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The relationship between the spatial distribution of poor college students and local geographical characteristics based on metrology model

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Abstract. Sichuan Province is a less developed province in China, the proportion of poor college students is higher than other regions. The differences in geographical features and traffic are very important factors for the phenomena. However, people always ignore the relationship between the number of poor college students and local geographical characteristics. A new attempt was done in the paper: first of all, the spatial analysis model was built based on the sample data of poor college students of Sichuan province in 2016, then the traffic, land cover types and terrain data were collected to analyze the correlation between them based on metrology model. The results show that: poor college students were mainly from the high altitude areas of west Sichuan Plateau, and their home towns were far away from highways, national roads and provincial roads, and their families are mainly located in the region between middle to high slope of agricultural areas.

Key words. geographical factor; poor college students; general survey of geographic national conditions; distribution characteristics.

1. Introduction

Sichuan Province is located in the less developed western economy region, the proportion of poor college students of which is higher than other regions. Put aside the influence of system, policy, capital, education, human resources and many other socio-economic factors, the poverty effect of geographical environment caused by

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regional differences and geographical constraints is a crucial and unavoidable reality problem[1,2]. Spatial geographical location endowment difference is one of the important causes of regional poverty[2,3]. However, in traditional economic analysis, people always ignore the spatial correlation characteristics of poverty. Through investigating and analyzing the status quo of poor college students of comprehensive universities in Sichuan Province, this paper studies the spatial distribution characteristics of poor college students based on geographical factors, selecting sample data randomly, aiming to explore the correlation between them.

2. Research area profile

Sichuan Province is located in the southwest hinterland of China, between the east longitude 97°21'–108°33', north latitude 26°03'–34°19', including 18 prefecture-level cities, 3 ethnic autonomous prefectures, 183 counties (cities, districts), 2314townships, 2038 towns and 47,285 villages[4-6]. The landscape is dominated by mountains and hills, with big topographic relief and large environmental differences. The study area has complex terrain, the frequency of major natural disasters, such as floods, mud slides, droughts, and earthquakes have caused a complex factor of poverty in the study area[5].

3. Research methods and data sources

3.1. Research methods

In the traditional research, the factors affecting the distribution of poor college students are mostly economic or social indicators[7,8]. In fact, the geographical features have a very important influence on the distribution of poor college students in the complicated terrain and geomorphology area of Sichuan, but it's difficult to dig the information in conventional statistical data. Fortunately, geospatial data will provide an important complement for our research. Therefore, this paper carries out spatial metrological analysis by researching the correlation of regional location, traffic, surface cover, terrain and poor college students' spatial distribution. The main research methods are including the following two methods:

3.1.1. Geographical spatial analysis method Geographical spatial analysis is a spatial data analysis technique based on the location and morphological features of geographical objects[8]. Through the study of the spatial distribution characteristics and spatial pattern of poor college students, elasticity analysis on the geographical spatial distribution of poor college students and influence factors, such as regional position, the traffic, terrain and surface cover, analyze and mine the statistical data of poor college students, discuss the relationship between spatial layout of poor college students and geographical factors, and explore countermeasures that bring poor college students out of poverty in the southwest region. College students' data belongs to point features. Usually, the spatial distribution types of the point features

contain well-distributed, random and cohesion three types, which can be determined by the nearest neighbor index. The formula is:

$\delta\left(V_1 - \lambda^2 T_1\right) = 0$ (1)

In the formula: is the actual closest distance, is theoretical closest distance, D is point density. When , it explains that the distribution of point features is random; When, it explains that the distribution of point features is well-distributed; When, it explains that the distribution of point features is cohesion.

3.1.2. Qualitative analysis and quantitative analysis We focus on data statistics and processing of survey data, establish the relevant database to study the distribution characteristics of poor college students and spatial situation, and look for the generation mechanism and the causing of social space through the qualitative analysis.

Poverty ratio refers to the proportion of the poor in the region to the total population in the region, which is used to measure the poverty level of sample college students. The formula is

$H = Q/N$ (2)

In the formula: H is poverty ratio, Q is the number of the poor in the region, N is the total population number in the region. $0 \leq H \leq 1$, the greater the value of H, the greater the level of poverty in the region, the smaller the value of H, the lower the level of poverty in the region.

