International Journal of Scientific Engineering and Science
Volume 3, Issue 1, pp. 55-61, 2019. ISSN (Online): 2456-7361

Study on the Temporal and Spatial Characteristics of Urban Resilience in Yunnan Ethnic Areas, China

Chunhong Xia[1], Yan Li[2*], RuiLiang Li[3], Feixue Lizhang[4], Jie Shen[5], Chao Fu[6]
[1, 2, 3, 4, 5, 6]School of Architecture and Urban Planning, Yunnan University, Kunming, China-650000

Abstract—*China's ethnic minority groups are mostly distributed in ecologically fragile areas of Yunnan Province, facing natural disasters such as mudslides, earthquakes and land pollution, preventing the sustainable development of ethnic areas. Therefore, this paper takes eight ethnic regions in Yunnan Province as the research object, and uses the entropy weight method, linear weighting method and coupling model to quantitatively analyze the urban resilience level in minority areas. The results show that: (1) In the evaluation index system of urban resilience in Yunnan ethnic areas, the weight of ecological resilience is higher than engineering resilience, economic resilience and social resilience, and plays an important role in the construction of urban resilience; (2) Yunnan ethnic minority areas the urban resilience is rising volatility, and the urban resilience level is developing well from 2008 to 2017. (3) The urban resilience of the central, western and eastern regions of Yunnan Province are in different coupling and coordination stages. Meanwhile, the coordination degree of urban resilience in the western region is higher than others in Yunnan ethnic areas.*

Keywords— *Minority areas; urban resilience; coordination.*

I. INTRODUCTION

The city is a highly complex coupling system integrating natural ecosystems, infrastructure systems and social and economic activities. It faces the interference of various uncertain factors such as natural disasters, environmental pollution and human conflicts. The concept of "resilience" and its theory have been applied and developed to varying degrees in the fields of natural science research, engineering technology, and social economy. It is an important theoretical basis for integrating urban ecological security, human settlement environmental health, and social and economic sustainable development. Therefore, the resilient city emerged as a new concept.

In recent years, the concepts of green cities, low-carbon cities, and eco-cities have been in the ascendant, but they all focus on the later ecological restoration of urban environmental problems and cannot individually respond to changes in ecological-social systems with complex scales and complex levels. The concept of the resilient city coincides with these changes in the city. The core of the city is that the city itself can not only defend the disaster to the maximum extent, but also repair and surpass the urban functional system after the disaster. Since 1973, the Canadian ecologist Holling first proposed the concept of “ecological resilience” and distinguished it from “engineering resilience” (Holling, 1973). Foreign academic and practical fields have integrated the concept of “resilience” into urban planning, construction and management. And put it into practice. For example, the United Nations Disaster Reduction Strategy Agency launched the “Let the City Act on Resilience” in the field of global disaster prevention and reduction in 2012, and identified the ten criteria for urban resilience action (Xu Yaoyang, Li Gang, Cui Shenghui. 2018). In the process of urban development, people are demanding the speed and quantity of urban development while pursuing safety and sustainable development. In this context, the modern “resilient city” is no longer confined to the traditional urban disaster prevention and mitigation and self-repair, but gradually transforms into a composite concept, transforming a single “ecological resilience” into “social-ecological system resilience” and then " The core of a resilient city is to focus on the survival, adaptation, and development capabilities of cities undergoing sudden disturbances and chronic stress. Therefore, the concept of resilient city provides a new direction for global disaster reduction and prevention.

II. LITERATURE REVIEW

From a linguistic point of view, "resilience" stems from the Latin word "resilio" (lein RJT, 2003), meaning "bounce back". People translate it in English “Resilience” now. The basic idea of “resilience” stems from a study by Darwin who argues that not the strongest and brightest people can survive, but the most adaptable people can survive (Ján Havkoa, Veronika Mitasová, et al., 2017). Since then, Holly described the characteristics of ecosystems with “resilience” and gradually evolved into the basic elements of building ecosystems (Holling, 1973). Ecologists focus on using "resilience" to describe systems that adapt to natural adaptation and resilience after disasters. With the development of practice and theory, the concept of resilience has been applied to the urban field, providing new thinking and new horizons for the study of urban related science. Initially, its research focused on urban disaster management, focusing on urban response to various natural and man-made disasters and resilience (Aldrich D.P., 2016). At this stage, the construction of resilient cities has become the focus of scholars' attention, and the “resilientity” has penetrated the whole process of urban planning, construction and management, thus continuously promoting the sustainable development of the city.

