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Rethinking the Urban Fringe: A Scoping Review of Theories, Models and Applications in Contemporary China

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Abstract. *This scoping review explores how the urban fringe is conceptualized and applied in the context of China's rapid urbanization. Drawing on the PRISMA framework, a systematic search of the Web of Science (WoS) and CNKI databases identified thirteen relevant studies published between 2014 and 2024. The review synthesizes key theoretical approaches, spatial models, and empirical applications to examine the evolving characteristics of urban fringe zones. The findings reveal that economic transformation, changing social structures, and spatial heterogeneity jointly shape urban fringe development in China. While the urban fringe plays a critical role in mediating urban expansion, land-use change, and governance innovation, a notable gap remains: the absence of a universally applicable framework to define and manage urban fringe areas, largely due to regional variability and fragmented institutional structures. This study argues for the development of flexible yet standardized governance models that accommodate local conditions while supporting sustainable urban growth. The review contributes to the theoretical refinement of peri-urban studies and offers actionable insights for urban planners and policymakers seeking to manage the tensions between rural preservation and urban expansion in a rapidly developing region.*

Keywords. *Urban fringe, PRISMA, scoping review, China, urbanization.*

Introduction

Urbanization represents a significant global phenomenon primarily influenced by socio-economic and environmental factors that drive populations to migrate from rural to urban locales. This migration transforms urban landscapes and impacts economic growth and environmental sustainability, thereby reshaping patterns of human settlement.

Numerous factors contribute to urbanization. In many nations, this process commenced with the emergence of the modern sector, which catalyzed urban growth by generating extensive employment opportunities in urban centers and attracting substantial numbers of rural inhabitants (Byulegenova, 2023). Furthermore, the appeal of enhanced access to services, education, and healthcare entices rural residents to urban areas (Dolnicar, 2023). Additionally, advancements in technology, particularly in information and communication technologies, have facilitated urban expansion and improved connectivity within cities, accelerating the pace of urbanization (Byulegenova, 2023). These developments bear significant implications for social structures, environmental health, and the well-being of urban populations (Zhou & Hinsch, 2022; Dolnicar, 2023).

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Urbanization in China has generally progressed through two broad phases: traditional and new urbanization (Wang, 2024). Traditional urbanization is characterized by dense, compact cityscapes that face spatial and infrastructural limitations. Conversely, new urbanization seeks to extend urban development into peripheral regions, aiming to harmonize urban-rural growth and mitigate spatial, social, and environmental pressures. This transition signifies a move toward integrated urban development (Zhang, 2016).

In the wake of economic reforms, the urbanization trajectory has accelerated markedly, transforming the relationship between urban and rural areas from separation to integration, and ultimately to mutual development. This transition has led to a substantial increase in the urban population, underscoring the evolving challenges in urban planning and management, particularly in fringe areas in China (He, 2024).

Urban fringe areas, commonly referred to as peri-urban zones, are transitional spaces where urban expansion intersects with rural landscapes. These areas exhibit dynamic socio-economic, environmental, and spatial characteristics shaped by rapid urbanization and policy frameworks. While studies have proposed various definitions, a common understanding identifies urban fringes as regions characterized by mixed land uses, evolving population structures, and shifting economic functions (Adell, 1999; Shaw, 2005). Given their unique and complex characteristics, these areas require a comprehensive understanding for effective urban management.

Recent studies consistently highlight China as one of the countries with the most complex and dynamic urban fringe characteristics globally. Unlike many Western cities, where suburban growth follows relatively linear patterns, China's urban fringe zones are shaped by rapid industrialization, land-use conversion, rural-to-urban migration, and overlapping governance regimes. These fringe areas often exhibit hybrid land functions, combining agricultural activity, informal housing, industrial facilities, and new urban infrastructure within a fragmented spatial mosaic (Song et al., 2023). Studies in regions such as Xi'an–Xianyang demonstrate how peri-urban zones have evolved into multi-functional spaces, integrating diverse economic activities, housing forms, and transport systems (Robinson & Song, 2018).

Moreover, Harbin's urban fringe has undergone a phased transformation, from rural hinterland to semi-urban space and, more recently, to a zone of integrated ecological and industrial functions, illustrating the longitudinal evolution of such areas (Wang et al., 2021). The overlapping jurisdictions of urban and rural authorities further contribute to governance complexity, often resulting in uneven development and planning gaps (Chen et al., 2018). Urban fringe governance challenges also reflect broader institutional coordination issues, where effective planning depends on knowledge exchange and stakeholder engagement across organizational boundaries (Firdaus et al., 2020). These observations support the argument that China's urban fringe cannot be effectively understood through universal models; instead, it requires context-sensitive frameworks that account for its socio-spatial, institutional, and economic particularities.

Why China?

While this review specifically addresses urban fringe development in China, its implications extend beyond national boundaries. The findings challenge the applicability of conventional, one-size-fits-all models of peri-urban development and advocate for more nuanced, context-sensitive frameworks that consider varying governance structures, land-use patterns, and socio-economic conditions. As cities globally contend with the pressures of rapid expansion and fragmented

peripheries, the Chinese experience offers valuable insights and cautionary lessons for urban scholars, planners, and policymakers striving to promote sustainable and inclusive urbanization.