3.1.3. Metrology model In the process of spatial metrology, researchers usually want to get a model that can describe spatial characteristics well after obtaining spatial data. In subsequent analysis, the researchers assumed that the data generated using the model matched the real model. The following are the existing metrology models:

$SEM : y = X\beta + \mu, \mu = \lambda W\mu + \varepsilon, \varepsilon \sim N(0, \sigma^2 I_n)$(3)

$SMA : y = X\beta + \mu, \mu = \varepsilon + \lambda W\varepsilon, \varepsilon \sim N(0, \sigma^2 I_n)$(4)

$SEC : y = XX + \mu, \mu = W\eta + \varepsilon, \eta \sim N(0, \sigma^2 I_n), \varepsilon \sim N(0, \sigma^2 I_n)$(5)

$SLX : y = X\beta_1 + WXX\beta_2 + \varepsilon, \varepsilon \sim N(0, \sigma^2 I_n)$(6)

$FAR : y = \rho Wy + \varepsilon, \varepsilon \sim N(0, \sigma^2 I_n)$(7)

$SAR : y = \rho Wy + X\beta + \varepsilon, \varepsilon \sim N(0, \sigma^2 I_n)$(8)

$SARMA : y = \rho W_1 y + X\beta + \mu, \mu = \varepsilon + \lambda W_2\varepsilon, \varepsilon \sim N(0, \sigma^2 I_n)$(9)

$SAC : y = \rho W_1 y + X\beta + \mu, \mu = \lambda W_2\varepsilon + \varepsilon, \varepsilon \sim N(0, \sigma^2 I_n)$(10)

$SDM : y = \rho Wy + X\beta + WX\theta + \varepsilon, \varepsilon \sim N(0, \sigma^2 I_n)$(11)

$SDEM : y = X\beta + WX\theta + \mu, \mu = \lambda W\mu + \varepsilon, \varepsilon \sim N(0, \sigma^2 I_n)$(12)

In the formula: Spatial error model (SEM), Spatial moving average model (SMA), Spatial error component model (SEC), Spatial lag of X model(SLX), First-order spatial autoregressive model (FAR), Spatial autoregressive model (SAR), Spatial autoregressive moving average (SARMA), Spatial autocorrelation model (SAC), Spatial dobbin model (SDM), Spatial dobbin error model (SDEM).

formula (2) is used to analyze the spatial distribution characteristics of poor college students in this paper.

3.2. Data sources

In this study, the data of poor college students is from 1000 students sample data of the relevant colleges and universities in 2016 of Sichuan Province. The data of DEM with the 20m resolution, surface cover, traffic data are from the first national geographic conditions census data set of Sichuan Province.

4. Results and analysis

4.1. Distribution of poor college students and regional position

Sichuan has complex and diverse terrain, according to its geographical differences, mainly includes five parts: hilly areas of East-Sichuan, plateau areas of West-Sichuan, mountain area of South-Sichuan, mountain area of North-Sichuan and Chengdu Plain. According to the sample data of poor college students of Sichuan in 2016(as shown in the Fig. 1), Using the formula (1), we can get R=0.82, the distribution of student point features is cohesion. Using the formula (2), we can know the poverty ratio of poor college students in the above five areas in Sichuan province is calculated, which is shown in the Table1.

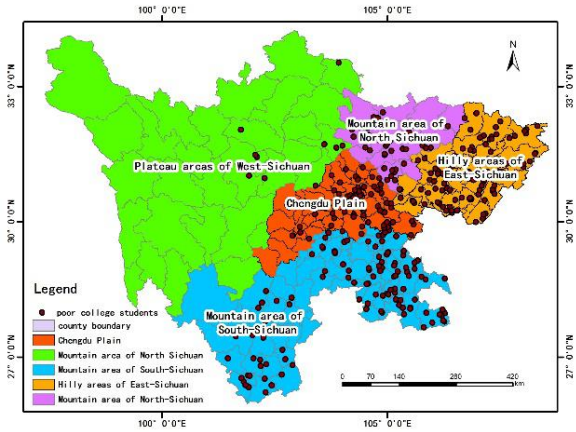

Fig. 1. Distribution map of poor college students and the regional location

Table 1. Poverty ratio of poor college students of Sichuan Province

Area	Sample Size	Poor College Students	Poverty Ratio
Hilly areas of East-Sichuan	228	97	42.54%
Mountain area of South-Sichuan	149	117	78.52%
Plateau areas of West-Sichuan	10	10	100%
Mountain area of North-Sichuan	154	41	26.62%
Chengdu Plain	459	67	14.60%
Summary	1000	315	31.5%

