B4), co-design charrettes and stewardship arrangements align micro-scale upgrades with everyday use and stabilize maintenance cycles (Curovic *et al.*, 2019; Michalka & Siláci, 2017; Q. Li *et al.*, 2024; N. Liu & Zhang, 2024). Perceptual quality can be reviewed through evidence-led monitoring that combines UAV and LiDAR mapping with GIS analytics and VR-based eye-tracking, enabling iterative adjustment over time (C. Liu *et al.*, 2020; K. Wu *et al.*, 2023; H. Zhang *et al.*, 2024). Taken together, the attribute-strategy-indicator linkages summarized in Table 3 operationalize resilience and long-term sustainability through a routine of baseline assessment, pilot implementation, periodic audits, and guidance updates, thereby advancing RQ3.

4.7. Limitations and future research

This review has several limitations. First, reliance on bibliometric visualization and algorithm-driven clustering reveals topic-level patterns but may introduce parameter bias and lack case-level resolution.

Second, this review is based on records from the English-language WoS database. Although important

to the scope of this study, they are not usually included in the core WoS dataset, making the data sample size inadequate. Important studies from the China National Knowledge Infrastructure database, Scopus, and gray literature (e.g., policy documents and project reports) may not have been fully included; therefore, a follow-up multilingual database synthesis is planned.

Third, heterogeneous designs, indicators, and reporting across studies reduce cross-study comparability and preclude meta-analysis. Finally, although this review proposed a two-layer, six-aspect classification of environmental attributes, it did not quantitatively model interactions among attributes, constraining assessment of their relative influence on conservation outcomes.

Future research should adopt inclusive and transparent methods, extend database coverage beyond the English-language WoS database, and use common, reportable indicators to model interactions among attributes. An interdisciplinary toolchain—integrating GIS, 3D scanning, photogrammetry, and other remote-sensing methods with micro-climate, CFD, and hydrological modeling, complemented by VR-based eye-tracking—can quantify morphology-perception couplings and support both before-and-after and longitudinal assessments of conservation effectiveness.

5. Conclusion

This systematic analysis of the literature thoroughly investigated the environmental factors that are crucial to the preservation of traditional villages. The results emphasize that preserving these distinctive cultural landscapes calls for a multimodal strategy that incorporates both material and immaterial components. The current study refines the definition into six aspects and a two-layer framing, and also recognizes the interlinkages among these aspects that together form an operational framework of environmental attributes for traditional village conservation. By classifying these attributes into natural, built-environment, historical-cultural, social, economic, and sensory aspects, this study highlights the complex interactions across these factors and their common importance in preserving traditional village heritage and identity. The physical characteristics of traditional villages, such as their architecture, spatial arrangements, and infrastructure, as well as their natural and built-environment components, form the basis of conservation efforts. These physical characteristics are crucial for representing the rich cultural legacy ingrained in these communities as well as for preserving the villages' structural integrity and historical continuity.

At the same time, the review also reveals that an

overemphasis on physical attributes in current conservation practices may overlook equally vital intangible aspects, such as historical-cultural practices, social networks, and sensory qualities. These intangible attributes are crucial for sustaining the cultural identity and social cohesion of traditional villages, ensuring that they remain as living, dynamic communities rather than static relics of the past. Theories such as place identity and symbolic interactionism emphasize the need for a more holistic conservation strategy that encompasses both the material and emotional bonds that people have with these places. Economic factors, including tourism and local industry, play a significant role in the sustainability of conservation efforts. The review highlights the dual impact of economic development, where increased financial resources can enhance preservation initiatives, but rapid urbanization and commercialization can also pose threats to the cultural integrity of traditional villages. In addition, perceptual attributes, such as residents' emotional attachment and esthetic appreciation, are increasingly recognized as vital components of successful conservation strategies.

The review also identifies China-international contrasts in governance frameworks, technical toolkits, and participatory practices. These contrasts distil four practice-oriented strategies: heritage-sensitive infrastructure, managed accessibility, minimum-intervention adaptive reuse, and participatory place-making supported by evidence-led monitoring. Overall, this review underscores that the effective conservation of traditional villages requires an integrated, practice-oriented framework that balances physical and intangible attributes, adapts to economic and governance contexts, and sustains both the cultural identity and the living vitality of these communities.

Acknowledgments

None.

Funding

This review was funded by the Research University Grant (GUP - Geran Universiti Penyelidikan; grant no.: GUP-2018-096) from Universiti Kebangsaan Malaysia.

Conflict of interest

The authors declare that they have no competing interests.

Author contributions

Conceptualization: Yihan Wang, Mohd Khairul Azhar Mat Sulaiman

Visualization: Yihan Wang

Writing—original draft: Yihan Wang

Writing-review & editing: Mohd Khairul Azhar Mat Sulaiman, Nor Zalina Harun

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data

This study is a literature review and does not generate any primary data. All data analyzed were derived from previously published articles indexed in the WoS database. No data were used for the research described in the article.