This scoping review focuses on China instead of a broad global comparison. This targeted approach aligns with the objectives of a scoping review: to map the nature and extent of available evidence within a defined context (Chambergo-Michilot et al., 2021). Geographic search filters enhance relevance by minimizing information overload and ensuring that the findings pertain to the selected setting (Muente et al., 2024).

In the context of urban fringe areas, where governance, land markets, and socio-spatial dynamics vary considerably, broad international comparisons may obscure rather than clarify policy-relevant patterns. Scoping reviews with a regional emphasis are thus particularly well-suited to identify knowledge gaps and inform locally appropriate policy and planning strategies (Chironda et al., 2022). Consequently, our China-focused review enhances both the analytical precision and practical applicability of the study, providing critical insights into the challenges and opportunities of urban fringe governance in rapidly urbanizing contexts.

This study aims to systematically map and synthesize the existing academic literature on urban fringe areas in China, with the objective of identifying key theoretical frameworks, models of development, and socio-economic, spatial, and governance-related characteristics. Through this scoping review, the study also seeks to uncover gaps in current research and offer policy-relevant insights for managing peri-urban areas in rapidly urbanizing contexts.

This paper is organized as follows: The methodology section outlines the scoping review approach, the databases utilized, and the criteria for selecting pertinent studies. The results section subsequently presents the key findings, including the characteristics of urban fringe areas and the theories/models applied. The discussion section contextualizes these findings, explores their implications for urban planning, and identifies areas for future study. Finally, the conclusion summarizes the study's contributions and emphasizes the necessity for further investigation into the dynamics of urban fringe areas.

Materials and Methods

Study design

Given the complexity of defining and analyzing urban fringe areas, this study adopted a scoping review approach to systematically identify existing theories, models, and applications relevant to urban fringe dynamics in China. Unlike systematic reviews, scoping reviews are particularly useful for mapping key concepts, identifying research gaps, and synthesizing diverse methodologies (Munn et al., 2018).

We conducted a scoping review to identify the characteristics that define urban fringe areas, aiming to map, organize, and summarize existing literature on features relevant to their analysis. This assists in understanding the scope and nature of current studies. We adhered to the PRISMA Extension for Scoping Reviews (PRISMA-ScR) reporting guidelines and employed Arksey and O'Malley's methodological framework, which consists of five stages (Arksey & O'Malley, 2005). This framework is appropriate as it accommodates a wide range of concepts, allowing for the analysis of various studies and their findings on urban fringe areas. To enhance transparency and facilitate access, this scoping review report will be made available on an open-access platform.

Identifying relevant studies

We used the following questions to guide our review: What theories and models have been explored in the literature regarding urban fringe areas in China? What key characteristics of urban fringe areas have been identified in existing studies conducted in China?

The databases used in this study, i.e., CNKI for Chinese-language sources and Web of Science (WoS) for English-language sources, were selected due to their comprehensive coverage of peer-reviewed academic literature. However, this selection may introduce publication bias, as studies published in regional journals, government reports, and policy briefs were excluded. Future research should incorporate grey literature and datasets from institutional planning agencies to enhance the scope of analysis. To ensure the studies were current, we focused on academic journals published from 2014 onwards, with the latest search performed on 5 December 2024.

The WoS database is well-regarded for its high quality and comprehensive coverage of publications, complete with citation networks in specific research fields (Hosseini et al., 2018). Consequently, we selected WoS as our source for English-language literature. CNKI, the largest and most comprehensive Chinese-language literature database in China, includes over 99 per cent of Chinese academic and practical journals, ensuring the representativeness and authority of the sources used (Xu et al., 2022). Therefore, it was chosen as the retrieval database for Chinese-language materials in this study.

The first author, skilled in literature search systems, developed a comprehensive search strategy. The results were filtered using the PRISMA flow diagram for the scoping review process. We employed snowball sampling for citation tracking and excluded retracted publications. Zotero was used to organize both English and Chinese literature. Table 1 displays the search strategies for journal articles in the CNKI and WoS databases, utilizing Boolean operators. The Boolean search terms were carefully constructed and specific inclusion and exclusion criteria were applied to select relevant studies. Keywords were chosen based on their relevance to the conceptual and operational definitions of urban fringe areas and their frequent use in the literature.

Table 1. Boolean Operators and Search Results

Database	Keywords	Articles	Retrieve Date
WoS	("peri-urban" OR "urban fringe" OR "urban-rural" OR "suburban" OR "edge") (Topic) and "identification" OR "definition" OR "characteristics" (Topic) and "approach" OR "method" OR "strategy" OR "model" (Topic)	35,658	05/12/2024
CNKI	(Urban Fringe + Peri-urban + Suburban + Marginal City) (Topic) AND (Identification + Definition + Characteristics) (Topic)	1,417	03/12/2024

Study selection criteria

This study strictly adhered to the PRISMA guidelines to ensure objectivity and scientific rigor in the selection process (Kim & So, 2022). The PRISMA framework (see Figure 1) consists of four key stages: identification, screening, eligibility, and inclusion (Kim & So, 2022; Booth et al., 2020). To ensure the quality and reliability of the selection process, we independently reviewed

the titles, abstracts, and full texts of the retrieved studies. Discrepancies in study selection were resolved through discussions with a third researcher.

