Identifying Suburban Rural: A Multidisciplinary Perspective on Assessing Rurality in Changchun

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Abstract: Promoting integrated urban-rural development is a crucial strategy for addressing the imbalance in urban and rural growth, tackling rural issues, and advancing Sustainable Development Goals 11 (SDGs 11). Current methods for identifying suburban rurality lack comprehensive coverage of rural elements and their interconnections. Rurality serves as a comprehensive indicator of rural development levels and is essential for revealing internal disparities within rural regions. In this context, this study adopts a multidisciplinary perspective encompassing geography and ecology, sociology and anthropology, economics, as well as architecture and planning. Focusing on villages, towns, and sub-districts as research units, we have developed a multidisciplinary evaluation system for rurality. We utilized linear weighting and natural breakpoint methods to identify suburban rural units in Changchun City. The research findings indicate that identifying suburban rurality from a multidisciplinary perspective aligns well with the diverse and complex characteristics of suburban rural structures. This approach effectively reflects the spatial distribution features of rurality in Changchun City and provides practical guidance for constructing sustainable cities and communities. Ultimately, the spatial distribution of rurality in Changchun exhibits a trend of diminishing influence from multiple centers outward, suggesting that the city has made progress in its polycentric development.

1. Introduction

The widening gap between urban and rural development poses a serious threat to social stability and sustainable development. The Sustainable Development Goals (SDGs) call for reducing inequalities both within and among countries, enhancing urban resource utilization, and mitigating pollution and poverty. Integrated urban-rural development holds significant practical value in promoting equality and addressing urban development challenges related to sustainable development goals.

With the rapid expansion of cities and the development of multi-centered urban areas, a new type of composite rural-suburban village has emerged in the suburbs and outskirts of cities.although suburban rural areas share similarities with western suburban rural areas, they exhibit fundamental differences due to variations in urbanization trajectories. On one hand, both are situated in transitional zones blending urban and rural elements, influenced by the urbanization process, characterized by well-developed transportation networks and diverse industries, thus attracting a large population influx [1]. On the other hand, unlike western suburban rural areas primarily inhabited by the middle class, in china's suburban rural areas, a phenomenon of local residents being outnumbered by migrant populations exists, leading to fragile social relationships and sharp conflicts. At the same time, rural areas still retain some agricultural industries, facing numerous challenges such as severe aging populations and constrained living spaces[2].

As early as the 1930s, scholar smith began to focus on suburban areas, defining them as developed areas outside the city boundaries[3]. Due to the distinctive peripheral nature of urban suburbs, they always adjoin the main urban areas regardless of the direction of development. The relatively lower land costs contribute to lower living expenses. However, influenced by the radiance of the main urban areas, the landscape features of suburbs differ significantly from traditional rural

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areas, explaining why suburbs initially evolved into residential and industrial zones[3].

Scholar[5] asserts that urban-suburban rural areas represent an unfinished segment of suburban urbanization, vividly illustrating the urban impact on rural areas. Clarifying the distribution characteristics of suburban rural area is instrumental in gaining a deeper understanding of the driving forces behind urban development and the intrinsic elements of rural development, thereby serving as a vital link for urban-rural integration. Accurately identifying urban-suburban rural areas holds significant practical implications for addressing rural issues [6].

Currently, research on urban-suburban rural areas primarily focuses on utilizing remote sensing technology to acquire data on rural land use, aiming to gain a deeper understanding of these areas[7]. While changes in land use can effectively reflect shifts in rural spatial structures and, to some extent, urbanization and economic development levels, this approach has its limitations. With evolving societal perspectives and adjustments in industrial structures, it is challenging to comprehensively explain the complex interrelationships among various rural elements solely through land use data[8].

With the ongoing waves of global urbanization and industrialization, the development of urban-suburban rural areas has become a focal point in the inevitable process of urbanization. Faced with the challenges posed by this development, countries worldwide are actively exploring and implementing a range of strategies. Examples include South Korea's "Comprehensive Rural Village Development Plan (CRVDP)" [9], Indonesia's "Republic of Indonesia Village Law"[10] and China's "Rural Revitalization Strategy". These initiatives offer valuable experiential insights for the global development of rural urbanization.