References

- Ali, I. (2021). Rituals of containment: Many pandemics, body politics, and social dramas during COVID-19 in Pakistan. *Frontiers in Sociology*, 6:648149.
<https://doi.org/10.3389/fsoc.2021.648149>
- Asadi, H., Raeisvandi, A., Rabiei, B., & Ghadiri, H. (2012). Effect of land use and topography on soil properties and agronomic productivity on calcareous soils of a semiarid region, Iran. *Land Degradation and Development*, 23(5):496-504.
<https://doi.org/10.1002/ldr.1081>
- Ashworth, G. J., & Graham, B. (2018). Senses of place, senses of time and heritage. In: *A Museum Studies Approach to Heritage*. London: Routledge.
- Bai, N., & Wang, L. (2019). Village Heritage Conservation in the New Data Age-Rural Information Modelling in the Context of Rural Vitalization in China. In: *Conference: Intelligent & Informed, the 24th CAADRIA Conference at: Victoria University of Wellington, Wellington, New Zealand*, p.41-50.
<https://doi.org/10.52842/conf.caadria.2019.2.041>
- Barrett, C. B., Ghezzi-Kopel, K., Hoddinott, J., Homami, N., Tennant, E., Upton, J., et al. (2021). A scoping review of the development resilience literature: Theory, methods and evidence. *World Development*, 146:105612.
<https://doi.org/10.1016/j.worlddev.2021.105612>
- Blumer, H. (2009). *Symbolic Interactionism: Perspective and Method (1. Paperback Print., Renewed)*. United States: University of California Press.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2):77-101.
- Brown, G., & Raymond, C. (2007). The relationship between place attachment and landscape values: Toward mapping place attachment. *Applied Geography*, 27(2):89-111.
<https://doi.org/10.1016/j.apgeog.2006.11.002>
- Cao, J. (2023). Construction of ecological landscape environment in guanzhong traditional villages from the perspective of rural revitalization. *Health and Social Care in the Community*, 2023:1-15.
<https://doi.org/10.1155/2023/9974511>
- Chen, C. (2004). Searching for intellectual turning points: Progressive knowledge domain visualization. *Proceedings of the National Academy of Sciences*, 101(suppl_1):5303-5310.
<https://doi.org/10.1073/pnas.0307513100>
- Chen, C. (2006). CiteSpace II: Detecting and visualizing emerging trends and transient patterns in scientific literature. *Journal of the American Society for Information Science and Technology*, 57(3):359-377.
<https://doi.org/10.1002/asi.20317>
- Chen, C. F., & Chen, P. C. (2010). *Resident Attitudes toward Heritage Tourism Development*. Tourism Geographies. Available from: <https://www.tandfonline.com/doi/abs/10.1080/14616688.2010.516398> [Last accessed on 2024 Aug 31].
- Chen, G., Sun, X., Yu, W., & Wang, H. (2022). Analysis model of the relationship between public spatial forms in traditional villages and scenic beauty preference based on LiDAR point cloud data. *Land*, 11(8):8.
<https://doi.org/10.3390/land11081133>
- Chen, L., Zhong, Q., & Li, Z. (2023). Analysis of spatial characteristics and influence mechanism of human settlement suitability in traditional villages based on multi-scale geographically weighted regression model: A case study of Hunan province. *Ecological Indicators*, 154:110828.
<https://doi.org/10.1016/j.ecolind.2023.110828>
- Chen, S. (2024). The impact of villagers' participation in the protection and development of traditional villages on the revitalization of traditional villages. *Highlights in Business, Economics and Management*, 34:32-37.
<https://doi.org/10.54097/yhp56065>
- Chen, X., Xie, W., & Li, H. (2020). The spatial evolution process, characteristics and driving factors of traditional villages from the perspective of the cultural ecosystem: A case study of Chengkan Village. *Habitat International*, 104:102250.
<https://doi.org/10.1016/j.habitatint.2020.102250>
- Cheng, G., Li, Z., Xia, S., Gao, M., Ye, M., & Shi, T. (2023). Research on the spatial sequence of building facades in huizhou regional traditional villages. *Buildings*, 13(1):1.
<https://doi.org/10.3390/buildings13010174>
- Csurgó, B., & Smith, M. K. (2021). The value of cultural ecosystem services in a rural landscape context. *Journal of Rural Studies*, 86:76-86.
<https://doi.org/10.1016/j.jrurstud.2021.05.030>
- Curovic, Z., Curovic, M., Spalevic, V., Janic, M., Sestras, P., & Popovic, S. (2019). Identification and evaluation of

landscape as a precondition for planning revitalization and development of mediterranean rural settlements-case study: Mrkovi Village, Bay of Kotor, Montenegro. *Sustainability*, 11(7):17.

<https://doi.org/10.3390/su11072039>

Devine-Wright, P. (2009). Rethinking NIMBYism: The role of place attachment and place identity in explaining place-protective action. *Journal of Community and Applied Social Psychology*, 19(6):426-441.

<https://doi.org/10.1002/casp.1004>

Durukan, A., Ertaş Beşir, Ş., Koç Altuntaş, S., & Açikel, M. (2021). Evaluation of sustainability principles in adaptable re-functioning: Traditional residences in demirel complex. *Sustainability*, 13(5):2514.

<https://doi.org/10.3390/su13052514>

Dwan, K., Altman, D. G., Clarke, M., Gamble, C., Higgins, J. P. T., Sterne, J. A. C., et al. (2014). Evidence for the selective reporting of analyses and discrepancies in clinical trials: A systematic review of cohort studies of clinical trials. *PLoS Medicine*, 11(6):e1001666.

<https://doi.org/10.1371/journal.pmed.1001666>

Feng, Y., Wei, H., Huang, Y., Li, J., Mu, Z., & Kong, D. (2023). Spatiotemporal evolution characteristics and influencing factors of traditional villages: The Yellow River Basin in Henan Province, China. *Heritage Science*, 11(1):1.

<https://doi.org/10.1186/s40494-023-00939-y>

Fereday, J., & Muir-Cochrane, E. (2006). Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development. *International Journal of Qualitative Methods*, 5(1):80-92.

Fu, J., Zhou, J., & Deng, Y. (2021). Heritage values of ancient vernacular residences in traditional villages in Western Hunan, China: Spatial patterns and influencing factors. *Building and Environment*, 188:107473.

<https://doi.org/10.1016/j.buildenv.2020.107473>

Gocer, O., Boyacioglu, D., Karahan, E. E., & Shrestha, P. (2024). Cultural tourism and rural community resilience: A framework and its application. *Journal of Rural Studies*, 107:103238.