Global researchers study resilient cities in different perspectives. Based on the origin and development of the concept of resilience, Manyena points out the guiding significance of the concept of “resilience” in dealing with disasters (Manyena SB, 2006); Godschalk studies the composition of resilient cities, which considers tough cities to be composed of material systems and humans. Community composition (Godschalk, DR, 2003); Joerin constructed a climate disaster resilience index (CDRI) model from five dimensions: economic, institutional, natural, material, and social, and used this model to assess urban resilience in Chennai, India (Joerin) J, Shaw R, Takeuchi Y, et al., 2014); Suárez defines the connotation of urban resilience based on a socio-ecological perspective, and constructs a methodological framework for measuring urban resilience, defining the urban resilience index (uárez M, Gómez- Baggethun E, Benayas J, et al., 2016). Subsequently, the tough city has gradually moved from theoretical exploration to practical exploration. The United Nations International Strategy for Disaster Reduction (UNIDSR) proposed the “making cities resilient” campaign; the Rockefeller Foundation of the United States proposed the “100 Resilient Cities”, and four cities in China were selected: Yiwu, Zhejiang, Deyang, Sichuan, Haiyan, Zhejiang, and Huangshi, Hubei.

For China, the study of resilient cities focuses on the following four aspects: (1) A review of the literature on the progress of foreign resilient cities (Xu Yaoyang, Li Gang, Cui Shenghui. 2018; Xie Qihui. 2017), by combing the concepts, theories and resilient cases. (2) Focusing on improving the ability of urban infrastructure to resist earthquakes and disasters (Zhang Yongtao, 2011; Yan Yuanfang, 2017); (3) Because Huangshi City, Hubei Province is the first to enter the US Rockefeller Fund initiative in China, the scholars use it as a research object to define and think about resilience cities (Lu Wenchao, Li Lin, 2016); (4) Setting up different The resilient city evaluation index system to meansure the urban resilience level in different cities in China(Zheng Yan, Lin Chenxuan, 2017; Li Gang, Xu Bo, 2018).

In summary, the study of resilient cities has become one of the major concerns of the academic community. Starting from the concept of resilience, it was first applied to the field of ecology, and then gradually expanded to the macro level of economy, city, community, etc. However, the level of resilience is just in the stage of qualitative quantitative research for the common regions. For the fragile situations of ethnic minority areas in China, there are few studies on the level of urban resilience, which needs to be further explored.

III. RESEARCH PROCESS AND METHOD

A. Overview of Yunnan Minority Areas

Yunnan is located in the southwestern frontier of China. It has jurisdiction over 16 prefectures, including 8 ethnic minority autonomous prefectures (Figure 1) whose total population is 14.925 million and accounts for 31.51% of the province's population (Yunnan Provincial Bureau of Statistics, 2016). In the past ten years, the overall urbanization rate of Yunnan Province has risen from 35.5% to 50.5%, and the urbanization stage has transitioned from the initial stage to the medium term. However, the imbalanced and uncoordinated urban development of the 16 prefectures and cities is prominent, especially the urbanization rate of minority autonomous prefectures lags far behind other regions. According to the 2016 Yunnan Statistical Yearbook, the top three cities in terms of urbanization rate are Kunming (70.5%), Yuxi (47.08%) and Qujing (44.58%); the last three in the ranking are Nujiang (28.23%), Zhaotong (29.13%) and Diqing (31.12%) (Yunnan Provincial Bureau of Statistics, 2016). The urbanization construction in Yunnan Province is facing difficulties such as environmental pollution and ecological deterioration nowadays. The concept of resilient city will undoubtedly provide a practical and effective solution for the above problems.

In addition, ethnic minority areas in Yunnan Province are widely distributed in ecologically fragile zones such as high-cold and arid regions and karst regions. Because the natural environment is diverse and the types of geological features are complex, natural disasters continue to erode and destroy the achievements of economic construction in ethnic areas, threatening people's living environment and affecting the coordinated development of regional economic, social, and ecological cultures.

Fig. 1. Administrative division map of Yunnan minority autonomous prefecture.