Rurality serves as a comprehensive representation of the characteristics of rural areas, reflecting the level of rural development, revealing internal disparities within rural regions, and playing a crucial role in identifying rural spaces. [11].The rurality index reflects the developmental disparities among rural areas and serves as a critical basis for distinguishing the overall development status of these regions. It can provide data support for urban planning and sustainable development.

From a global perspective, suburban rural areas are widely regarded as a state of traditional rural evolution, preserving the essential characteristics of rural areas. In this context, to enrich the content of suburban rural areas research, meet the needs of urban development, and alleviate the challenges faced by rural development, this study has constructed a rural evaluation index system based on a multidisciplinary approach (including geography, ecology, planning, sociology, anthropology, economics, and architecture) to accurately identify suburban rural areas.

2. Definition of Suburban rural areas

Since the reform and opening-up in the 1980s, China's urbanization process has accelerated significantly, with its impacts first evident in the rural areas of urban suburbs. Traditionally agrarian villages have gradually transitioned towards an "industrial-led" model, resulting in a notable increase in the proportion of non-agricultural land use within land utilization structures. Population demographics and spatial distributions also reflect urbanization trends [12]. Against this backdrop, the urbanization process in China has given rise to suburban-rural areas.

The reallocation of resources has facilitated the urbanization of these rural regions, further altering the spatial structure and layout principles of suburban settlements. The agricultural environment, population structure, settlement forms, landscape patterns, and social culture have collectively shaped the distinctive characteristics of suburban-rural areas in China [13]. Although some traditional rural features remain, the social structure and nature of these areas can no longer be simply categorized as "rural"[14].

China's suburban-rural areas exhibit unique characteristics in terms of spatial geography, landscape and architectural structure, social and economic frameworks, as well as demographic and planning aspects. Specifically, these areas are located on the outskirts of cities and are characterized by relatively high population density and compact, "box-like" housing. Agricultural land is scarce, with the economy primarily driven by the secondary and tertiary industries. Additionally, these regions feature a certain amount of natural landscape, creating a distinct closed-loop spatial configuration of rural settlements around urban centers[15, 16].

In summary, suburban-rural areas can be identified through characteristics such as rural geographic space, landscape and architectural features, social and economic structures, and demographic and planning aspects. Based on these characteristics, this study approaches the examination of rural areas from a multidisciplinary perspective and employs rurality evaluation indicators alongside a linear weighting method to identify suburban-rural areas. This approach, grounded in the diverse characteristics of suburban-rural regions, effectively addresses the spatial ambiguity associated with these areas.

3. Methods and Areas

3.1 Study Area and Data Sources

Changchun, often referred to as the "Spring City of the North," is located between 43°05′-45°15′ N latitude and 124°18′-127°02′ E longitude, situated in the geographical center of Northeast China. It is bordered to the north by Harbin, to the east by Jilin City, to the west by Songyuan, and to the south by Siping. The city governs seven urban districts, one county-level city, and two counties, covering an area of approximately 24,700 square kilometers. The terrain of Changchun is relatively flat, predominantly consisting of plains and hills, with a higher coverage of natural vegetation in the southern region.

To identify suburban-rural areas in Changchun from a multidisciplinary perspective, it is essential to understand the city's land use types, demographic structure, and socio-economic development status. Considering the official nature and reliability of the data, land use data is sourced from the Resource and Environmental Science Data Center of the Chinese Academy of Sciences (https://www.resdc.cn).

As illustrated in (Figure 1), land use is categorized into six types: arable land, forest land, grassland, water areas, built-up land, and unused land. Road data is collected from the openstreetmap website and processed using ArcGIS 10.7. Population data is derived from the seventh national census of China and the Statistical Yearbook of Chinese Counties. Additionally, Points of Interest (POI) data is obtained from the AMAP open platform.