In the identification stage, we conducted searches in the WoS and China National Knowledge Infrastructure (CNKI) databases using specific keywords, resulting in a total of 37,075 papers. We excluded articles that were not journals and studies focused on regions outside China unless they provided comparative insights relevant to the Chinese context. Additionally, studies without specific indicators, data, or frameworks relevant to urban fringe areas were removed. We also removed articles from CNKI that were not indexed in CSSCI and SCI. From WoS, we excluded records outside the targeted categories. This refinement ensured that our review focused exclusively on the most relevant scholarly work concerning characteristics of urban fringe areas. The selected databases, CNKI and WoS, cater to researchers proficient in both Chinese and English. They encompass peer-reviewed journal articles pertinent to China, published between 2014 and 2024, ensuring the study reflects recent developments in urbanization and urban fringe analysis.

During the screening stage, we excluded 277 articles based on their titles and abstracts because they were not relevant to the research focus, leaving 27 articles for full-text assessment. We then reviewed the full texts to confirm their completeness and accessibility. In the eligibility stage, studies were excluded if they did not provide analyzable evidence for identifying or interpreting urban fringe areas in China. This included studies that did not examine relevant social, economic, spatial, land-use, ecological, demographic, or governance-related dimensions; studies that lacked empirical variables or drivers based on data or case evidence, including conceptual or reflective papers that offered general discussion but did not provide operationalized indicators, case-based evidence, or measurable criteria for identifying urban fringe areas; and studies that did not include specific indicators, such as measurable variables, indices, classification criteria, or model inputs. In the inclusion stage, we conducted a detailed review of all remaining literature and performed citation searches.

Although the initial search yielded 37,075 records, only 13 studies met the strict inclusion criteria of relevance, methodological rigor, and data completeness. This limited sample size highlights the need for further empirical studies to establish a more comprehensive analytical framework for identifying the urban fringe. These selected studies focused on various characteristics and their influence on the identification and analysis of these urban fringe areas. During the screening process, the first and second authors independently reviewed the titles, abstracts, and full texts of the literature. Any disagreements in the selection process were resolved through discussions with the research team.

Charting the data

After applying our inclusion and exclusion criteria, we imported the full texts of eligible studies into the Zotero research tool. To ensure completeness and accuracy in our data handling, we created a structured data extraction table to facilitate the retrieval of key information essential for addressing our research questions. The extracted data elements included the authors, publication date, country/region, theory/model, and characteristics of each study. Two authors independently extracted the relevant data and any discrepancies were resolved by a third party. This approach enables a thorough comparison and synthesis of the data thereafter.

Collating, summarizing and reporting results

This study presents a descriptive summary and narrative synthesis of key information extracted from the included studies, outlining the characteristics of urban fringe areas as identified through various elements. It also examined the factors influencing spatial interactions within these areas and the methods employed for their analysis. Additionally, the review highlights existing research gaps and provides insights into areas that warrant further investigation.

Results

The initial search resulted in 37,075 titles. After applying the exclusion criteria and removing duplicates, 27 documents underwent full-text analysis. Ultimately, 13 peer-reviewed journal articles met the inclusion criteria for this scoping review, as shown in the PRISMA flowchart (Figure 1), which depicts the screening process.

Although only 13 peer-reviewed journal articles were ultimately included in this scoping review, this number aligns with the methodological purpose of scoping reviews, which aim to map the scope, characteristics, and gaps in existing literature rather than perform an exhaustive synthesis. The inclusion of 13 studies in the present review is methodologically sound and adequate to achieve its objective of identifying patterns, conceptual boundaries, and evidence gaps within the existing literature. A small number of reviewed studies can still provide significant insights, particularly when the review concentrates on a narrowly defined research domain (e.g., Tricco et al., 2016; Söderbacka et al., 2020; Coffey et al., 2023).