B. Constructing an Evaluation Index System for Resilience Cities in Ethnic Areas

The selection of each factor indicator in the evaluation index system is related to the correctness of the whole system analysis and evaluation. This paper combines the geographical situation, natural resources, and the living habits of ethnic minorities of Yunnan Province. The number of 12 representative factor indexes are selected for "engineering resilience", "ecological resilience", "economic resilience" and "social resilience" in resilient cities to calculate the urban resilience level of Yunnan minority areas. First of all, we should pay attention to the infrastructure that can provide timely shelter and effective rescue when the city is faced with sudden events such as natural disasters in the aspect of "engineering resilience". Therefore, "highway traffic mileage", "number of schools" and "communication coverage rate" are selected. Secondly, it focuses on the stability and balance of the ecological system, aiming to reduce the pollution degree of the city and provide the city's natural defense capacity through the purification function of nature in the aspect of "ecological resilience". Therefore, "natural wetland area", "forest coverage rate" and "per capita park green space" are selected. Thirdly, it pays attention to the basic economic factors and economic vitality of urban development in the aspect of "economic resilience", so it selects "resident disposable income", "the proportion of secondary and tertiary industries in GDP" and "total retail sales of consumer goods". Finally, it focuses on

International Journal of Scientific Engineering and Science
Volume 3, Issue 1, pp. 55-61, 2019. ISSN (Online): 2456-7361

"urbanization level", "medical living conditions" and "public education level" in terms of "social resilience"(table II).

C. Entropy Weight Method to Determine the Weight

The research data in this paper mainly comes from the "Yunnan Statistical Yearbook (2009-2018)" and the local state yearbooks, so the authority, reliability and authenticity of the data source can be guaranteed.

1. Standardization of data

Before calculating the weight of the selected index, the data needs to be processed, which means reducing or offsetting the impact of the original variable dimension on the evaluation results by mathematical methods(Chunhong Xia& Yan Li,2018). In this paper, the indicators of different nature are processed by the range method. The formula is as follows:

Standardization of positive indicators: $X'_{ij} = \frac{X_{ij}-X_{ijmin}}{Xijmin_{ijmax}}$

Standardization of negative indicators: $X'_{ij} = \frac{Xij_{ijmax}}{Xijmin_{ijmax}}$

Among them, X'_{ij} is a standardized indicator value; X_{ij} is the original value. The positive indicator is equivalent to the incentive effect, so the larger the value of the positive indicator is, the better the result is; the negative indicator is equivalent to the hindrance effect, so the smaller the value of the negative indicator is, the better the result is.

D. Entropy Weight Method to Determine the Weight

There are many methods for the analysis of weights, which can be divided into two categories, one is subjective assignment, such as Delphi method, AHP; the other type is assigned by different types of mathematical formulas, such as principal component analysis, entropy weighting, and coefficient of variation. In order to reflect the objectiveness of the guarantee index weight and avoid the interference of human factors, this paper uses the entropy weight method to determine the index weight. The specific calculation steps of the entropy weight method are as follows:

(1) If there are j items to be assessed, i evaluation indicators, the original evaluation matrix is formed.

$$R = (X_{nm})_{i*j} \text{ , so } P_{nm} = \frac{X'_{nm}}{\sum_{n=1}^{j} X'_{nm}}$$

(2) Calculate the entropy of the mth indicator

$$e_m : e_m = -k \sum_{n=1}^{j} P_{nm} \cdot ln\, p_{nm}$$

(3) Calculate the entropy weight of the mth indicator

$$Z_m : Z_m = (1 - e_m) / \sum_{n=1}^{i} (1 - e_j)$$

E. Comprehensive Score of Urban Resilience Level

After determining the weight of four indexes, namely engineering resilience, ecological resilience, economic resilience and social resilience, the resilience level values of eight prefectures in each year are calculated by linear weighting method, and the formula is as follows:

$$W = \sum_{i=1}^{n} W_{ij} X'_{ij}$$

Among them, W represents the comprehensive score of social-ecological resilience, W_{ij} represents the weight value of each indicator, and X'_{ij} represents the extreme value index value.

F. Coordination Analysis Using Coupled Models

1. Coupling degree model

The word "coupling" comes from physics and is a measure It reflects the degree of interdependence between two or more objects. Coupling degree calculation formula:

$$C = \left[\frac{W_1 \times W_2 \times W_3 \times W_4}{(W_1 + W_2 + W_3 + W_4)^4} \right]^{1/4}$$

Among them, W_1、W_2、W_3 and W_4 are the comprehensive scores of engineering resilience, ecological resilience, economic resilience and social resilience, respectively, and C is the coupling value of four systems, and its range is $C \in [0,1]$.