As seen from the Table1, the regions which have higher proportion of poor college students in Sichuan province are mainly distributed in the plateau areas of West-Sichuan, namely ethnic minority areas of Aba Tibetan and Qiang Autonomous Prefecture, Ganzi Tibetan Autonomous Prefecture, Liangshan Yi Autonomous Prefecture. The mountain area of South-Sichuan, hilly areas of East-Sichuan, mountain area of North-Sichuan come second. Chengdu plain which is mainly composed of city groups, with the fast development, has the lowest proportion of poor college students.

4.2. Distribution of poor college students and the traffic

Because of the complex terrain and the inconvenient traffic of Sichuan Province, and the restriction of transportation infrastructure construction, the economic development speed of poor area is very slow in Sichuan Province. The relationship between traffic and the distribution of poor college students is shown as the Fig. 2.

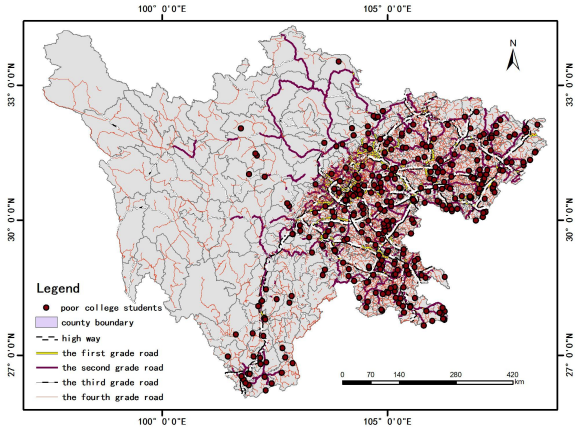

Fig. 2. Distribution map of poor college students and the traffic

We can see from the Fig. 2, the poor college students are mainly distributed in

the traffic inconvenience, away from the highway, national highway and provincial highway areas. Poor college students are usually located in the areas where the highway, the first grade road, the second grade road, and the third grade road are not accessible, On the contrary, which is mainly gathered around four township roads. Therefore, the economic development is relatively slow, and has a larger proportion of poor college students. The economic development of the poor areas can not be separated from the commodity circulation, and the commodity circulation must depend on the traffic. Therefore, the construction of transportation infrastructure has great significance for the poor college students getting rid of poverty.

4.3. Distribution of poor college students and the surface cover

Sichuan province is a big province of grain production in western China. This paper is based on the first general survey of geographic national conditions data of Sichuan province, the relative analysis on the surface cover and poor college students is made. The results are shown in the Fig. 3.

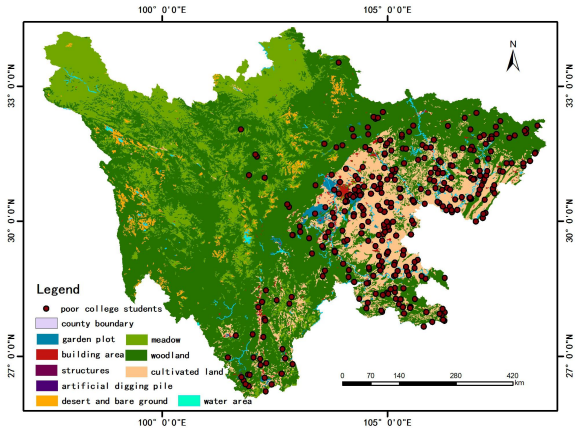

Fig. 3. Distribution map of poor college students and the surface cover

The Fig. 3 shows that the poor college students are mainly distributed in the surface cover type is given priority to with cultivated land area, the family economic income is mainly dominated by crops in this region. Building surface cover types consist mainly of towns, the economy is relatively developed, and the poor college students are the least.