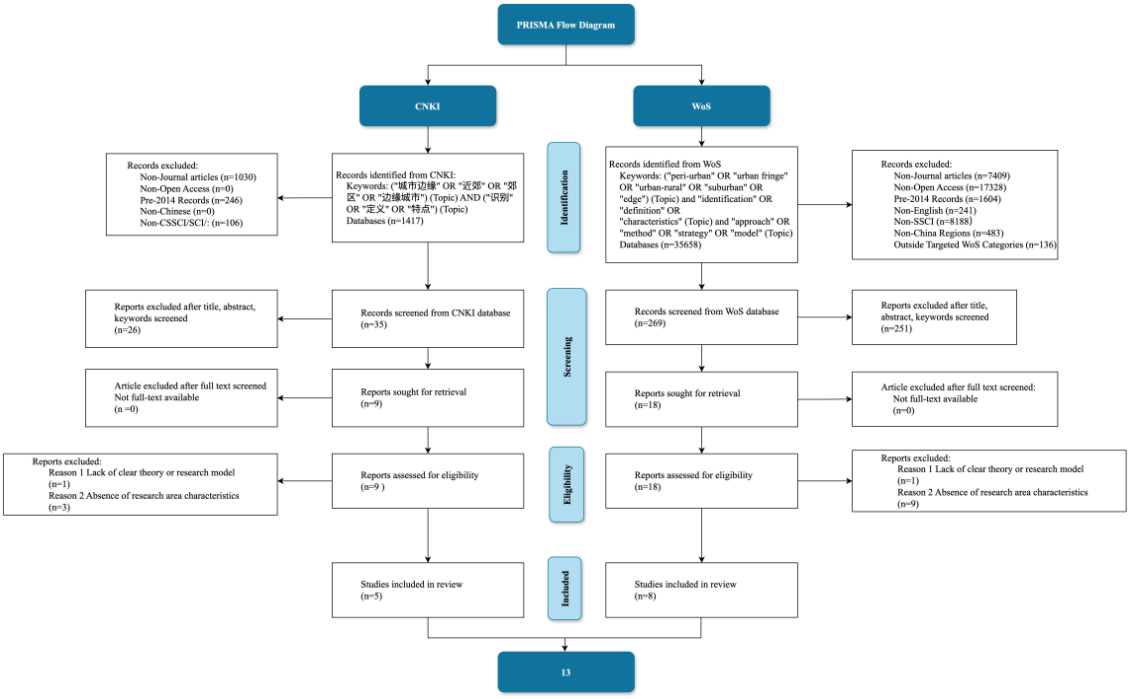

Figure 1. PRISMA flow diagram for the scoping review process.
Source: Adopted from Page et al. (2021)

The articles we reviewed focused on urban fringe areas in China, including city outskirts and semi-suburbs, primarily in megacities with GDPs exceeding one trillion yuan, such as Shanghai, which has a GDP of approximately 4 trillion yuan. Most of these studies were published between 2021 and 2024, with four published in 2024 and six in 2023. Geographically, we included regions

such as Dalian and Harbin in northeastern China, where 64 county-level cities have recently experienced significant urban shrinkage and population outflow (Ma et al., 2020). These trends demonstrate that both expanding and shrinking cities have contributed to the evolution of urban fringe areas.

The reviewed studies applied various theoretical and modelling approaches, each with distinct advantages and limitations (Table 2), focusing on urban and regional vitality, population flows, and urban expansion. The Vitality Evaluation System and Residential Relocation Activity Index effectively capture socioeconomic dynamics, whereas Logistic-CA-Markov models are better suited for predicting spatial evolution. Random forest models, meanwhile, provide a data-driven approach; however, their reliance on large datasets limits their applicability in regions with incomplete records. Future research should explore hybrid models that combine socioeconomic indicators with spatial analysis tools to enhance predictive accuracy.

Table 2. Theories and Models Coding Guidelines

Code	Application Goal	Theories/Models Covered
A1	Urban and Regional Vitality Assessment	Vitality Evaluation System, Residential Relocation Activity Index
A2	Population and Behavioral Flow Analysis	Evaluation System for Employment Population Mobility, PLEB Flow, Distance Decay Theory
A3	Spatial Morphology and Structure Prediction	Spatial Morphology, Logistic-CA-Markov Models, Spatial Segmentation Model (SSM)
A4	Urban Dynamics and Expansion Prediction	Symbiosis Theory and Urban Expansion Theory, Urban Shrinkage Theory
A5	Regional Functions and Planning	Regional Functions
A6	Data-Driven Modelling and Analysis	Random Forest Model

The theories and models reviewed are crucial for predicting and planning urban dynamics, especially in rapidly evolving urban fringe areas. The selected studies employ both macro- and micro-analytical tools, offering a comprehensive view of urban sprawl and regional functionality (see Table 3). The analysis of urban fringe characteristics covers social, economic, and geographical aspects from 13 articles (see Tables 4 and 5).

Table 3. Theories/Models of Reviewed Studies

Theory/Model (Code)	Author, Year	Region	Decade GDP Trends	Trillion RMB GDP
A1	Xu et al. (2024)	Hangzhou	↑	√
A6	Wang et al. (2024)	Guizhou Province	↑	N/A
A2	Sun et al. (2024)	Tianjin	↑	√
A3	Xiong & Yang (2023)	Shanghai	↑	√
A3	Long et al. (2023)	Wuhan	↑	√
A3	Wang et al. (2023)	Dalian	↑	×
A4	Ma et al. (2023)	Northeast China	N/A	N/A
A5	Wang et al. (2023)	Shanghai	↑	√
A2	Yan et al. (2023)	Wuhan	↑	√
A6	Cao et al. (2023)	Nanjing	↑	√
A1	Niu et al. (2022)	Wuhan	↑	√
A3	Wang et al. (2021)	Harbin	↑	×
A2	Liu et al. (2018)	Nanjing	↑	√