2. Coupling coordination model

The degree of coupling can only explain the relationship between the four dimensions of engineering resilience, ecological resilience, economic resilience and social resilience and can't reflect whether the two develop synchronously and the degree of coordination, so it is necessary to introduce coupling coordination degree model. Coupling coordination degree calculation formula:

$$R = \sqrt{C \times T}, T = \alpha \times W_1 + \beta \times W_2 + \varepsilon \times W_3 + \delta \times W_4$$

Among them, R is the coupling coordination degree, T is the inter-system comprehensive coordination index, and α、β、ε and δ are the undetermined coefficients and $\alpha+\beta+\varepsilon+\delta=1$. This paper believes that engineering resilience, ecological resilience, economic resilience and social resilience play an equally important role in the construction and development of resilient cities, so the weight takes $\alpha=\beta=\varepsilon=\delta=0.25$

3. Coupling coordination level type

The coupling coordination degree model reflects the degree of coordinated development of engineering resilience, ecological resilience, economic resilience and social resilience. Based on the authoritative journal literature（Bi Guohua, Yang Qingyuan, Liu Su, 2017; Yang Zhuquan, Zhang Zhiming, 2014）and consulting related experts, this paper divides the degree of coordination into 10 levels (Table I).

TABLE I. Coordination degree classification standard.

Coordination		
interval	**level**	**type**
0.000-0.100	extreme antagonism	I
0.001-0.200	moderate antagonism	II
0.201-0.300	mild antagonism	III
0.301-0.400	slight the running-in period	IV
0.401-0.500	mild the running-in period	V
0.501-0.600	moderate the running-in period	VI
0.601-0.700	extreme the running-in period	VII
0.701-0.800	mild coordination	VIII
0.801-0.900	moderate coordination	IX
0.900-1.000	extreme coordination	X

International Journal of Scientific Engineering and Science
Volume 3, Issue 1, pp. 55-61, 2019. ISSN (Online): 2456-7361

IV. Research Results and Analysis

A. The Weight of Urban Resilience in Yunnan Ethnic Areas

By using the formula of entropy weight method, this paper objectively assigns the weights of the resilient city evaluation indexes of eight minority areas in Yunnan province to make a comprehensive measurement of the tenacity level of Yunnan minority areas in the past ten years and intuitively reflect the level measurement of engineering resilience, ecological resilience, economic resilience and social resilience.

TABLE II. The evaluation of the resilient cities in ethnic areas of Yunnan.

Target layer	Indicator layer	Feature layer	Weights
The evaluation index system of resilient city	Engineering resilience	Highway mileage	0.084
		Number of schools	0.085
		Communication coverage	0.085
	Ecological resilience	Natural wetland area	0.085
		Forest cover rate	0.085
		Per capita park green area	0.084
	Economic resilience	Resident disposable income	0.081
		The proportion of secondary and tertiary industries in GDP	0.085
		The total retail sales of social consumer goods	0.078
	social resilience	Urbanization rate	0.082
		Number of beds in hospitals and health institutions	0.082
		Number of students in school	0.085

Note: This table retains the number to 3 digits after the decimal point due to rounding. Therefore, the weights of the various levels are slightly different from the actual values, but the actual values are used in the actual calculation process.

According to the weights of the evaluation index of the toughness city construction in Yunnan ethnic minority areas (Table II), we can see that: (1)About the weights, ecological resilience (0.254)> engineering resilience (0.253)> social resilience (0.249)> economic resilience (0.244),it indicated that ecological resilience and engineering resilience plays a leading role in the construction of resilient cities in the current minority areas, while social resilience and economic resilience are in a relatively minor position and play an auxiliary role. It is further reflected that the level of urban resilience in Yunnan ethnic areas is closely related to hardware facilities (ecological resilience and engineering resilience), and the construction of software facilities (social resilience and economic resilience) needs to be strengthened. Of course, this status is closely related to the special geographical location of Yunnan. Because Yunnan Province is located in the Yunnan-Guizhou Plateau and has dense forests and vegetation, it is known as the “plant kingdom”. The natural ecological advantages make Yunnan a livable climate environment, which can effectively cope with the natural disasters caused by global climate change. Among the lever of city resilience, ecological resilience accounts for the highest proportion. However, the plateau terrain is complex and changeable and different ethnic minorities are scattered, most people have lived in the deep mountain jungles and lived a self-sufficient farming life since ancient times. Therefore, the inconvenient transportation, the occlusion of communication and the low level of education of people make their economic development lag far behind the eastern region, and the level of economic resilience and social resilience needs to be further improved;(2)It can be intuitively seen that the total retail sales of social consumer goods (0.078), disposable income of residents (0.081), urbanization rate (0.82) and the number of beds in hospitals and health institutions (0.082) lag significantly behind other factors through observing the factor layer .It is another proof that the level of development of resilient cities in Yunnan's ethnic minority areas is uneven, and the level of urban economic resilience and social resilience is not enough to resist and repair external shocks and disturbances.