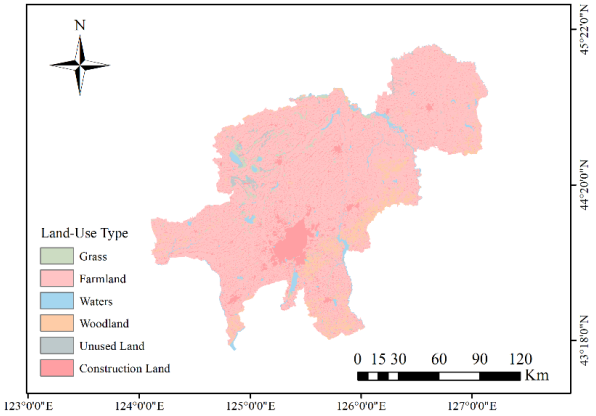

Figure 1 Land use characteristics of Changchun city in 2020

3.2 Study Methods

3.2.1 Indicator System

The development and transformation of rural areas are influenced by a multitude of complex factors. A single-disciplinary perspective often fails to comprehensively capture and reflect the uniqueness and dynamic changes of modern rural environments. Suburban-rural areas, as a form of "modern rural" that emerges at a certain stage of urbanization, require in-depth analysis from multiple perspectives. China's land spatial planning system is structured into "five levels and three categories," with villages, towns, and streets serving as the lowest planning units. This study will thus focus on the villages, towns, and streets of Changchun to explore these dynamics.

Rurality, as an important tool for evaluating rural characteristics and developmental status[17],

effectively reflects the specific conditions of rural development in various regions. Scholars such as Nelson and colleagues have systematically summarized findings from global research in geography, sociology, planning, economics, anthropology, landscape ecology, and architecture to distill 22 core indicators for assessing rurality[18]. However, the selection of indicators for rurality assessment is a crucial step in ensuring the scientific rigor of the evaluation process. As a distinctive type of rural area resulting from urbanization in China, the construction of indicators for suburban-rural areas requires a multidimensional and multi-factorial approach.

Suburban-rural areas, characterized by their location on the urban fringe, significant influence from urban economic dynamics, diverse social structures, and intermingled ecological landscapes, necessitate a careful selection of indicators that balance comprehensiveness, accessibility, scientific validity, and representativeness. Therefore, this study adopts a multidisciplinary approach, drawing on existing research from both Chinese and Western scholars[2, 17-20], while integrating the unique conditions of suburban-rural areas.

To avoid subjectivity in the indicator system and ensure the objectivity of the assessment results, this study employs a combination of the entropy weight method and the CRITIC method for the quantitative evaluation of the rural assessment system.

Table 1 The evaluation system of rurality

Discipline	Variable (Unit)	Explanation	Direction	Assignment score
Geography and Ecology	Forest Coverage Rate (%)	Total forest area / Total area of the region × 100%	+	0.073
	Water Resource Coverage Rate (%)	Water resource area / Total area of the region × 100%	+	0.082
	Grassland Coverage Rate (%)	Grassland area / Total area of the region × 100%	+	0.073
	Per Capita Arable Land (person/hm²)	Total population of the region / Total arable land area	+	0.129
Society and Anthropology	Population Density (person/hm²)	Total population / Total area of the region	-	0.068
	Young Children Rate (%)	Total number of young children (aged 14 and below) / Total population × 100	-	0.043
	Aging Rate (%)	Total number of elderly individuals (aged 60 and above) / Total population × 100%	+	0.039
	Degree of Grassroots Autonomy (%)	Number of village committees / Total population × 100%	+	0.054
Economics	Arable Land Coverage Rate (%)	Arable land area / Total area of the region × 100%	+	0.049
	Number of Companies in the Region (count)	Count of registered companies in the region	-	0.049
	Number of Financial and Insurance Services (count)	Count of financial and insurance services in the region	-	0.048
	Number of Catering Services (count)	Count of catering services in the region	-	0.050
Architecture and Planning	Land Abandonment Rate (%)	Area of unused land in the region / Total area of the region × 100%	+	0.084
	Development Intensity in the Region (%)	Area of developed land / Total area of the region × 100%	-	0.052
	Transportation Accessibility in the Region (%)	Length of roads in the region / Total area of the region × 100%	-	0.055
	Number of Public Facilities (count)	Count of public facilities in the region	-	0.052

The study has constructed a comprehensive indicator system aimed at reflecting the features of urban-rural integration in Changchun. This system encompasses four subsystems and 16 specific indicators (Table. 1). Given the different dimensions of the various indicators, standardization is required before calculating rurality. Subsequently, the rurality index will be computed using a linear

weighted summation[21].