<https://doi.org/10.1016/j.jrurstud.2024.103238>

Grilli, G., Pagliacci, F., & Gatto, P. (2024). Determinants of agricultural diversification: What really matters? A review. *Journal of Rural Studies*, 110:103365.

<https://doi.org/10.1016/j.jrurstud.2024.103365>

Hale, J., Irish, A., Carolan, M., Clark, J. K., Inwood, S., Jablonski, B. B. R., et al. (2023). A systematic review of cultural capital in U.S. community development research. *Journal of Rural Studies*, 103:103113.

<https://doi.org/10.1016/j.jrurstud.2023.103113>

Harun, N. Z., & Jaffar, N. (2018). Enhancement for rural livability: Changes and impacts on the traditional Malay settlement. *Environment-Behaviour Proceedings Journal*, 3(9):127.

<https://doi.org/10.21834/e-bpj.v3i9.1544>

Hassan, N. A., Harun, N. Z., & Tambi, N. (2020). Nilai simbolik sebagai penunjuk kelestarian modal sosial petempatan tradisional di Kuala Terengganu, Malaysia. *Malaysian Journal of Society and Space*, 16(3):201-218.

<https://doi.org/10.17576/geo-2020-1603-15>

Hou, J., Yang, X., & Chen, C. (2018). Emerging trends and new developments in information science: A document co-citation analysis (2009–2016). *Scientometrics*, 115(2):869-892.

<https://doi.org/10.1007/s11192-018-2695-9>

Jiang, S., Ma, H., Yang, L., & Luo, S. (2023). The influence of perceived physical and aesthetic quality of rural settlements on tourists' preferences-a case study of Zhaoxing Dong Village. *Land*, 12(8):8.

<https://doi.org/10.3390/land12081542>

Jiang, Y., Li, N., & Wang, Z. (2023). Parametric reconstruction of traditional village morphology based on the space gene perspective-the case study of Xiaoxi Village in Western Hunan, China. *Sustainability*, 15(3):3.

<https://doi.org/10.3390/su15032088>

Kastenholz, E., Carneiro, M. J., Eusébio, C., & Figueiredo, E. (2013). Host-guest relationships in rural tourism: Evidence from two Portuguese villages. *Anatolia*, 24(3):367-380.

Katapidi, I. (2021). Heritage policy meets community praxis: Widening conservation approaches in the traditional villages of central Greece. *Journal of Rural Studies*, 81:47-58.

<https://doi.org/10.1016/j.jrurstud.2020.09.012>

Kawabe, Y., Morio, T., James, J. L., Prescott, A. R., Tanaka, Y., & Schaap, P. (2009). Activated cAMP receptors switch encystation into sporulation. *Proceedings of the National Academy of Sciences*, 106(17):7089-7094.

<https://doi.org/10.1073/pnas.0901617106>

Kim, M., & Park, J. (2016). The effect of village regeneration on settlement and residential satisfaction: Change to tourist attraction from residential area. *Journal of Asian Architecture and Building Engineering*, 15:519-526.

<https://doi.org/10.3130/jaabe.15.519>

Koster, J., Lukas, D., Nolin, D., Power, E., Alvergne, A., Mace, R., et al. (2019). Kinship ties across the lifespan in human communities. *Philosophical Transactions of the Royal Society B*, 374:20180069.