B. Dynamic Evolution Characteristics of Urban Resilience Level in Yunnan Ethnic Areas

According to the linear weighting method, the urban resilience level of eight minority autonomous prefectures in Yunnan province from 2008 to 2017 is quantified (Figure 2), which can directly reflect the changes of urban resilience level in eight minority autonomous prefectures and facilitate the horizontal and vertical comparative analysis.

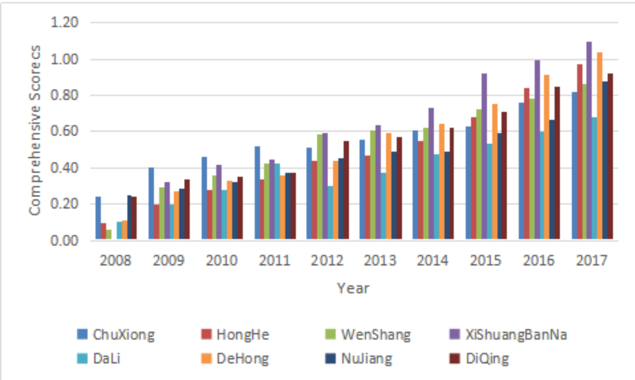

Fig. 2. Measurement of urban resilience level in eight ethnic regions in Yunnan Province.

According to the Fig. we can see that (1) The urban resilience of Yunnan ethnic minority areas showed a wave-like upward trend from 2008 to 2017. Compared with 2008, the eight ethnic minority regions all showed the obvious increase in 2017, indicating that the urban resilience level of Yunnan ethnic minority areas was developing towards a good trend. (2) The scores for all the regions were generally low and then it reflected the impact of the global financial crisis on various regions of China. The proportion of the secondary and tertiary industries in the process of urban economic development, the purchasing power of social consumer goods and the income of residents have all suffered a large impact, seriously affected the urbanization process in minority areas and restricted the normal and effective operation of urban systems. In terms of the level of urban resilience, it undoubtedly brings serious negative benefits. ③During the past ten years, the difference between Xishuangbanna (0.01) with the lowest urban resilience and Nujiang (0.25) with the highest urban resilience was 0.24 in the initial year. By the end of the year, the difference between Dali (0.68) with the lowest urban resilience and Xishuangbanna (1.10) with the highest urban resilience is 0.42. It can be seen that the gap in urban resilience level between ethnic regions is becoming larger, resulting in the drawbacks of uneven development of urban resilience level, although the urban resilience level of different ethnic regions in Yunnan has been improved. (4) The urban resilience level in Xishuangbanna and Dehong is the best overall development compared with the other six regions. .Xishuangbanna has made great progress from the last place in urban resilience (0.01) in 2008 to the first place in urban resilience (1.10) in 2017. It is closely related to the urban development plan. On the one hand, Xishuangbanna actively cultivates tropical economic crops, such as rubber and tea with natural tropical climate. On the other hand, it protects tropical rain forests and develops eco-tourism to increase fiscal revenue and develop a diversified economic pillar industry. It improves the urban ecological, economic and social resilience. In addition, it shows a rule: on the basis of respecting, conforming to and protecting nature. the development of any city will be steadily promoted and the ability of defending against external shocks will be continuously enhanced.

C. Temporal and Spatial Differentiation Characteristics of Urban Resilience Level in Yunnan Ethnic Areas

1. Analysis of the coordinated development stage

According to the table I, this paper quantified the stages and types of coupling coordinated development of the four internal elements of resilience cities in eight minority regions in Yunnan province from 2008 to 2017.However, the paper only selected the conditions for the year of 2008, 2011, 2014 and 2017 were selected to analyze. Because of the limited length of the article (Table III).