Rurality Index Measurement Formula:

$$RI_i = \sum_{j=1}^{n} W_{ij} \times S_{ij}$$

In the equation, RI_i represents the rural identity index of unit i; W_{ij} stands for the weight of indicator j in unit i; S_{ij} denotes the standardized value of indicator j in unit i; n is the total number of indicators; The rurality value indicates a stronger rural identity of the unit.

3.2.2 Division of Urban Development Intensity Based on Rurality Index

The rurality index derived from the evaluation indicator system reflects the development status of rural elements within regional units and, to some extent, indicates the level of urbanization in those areas. A higher rurality index suggests better development of rural elements, indicating closer proximity to urban areas. According to the overall spatial planning documents of Changchun City, the central urban districts include Nanguan District, Kuancheng District, Chaoyang District, Erdao District, and Luyuan District, which collectively define the urban boundary of Changchun City. The overall rurality index of Changchun City is categorized into three levels:(1)Level One: Urban Units; (2)Level Two: Suburban Units ; (3)Level Three: Traditional Rural Units.

The rural units within suburban areas are classified as suburban-type rural areas. Due to the limited practical significance of administrative units such as ranches and research institutes, this study does not include rural areas at the township and street administrative levels in Changchun City.

4. Results

By identifying suburban rural areas through a multidisciplinary lens, we can clearly reflect the developmental status of various elements—such as geomorphology, society, economy, and culture—across multiple dimensions and scales. This approach highlights the comprehensive development of the region and provides a more integrative overview of the developmental context and conditions within the area.

As illustrated in (Figure 2), the comprehensive rurality index for Changchun City in 2020 ranged from -0.288 to 2.121, with an average value of 0.007. Most administrative units exhibited indices below zero, indicating that the overall developmental trend of rural, township, and street administrative units in Changchun City is similar. However, there is a marked imbalance in development across the city, highlighting significant disparities. This finding underscores the urgency and necessity of the research and provides important reference points for a deeper understanding of the urban-rural development status in Changchun City.