<https://doi.org/10.1098/rstb.2018.0069>

- Lewicka, M. (2011). Place attachment: How far have we come in the last 40 years? *Journal of Environmental Psychology*, 31(3):207-230.
<https://doi.org/10.1016/j.jenvp.2010.10.001>
- Li, M., Yan, Y., Ying, Z., & Zhou, L. (2024). Measuring villagers' perceptions of changes in the landscape values of traditional villages. *ISPRS International Journal of Geo-Information*, 13(2):2.
<https://doi.org/10.3390/ijgi13020060>
- Li, Q., Lv, S., Cui, J., Liu, Y., & Chen, Z. (2024). Research on the public environment renewal of traditional villages based on the social network analysis method. *Sustainability*, 16(3):3.
<https://doi.org/10.3390/su16031006>
- Li, T., Zhang, M., & Gu, X. (2022). Optimization strategies for conservation of traditional dwellings in Hongcun Village, China, based on decay phenomena analysis. *PLoS One*, 17(11):e0276306.
<https://doi.org/10.1371/journal.pone.0276306>
- Lian, J., Nijhuis, S., Bracken, G., Wu, X., Wu, X., & Chen, D. (2024). Conservation and development of the historic garden in a landscape context: A systematic literature review. *Landscape and Urban Planning*, 246:105027.
<https://doi.org/10.1016/j.landurbplan.2024.105027>
- Lin, L., & Gui, Y. (2024). Traditional culture of settlements associated with the natural environment: The case of Yi minority Southwest China. *Journal of Asian Architecture and Building Engineering*, 24(4):2411-2429.
<https://doi.org/10.1080/13467581.2024.2373822>
- Liu, J., Dietz, T., Carpenter, S. R., Alberti, M., Folke, C., Moran, E., et al. (2007). Complexity of coupled human and natural systems. *Science*, 317(5844):1513-1516.
<https://doi.org/10.1126/science.1144004>
- Liu, L., Ross, H., & Ariyawardana, A. (2023). Building rural resilience through agri-food value chains and community interactions: A vegetable case study in wuhan, China. *Journal of Rural Studies*, 101:103047.
<https://doi.org/10.1016/j.jrurstud.2023.103047>
- Liu, N., & Zhang, H. (2024). A comparative study of traditional village renewal characteristics driven by different entities from the perspective of place-making. *Buildings*, 14(6):6.
<https://doi.org/10.3390/buildings14061520>
- Liu, Y., Dai, L., Long, H., Woods, M., & Fois, F. (2022). Rural vitalization promoted by industrial transformation under globalization: The case of Tengtou village in China. *Journal of Rural Studies*, 95:241-255.
<https://doi.org/10.1016/j.jrurstud.2022.09.020>
- Lu, Y., & Ahmad, Y. (2023). Heritage protection perspective of sustainable development of traditional villages in Guangxi, China. *Sustainability*, 15(4):4.
<https://doi.org/10.3390/su15043387>
- Lu, Y., & Qian, J. (2023). Rural creativity for community revitalization in Bishan Village, China: The nexus of creative practices, cultural revival, and social resilience. *Journal of Rural Studies*, 97:255-268.
<https://doi.org/10.1016/j.jrurstud.2022.12.017>
- Luo, K., & Wu, H. (2015). Cultural adaptation and consciousness: A case study of dong people in huanggang village. *Anthropologist*, 22(3):576-586.
<https://doi.org/10.31901/24566802.2015/22.02.34>
- Luo, Y., Lai, B., Zhang, Y., & Liu, J. (2024). Village leadership, social networks and collective actions in indigenous communities: Case of Hani rice terrace social-ecological system in Southwest China. *Journal of Rural Studies*, 106:103237.
<https://doi.org/10.1016/j.jrurstud.2024.103237>
- Manzo, L. C. (2005). For better or worse: Exploring multiple dimensions of place meaning. *Journal of Environmental Psychology*, 25(1):67-86.
<https://doi.org/10.1016/j.jenvp.2005.01.002>
- Nie, X., Wang, C., & Huang, W. (2023). Evolution and spatial reconstruction of rural settlements based on composite features of agglomeration effect and ecological effects in the Hexi Corridor, Northwest China. *PLoS One*, 18(11):e0294037.
<https://doi.org/10.1371/journal.pone.0294037>
- Nie, Z., Chen, C., Pan, W., & Dong, T. (2023). Exploring the dynamic cultural driving factors underlying the regional spatial pattern of Chinese traditional villages. *Buildings*, 13(12):3068.
<https://doi.org/10.3390/buildings13123068>
- Norberg-Schulz, C. (1980). *Genius Loci: Towards a Phenomenology of Architecture*. London: Academy Editions.
- Olgun, T. N., & Karatosun, M. B. (2019). Rural architectural heritage conservation and sustainability in Turkey: The case of Karaca village of Malatya region. *International Journal of Design and Nature and Ecodynamics*, 14(3):195-205.
<https://doi.org/10.2495/DNE-V14-N3-195-205>
- Pai, C. K., Chen, H., Lee, T. J., Hyun, S. S., Liu, Y., & Zheng, Y. (2023). The impacts of under-tourism and place attachment on residents' life satisfaction. *Journal of Vacation Marketing*, 30:1-19.
<https://doi.org/10.1177/13567667231164807>
- Pérez Ibarra, R. E., Tapia-Fonllem, C. O., Fraijo-Sing, B. S., Nieblas Soto, N., & Poggio, L. (2020). Psychosocial predispositions towards sustainability and their relationship with environmental identity. *Sustainability*, 12(17):17.
<https://doi.org/10.3390/su1217195>
- Perianes-Rodriguez, A., Waltman, L., & van Eck, N. J. (2016). Constructing bibliometric networks: A comparison