TABLE III. Calculation results of Urban resilience coupling coordination degree.

Years / States	2018		2011		2014		2017	
	C	R	C	R	C	R	C	R
Chuxiong	0.76	0.47	0.94	0.59	0.99	0.62	0.98	0.67
Honghe	0.63	0.36	0.95	0.51	0.99	0.61	0.99	0.70
Wenshan	0.86	0.36	0.98	0.57	0.96	0.62	0.99	0.68
Xishuangbanna	0.76	0.21	0.95	0.57	0.97	0.65	0.99	0.72
Dali	0.65	0.36	0.99	0.58	0.94	0.60	0.92	0.64
Dehong	0.58	0.35	0.98	0.54	0.95	0.63	0.99	0.71
Nujiang	0.80	0.47	0.93	0.54	0.94	0.58	0.99	0.68
Diqing	0.76	0.46	0.94	0.55	0.97	0.62	0.99	0.69

This paper can analyze the coupling degree (C) and the coupling coordination degree (R) at two levels through Table III. First, in terms of its degree of coupling, the degree of coupling can reflect the degree of interdependence and interaction between the various elements. Therefore, the degree of coupling can visually reflect the correlation between the engineering resilience, ecological resilience, economic resilience and social resilience. From 2008 to 2017, the coupling degree of the eight regions increased linearly, reaching a high coupling value of 0.99. It can be seen that the degree of interdependence of engineering resilience, ecological resilience, economic resilience and social resilience is deepening with the development of the city. In the past, only engineering and ecological resilience were emphasized and the importance of economic resilience and social resilience was neglected. At the same time, the strategy of developing the western region promoted the economic development in Yunnan. In addition, in recent years, China has carried out the work of “getting rid of poverty and tackling the hardships” and has provided corresponding assistance to ethnic minority poverty areas, including resettlement, science and technology poverty alleviation, labor export and wetland compensation, etc. The actions improve the level of engineering, ecological, economic and social resilience in ethnic minority areas.

Secondly, in terms of its coupling degree of coordination (R), the value of the coupling degree of coordination can directly reflect whether the engineering resilience, ecological resilience, economic resilience and social resilience of various ethnic minority areas develop synchronously and how well they coordinate with each other in the process of urban resilience level development. From the degree of coupling coordination (table I), it can be divided into three stages: antagonism, running-in and coordination. "Antagonistic stage" meant the divergence between engineering resilience, ecological resilience, economic resilience and social resilience. And the whole urban resilience system tends to decline. The coupling coordination degree of Xishuangbanna was in an antagonistic stage in 2008, which meant that the development of the four elements within Xishuangbanna was contrary.Before 2008, the economic development model of Xishuangbanna was mainly based on resources. The main driving force of regional development was the exploitation of forest resources. The extensive industrial structure led to the loss of a large number of natural resources. Its ecological environment and social development are facing an imbalance and the economy is difficult to sustain development, thus these error behaviors caused an antagonism in the internal system of urban resilience. Compared with the “antagonistic phase”, the “run-in phase” is an improvement of urban resilience level, which meant that the whole of resilience gradually develop synchronously, but there are still some unstable factors that hinder the improvement of the overall level of resilience. The stage is an important link to promote the smooth transition of the resilience level in the city from antagonism to coordination. Identifying and eliminating these negative factors is the key task of this stage. From 2011 to 2014, all eight ethnic regions were in the running-in stage. By 2017, the remaining six regions are still in the stage of coordination except Xishuangbanna and Dehong. It can be seen that construction of the resilient city in the majority ethnic areas will be in a long-term run-in period.

At present, China's urbanization has entered a period of strategic opportunities combining accelerated development with transformation and development, faced with challenges such as ecological environment destruction, outdated urban infrastructure and severe aging trend of the population. Therefore, ethnic minority areas should promote the coordinated development of population urbanization, economic urbanization, social urbanization and spatial urbanization in the whole process of future urban planning, construction and management to withstand shocks and improve the coupling and coordination degree of urban resilience. The "coordination phase" indicates that the level of urban resilience has entered a period of good development. This stage means that the ability of urban resilience has a qualitative leap compared with the previous two stages and the entire city's resilience system tends to be optimized. In 2017, Xishuangbanna and Dehong entered the coordination phase. Especially in Xishuangbanna area, it took the lead in the coordinated development period in 2016 (coupling coordination degree R=0.71), which opened a excellent beginning for the coordinated development of urban internal resilience in Yunnan ethnic areas.

