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Optimization and Zoning of Rural Residential Areas Based on Accessibility of Production and Living Transportation: A Case Study of MengLa County

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Abstract: Spatial layout optimization of rural residential areas is an important part of rural revitalization. Mengla County, as a border county of Yunnan Province, has a large gap between urban and rural areas, and the layout of residential areas is relatively scattered. Therefore, it is of great significance to organize and optimize the spatial layout of rural residential areas. Based on the POI data and road network data information of Mengla County, with the help of ArcGIS tool, Arcpy batch processing, MCR model, OD cost matrix and other methods, the production and living transportation accessibility of rural residential areas in Mengla County was analyzed. The results show that the production and life transportation accessibility of the residential areas in the edge area of Mengla County is poor and the number is small, the transportation accessibility of the natural village gathering area in the urban center is high, and the high accessibility of natural villages between the north and the south is discontinuous. This study evaluated the traffic accessibility of rural settlements from the perspective of production and life traffic accessibility, identified the natural villages with weak traffic, classified the villages accordingly, and put forward corresponding improvement suggestions and strategies.

Keywords: Rural Residential Area; Transportation Accessibility; Residential Area; Arrangement; Optimization.

1. Introduction

The optimization of the spatial layout of rural settlements is an important element of rural revitalization, and at the same time is of great significance to the integrated development of urban and rural areas. The Opinions of the Central Committee of the Communist Party of China and the State Council on Doing a Good Job of Promoting the Key Work of Rural Revitalization in a Comprehensive Way in 2022 (Document No. 1 of the Central Committee of the People's Republic of China in 2022) mentions that the layout of towns and villages should be coordinated, the classification of villages should be determined in a scientific manner, village planning should be accelerated in villages with the necessary conditions and needs, and the removal and annexation of villages should be strictly regulated. When spatial optimization of villages is carried out, villages should be classified and planned on the basis of the different conditions of villages and the overall consideration of urban and rural layouts.

In the process of historical evolution, people choose to settle in areas that are richer in natural resources, thus forming China's rural settlements, for a long time, although the living standards of the residents continue to improve, but the general lack of planning and effective guidance in the construction process of settlements, in a laissez-faire state, leading to the prevalence of rural settlements to build new and not demolish the old, the expansion of the outer edges of the disordered, the internal idleness of the decline and the area of the substantial overrun, Ecological environment degradation problems[1], spatial layout optimization and adjustment of rural settlements is particularly urgent[2], which can not only realize the intensive use of scarce land resources, create the necessary conditions for the development of rural industries, enhancement of the human habitat environment, improvement of public services and other socio-economic restructuring, but also for the flow of factors between urban and rural areas, rural industrial development, public services and other social and economic activities, and also for the urban and rural areas. It can also create a solid foundation for the circulation of factors between urban and rural areas, the development of rural industries, and the improvement of public services, which is of great significance for promoting the integrated development of urban and rural areas and promoting the prosperity of the rural economy [3]. How to promote the optimization of the spatial structure of rural settlements, and then guide the reasonable flow of factors between rural and urban areas has become an urgent problem [4]. Guiding the efficient circulation of factors between urban and rural areas is an important means to drive the development of rural areas, which is one of the key issues in the process of land use and management. Accessibility reflects the convenience of factor circulation to a certain extent. Evaluating the accessibility of rural settlements and proposing settlement optimization strategies accordingly can provide certain support for promoting factor circulation between urban and rural areas and narrowing the gap between urban and rural areas.

As a border county in Yunnan Province, Mengla County is not only lagging behind compared with other counties in Yunnan Province, but also has a large gap between urban and rural areas in the province, and is in urgent need of rural land improvement. In this context, optimizing the spatial layout of rural settlements can coordinate the supply and demand of urban and rural construction land and alleviate the contradiction between people and land. This paper takes Mengla County as an example, takes rural settlements as a research unit, and simulates the production and life travel resistance of rural settlements in Mengla County from the perspective of traffic accessibility, taking into account both production and life, and then divides villages into types and puts forward corresponding optimization paths and suggestions.

2. Overview of the Study Area, Data Sources and Research Methodology

2.1. Overview of the Study Area

Mengla County, one of the counties under the Xishuangbanna Dai Autonomous Prefecture in Yunnan Province, is located in the southeastern part of Xishuangbanna Autonomous Prefecture, with a total area of 6,860.84 square kilometers. Mengla County is half encircled by Laos in the east and south, separated from Myanmar by the Lancang River in the southwest, close to Jinghong City, the capital of the autonomous prefecture in the northwest, and neighboring with Jiangcheng Hani and Yi Autonomous County of Pu'er City in the north. It has 8 towns, 2 townships and 4 farms under its jurisdiction. According to the seventh census, the resident population of Mengla County is 304,950.