- between full and fractional counting. *Journal of Informetrics*, 10(4):1178-1195.
<https://doi.org/10.1016/j.joi.2016.10.006>
- Porteous, J. D. (1990). Landscapes of the mind: Worlds of sense and metaphor. In: *Landscapes of the Mind*. Toronto: University of Toronto Press.
- Pretty, J., Peacock, J., Sellens, M., & Griffin, M. (2005). The mental and physical health outcomes of green exercise. *International Journal of Environmental Health Research*, 15(5):319-337.
<https://doi.org/10.1080/09603120500155963>
- Proshansky, H. M., Fabian, A. K., & Kaminoff, R. (1983). Place-identity: Physical world socialization of the self. In: *The People, Place, and Space Reader*. London: Routledge, p. 77-78.
- Reicher, S., Hopkins, N., & Harrison, K. (2006). Social identity and spatial behaviour: The relationship between national category salience, the sense of home, and labour mobility across national boundaries. *Political Psychology*, 27(2):247-263.
<https://doi.org/10.1111/j.1467-9221.2006.00005.x>
- Relf, E. (1976). *Place and Placelessness*. Vol. 67. London: Pion, p. 45.
- Ridder, H. G. (2014). *Book Review: Qualitative Data Analysis. A Methods Sourcebook*. London, England: Sage Publications Sage UK.
- Rodaway, P. (2002). *Sensuous Geographies: Body, Sense and Place*. London: Routledge.
- Rosetia, A., & Harun, N. Z. (2023). An exploratory analysis of the definition and conceptualization of cultural landscape. *Jurnal Kejuruteraan*, 1(6):17-27.
[https://doi.org/10.17576/jkukm-2023-si6\(1\)-02](https://doi.org/10.17576/jkukm-2023-si6(1)-02)
- Roslan, Z. B., Ramli, Z., Razman, M. R., Asyraf, M. R. M., Ishak, M. R., Ilyas, R. A., et al. (2021). Reflections on local community identity by evaluating heritage sustainability protection in Jugra, Selangor, Malaysia. *Sustainability*, 13(16):8705.
<https://doi.org/10.3390/su13168705>
- Salleh, A. R., Mustaffa, N. K., Mat Isa, C. M., & Aziz, A. S. (2024). Challenges and strategies of rural community towards sustainable development. *Jurnal Kejuruteraan*, 36(5):2239-2249.
[https://doi.org/10.17576/jkukm-2024-36\(5\)-40](https://doi.org/10.17576/jkukm-2024-36(5)-40)
- Shah Khaidzir, M. F., & Ahmad Kamal, M. A. (2023). Sense of place: Place identity, place attachment and place dependence among university students. *International Journal of Academic Research in Business and Social Sciences*, 13(10):1020-1033.
<https://doi.org/10.6007/IJARBS/v13-i10/18945>
- Shi, B., Liu, H., Huang, L., Zhang, Y., & Xiang, Z. (2023). Increasing vulnerability of village heritage: Evidence from 123 villages in Aba prefecture, Sichuan, China. *Land*, 12(11):11.
<https://doi.org/10.3390/land12112048>
- Stedman, R. C. (2002). Toward a social psychology of place: Predicting behavior from place-based cognitions, attitude, and identity. *Environment and Behavior*, 34(5):561-581.
<https://doi.org/10.1177/0013916502034005001>
- Stokols, D. (1992). Establishing and maintaining healthy environments: Toward a social ecology of health promotion. *American Psychologist*, 47(1):6-22.
<https://doi.org/10.1037/0003-066X.47.1.6>
- Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., et al. (2018). PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. *Annals of Internal Medicine*, 169(7):467-473.
<https://doi.org/10.7326/M18-0850>
- Tuan, Y. F. (1977). *Space and Place: The Perspective of Experience*. Minneapolis, MN: University of Minnesota Press.
- Van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, 84(2): 523-538.
<https://doi.org/10.1007/s11192-009-0146-3>
- Vythoulka, A., Delegou, E. T., Caradimas, C., & Moropoulou, A. (2021). Protection and revealing of traditional settlements and cultural assets, as a tool for sustainable development: The case of Kythera Island in Greece. *Land*, 10(12):12.
<https://doi.org/10.3390/land10121324>
- Wang, H., Shan, Y., Xia, S., & Cao, J. (2024). Traditional village morphological characteristics and driving mechanism from a rural sustainability perspective: Evidence from Jiangsu Province. *Buildings*, 14(5):5.
<https://doi.org/10.3390/buildings14051302>
- Wang, Q., Bing, H., Wang, S., & Xu, Q. (2022). Study on the spatial distribution characteristics and influencing factors of famous historical and cultural towns or villages in Hubei Province, China. *Sustainability*, 14(21):13735.
<https://doi.org/10.3390/su142113735>
- Wang, X., & Zhu, Q. (2022). Influencing factors of traditional village protection and development from the perspective of resilience theory. *Land*, 11(12):12.
<https://doi.org/10.3390/land11122314>
- Wang, Y., Duan, X., Wang, L., & Wang, L. (2023). Evolution of rural multifunction and its natural and socioeconomic factors in coastal China. *Journal Of Geographical Sciences*, 33(9):1791-1814.
<https://doi.org/10.1007/s11442-023-2153-3>
- Wilkinson, D. (2019). Towards an archaeological theory of