Table 4. Characteristics of Coding Guidelines

Code	Category	Description
		Social Characteristics Encoding
SB	Behavioral Traits	Behavioral needs vary due to social factors, such as income level, family structure, and personal preferences, showing a dynamic interaction with spatial functions.
SP	Population Dynamics	The population expands from major urban centers to peripheral areas, with higher densities in city centers and lower densities in the outskirts. Population growth is concentrated in newly developed areas, while peripheral populations decrease.
SS	Spatial Supply-Demand Relationships	Resident behavior flows and spatial supply-demand relationships are complex, shaped by natural and social contexts while reflecting individual agency. Conflicts between ecological protection and livelihood improvement are evident, requiring balanced coordination.
SU	Urban-Rural Coordination	Fringe areas lack sufficient public services but are gradually taking on urban-rural bridging functions. Policy guidance and development projects are crucial to promote balanced development and resource optimization.
		Economic Characteristics Encoding
EI	Industrial Structure	The economy is shifting from agriculture to secondary and tertiary industries, with growing populations in services and IT sectors, while traditional industries such as construction and manufacturing see a decline in mobile labor.
EL	Land Use and Development	Land development is focused on industrial and residential uses. High development density is observed near transport hubs and industrial parks, while remote and tourism areas exhibit lower densities.
EE	Economic Function and Efficiency	Regional economies are transitioning from traditional industries to high-value-added sectors. However, some areas suffer from overcapacity and resource waste, indicating uneven economic efficiency and a need for policy-driven optimization.
EP	Development Potential and Constraints	Fringe areas hold growth potential but face challenges such as inadequate public and infrastructure facilities. The balance between ecological and economic priorities remains a key bottleneck requiring integrated strategies.
		Geographical Characteristics Encoding
GL	Land Use and Functional Zoning	The land is multifunctional, including ecological reserves, agricultural production zones, and construction areas. The distribution of production, living, and ecological functions is uneven, with increasing competition in some regions.
GS	Spatial Structure and Patterns	Spatial development is centered around urban cores and extends outward, showing a trend of decentralized, multi-nodal growth. Peripheral areas exhibit lower land utilization rates and underdevelopment in some regions.
GE	Ecological Environment and Carrying Capacity	High development intensity in some areas has led to decreased ecological stability and stressed environmental carrying capacity. Ecological protection is prioritized, but resource utilization efficiency needs improvement through integrated planning.

GR	Regional Development and Trends	Regional development shows a declining trend from the center outward. The urban expansion brings resource pressure, and rural-urban integration lags. Balanced development and strengthened planning are needed to address disparities.

Figure 2 illustrates the research focus areas identified in the selected literature, while Table 4 provides a detailed breakdown of these thematic emphases. By integrating these two visual summaries, we can identify the key characteristics of urban fringe areas across three primary dimensions: social, economic, and geographical.

From a social perspective, most studies focused on behavioral traits (SB), population dynamics (SP), and urban-rural coordination (SU). These aspects underscore the unique social fabric and demographic trends shaping urban fringe areas, distinct from urban cores. For instance, Wang, H. et al. (2024) explored the interplay between population dynamics and urban-rural coordination, while Wang, Y. et al. (2021) examined both spatial supply and demand (SS) and behavioral traits, revealing the complexity of social adaptation in these transitional spaces.

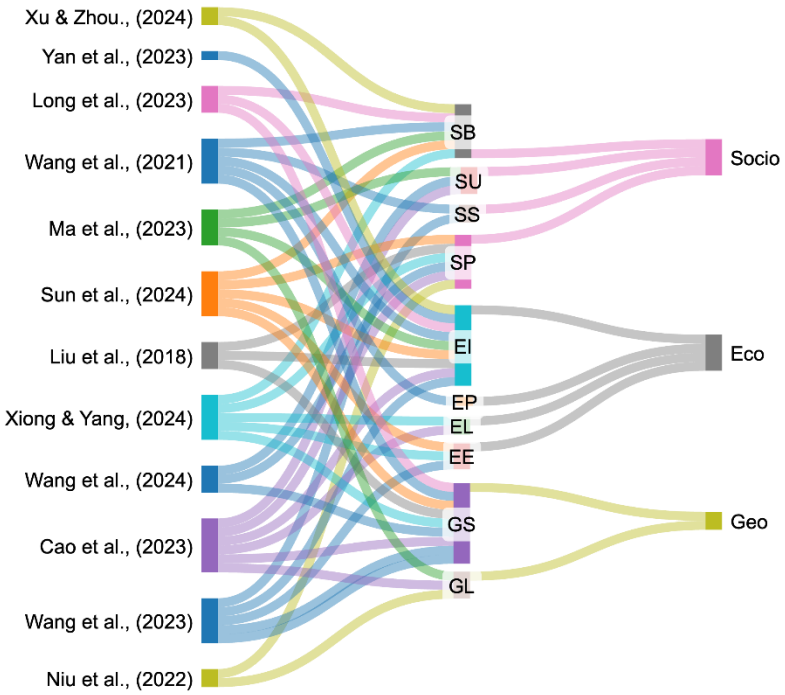

Figure 2. Research focuses in urban fringe area studies.