Mengla County has a total of 4111.43 kilometers of traffic mileage, but there are still some settlements that are old and have existed for a long time, with poorly configured public service facilities in their vicinity, difficulties in transportation, lack of resources, and an urgent need to improve the transportation situation in some areas to organize the settlements.

2.2. Data Sources

(1) Vector boundaries of counties and townships in Mo ngla County. (Data sources: OpenStreetMap, www.openstr eetmap.org).

(2) Road network data of Yunnan Province in 2022, used for calculating transportation accessibility for production and life. (Data sources: Open Street Maphttps:// www. OpenStreetMap. org).

(3) Point locations of natural villages in Mongla County, starting and ending points for calculating urban-rural transportation accessibility (Data sources: Peking University Geographic Data Platform, geodata.pku.edu.cn).

(4) DEM (Digital Elevation Model): ASTERGDEMv3, used to form a raster resistance surface to calculate the shortest path from the pedestrian to the roadway LCP (data source: Geospatial data cloud, www.gscloud.cn).

(5) POI Point data to calculate the transportation accessibility for production and living in the settlements (Data source: Baidu LBS open platform, obtained through PlaceAPIV2.0).

2.3. Research Method

Research Idea: Construct the evaluation index system from the aspects of production and life, determine the weights of the indexes by hierarchical analysis, and quantitatively evaluate the accessibility of production transportation and life transportation of rural settlements in typical counties and districts, the accessibility of production transportation includes the aspects of agricultural production and non-agricultural production, and the accessibility of life transportation includes the aspects of education, medical care, culture, sports, and commerce, etc. When calculating various types of accessibility, the travel time to other types of locations through road network is measured with natural villages as the starting point. When calculating the accessibility of each category, the natural village is taken as the starting point, and the travel time to reach other types of locations through the road network is measured as the measure of accessibility of each category.

According to the accessibility of production transportation and living transportation in each natural village, the problems in the spatial distribution of settlements in typical counties are analyzed. The accessibility of production traffic and living traffic of each rural settlement is graded by the NaturalBreaks method, and then divided into different optimization types according to the grading results, so as to put forward corresponding spatial layout optimization paths and suggestions for different types of rural settlements in typical counties and regions.

2.3.1. Pedestrian LCP Simulation

In the mountainous environment, the absolute value of the difference in elevation between the natural village and the surrounding mountains can be used as the resistance raster to reflect the travel resistance in mountainous rural areas reasonably and realistically. Therefore, in this study, based on the resistance distance (CostDistance) tool of ArcGIS10.8 platform, we set up the resistance raster according to the above method to simulate the pedestrian LCP with this natural village as the source and the nearby highway as the destination.

2.3.2. MCR Model

Transportation accessibility in this paper refers to the travel time from the origin point to the destination point of the nearest distance facility, therefore, this study uses the Minimum Cumulative Resistance (MCR) model to calculate the LCP of pedestrians in mountainous environments, and the principle of the MCR model refers to the work done by overcoming the resistance in different areas to reach the destination point from the "source". The principle of MCR model is the work done by overcoming the resistance from the "source" to the "destination" through different areas, as shown in Equation 1:

$$MCR = fmin(\sum_{j=n}^{i=m} D_{ij} \times R_i \times K_j) \quad (1)$$

Where: MCR is the minimum cumulative resistance value; f is an unknown positive function; min is the minimum value of cumulative resistance of a unit to a different source; D_{ij} is the spatial distance from source i to landscape unit j; R_i is the resistance coefficient of a landscape unit to a movement process; K_j denotes the relative resistance factor of the class to which source j belongs; and $\sum$ denotes the cumulative resistance computed from parcel i to the source area j.

2.3.3. Arcpy Batching

Arcpy Provides users with interfaces to manipulate all geoprocessing tools (including extension modules) using Python language for processing and querying GIS data. In this study, we build an arithmetic loop based on the Arcpy library of ArcGIS 10.6 platform to batch process the pedestrian LCPs of all natural villages in the arithmetic domain and associate them with each natural village.