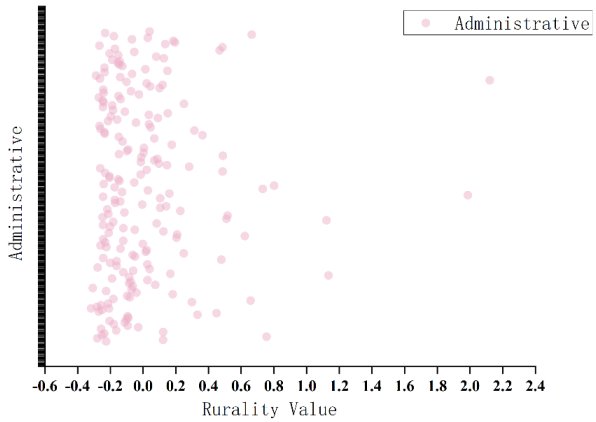

Figure 2 The change of rurality indexes in Changchun City

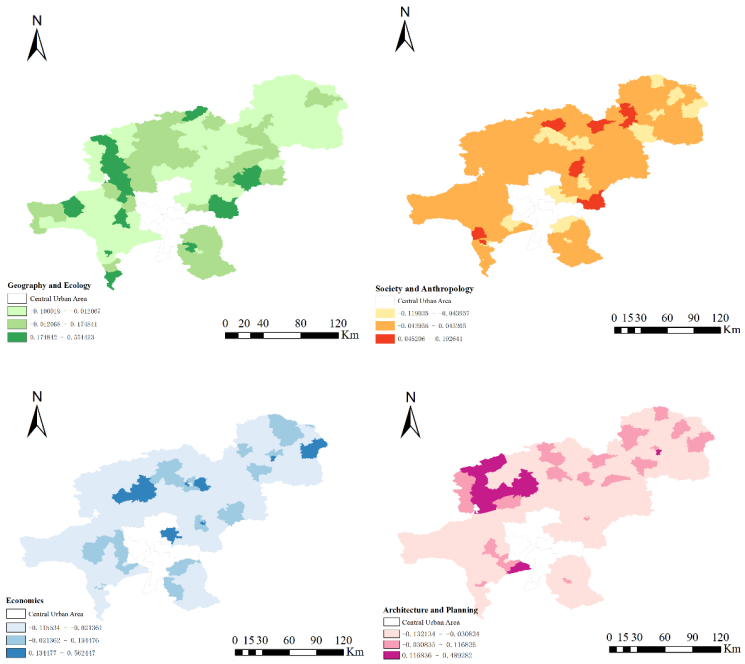

Figure 3 Spatial distribution pattern of rurality indexes in Changchun City

The rurality evaluation system serves as a multiscale comprehensive assessment framework, as relying on a single scale or disciplinary perspective may lead to limitations in understanding. According to the results depicted in (Figure 3), the rurality index for Changchun City has been categorized into three levels using the natural breaks method.

From the perspectives of geography and ecology, the rurality index for changchun city ranges from -0.100 to 0.554. high-value areas are primarily concentrated in the central regions of the city, such as Longwang Township, Bajile Town, Sanshengyu Town, Yongfa Township, and Shuangyingzi Hui Township. These areas feature relatively flat terrain and extensive arable land, with agriculture being the main economic activity. Additionally, these regions possess abundant natural resources, including forests and water bodies, and are less affected by urban development and human activities. Consequently, they exhibit higher rurality indices. The prominence of the rurality index in these areas reflects their relatively favorable rural development status, providing important references for further exploration of rural development models and planning strategies.

From the viewpoint of social and anthropological disciplines, the rurality index for Changchun City ranges from -0.119 to 0.193. As illustrated in Figure 3, the development of social and demographic structures across various regions of Changchun City is relatively uniform, with most areas situated in the mid-range and high-value zones primarily concentrated around the centers of county-level administrative units. This outcome suggests that a singular focus on social and demographic structures does not distinctly highlight the developmental conditions of different regions within Changchun City. It also underscores the necessity of adopting a multidisciplinary perspective to comprehensively assess regional development.

From an economic perspective, the rurality index for Changchun City ranges from -0.116 to 0.562. As shown in Figure 3, high-value areas are primarily located around the city outskirts and the centers of various administrative units, indicating a relatively balanced development across the city. These high-value regions align with the urban spatial layout proposed in Changchun City's overall land use planning, demonstrating that development policies have played a significant role in enhancing the rurality index of regional units. For instance, Yujia Town, situated on the boundary of Changchun City, is classified as a high-value area due to its flat terrain, abundant natural resources, and robust agricultural development. This has stimulated the growth of related industries, showcasing a high degree of tertiary industry integration. This indicates that even regions primarily focused on agriculture and animal husbandry can effectively drive regional development through industrial convergence.

From the perspective of architecture and planning, the rurality index ranges from -0.132 to 0.489. Excluding urban areas, high-value regions are mainly found in the northwest part of Changchun City. This area features flat terrain conducive to road and building construction, along with larger unit areas that encompass multiple rural units, contributing to a higher rurality index. For example, Nongan Town covers an area of 579 km² and includes 40 administrative villages and 42 public facility points, leading to a significantly high rurality index. Similar conditions are observed in Bajile Town, Yangshulin Township, and Sanshengyu Town. Overall, after accounting for these factors, high-value areas in Changchun City are concentrated around the urban outskirts and the central areas of Yushu City, Jiutai City, Shuangyang District, Nongan County, Dehui City, and Gongzhuling City. This distribution is consistent with the urban development planning outlined in Changchun City's overall spatial plan.

4.1 Comprehensive Rurality Index Calculation for Changchun City

Using the linear weighting method, the comprehensive rurality index for various fourth-level administrative units in Changchun City was calculated and categorized into three segments using the natural breaks method:1. Low-value areas: $-0.308 \leq RI < -0.002$; 2.Moderate areas: $-0.002 \leq RI < 0.516$;3.High-value areas: $0.516 \leq RI \leq 2.121$.