Economically, the literature highlighted the restructuring of industrial patterns and emerging economic functions. Several works noted the ongoing shift from traditional manufacturing to services and IT industries, with Xiong & Yang (2024) addressing the impact of economic transformation on land use and spatial functions. These studies collectively underscore how economic transitions shape the functionality and development trajectories of urban fringe areas.

Geographically, research has centered on land use and functional zoning (GL), as well as spatial structure and pattern (GS). Studies such as Cao et al. (2023) identified shortcomings in land use

and planning, emphasizing the importance of spatial governance in managing urban expansion and ensuring sustainable development in peri-urban regions.

Discussion

This section presents the key findings of the scoping review, organized around the three central objectives of the study: (1) identifying major theoretical frameworks and models used to conceptualize urban fringe areas in China, (2) analyzing their social, economic, and geographic characteristics, and (3) examining policy and governance frameworks, particularly the role of the 3Z3L policy in managing peri-urban expansion.

Theories and Models

In the reviewed literature, models mainly function as analytical tools for delineation, classification, and prediction, whereas theories provide broader explanations for why urban fringe areas emerge and take different forms across regions. Methodologically, recent studies have moved beyond impressionistic judgement and increasingly rely on multidimensional identification based on heterogeneous data and purpose-specific models. Vitality- and mobility-based approaches, for example, are used to identify fringe areas through changes in socio-economic activity, employment movement, behavioral flow, and residential relocation, showing that the urban fringe is not merely a morphological edge but also a zone of shifting functional intensity and population interaction (Yan et al., 2023; Sun et al., 2024). Multi-source identification methods further improve delineation by combining land use, population, POI, remote sensing, and traffic-related indicators, thereby reducing the limitations of single-factor judgement and capturing the transitional character of urban-rural space more precisely (Liu et al., 2018; Cao et al., 2023; Wang et al., 2024). Morphology-based and predictive models extend this line of inquiry by tracing how fringe areas evolve over time. In Shanghai and Harbin, spatial morphology and spatial segmentation are used to reveal internal heterogeneity and differentiated expansion patterns, while in Wuhan the Logistic-CA-Markov framework is applied to analyze driving factors and project future fringe evolution under planning constraints (Xiong & Yang, 2023; Long et al., 2023). These models show that urban fringe identification in China has become increasingly multidimensional and data rich. At the same time, they also expose an unresolved weakness in the literature: methodological sophistication has advanced more quickly than theoretical explanation and many studies remain more effective at identifying where the fringe is than at explaining why different forms of fringe emerge.

The theoretical contribution of the reviewed literature is more uneven, but several studies move beyond description by linking fringe formation to broader processes of urban-rural reorganization. Wang et al. (2023), for instance, explicitly applied symbiosis theory and urban expansion theory to compare two identification methods in Dalian. In that study, symbiosis theory was used to conceptualize the urban-rural integration zone as a space characterized by hybridity, diversity, transition, and interdependence, which justifies the inclusion of social, landscape, and land-use indicators in the identification process. Urban expansion theory, by contrast, is used to explain why these zones emerge through the outward extension of urban functions into rural territory and to support a gradient-based interpretation of transition rather than a simple urban-rural dichotomy (Wang et al., 2023). The relevance of expansion, however, is not universal. Research on shrinking cities in Northeast China shows that transitional peripheral zones may also be shaped by population loss, industrial decline, and uneven regional restructuring, indicating that fringe transformation is not always a product of growth alone (Ma et al., 2023). In this respect, the broader argument that China is shifting from a highly concentrated model of urbanization toward outward restructuring, multi-centered development, and deeper urban-rural integration provides a useful macro-level lens for understanding why fringe areas have become increasingly prominent

in recent decades (Wang, 2024). Rather than supporting a single fixed conceptual model, these studies refine urban fringe research by showing that fringe areas are better understood as processual and context-dependent socio-spatial formations, shaped not only by spatial expansion but also by functional reorganization, uneven restructuring, and overlapping urban-rural institutions.

Characteristics of Urban Fringe Areas

The reviewed studies suggest that the social, economic, and geographical characteristics of China's urban fringe should not be treated as separate descriptive categories but as interconnected expressions of a broader process of urban transformation. Although urban fringe areas differ markedly across regions in their geographical setting, social composition, and economic activity, the literature also reveals recurring features that are important for both identification and interpretation. These findings indicate that China's urban fringe is not simply an outer belt of urban expansion but a transitional space in which demographic redistribution, functional restructuring, and spatial reorganization are taking place at the same time. In this sense, the evidence also reinforces a broader conclusion of this review: context-specific approaches are necessary because no single universal framework can adequately capture the diversity of peri-urban change in contemporary China. More broadly, these patterns suggest that China's urban–rural transition is not a linear shift from rural to urban space but a layered process in which expansion, restructuring, and institutional reorganization coexist within the same transitional zones.