2.3.4. Network Analysis

Merge the LCP of each natural village to reach the highway with the road network, assign the speed to each road, and then construct the network data set, establish topology rules to correct the topological errors in the road network (overlapping roads, intersections, etc.). Referring to the corresponding standard specifications of roads at all levels, set the maximum speed of each level of road (as shown in Table 1), and then create an OD (OriginDestination) cost matrix based on the corrected network data, add the location of each natural village and destination point (each type of POI point), and then solve for the travel time for pedestrians to arrive at the destination from the natural village as the transportation accessibility for their production and life. and

living transportation accessibility.

Table 1. Maximum Speed for Each Class of Road

Road class	maximum speed (km/h)	Road level	maximum speed(km/h)
motorway	120	prefectural highway	40
National Highway	80	Other roads	30
Provincial, urban main roads	60	LCP	5

2.3.5. Kriging Interpolation

Using the Geostatistical module of ArcGIS 10.6 platform, the time cost to reach each destination of natural villages in Mengla County was set as field (Z), and ordinary Kriging interpolation was performed to derive the transportation accessibility pattern of natural villages in Meng la County.

2.3.6. Analytic Hierarchy Process

The Analytic Hierarchy Process (AHP) is used to determine the weights of various indicators, which combines qualitative and quantitative analysis. It is a calculation method with decision analysis. Based on the actual experience of decision-makers, different evaluation criteria for measuring target projects in different periods are observed and judged, and the standard weights for each measurement project are reasonably analyzed and calculated.

2.3.7. Building a Production and Living Transportation Accessibility Index System

As shown in Table 2, this article starts from the residents' needs in rural residential areas, considering both production and living aspects, and considering agricultural and non agricultural production in terms of production; In terms of accessibility to daily life and transportation, four aspects are considered: business, education, healthcare, and cultural and sports. The indicator layer is derived from various types of interest points crawled from the Gaode Map API network interface. Finally, the weights of each indicator are determined using the AHP analytic hierarchy process.

Table 2. Production and Living Transportation Accessibility Indicators

Target layer	Criterion layer	Indicator layer	weight
Production transportation accessibility	Accessibility of agricultural production and transportation	cultivated land	0.444
		Agricultural production enterprises	0.222
	Non agricultural production transportation accessibility	factory	0.222
		company	0.111
Accessibility of daily transportation	Commercial transportation accessibility	Dining facilities	0.080
		Shopping and consumption facilities	0.080
		recreational facilities	0.040
	Education transportation accessibility	kindergarten	0.05
		primary school	0.098
		middle school	0.177
	Medical transportation accessibility	hospital	0.196
		clinic	0.092
		Pharmaceutical sales	0.044
	Accessibility of cultural and sports transportation	Sports venues	0.025
		Tourist Location	0.055
		Library	0.063

2.3.8. Classification Basis for Rural Settlement Types

Areas with poor accessibility to production and daily life are generally located at a certain distance from the city center and relatively far from similar production and living facilities. These natural villages are generally located in remote areas with significant terrain fluctuations, outdated transportation infrastructure, and emergency development, making it inconvenient for farmers to carry out production activities and daily life. Therefore, these natural villages are classified as being dismantled, merged, and relocated, Areas with good accessibility to production and living can effectively improve rural living conditions. Generally, transportation is more developed, and various public service facilities and production and living facilities are close, with good development conditions and foundation. It is an ideal rural settlement with superior development conditions. Optimizing these areas can better promote urban-rural interaction and improve the level of integration. Therefore, efforts should be made to develop this area, Divide these types of natural villages into cluster development categories. Natural villages with second level accessibility to production, living, and transportation have lower physical and geographical conditions compared to the first category, and there are also differences in transportation conditions. There are certain shortcomings in the construction of related public facilities, but the large number of rural residents in the area is not suitable for large-scale renovation. At the same time, because the area has a certain development foundation, the rural residential areas in the area can be classified as general village types, when optimizing, it is necessary to build certain public infrastructure and service facilities in the surrounding areas, while also improving transportation accessibility and production and living accessibility. It is also difficult to carry out production and living in third level natural villages, which have poor transportation conditions, fewer public service

facilities, and scattered distribution of rural residential areas. If comprehensive renovation is carried out, the cost is too high, and these natural villages can be classified as guiding villages, guide them to develop towards natural village areas with relatively complete facilities to make up for their own shortcomings.