- infrastructure. *Journal of Archaeological Method and Theory*, 26(3):1216-1241.
<https://doi.org/10.1007/s10816-018-9410-2>
- Wilson, G. A., Hu, Z., & Rahman, S. (2018). Community resilience in rural China: The case of Hu Village, Sichuan Province. *Journal of Rural Studies*, 60:130-140.
<https://doi.org/10.1016/j.jrurstud.2018.03.016>
- Wu, H., Liang, T., & Shen, T. (2023). The spatial characteristics of traditional villages and their heritage protection based on landscape genes. *WSEAS Transactions on Environment and Development*, 19:320-328.
<https://doi.org/10.37394/232015.2023.19.28>
- Wu, K., Su, W., Ye, S., Li, W., Cao, Y., & Jia, Z. (2023). Analysis on the geographical pattern and driving force of traditional villages based on GIS and Geodetector: A case study of Guizhou, China. *Scientific Reports*, 13(1):20659.
<https://doi.org/10.1038/s41598-023-47921-z>
- Xia, J., Gu, X., Fu, T., Ren, Y., & Sun, Y. (2024). Trends and future directions in research on the protection of traditional village cultural heritage in Urban renewal. *Buildings*, 14(5):1362.
<https://doi.org/10.3390/buildings14051362>
- Xiao, Y., & Fang, Z. (2023). The mechanism of “ruralness” expression in Chinese rural landscape design: An exploratory study based on grounded theory. *Reviews of Adhesion and Adhesives*, 11(3):174-197.
<https://doi.org/10.47750/RAA/11.3.10>
- Xiao, Y., Zhao, J., Sun, S., Guo, L., Axmacher, J., & Sang, W. (2020). Sustainability dynamics of traditional villages: A case study in Qiannan prefecture, Guizhou, China. *Sustainability*, 12(1):1.
<https://doi.org/10.3390/su12010314>
- Xu, Q., & Wang, J. (2021). Recognition of values of traditional villages in Southwest China for sustainable development: A case study of Liufang village. *Sustainability*, 13(14):7569.
<https://doi.org/10.3390/su13147569>
- Yang, G., Wu, L., Xie, L., Liu, Z., & Li, Z. (2023). Study on the distribution characteristics and influencing factors of traditional villages in the Yunnan, Guangxi, and Guizhou Rocky desertification area. *Sustainability*, 15(20):14902.
<https://doi.org/10.3390/su152014902>
- Yin, J., Feng, J., & Jia, M. (2024). Research on rural tourism environment perception based on grounded theory A case study of Beishan Village, Zhuhai City, Guangdong Province, China. *Heliyon*, 10(11):e32373.
<https://doi.org/10.1016/j.heliyon.2024.e32373>
- Yu, X. H., Wang, X., Ren, Y. G., & Liu, J. C. (2019). The landscape evaluation system of ecotourism villages in Qinling mountains. *Applied Ecology and Environmental Research*, 17(4):8955-8968.
https://doi.org/10.15666/aer/1704_89558968
- Zhang, C. (2015). Study on value characteristics of traditional village and its protection strategy. In 2015: *International Conference on Economics, Social Science, Arts, Education and Management Engineering*. Atlantis Press. pp. 263-266.
- Zhang, H., Andrade, B., Wang, X., Aburabee, I., & Yuan, S. (2024). A study of spatial cognition in the rural heritage based on VR 3D eye-tracking experiments. *Heritage Science*, 12(1):141.
<https://doi.org/10.1186/s40494-024-01264-8>
- Zhao, Q., & Ren, Y. (2021). Pattern matching system of traditional village pattern ecological protection based on cluster analysis. *Fresenius Environmental Bulletin*, 30(6A):6509-6515.
- Zhao, Q., Bao, H. X. H., & Yao, S. (2024). Unpacking the effects of rural homestead development rights reform on rural revitalization in China. *Journal of Rural Studies*, 108:103265.
<https://doi.org/10.1016/j.jrurstud.2024.103265>
- Zhao, W., Xiao, D., Li, J., Xu, Z., & Tao, J. (2024). Research on traditional village spatial differentiation from the perspective of cultural routes: A case study of 338 villages in the Miao Frontier Corridor. *Sustainability*, 16(13):5298.
<https://doi.org/10.3390/su16135298>
- Zheng, X., Wu, J., & Deng, H. (2021). Spatial distribution and land use of traditional villages in Southwest China. *Sustainability*, 13(11):11.
<https://doi.org/10.3390/su13116326>
- Zhou, Y., Liu, M., Xie, G., & Liu, C. (2024). Landscape ecology analysis of traditional villages: A case study of ganjiang river basin. *Applied Sciences-Basel*, 14(2):929.
<https://doi.org/10.3390/app14020929>
- Zhou, Z., Deng, J., Wang, P., Zhou, C., Xu, Y., Jiang, W., et al. (2022). Physical environment study of traditional village patterns in Jinxi County, Jiangxi province based on CFD Simulation. *Processes*, 10(11):11.
<https://doi.org/10.3390/pr10112453>
- Zhu, J., Xu, W., Xiao, Y., Shi, J., Hu, X., & Yan, B. (2023). Temporal and spatial patterns of traditional village distribution evolution in Xiangxi, China: Identifying multidimensional influential factors and conservation significance. *Heritage Science*, 11(1):261.
<https://doi.org/10.1186/s40494-023-01110-3>
- Zhu, J., Yuan, X., Yuan, X., Liu, S., Guan, B., Sun, J., et al. (2021). Evaluating the sustainability of rural complex ecosystems during the development of traditional farming villages into tourism destinations: A diachronic emergy approach. *Journal of Rural Studies*, 86:473-484.
<https://doi.org/10.1016/j.jrurstud.2021.07.010>

Appendix

Included articles through Preferred Reporting Items for Systematic reviews and Meta-Analyses

- Cao, J. (2023). Construction of ecological landscape environment in Guanzhong traditional villages from the perspective of rural revitalization. *Health and Social Care in the Community*, 2023, 1-15.
<https://doi.org/10.1155/2023/9974511>
- Chen, G., Sun, X., Yu, W., & Wang, H. (2022). Analysis model of the relationship between public spatial forms in traditional villages and scenic beauty preference based on LiDAR point cloud data. *Land*, 11(8):8.
<https://doi.org/10.3390/land11081133>
- Chen, L., Zhong, Q., & Li, Z. (2023). Analysis of spatial characteristics and influence mechanism of human settlement suitability in traditional villages based on multi-scale geographically weighted regression model: A case study of Hunan province. *Ecological Indicators*, 154:110828.
<https://doi.org/10.1016/j.ecolind.2023.110828>
- Chen, X., Xie, W., & Li, H. (2020). The spatial evolution process, characteristics, and driving factors of traditional villages from the perspective of the cultural ecosystem: A case study of Chengkan Village. *Habitat International*, 104:102250.
<https://doi.org/10.1016/j.habitatint.2020.102250>
- Cheng, G., Li, Z., Xia, S., Gao, M., Ye, M., & Shi, T. (2023). Research on the spatial sequence of building facades in Huizhou regional traditional villages. *Buildings*, 13(1):1.
<https://doi.org/10.3390/buildings13010174>
- Curovic, Z., Curovic, M., Spalevic, V., Janic, M., Sestras, P., & Popovic, S. (2019). Identification and evaluation of landscape as a precondition for planning revitalization and development of mediterranean rural settlements-case study: Mrkovi Village, Bay of Kotor, Montenegro. *Sustainability*, 11(7):17.
<https://doi.org/10.3390/su11072039>
- Feng, Y., Wei, H., Huang, Y., Li, J., Mu, Z., & Kong, D. (2023). Spatiotemporal evolution characteristics and influencing factors of traditional villages: The Yellow River Basin in Henan Province, China. *Heritage Science*, 11(1):1.
<https://doi.org/10.1186/s40494-023-00939-y>
- Gong, L., Yang, J., Wu, C., & Zhou, H. (2023). Fractal characteristics of the spatial texture in traditional Miao Villages in Qiandongnan, Guizhou, China. *Sustainability*, 15(17):13218.
<https://doi.org/10.3390/su151713218>
- Jiang, S., Ma, H., Yang, L., & Luo, S. (2023). The influence of perceived physical and aesthetic quality of rural settlements on tourists' preferences-a case study of Zhaoxing Dong Village. *Land*, 12(8):8.
<https://doi.org/10.3390/land12081542>
- Jiang, Y., Li, N., & Wang, Z. (2023). Parametric reconstruction of traditional village morphology based on the space gene perspective-the case study of Xiaoxi Village in Western Hunan, China. *Sustainability*, 15(3):3.
<https://doi.org/10.3390/su15032088>
- Kim, M., & Park, J. (2016). The effect of village regeneration on settlement and residential satisfaction: Change to tourist attraction from residential area. *Journal of Asian Architecture And Building Engineering*, 15(3):519-526.
<https://doi.org/10.3130/jaabe.15.519>
- Lei, Y., Zhou, H., Wang, M., & Wang, C. (2022). Analysis on spatial characteristics and the adaptation mechanism of Miao traditional settlement in Qiandongnan, China. *Mathematical Problems in Engineering*, 2022:1-11.
<https://doi.org/10.1155/2022/6293833>
- Li, B., Wang, J., & Jin, Y. (2022). Spatial distribution characteristics of traditional villages and influence factors thereof in hilly and gully areas of Northern Shaanxi. *Sustainability*, 14:15327.
<https://doi.org/10.3390/su142215327>
- Li, M., Yan, Y., Ying, Z., & Zhou, L. (2024). Measuring villagers' perceptions of changes in the landscape values of traditional villages. *ISPRS International Journal of Geo-Information*, 13(2):2.
<https://doi.org/10.3390/ijgi13020060>
- Li, Q., Lv, S., Cui, J., Liu, Y., & Chen, Z. (2024). Research on the public environment renewal of traditional villages based on the social network analysis method. *Sustainability*, 16(3):3.
<https://doi.org/10.3390/su16031006>
- Lin, L., & Gui, Y. (2024). Traditional culture of settlements associated with the natural environment: The case of Yi minority Southwest China. *Journal of Asian Architecture and Building Engineering*, 24(4):2411-2429.
<https://doi.org/10.1080/13467581.2024.2373822>
- Liu, C., Cao, Y., Yang, C., Zhou, Y., & Ai, M. (2020). Pattern identification and analysis for the traditional village using low altitude UAV-borne remote sensing: Multifaceted geospatial data to support rural landscape investigation, documentation and management. *Journal of Cultural Heritage*, 44:185-195.
<https://doi.org/10.1016/j.culher.2019.12.013>
- Liu, N., & Zhang, H. (2024). A comparative study of traditional village renewal characteristics driven by different entities from the perspective of place-making. *Buildings*, 14(6):6.
<https://doi.org/10.3390/buildings14061520>