As shown in (Figure 4A), most regions of Changchun City fall within the low-value category, while moderate areas are primarily located in Nong'an County, Jiutai District, and Shuangyang District. High-value areas include Nong'an Town and Bajile Town in Nong'an County, as well as the Luyuan District, Chaoyang District, and Nanguan District, along with Zhengyang Street in Yushu City. This spatial distribution reflects a trend of diffusion from the central area outward, aligning with the urban development strategy outlined in Changchun City's overall land use planning.

To further meet the urban development planning needs of Changchun City and align with actual conditions, this study extends the high-value areas into the central urban area, based on the "Changchun Land Spatial Master Plan (2021-2035)." The extended results are illustrated in (Figure 4B). High-value areas: $0.150 \leq RI \leq 2.121$, primarily concentrated in the central urban area and various sub-central cities (Shuangyang, Jiutai, Gongzhuling, Yushu, Nong'an, and Dehui). Moderate areas: $-0.144 \leq RI < 0.150$, mainly distributed around the central urban area and sub-central cities, forming a ring-like pattern. Low-value areas: $-0.308 \leq RI < -0.144$, concentrated in Dehui City, Yushu City, and Gongzhuling City. This may be attributed to their relatively remote locations, limited influence from the central urban area, or the recent inclusion of Gongzhuling City into Changchun's administrative framework.

These adjustments provide a forward-looking reference for the integrated urban-rural development of Changchun City and align with local realities.

4.2 Comprehensive Evaluation of Rurality in Changchun City

Based on the final comprehensive rurality evaluation index for Changchun City, high-value areas primarily correspond to the urban center, which is the core zone of urbanization and bears the main responsibilities and tasks of modernization. These areas play a leading role in the city's transformation and development. Conversely, low-value areas mainly represent rural regions that exhibit relatively lower overall development levels and significant industrial disparities. These areas are relatively weak within the urban spatial structure of Changchun and face developmental challenges during the urbanization process, necessitating special attention and support to narrow the urban-rural development gap.

Moderate-value areas typically refer to the suburban zones of Changchun, characterized by urban-rural integration. These regions embody both urbanization traits and traditional rural atmospheres, serving as crucial junctions for coordinated urban-rural development. They act as platforms and demonstration zones for promoting the interconnectedness of resources, industries, and economies.

The results are shown in (Figure 5):

Suburban rural areas act as bridges for urban-rural integration, playing a vital role in promoting complementary resource flows. The government can enhance integration by adjusting the industrial structure, improving infrastructure, protecting the ecological environment, and facilitating social and cultural exchanges. These actions can help dismantle barriers to urban-rural integration, deepen the process, and promote coordinated urban-rural development, thereby stabilizing society.