3. Result Analysis

3.1. Agricultural and Non Agricultural Transportation Accessibility

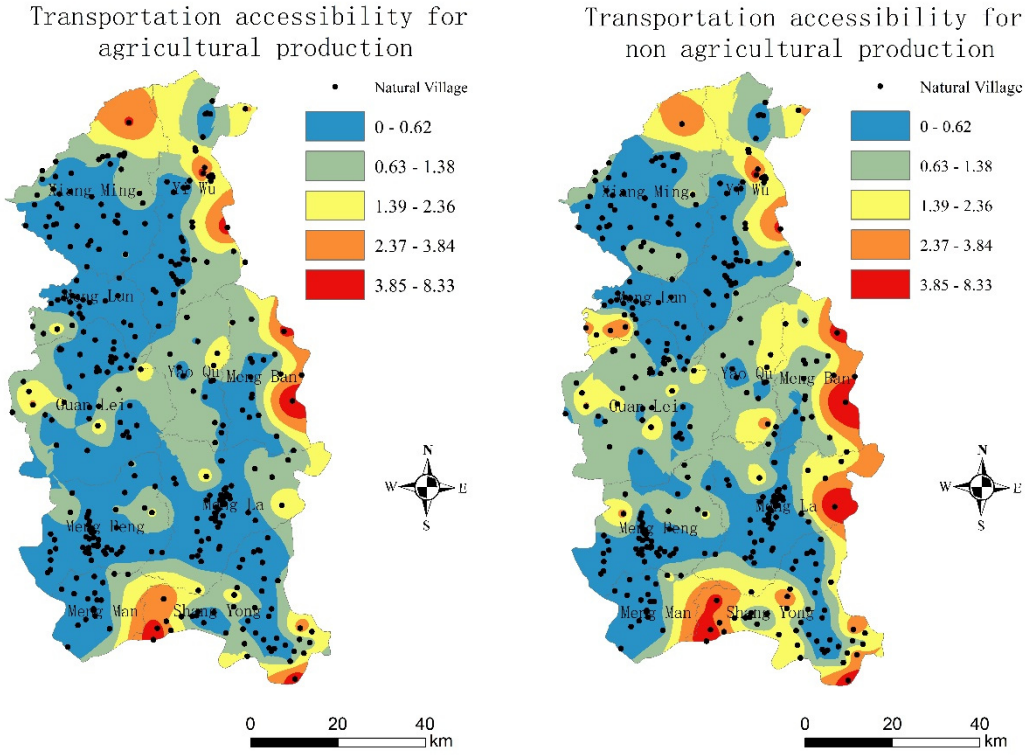


Figure 1. Agricultural and non agricultural transportation accessibility

As shown in Figure 1, the distribution of natural villages in Mengla County is relatively scattered, with a large number of natural villages in the north and south, while the number of natural villages in the central region is relatively small. The difference between agricultural production transportation accessibility and non agricultural production transportation accessibility is mainly reflected in the central and western regions, where the former has higher accessibility.

Specifically, in most areas of Xiangming Township, the accessibility of agricultural and non agricultural production transportation in natural villages is relatively high, located in the first tier, with a travel time of less than 0.62 hours. However, a natural village in the north is located in a remote location, far from the road, with a travel time of over 2.37 hours, reaching the fourth and fifth tier; The accessibility of transportation in Yiwu Township is higher in the south and lower in the north, while higher in the west and lower in the east. A few natural villages located in the eastern region have lower accessibility for agricultural and non agricultural production transportation, ranking in the fourth and fifth echelons. The accessibility of transportation in several natural villages in the north is higher, ranking in the first echelon; Except for a few natural villages in the west, Menglun Town has high overall transportation accessibility, with a travel time of within 0.62 hours; The accessibility of agricultural production transportation in Guanli Town is relatively good in the south and north, but relatively poor in the east and west. However, the travel time is within 1.38 hours, and the accessibility of non agricultural production transportation is relatively poor compared to agricultural production. Except for a few natural villages in the north and south, as well as natural villages in the central and eastern regions, which have transportation accessibility in the first tier, the rest of the travel time exceeds 0.63 hours, with a maximum of no more than 2.36 hours. The number of natural villages in Yao District is relatively small, the accessibility of non agricultural production transportation in the southeast is poor, with a passage time exceeding 2.37 hours. The accessibility of agricultural and non agricultural production transportation in two natural villages in the northeast is poor, ranking in the third tier; The accessibility of transportation in Mengbian Town is higher in the west and lower in the east, with the highest accessibility for agricultural production in the southwest, followed by the northwest, and then decreasing towards the east. The accessibility for non agricultural production transportation is relatively poor compared to agriculture, and the distribution trend is generally similar. The number of natural villages in the first tier in the southwest decreases, entering the second tier. The accessibility of transportation in the three natural villages in the east is poor, with a passage time of over 3.84 hours; The distribution of natural villages in Mengpeng Town is relatively concentrated, and the overall transportation accessibility is relatively high. Except for one natural village in the east that is in the third tier, the accessibility of agricultural production transportation is less than 1.38 hours, with the majority within 0.62 hours. The accessibility of non agricultural production transportation is higher in the south and lower in the north.