- Long, T., Işık, C., Yan, J., & Zhong, Q. (2024). Promoting the sustainable development of traditional villages: Exploring the comprehensive assessment, spatial and temporal evolution, and internal and external impacts of traditional village human settlements in hunan province. *Heliyon*, 10(11):e32439.
<https://doi.org/10.1016/j.heliyon.2024.e32439>
- Lu, Y., & Ahmad, Y. (2023). Heritage protection perspective of sustainable development of traditional villages in Guangxi, China. *Sustainability*, 15(4):3387.
<https://doi.org/10.3390/su15043387>
- Luo, K., & Wu, H. (2015). Cultural adaptation and consciousness: A case study of dong people in Huanggang Village. *Anthropologist*, 22(3):576-586.
- Michalka, L., & Siláci, I. (2017). the transformation of transport and public spaces of the selected rural settlement. *Procedia Engineering*, 192:592-596.
<https://doi.org/10.1016/j.proeng.2017.06.102>
- Nie, X., Wang, C., & Huang, W. (2023). Evolution and spatial reconstruction of rural settlements based on composite features of agglomeration effect and ecological effects in the Hexi Corridor, Northwest China. *PLoS One*, 18(11):e0294037.
<https://doi.org/10.1371/journal.pone.0294037>
- Nie, Z., Chen, C., Pan, W., & Dong, T. (2023). Exploring the dynamic cultural driving factors underlying the regional spatial pattern of Chinese traditional villages. *Buildings*, 13(12):3068.
<https://doi.org/10.3390/buildings13123068>
- Peng, P., Fu, Y., Zhou, X., Wu, S., Zhao, J., & Zhang, Y. (2024). Quantitative research on the degree of disorder of traditional settlements: A case study of Liangjia Village, Jingxing, Hebei Province. *Heritage Science*, 12(1):109.
<https://doi.org/10.1186/s40494-024-01223-3>
- Shi, B., Liu, H., Huang, L., Zhang, Y., & Xiang, Z. (2023). Increasing vulnerability of village heritage: Evidence from 123 villages in Aba Prefecture, Sichuan, China. *Land*, 12(11):11.
<https://doi.org/10.3390/land12112048>
- Wang, H., Shan, Y., Xia, S., & Cao, J. (2024). Traditional village morphological characteristics and driving mechanism from a rural sustainability perspective: Evidence from Jiangsu Province. *Buildings*, 14(5):5.
<https://doi.org/10.3390/buildings14051302>
- Wang, Q., Bing, H., Wang, S., & Xu, Q. (2022). Study on the spatial distribution characteristics and influencing factors of famous historical and cultural towns or villages in Hubei Province, China. *Sustainability*, 14(21):21.
<https://doi.org/10.3390/su142113735>
- Wang, T., Adeyeye, K., Wang, D., Guo, H., & Chen, S. (2017). The reconciliation of the contradictions in the preservation and development of traditional villages: Refinement of contradictions through extenics. *Procedia Computer Science*, 122:1149-1155.
<https://doi.org/10.1016/j.procs.2017.11.485>
- Wang, X., & Zhu, Q. (2022). Influencing factors of traditional village protection and development from the perspective of resilience theory. *Land*, 11(12):12.
<https://doi.org/10.3390/land11122314>
- Wang, Y., Duan, X., Wang, L., & Wang, L. (2023). Evolution of rural multifunction and its natural and socioeconomic factors in coastal China. *Journal of Geographical Sciences*, 33(9):1791-1814.
<https://doi.org/10.1007/s11442-023-2153-3>
- Wu, K., Su, W., Ye, S., Li, W., Cao, Y., & Jia, Z. (2023). Analysis on the geographical pattern and driving force of traditional villages based on GIS and Geodetector: A case study of Guizhou, China. *Scientific Reports*, 13(1):20659.
<https://doi.org/10.1038/s41598-023-47921-z>
- Yang, G., Wu, L., Xie, L., Liu, Z., & Li, Z. (2023). Study on the distribution characteristics and influencing factors of traditional villages in the Yunnan, Guangxi, and Guizhou Rocky Desertification Area. *Sustainability*, 15(20):20.
<https://doi.org/10.3390/su152014902>
- Yao, P. (2016). Research on the space environment characteristic and the development of the traditional village in China: Taking Pengzhuang in the northern Jiangsu province as an example. *Brazilian Archives of Biology and Technology*, 59:e16160543.
<https://doi.org/10.1590/1678-4324-2016160543>
- Yin, J., Feng, J., & Jia, M. (2024). Research on rural tourism environment perception based on grounded theory A case study of Beishan Village, Zhuhai City, Guangdong Province, China. *Heliyon*, 10(11):e32373.
<https://doi.org/10.1016/j.heliyon.2024.e32373>
- Yu, X. H., Wang, X., Ren, Y. G., & Liu, J. C. (2019). The landscape evaluation system of ecotourism villages in qinling mountains. *Applied Ecology and Environmental Research*, 17(4):8955-8968.
https://doi.org/10.15666/aeer/1704_89558968
- Yu, Y. (2013). Landscape transition of historic villages in Southwest China. *Frontiers of Architectural Research*, 2(2):234-242.
<https://doi.org/10.1016/j.foar.2012.12.004>
- Zhang, H. (2022). The spatial distribution and evolution of traditional villages based on remote sensing technology. *Mobile Information Systems*, 2022(1):8022002.
<https://doi.org/10.1155/2022/8022002>
- Zhang, H., Andrade, B., Wang, X., Aburabee, I., & Yuan, S.