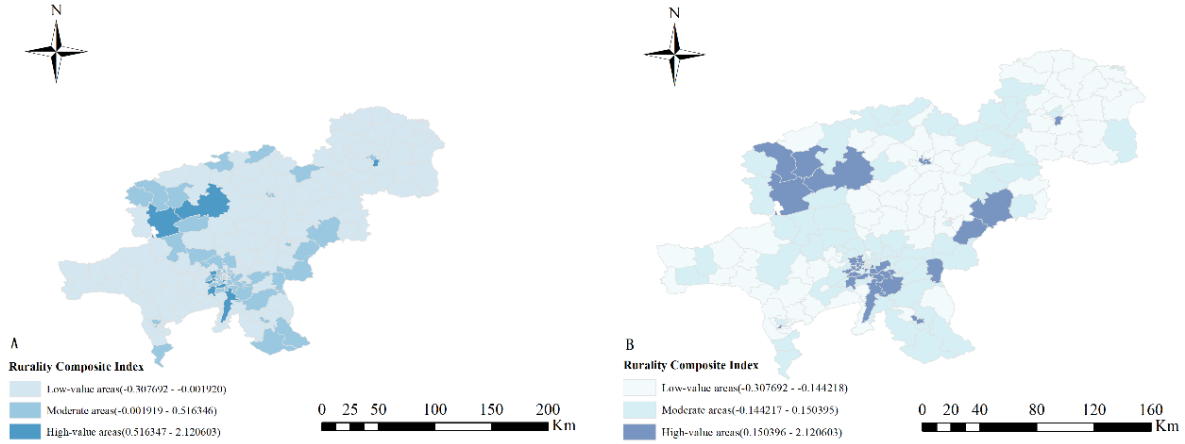

Figure 4 Intensity distribution of rurality in Changchun City

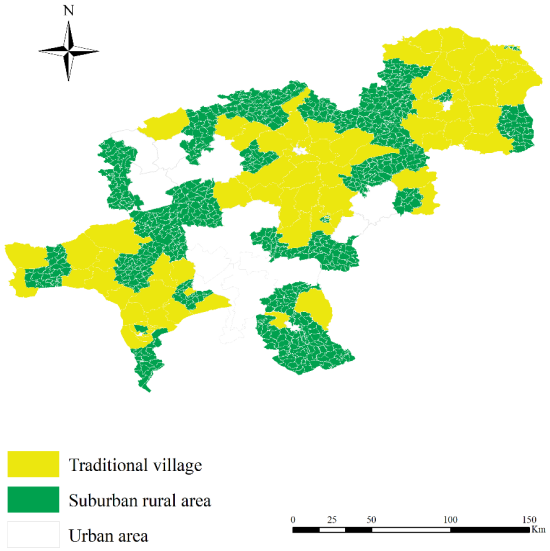

Figure 5 Spatial distribution of suburb Villages in Changchun City

5. Conclusion and Discussion

The spatial characteristics of suburban rural areas partially reflect the fabric of urban development, highlighting weaknesses and directions in that development. The effectiveness of the megacenter development model is limited, and the circulation and flow of resources between regional blocks are key to advancing the Sustainable Development Goals (SDGs). Contemporary urban development should focus on the complementary and equitable distribution of resource elements. This study validates an identification method for suburban rural areas that organically combines multidisciplinary perspectives. This approach provides practical guidance for promoting SDG objectives and rural revitalization, opens new avenues for rural development research, and broadens pathways for urban planning.

Rurality is a condensation of the comprehensive elements of rural areas, representing the trends of flows within rural systems. Taking rurality as the starting point to understand the characteristics of rural areas and to plan developmental pathways is a crucial indicator that aligns with the actual needs of suburban rural areas and aids in strategizing future development.

Traditional monocentric development strategies that drive surrounding areas often exacerbate regional disparities, negatively affecting social equality, which contradicts the objectives outlined in the SDGs. Contemporary urban-rural development should consider the circulation and recycling of resource elements. Only through continuous circulation can these elements appreciate and expand, enabling social progress and the enhancement of overall and comprehensive strength, ultimately achieving the sdgs.

Exploring suburban rural areas from a multidisciplinary perspective provides a comprehensive understanding of their diverse and complex rural fabric. This approach lays a foundation for the deeper implementation of urban-rural integration and rural revitalization strategies, aiming for a more harmonious and sustainable urban-rural relationship.

The issues surrounding urban-rural development are critical to the sustainability of society. This study explores the relationship between urban and rural areas and identifies the characteristics of rurality, which hold significant practical value in addressing global challenges such as urban-rural imbalances and rural development dilemmas. Our findings aim to provide theoretical support and directional guidance for rural development and the sustainable integration of urban and rural areas.

However, this research has several limitations. First, as studies across various disciplines regarding rural areas continue to deepen, the evaluation index system may require ongoing adjustments and enhancements to improve identification accuracy. Second, the potential cultural sentiments and familial consciousness within rural areas are difficult to quantify. Future research could explore technological advancements to refine evaluation models for these qualitative factors. Due to data limitations, this study focuses on the practical realities of China's administrative planning, identifying suburban-type rural areas at the township, town, and street levels. As rural data improves, future studies could enhance the precision of identification by examining these areas at the village scale.

Acknowledgements

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