The natural villages that are more concentrated in the south have shorter travel times, less than 0.62 hours, while the majority in the north are between 0.63 and 1.38 hours, One natural village in the west has a passage time of over 2.37 hours; The natural villages in Mengla Town are also densely distributed, while a few scattered natural villages in the east, northwest, and south have low transportation accessibility. The agricultural production transportation accessibility ranges from 1.39 to 2.36 hours, while the non agricultural production transportation accessibility remains unchanged in the northwest and southwest natural villages. However, the eastern natural villages have significantly decreased, with one natural village having a travel time exceeding 3.85 hours; The number of natural villages in Mengman Town is relatively small and scattered, mainly in the west. In the east, except for two natural villages in the east with poor accessibility for agricultural and non agricultural production transportation, the travel time of other western natural villages is within 0.62 hours; The distribution of natural villages in the Mohan Economic Development Zone (Shangyong Town) in Xishuangbanna is relatively uniform. The natural villages in the central and eastern regions and their northward extension areas have shorter travel times for agricultural and non agricultural production, and their transportation accessibility is in the first tier. In addition, most natural villages in the western region and a few natural villages in the southeastern region have poor transportation accessibility, and they are in the fourth and fifth tier.

3.2. Accessibility of Commercial, Educational, Medical, Cultural and Sports Transportation

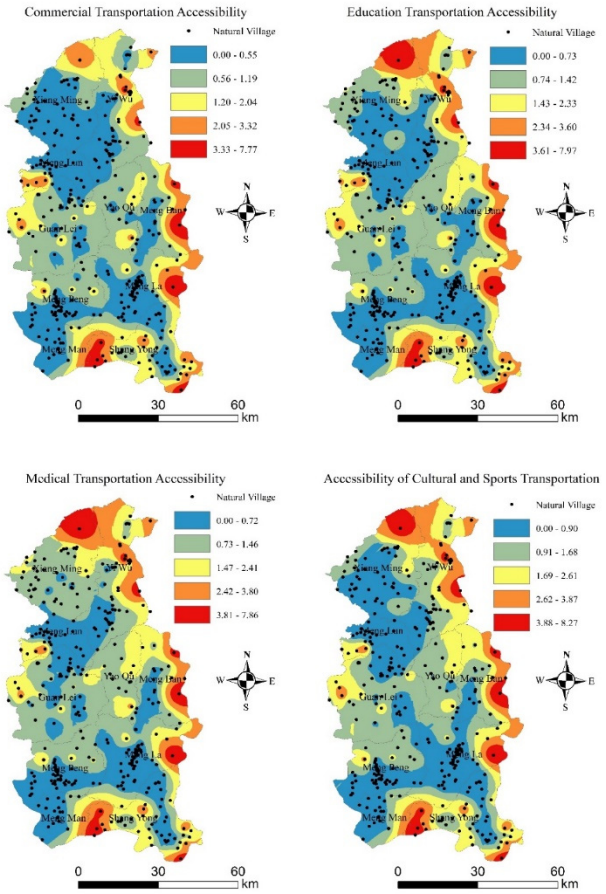


Figure 2. Accessibility of commercial, educational, medical, cultural and sports transportation