Socially, fringe areas absorb populations displaced by rising central-city costs, industrial relocation, suburban employment growth, and residential mobility, resulting in mixed settlement patterns and intensified urban-rural interaction (Yan et al., 2023; Niu et al., 2022; Sun et al., 2024). In many expanding cities, lower housing costs and diverse household needs draw low-income residents, migrants, and other mobile populations to peripheral locations, even though this often reduces their access to central-city facilities and services. As these populations accumulate, demand for healthcare, transport, education, and basic infrastructure also rises, yet service provision frequently lags. This shows that fringe development is not only a matter of outward population movement but also a process through which access to urban resources becomes more unevenly distributed. At the same time, this trajectory is not universal. Research on Northeast China shows that some transitional peripheral zones have been shaped by population loss and shrinkage rather than in-migration, highlighting that peri-urban change in China may emerge through decline and restructuring as well as growth (Ma et al., 2023).

Economically, fringe areas are shaped by functional restructuring rather than simple outward growth. Traditional agricultural or manufacturing land is increasingly reconfigured for residential, logistics, service, and high-tech uses, reflecting the broader reallocation of production, employment, and land value in peri-urban China (Xu et al., 2024; Cao et al., 2023; Ma et al., 2023). In expanding metropolitan regions, this often involves a shift away from traditional industries toward more efficient and less pollution-intensive sectors alongside the conversion of agricultural or industrial land into commercial and residential uses. At the same time, transport nodes, industrial parks, and new development zones become key anchors of fringe growth, concentrating employment and land demand in selected locations rather than evenly across the periphery. This helps explain why peri-urban development often produces differentiated opportunities rather than balanced integration: some fringe zones are incorporated into new circuits of growth, while others remain weakly serviced, underinvested, or structurally stagnant.

Geographically, these processes are expressed through fragmented land use, multi-nodal expansion, corridor-based development, and a strong dependence on transport accessibility and topographic conditions, meaning that the fringe rarely forms a simple and uniform ring around the city. Instead, it appears as a differentiated and path-dependent spatial mosaic (Wang et al., 2021; Xiong & Yang, 2023; Long et al., 2023; Wang et al., 2024). Shanghai, for instance, shows a roughly circular metropolitan fringe between the outer ring and suburban areas, whereas Wuhan's fringe expands through circular diffusion shaped by transport routes and waterside development, and Dalian's fringe extends along the coastline and major transport arteries. Urban core areas also tend to have much higher road densities than fringe zones, while fringe growth is often channeled along major roads, rail corridors, and development axes. These patterns reveal that peri-urbanization in China is not only an issue of outward spread but also a matter of selective connectivity, uneven accessibility, and differentiated spatial incorporation.

These characteristics are important not only because they help define urban fringe areas, but also because they clarify why fringe zones have become difficult to govern. The coexistence of mixed populations, overlapping land uses, ecological pressure, and rapid functional change often exceeds the capacity of conventional governance arrangements based on clear urban-rural separation or standardized zoning control. In this respect, the urban fringe reveals a persistent tension between integration and fragmentation: while population movement, land conversion, and functional linkages increasingly connect urban and rural systems, governance arrangements often remain divided across administrative, sectoral, and regulatory boundaries. In some places, the key challenge is managing growth pressures, service deficits, and land conversion; in others, it is responding to shrinkage, weak investment, and underused space. This means that fringe characteristics intersect directly with governance models: rigid boundary control may be inadequate where rapid functional mixing is already underway, while simple growth-oriented planning is equally unsuitable in shrinkage-affected regions. What the reviewed studies collectively suggest is the need for more differentiated and adaptive forms of peri-urban governance that can more effectively coordinate land development, public service provision, ecological protection, infrastructure investment, and urban-rural institutional integration (Long et al., 2023; Wang et al., 2021; Wang et al., 2023; Liu et al., 2018).

Seen from this perspective, the urban fringe is less a residual edge of the city than a space where the tensions of China's urban transformation become especially visible. For planning practice, this means that peri-urban policy cannot rely on simple containment or standardized zoning alone but must respond to different combinations of growth, decline, service pressure, ecological constraint, and institutional overlap across fringe areas. Its significance lies not only in boundary identification but in what it reveals about uneven development, fragmented governance, and the limits of uniform planning approaches.

The Application of National Spatial Policy in Delineating Urban Fringe Areas in China

Although the reviewed studies rarely examine the Three Zones Three Lines (3Z3L) framework directly as an empirical object, recent urban fringe research in China unfolds within a policy environment increasingly shaped by national spatial planning. In this respect, 3Z3L is relevant less as a fully substantiated finding of the reviewed sample than as an institutional framework through which ecological, agricultural, and urban spaces are formally classified and bounded (Wang et al., 2018). This top-down mode of spatial delineation differs from academic efforts to identify urban fringe areas through socio-economic, morphological, or multi-source indicators, yet it is highly relevant to peri-urban research because it demonstrates that transitional spaces are also being governed through direct policy boundary-making.