2. Coordinated development type space analysis

Based on the calculation results of superposition coupling degree and coupling coordination degree (table III), this paper conducted spatial division on the types of coordination of eight ethnic regions in 2008, 2011, 2014 and 2017 (Figure 3).

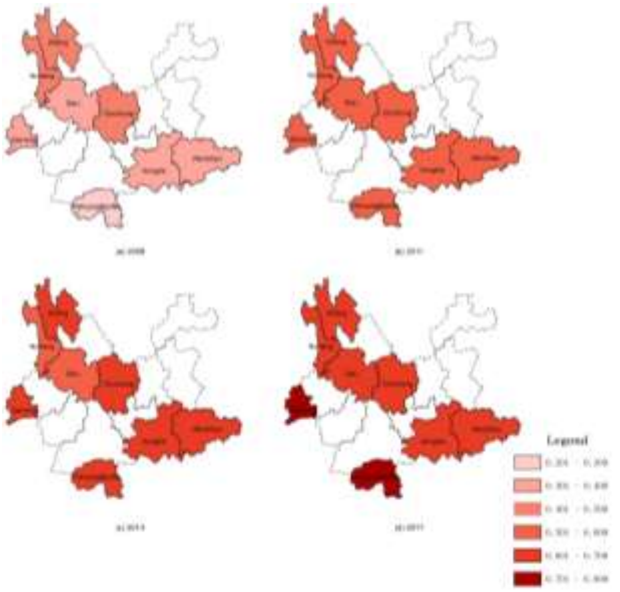

Fig. 3. Temporal and spatial coupling diagram of urban resilience in Yunnan ethnic regions.

It shows the spatial and temporal evolution of the coupling degree of resilience within cities of eight minority resilience in Yunnan province from Figure 3. This article conducts regional research from west to east: First, researching about the western region - Dehong. In 2008-2017, Dehong was the process of IV-VI-VII-VIII, which explained that Dehong's engineering resilience, ecological resilience, economic resilience and social resilience have shifted from uncoordinated development to coordinated development. The reason is related to its special geographical location. First, Dehong is located in the south extension of the Hengduan Mountains in the western part of the Yunnan-Guizhou Plateau. The terrain is high in the northeast and low in the southwest, thus forming a wide variety of forest resources. Secondly, Dehong is located in the low latitude area and belongs to the south subtropical monsoon climate. It has abundant rain all year round and provides good natural conditions for the growth of crops and cash crops. Third, Dehong is located in the southwestern border of China. It is an important port for China to trade with Southeast Asia and South Asia. Foreign trade has become one of the main sources of fiscal revenue in Dehong. Therefore, the gradual integration of ecological advantages and economic development has steadily prompted the level of urban resilience. Secondly, regarding the central region. It includes the five areas of Diqing, Nujiang, Dali, Chuxiong and Xishuangbanna. During the ten years, there was no type I, II, IX, and X in the internal cohesive coupling and coordinated development of the city, while the frequency of VI and VII was the same and the most, which together accounted for 70% of the total. The main reason lies in China's long-term unreasonable urbanization development path, blindly pursuing urban economic growth and land expansion, and it has not paid enough attention to the gap between the rich and the poor, the quality of life and the ecological environment of urban and rural residents, resulting in an inverse relationship between economic development speed and environmental quality, and the urban internal resilience is in the running-in stage. Finally, researching about the eastern region, including the Honghe and Wenshan. The two regions experienced the same process of IV-VI-VII. Because the two were adjacent and has the similar ways to develop. For one thing, the natural climatic conditions provided advantages for the growth of crops and economic forests and the development of local minority cultural resources. For another, the promotion of tourism revenue have improved the economic and social resistance and responsiveness of natural disasters .However, due to the lack of supporting urban infrastructure, strong industry and high-quality service industry as the foundation of urban development, it has been in the stage of VII and difficultly enter the coordination period.