As shown in Figure 2, the overall commercial transportation accessibility of Xiangming Township is better than the other three, with a shorter travel time. The distribution trend of commercial, educational, and cultural transportation accessibility is similar, and the transportation accessibility of most natural villages in most areas is in the first tier, with a decreasing trend from south to north. One natural village in the north, due to its distance from the road, has a much longer travel time than other natural villages, with a travel time of 2.05 or even 3.88 hours or more, On the other hand, the accessibility of medical transportation in large areas of natural villages is in the second tier, with travel time ranging from 0.73 to 1.46 hours. Some natural villages also have travel time exceeding 1.47 hours to the north, which is in the third tier; The distribution trend of the four villages in Yiwu Township is the same, showing a distribution trend of high in the southwest and low in the northwest. Except for a few natural villages in the northernmost part, the accessibility of education, medical treatment, cultural and sports, and commercial transportation in other eastern natural villages is poor; The accessibility of the four types of transportation in the natural villages in the southwest of Menglun Town is poor, ranking in the fourth and fifth echelons, while the rest of the areas are in the first echelons, with a travel time of 0.9 hours or even 0.55 hours; The four types of transportation accessibility in some natural villages in the northern and central regions of Guanjing Town are relatively high, ranking in the first tier. In addition, most natural villages have transportation accessibility in the second tier, while several natural villages in the western region have poor transportation accessibility, with travel time reaching 2.05 or even 2.62 hours or more; The transportation accessibility in the northeast and southeast areas of Yao District Township is poor, with a few in the third or even fourth tier, and the rest mostly in the first and second tier; The distribution of four types of transportation accessibility in Mengbian Town is similar, with higher accessibility in the southwest region, followed by the north. The transportation accessibility of natural villages in the two places is in the first and second echelons, and gradually decreases towards the east. The transportation accessibility of several natural villages on the eastern boundary is poor, with travel time exceeding 3.33 to 3.88 hours; The transportation accessibility of Mengpeng Town is higher in the south and lower in the north. The areas where natural villages gather in the central and southern regions have lower travel times, with the majority being in the first tier. However, the transportation accessibility of scattered natural villages in the north is poor and the travel time is longer; The scattered natural villages in the eastern part of Mengla Town have poor traffic accessibility due to being far from roads, and the travel time has exceeded 3.33 or even 3.88 hours; The natural villages in Mengman Town are concentrated in the western region, with high accessibility for transportation; The transportation accessibility of Shangyong Town is relatively low in the western and southeastern regions, while it is relatively high in the central and eastern regions. Several natural villages in the western and southeastern regions have poor accessibility in terms of education, healthcare, cultural and commercial transportation, and are in the fifth tier.

3.3. Accessibility of Production and Living Transportation

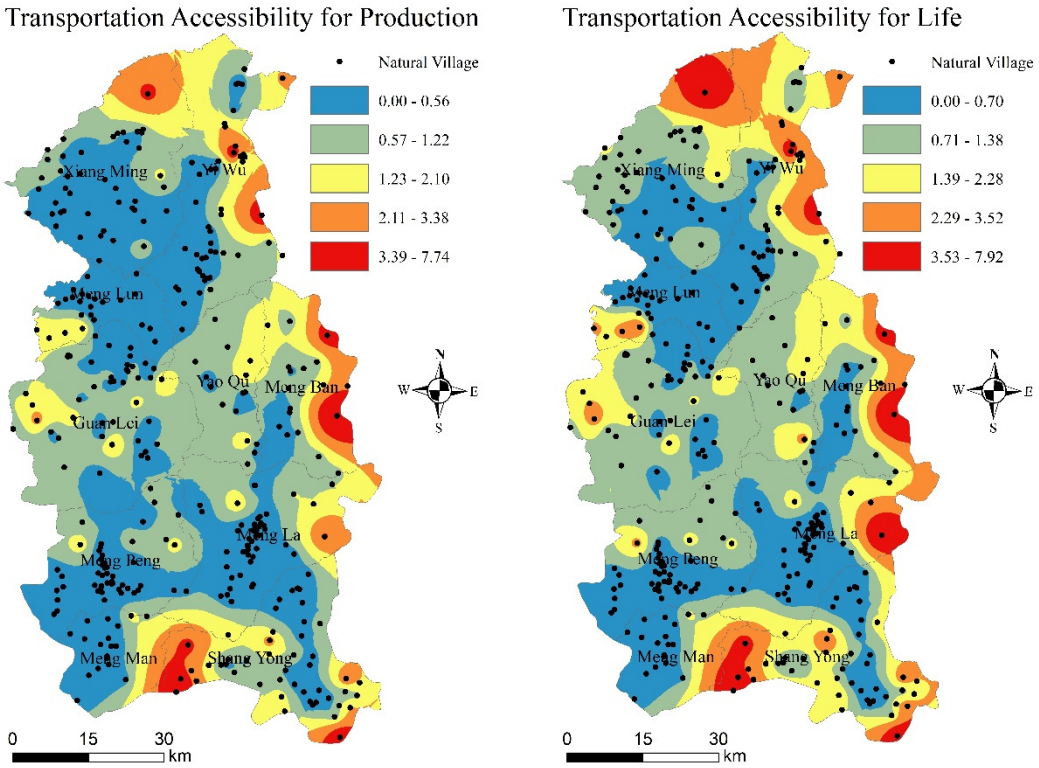


Figure 3. Accessibility of production and living transportation

As shown in Figure 3, the distribution trend of production and living transportation accessibility in Mengla County is generally similar, but production transportation accessibility is better than or even transportation accessibility, making it more convenient for people to engage in production activities.