China's 3Z3L framework follows an integrated land-use governance approach aimed at balancing economic development with ecological sustainability. The strategy divides land into three functional zones, i.e., ecological spaces, agricultural spaces, and urban spaces, each governed by corresponding control lines, namely the ecological protection red line, the permanent basic farmland protection line, and the urban development boundary (Zhao & Song, 2020). In practical terms, this framework does not define the urban fringe as a distinct academic category, but it does shape how transitional and potentially conflict-prone spaces are regulated, especially where urban expansion, farmland protection, and ecological control intersect. This helps explain why recent urban fringe studies increasingly emphasize boundary delineation, land-use coordination, spatial control, and planning-oriented identification (Long et al., 2023; Sun et al., 2024).

From a broader comparative perspective, 3Z3L also reflects an international tendency toward stronger territorial governance of ecological pressure and urban expansion. In this sense, it bears some resemblance to land-use control and conservation frameworks such as the US protected areas system, the EU's Natura 2000 network, and conservation-oriented planning efforts in Canada, all of which seek to preserve ecological functions and enhance resilience (Sahana et al., 2023). It also aligns, at a general level, with urban containment and land-use regulation strategies found in countries such as Japan, France, and the United Kingdom, where planning tools are used to restrict sprawl while maintaining agricultural and ecological integrity (Goerlich Gisbert et al., 2017; Cegielska et al., 2019; Samat et al., 2011; Hui & Wescoat, 2019). These comparisons do not suggest that these systems are identical, but they do show that China's recent planning turn forms part of a broader effort to regulate transitional spaces through formal boundaries and land-use control.

At the same time, the significance of 3Z3L in this discussion lies mainly in its role as a policy framework rather than as an empirically verified governance model. More precisely, it offers an additional perspective for identifying and interpreting urban fringe areas in China, one grounded in state-led spatial classification and regulatory control. This also points to a useful direction for future research: examining how policy-driven boundary-making interacts with the social, economic, and geographical diversity of peri-urban transformation.

Conclusion and Future Research Directions

This study identified the key characteristics of urban fringe areas and highlights their distinctive governance challenges, including land-use conflicts, infrastructure gaps, and socio-economic disparities. While these areas serve as important transition zones between urban cores and rural peripheries, they are often constrained by fragmented governance and limited policy coordination. The reviewed studies suggest that urban fringe areas should not be understood as simple belts of outward expansion but as uneven transitional spaces where demographic change, economic restructuring, and spatial reorganization unfold simultaneously.

Urban fringe areas are not uniform or residual; they are complex, evolving, and policy-relevant spaces shaped by local institutions, economic transitions, and demographic pressures. This study also helps place China's experience within the broader discussion of urban fringe development. China's fringe areas face land-use change, service mismatch, ecological pressure, and fragmented governance. At the same time, China's policy context makes clear that fringe development is also shaped by state-led spatial planning, institutional boundary-making, and overlapping urban-rural governance arrangements. In this sense, the Chinese case highlights the need to move beyond explanations based solely on market forces or suburbanization. By mapping these dynamics through a scoping review, this paper invites scholars and practitioners to reconsider how urban

peripheries are defined, managed, and conceptualized, particularly in contexts where urban transformation does not follow a single pathway.

A major implication of this review is not that there is a single model for analyzing urban fringe areas but that no single framework can fully explain fringe dynamics across different geographical, socio-economic, and institutional contexts. However, the characteristics identified in this paper may still support more flexible and multidimensional approaches to identifying and interpreting urban fringe areas. Methodologically, this scoping review shows the value of combining social, economic, and geographical dimensions rather than relying on one-dimensional definitions. Theoretically, it suggests that urban fringe transformation in China is shaped by the interaction of expansion, restructuring, and institutional transition. In policy terms, it indicates that peri-urban governance requires more adaptive and differentiated approaches than conventional zoning or simple boundary control alone.

Future research should therefore move in several directions. First, more work is needed on the internal diversity of fringe areas, including differences in demographic composition, land-use transformation, economic function, ageing, infrastructure provision, and service access. Second, larger-scale and more systematic literature reviews would be valuable for extending the scope of the present scoping review, broadening the evidence base, and supporting stronger comparisons across regions, methods, and conceptual approaches. Third, comparative research should be strengthened, both across different Chinese regions and between China and other international contexts, especially Western and Global South settings, in order to clarify similarities, differences, and distinctive trajectories of urban fringe transformation. Such comparisons would help clarify which features of urban fringe transformation are widely shared and which are more closely tied to specific policy, institutional, or development conditions. For planning and policy, this means that urban fringe governance cannot rely on simple demarcation or uniform zoning alone. More effective responses require flexible and differentiated strategies that recognize internal heterogeneity and better coordinate land development, public services, ecological protection, and governance across transitional spaces.

Declaration of Conflicts of Interest

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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