V. Conclusion

Based on the regional conditions, this paper firstly constructs an evaluation index system for the resilient cities in Yunnan ethnic areas. Secondly, the linear weighting method is used to calculate the resilient values. Thirdly, the coupling model and the coupling coordination degree model are used to measure the urban resilience level of Yunnan ethnic minority areas. From a spatial point of view, the following conclusions are drawn from 2008 to 2017: (1) The urban resilience of Yunnan ethnic minority areas is rising in a wave form and the level of urban resilience in all regions has been significantly improved. (2) The gap in urban resilience between Yunnan ethnic areas has gradually increased. There is an imbalance phenomenon in the development of urban resilience. (3)Compared with other regions, Xishuangbanna and Dehong have the best overall development of resilience. From a spatial point of view, the following conclusions are drawn from 2008 to 2017: (1) The urban resilience of Dehong, where it is located in the western region, has developed from a disharmonious to a coordinated stage. (2) The urban internal resilience of central region (Diqing, Nujiang, Dali, Chuxiong and Xishuangbanna) is in the running-in stage and the development quality is not good. (3) The resilient level in eastern regions has the same the experience and differently enter the coordinated development period.

ACKNOWLEDGMENT

This paper is supported by Yunnan University's Research Innovation Fund for Graduate (No.2018z039).

REFERENCES

[1] Holling CS. "Resilience and stability of ecological systems," *Annual Review of Ecology and Systematics*, vol.4, issue 4, pp. 1-23, 1973.
[2] Xu Yaoyang, Li Gang, "Cui Shenghui et al. "Retrospect and prospect of resilience science: From ecological theory to urban practice," *Chinese Journal of Ecology*, issue 15, pp. 5297-5304, 2018.
[3] lein RJT, Nicholls RJ, Thomalla F, "Resilience to natural hazards: How useful is this concept?" *Environmental Hazards*, issue 1, pp. 35-45, 2003.
[4] Ján Havkoa, Veronika Mitasová, et al. "Financing the disaster city in the Slovak Republic," *Procedia Engineering*, pp. 301-306, 2017.
[5] ldrich D.P, "It's who you know: Factors driving recovery from Japan's 11 March 2011 disaster," *Public Administration*, issue 2, pp. 399-413, 2016.
[6] Manyena S.B., "The concept of resilience revisited," *Disasters*, vol.30, issue 4, pp. 433-450, 2006.
[7] Godschalk, D.R., "Urban hazard mitigation: Creating resilient cities," *Natural Hazards Review*, vol.4, issue 3, pp. 136-143, 2003.
[8] Joerin J, Shaw R, Takeuchi Y, et al., "The adoption of a climate disaster resilience index in Chennai, India," *Disasters*, vol.38, issue 3, pp. 540-561, 2014.
[9] uárez M, Gómez-Baggethun E, Benayas J, et al., "Towards an urban resilience index: A case study in 50 Spanish cities," *Sustainability*, vol.8, issue 8, pp. 774, 2016.
[10] Xie Qihui, "Policy implications of building a tough city in developed countries," *Scientific Decision*, issue 4, pp. 60-75, 2017.
[11] Zhang Yongtao, "Rainstorm raid reveals the lack of urban resilience," *Today China Forum*, issue 7, pp. 80, 2011.
[12] Yan Yuanfang, "On the construction of resilient cities from earthquake prevention and disaster reduction," *Shanxi Architecture*, vol. 43, issue 32, pp. 130-131, 2017.
[13] Lu Wenchao, Li Lin, "Investigation and thinking on the construction of resilience city in Huangshi city," *Urban Development Strategy*, pp. 28-33, 2016
[14] Zheng Yan, Lin Chenwei, "The theoretical basis and assessment method of resilient cities," *Urban Development Strategy*, pp. 22-28, 2017.
[15] Li Gang, Xu Bo, "Measurement and improvement of urban resilience level in China," *Journal of Shandong University of Science and Technology*, vol.20, issue 2, pp. 84-89, 2018.
[16] Yunnan Provincial Bureau of Statistics, *Yunnan Statistical Yearbook*, China Statistics Press, Beijing, 2016.
[17] Chunhong Xia, Yan Li. "Evaluation of ecological construction in Kunming using the DPSIR model," *International Journal of Technology*, vol. 9, issue 7, pp.1338-1345, 2018.
[18] Bi Guohua, Yang Qingyuan, Liu Su, "Coupling and coordinated development of provincial ecological civilization construction and urbanization in China," *Economic Geography*, 2017.
[19] Yang Zhuquan, Zhang Zhiming, "Research on coordinated development of tourism economy and ecological environment based on coupling model——Taking Guilin City as an example," *Journal of Northwest Forestry University*, issue 3, pp. 262-268, 2014.