The areas with high transportation accessibility are basically located in the central areas of various towns, mainly distributed in the southeast, southwest, and northwest of Mengla County. There are also scattered distribution in the central area, but the area is not large. Natural villages with poor transportation accessibility are mainly located in the marginal and remote areas of Mengla County, which are far from roads and have a large elevation drop, the transportation accessibility of natural villages in the western and southeastern regions of Shangyong Town in the south is in the fifth tier, with travel time even exceeding 3 hours. In addition, there are also a few natural villages in the eastern part of Mengbian Town with high production and living transportation accessibility, and there are fewer natural villages in Yiwu Township, and there are many natural villages in the eastern and northeastern regions with poor transportation accessibility; The vast majority of natural villages in Xiangming Township have good transportation accessibility, with only one natural village in the north having poor transportation accessibility.

3.4. Comprehensive Transportation Accessibility

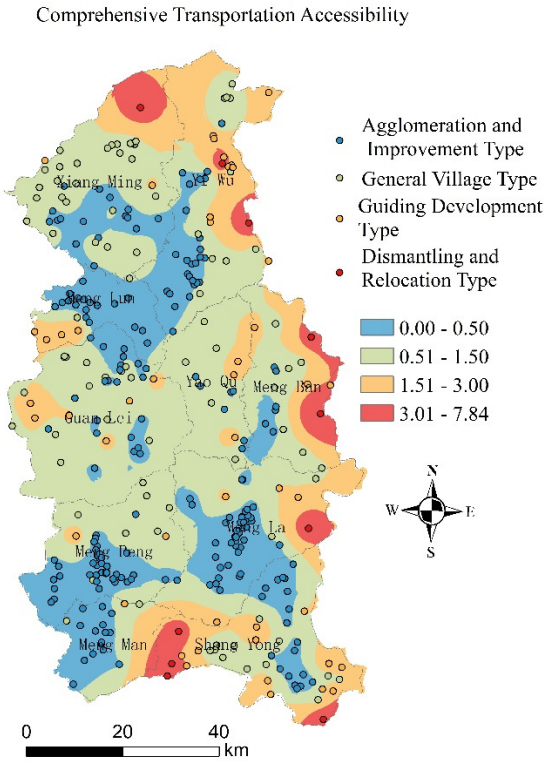


Figure 4. Comprehensive transportation accessibility and village classification

As shown in Figure 4, after weighting and combining the accessibility of production and living transportation, a map of the accessibility of production and living transportation in Mengla County is drawn using interpolation. It is divided into four categories according to the natural breakpoint classification method. According to the accessibility of transportation, it is classified from high to low: agglomeration improvement category, general village category, guided development category, and relocation category.

From the figure, it can be seen that the accessibility of production and living transportation in Mengla County is relatively high in the administrative center of Mengla Town, forming a southern transportation accessibility advantage area with Mengla Town and Mengpeng Town as axes, and extending northward. The town centers of Xiangming Township, Yiwu Township, and Menglun Town also form a triangular transportation accessibility advantage center in the northern area of Mengla County. Overall, the accessibility of production, living, and transportation has a clear trend of distribution along the road, with higher levels in the central area and gradually decreasing outward. The natural village locations with higher accessibility of production, living, and transportation are basically located at the edges and remote areas of each town.

4. Different Types of Development Models

4.1. Agglomeration Improvement Class

Villages that focus on agglomeration and upgrading are generally distributed in clusters. From the perspective of natural conditions, these areas have flat terrain, complete transportation networks, smooth traffic, and advantageous locations, which are conducive to economic agglomeration and development. These natural villages are generally close to urban areas, with abundant agricultural production, non agricultural production, education, commerce, cultural and sports resources, and medical resources. Therefore, they should seize their own advantages and leverage their strengths and avoid weaknesses, actively exchanging material and cultural production factors with cities and towns has resulted in a fault between the high accessibility natural villages in the north and the high accessibility natural villages in the south of Mengla County, which is not conducive to the communication and development between natural villages. It is necessary to improve the transportation accessibility in the central region and build corresponding roads to make the communication between the north and south of Mengla County smoother. The gathering and upgrading of residential areas should be guided by planning Industrial layout is used to promote urban-rural interaction and coordinate urban-rural development. Natural villages with good natural conditions and various transportation accessibility, in addition to interacting with urban development and exchanging elements with cities, also need to have a radiating and guiding effect on other vast rural areas. Other natural villages with poor transportation accessibility should approach these natural villages and achieve coordinated development.