- (2024). A study of spatial cognition in the rural heritage based on VR 3D eye-tracking experiments. *Heritage Science*, 12(1):141.
<https://doi.org/10.1186/s40494-024-01264-8>
- Zhang, L., Miao, Y., & Linna, A. (2023). The mechanism of 'ruralness' expression in Chinese rural landscape design: An exploratory study based on grounded theory. *Journal of Urban Planning and Development*, 149(4):04023039.
<https://doi.org/10.1061/JUPDDM.UPENG-4348>
- Zhang, M., Shen, C., Gu, W., & Chen, Q. (2023). Identification of traditional village aggregation areas from the perspective of historic layering: Evidence from hilly regions in Zhejiang Province, China. *Land*, 12(12):2088.
<https://doi.org/10.3390/land12122088>
- Zhang, S., Wu, D., & Yan, Z. (2018). Research on traditional village based on spatial pattern system in Guangdong province. *South China University of Technology*, 153:052039.
<https://doi.org/10.1088/1755-1315/153/5/052039>
- Zhao, Q., & Ren, Y. (2021). Pattern matching system of traditional village pattern ecological protection based on cluster analysis. *Fresenius Environmental Bulletin*, 30(6A):6509-6515.
- Zhao, W., Xiao, D., Li, J., Xu, Z., & Tao, J. (2024). Research on traditional village spatial differentiation from the perspective of cultural routes: A case study of 338 villages in the Miao Frontier Corridor. *Sustainability*, 16(13):13.
<https://doi.org/10.3390/su16135298>
- Zheng, X., Wu, J., & Deng, H. (2021). Spatial distribution and land use of traditional villages in Southwest China. *Sustainability*, 13(11):11.
<https://doi.org/10.3390/su13116326>
- Zhou, Y., Liu, M., Xie, G., & Liu, C. (2024). Landscape ecology analysis of traditional villages: A case study of Ganjiang river basin. *Applied Sciences*, 14(2):2.
<https://doi.org/10.3390/app14020929>
- Zhou, Z., & Zheng, X. (2022). A cultural route perspective on rural revitalization of traditional villages: A case study from Chishui, China. *Sustainability*, 14(4):2468.
<https://doi.org/10.3390/su14042468>
- Zhou, Z., Deng, J., Wang, P., Zhou, C., Xu, Y., Jiang, W., et al. (2022). Physical environment study of traditional village patterns in Jinxi County, Jiangxi Province Based on CFD simulation. *Processes*, 10(11):11.
<https://doi.org/10.3390/pr10112453>
- Zhou, Z., Jia, Z., Wang, N., & Fang, M. (2018). Sustainable mountain village construction adapted to livelihood, topography, and hydrology: A case of dong villages in Southeast Guizhou, China. *Sustainability*, 10(12):12.
<https://doi.org/10.3390/su10124619>
- Zhu, J., Xu, W., Xiao, Y., Shi, J., Hu, X., & Yan, B. (2023). Temporal and spatial patterns of traditional village distribution evolution in Xiangxi, China: Identifying multidimensional influential factors and conservation significance. *Heritage Science*, 11(1):261.
<https://doi.org/10.1186/s40494-023-01110-3>
- Zhu, Q., & Liu, S. (2023). Spatial morphological characteristics and evolution of traditional villages in the mountainous area of Southwest Zhejiang. *ISPRS International Journal of Geo-Information*, 12(8):8.
<https://doi.org/10.3390/ijgi12080317>