4.4. Distribution of poor college students and the terrain

Terrain factors mainly includes elevation, slope and aspect. Because of the plateau area of West-Sichuan with an average altitude of more than 1800m, which is not suitable for people to live compared with other areas, so the cardinal number of poor college students in this region is less; Also, because of the relationship between

aspect and the analysis of this paper has little relationship??this paper chooses slope as the basic variable, the data of DEM with 20m resolution is calculated for slope based on GIS software. The result is shown in the Fig. 4.

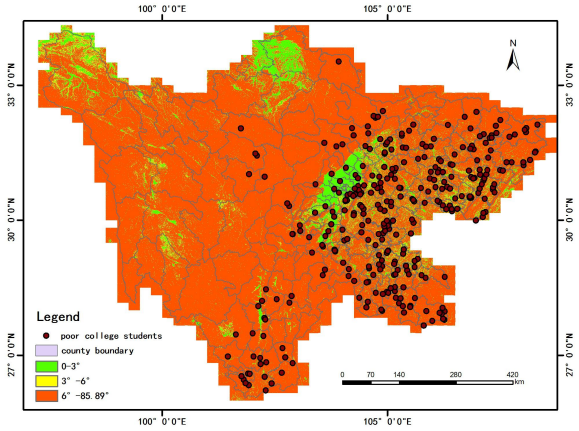

Fig. 4. Distribution map of poor college students and the terrain

The Fig. 4 shows that the poor college students are mainly distributed in areas with a slope of 3-6°. When the slope is greater than 6°, the area is unfit for human habitation, the poor college students are less. Meanwhile, When the slope is less than 3°, the terrain is relatively flat, which is fit for economic development, the poor college students are also less.

5. Conclusions

The above analysis shows that the poor college students of Sichuan province are mainly concentrated in the western areas of remote location, poor ecological environment, harsh natural condition, one-crop economy, weakness of the transportation infrastructure and the minority inhabited region. Distribution characteristics of poor college students resemble the characteristics of the poor population in China, having the obvious national and regional focus characteristics. Due to the serious lack of infrastructure, the laggard social service, remoteness, transport occlusion, farther removed from the social economic activity center, the regions do not have the human life and production basic conditions. Meanwhile, the population policy of China leads to the illiquidity characteristic of population, which makes the poor problem of these regions become worse off. Therefore, the government sectors are supposed to improve the strength of the accurate support for these regions, such as a variety of ways: moving to another place, improving transportation and changing planting economic corps and so on.

References

[1] Y. Y. Zhou: *Geospatial overflow, difference in endowments and provincial poverty agglomeration: empirical study based on spatial econometrics.*Scientific decision making *6* (2013), No. 13, 13-23.

[2] A. Rupasingha, S. J. Goetz: *Social and political forces as determinants of poverty: a spatial analysis.* The journal of socio-economics *36* (2007), No. 4,650-671.

[3] H. Du, Z. J. Pan: *Regional coordination of poverty alleviation and development work: analysis and forecast.* Finance and trade research*20* (2009), No. 5, 1-8.

[4] L. Zhou, J. G. Xu, W. Lin, L. C. Yang, D. Q. Sun, W. Z. T: *Yeerken. Relationship of terrain relief degree and Population Economic Development and Evaluation of Development Suitability in Continuous Poor Areas:A Case Study on qinba of national contiguous special poverty-stricken areas.* Journal of mountain science *33* (2015), No. 6, 742-750.

[5] C. L. Fang, H. T Ma, Z. B. Wang, G. D Li: *The sustainable development of innovative cities in China: comprehensive assessment and future configuration.* Journal of geographical sciences *24* (2014), No. 6, 1095-1114.

[6] Y. Long, G. A. Tang, T. Zhou: *The strategy of geographic spatial data integration facing geographic analysis and cartography.* Geo-information science *8* (2006) , No. 2,125-130.

[7] G. Q. Li, X. B. Li, G. M. Li, W. YẆen, H. Wang, L. H. Chen, J. J. Yu, F. Deng: *Comparison of spectral characteristics between China HJ1-CCD and Landsat 5 TM imagery.* IEEE journal of selected topics in applied earth observations and remote sensing *6* (2013), No. 1, 139-148.

[8] Y. H. Liu, Y. Xu: *A geographic identification of multidimensional poverty in rural China under the framework of sustainable livelihoods analysis.* Applied geography *73* (2016), 62-76.

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