4.2. General Type Villages

The accessibility of production and living in rural residential areas of general villages is only second to those of agglomeration and upgrading. The accessibility of production and living transportation around these natural villages is average, and there are also some shortcomings in the construction of education, medical, and cultural facilities, but overall, they still belong to a good level. These natural villages are scattered and not concentrated in distribution, and their geographical conditions are average, so they cannot effectively promote economic development, Except for adjusting some scattered natural villages, there is no need for large-scale optimization. When carrying out land remediation for such natural villages, the layout of production and living facilities in rural areas should be optimized, the number of local public service facilities should be increased, and on the other hand, their transportation conditions should be improved, the accessibility of production and living transportation should be improved, local living standards should be improved, and the production and living conditions of rural residential areas should be improved.

4.3. Guiding Development Type

Rural residential areas that guide development are mainly distributed in the edge areas of Mengla County. Due to location and natural geographical conditions, transportation accessibility is poor. These natural villages are not numerous and scattered, located in the middle of the worst level of transportation accessibility and general village types. The accessibility of production and living transportation is expected to enter the second tier and enter the general type of rural residential areas. However, due to location reasons, there is a significant gap in public service facilities, and if they are comprehensively renovated, the cost is too high and the significance is not significant. Therefore, active guidance measures can be taken for rural residential areas in the guidance area to guide farmers to concentrate in areas with high accessibility. In the future development process of villages, attention should be paid to expanding the direction and developing towards urban centers that cluster and enhance natural villages, It helps to improve production and living transportation conditions. If it is far from a natural village that is clustered for improvement, suitable areas can be selected around it to establish public infrastructure, provide relevant resources, and have a radiating impact on the surrounding area, thereby guiding rural residents to approach and gather for development.

4.4. Dismantling and Relocation

The rural residential areas designated as demolition areas in Mengla County are basically located at the edge of Mengla County. Both the location conditions and natural geographical environment are relatively poor, and economic development is slow. In addition, some natural villages are still located in national nature reserves, and it is not practical to build public service infrastructure locally. Within a certain period of time, their education, medical and other conditions may not be improved. However, the number of these natural villages is relatively small, Therefore, these natural villages can be classified into the category of demolition and relocation, and land consolidation can be carried out through relocation. These residential areas can be relocated to areas with superior conditions or nearby administrative villages with higher living standards, so that farmers have a better living and production environment.

5. Conclusion and Outlook

This article starts from the perspective of production and living accessibility, constructs an evaluation index system for

production and living transportation accessibility, takes rural residential areas in Mengla County as the research object, simulates the travel resistance of rural residential areas in Mengla County more realistically, calculates the shortest time they reach various types of facility points to evaluate production and living transportation accessibility, and classifies rural residential areas based on the evaluation results, Corresponding optimization paths and suggestions were proposed.

Overall, the transportation accessibility of Mengla County in the north and south is better than that in the central region. The advantage of transportation accessibility is that natural villages form two concentrated areas in the central north and central south. The areas with weak transportation accessibility are mainly distributed in the marginal areas of Mengla County, especially in the northeast and western areas of Shangyong Town in the south, The transportation accessibility in the eastern part of Mengbian Town is also relatively weak. The distribution of natural villages in the areas with weak transportation accessibility in Mengla Town is relatively scattered, but there is also a certain number. In the future, attention should be paid to the development of this part of natural villages. After the withdrawal and relocation of troops, attention should also be paid to the resettlement of farmers to ensure people's livelihoods. For villages with concentrated and improved transportation, attention should also be paid to the rational utilization of local public infrastructure resources, Guide its agglomeration and development.

Studying the zoning and mode selection of rural residential area renovation from the perspective of production and living accessibility provides new ideas for rural residential area renovation, but there are still some shortcomings. Due to the lack of relevant planning data in Mengla County, this article cannot be combined with future actual planning texts for exploration. In the future research process, it should focus on considering the impact of facility planning on the scale and layout of rural residential areas. In addition, the lack of data on the area and patch size of rural residential areas makes it difficult to optimize them in a very precise manner. In the future, more precise and detailed data is needed as support for the optimization of rural residential areas, so that research on spatial optimization of residential areas can comprehensively consider real influencing factors and maximize the accessibility of production, living, and transportation in rural residential areas.

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