The Quantitative Analysis of Land Use Structure Characteristics of County in Mountainous Areas in Sichuan Province of China——A Case Study of Rong County

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Abstract Based on the data concerning detailed survey on land in the year 2009 and land change in the year 2010 in Rong County, a mountainous region of Sichuan Province, by using quantitative geographical model, we conduct quantitative analysis of the status quo of land use in Rong County in terms of land use diversification, land use centralization, land use combination type, land use geographic significance and comprehensive use degree of land use. The results show some characteristics as follows. Firstly, land use in study area displays prominent characteristic of diversification; there is a high degree of completeness land use type; there is a great similarity among towns. Secondly, there is limited combination number of land use type; mostly the combination number of the towns is 2 -3; the holistic function of regional land is fragile; the proportion of farmland areas is big, reaching 40.09%; the land use type of 21 towns is farmland. Thirdly, the towns with prominent characteristic of diversification of land use in Rong County, have low degree of centralization of land use and relatively big combination number of land use type, and *vice versa*. Fourthly, the type and quantity of agricultural land resources with geographical significance are relatively complete with nothing missing; it abounds in untapped land, but the overall index values of land use are all smaller than 300, with low overall use degree of land.

Key words Land use, Quantity structure, Quantitative analysis, Rong County, Mountainous area of Sichuan Province, China

Land is important indispensable material basis for the survival and development of human. Researching land use structure has a great significance of guidance for rational use of regional land resources, implementation of effective regulation and control, and adjustment of regional industrial layout[1]. In recent years, the researches of overseas and domestic scholars on the status of land use structure mainly focus on the process of land use change, driving mechanism and model, situation prediction and optimization, land use space, landscape pattern change and so on[2-13]. Conducting quantitative analysis of the characteristics of land use structure can be conducive to deep understanding and cognition of dynamic process of land use system, situation prediction and optimization, continuous land use and so on[14]. Zhang Yufeng pointsoat that as for the research of regional land use structure, we can proceed from quantity structure or spatial structure[15]. The structural analyses of land quantity is the analyses of quantitative combination relations of various kinds of land types in the region, mainly including the analysis of diversification of land type combination, the analysis of centralization of land type combination, the analysis of regional combination type and the analysis of geographic significance. Based on the data concerning detailed survey on land in the year 2009 and land change in the year 2010 in Rong County, a mountainous region of Sichuan Province, by using quantitative geographical model, we conduct quantitative analysis of the status quo of land use in Rong County in terms of land use diversification, land use centralization, land use combination type, land use geographical significance and comprehensive use degree of land use, in order to provide scientific basis for rational use of land resources in Rong County, formulation of policies of land use resources and propulsion of urban-rural coordination strategy.

Received: May 25, 2011 Accepted: June13, 2011
Supported by National Technology Support Program (2006BAJ05A13); National Technology Support Program (2007BAD89B15); Technology Support Program of Sichuan Province (2009NZ0051).
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1 Research data and research method

1.1 The overview of study area Rong County, located in the central Sichuan Basin, at 104°02′58″ - 104°40′15″ E, 29°08′38″ -29°38′31″ N, with the topography of high northwest and low southeast, and the altitude of 350 -450 m. Its climate is subtropical monsoon climate, with the average annual temperature of 17.8 ℃. In summer, there are few sizzling days, and in winter, there are few chilly days, with four distinct seasons. The landscape in this region is mainly the mountainous terrain, hilly and flat land, the altitude of which ranges from 320 to 450 m. The soil types include paddy soil, purple soil, alluvial soil, and yellow soil. The county comprises 27 townships, with the total land area of 1 600 km^2, including farmland area of 64 491.14 hm^2, accounting for 48.49% of the total area of agricultural use land.

1.2 Research data The basic data of land use are from detailed survey data of land use in 2009 and land use change data in 2010 in Rong County. In the process of specific calculation, in order to make the data have comparability, this paper adopts the update classification standard of land use type, to divide the land in study area, into farmland, garden plot, woodland, other

agricultural use land, transport use land, water conservancy use land, settlements and mining use land, and untapped land. In order to accurately reflect the socio-economic attributes of the quantity structure of land use, we select the relevant quantitative indicators with clear and definite social and economic significance, and conduct the analysis by using land survey data (Table 1), from diversification of land use, centralization of land use, geographic significance and overall use degree.

Table 1 The structure of land use quantity in Rong County %

Unit	Farmland	Garden plot	Woodland	Other agricultural use land	Settlements and mining use land	Transportation use land	Water conservancy use land	Untapped land
Rong County	40.09	2.63	21.13	18.84	8.89	0.51	0.52	7.39
Xuyang Town	37.10	3.15	19.04	17.38	13.06	0.49	1.40	8.37
Shuangshi Town	58.29	0.75	1.65	21.73	13.24	0.47	0.79	3.08
Wangjia Town	55.33	0.11	2.69	22.27	12.17	0.24	0.12	7.07
Dingxin Town	37.17	2.11	27.44	15.91	8.79	0.32	1.12	7.13
Lede Town	49.01	1.33	13.91	19.16	7.92	0.48	0.38	7.82
Hekou Town	41.88	0.53	22.48	21.68	7.31	0.27	0.05	5.79
Guwen Town	37.93	0.41	22.47	23.78	9.09	0.28	0.08	5.96
Guoshui Town	59.07	1.78	2.84	17.21	11.55	0.35	0.80	6.42
Xinqiao Town	52.21	0.63	4.71	20.68	8.76	0.41	0.37	12.23
Zhengzi Town	40.75	10.77	13.28	18.02	8.56	0.59	0.46	7.57
Dujia Town	42.12	1.15	17.71	17.16	8.34	0.58	0.32	12.61
Dongjia Town	46.71	0.59	7.36	19.42	8.07	0.26	0.30	17.29
Changshan Town	35.98	3.37	28.81	16.56	9.89	0.47	0.19	4.74
Baohua Town	42.09	1.18	13.80	21.67	10.27	0.26	0.25	10.49
Liujia Town	40.28	3.99	12.22	26.98	9.78	0.35	0.85	5.56
Laimou Town	46.73	6.34	10.54	18.17	11.02	1.20	0.45	5.53
Shuanggu Town	29.10	6.47	37.93	15.56	5.79	0.54	0.03	4.58
Guanshan Town	48.38	3.18	9.28	24.33	9.35	0.36	0.86	4.26
Gaoshan Town	43.59	1.94	13.08	20.30	9.10	0.22	0.75	11.02
Dongxing Town	15.11	1.34	62.35	9.07	4.55	1.33	0.48	5.78
Tiechang Town	29.14	2.80	35.80	15.83	7.29	0.65	0.51	7.97
Jinhua Town	26.38	1.98	49.59	13.71	4.90	0.29	0.87	2.27
Leiyin Town	34.25	0.92	37.89	14.55	6.12	1.09	0.16	5.02
Gujia Town	39.44	3.27	24.89	18.17	7.33	0.23	0.23	6.44
Yujia Town	38.61	3.84	14.36	28.53	7.91	0.65	0.43	5.67
Fuxing Town	43.38	8.09	9.42	27.57	9.18	0.05	0.28	2.05
Molin Town	20.49	1.09	53.50	12.49	4.31	1.53	0.49	6.10

1.3 Research method

1.3.1 The diversification index of land use. The aim of diversification analysis of land use is to analyze the completeness degree and diversification status of land types. The diversification index of land use is to describe the quantity of land use types and the homogenization degree of all types in spatial distribution. This paper adopts Gibbs-Martin diversification index to conduct calculation, and the formula is as follows:

$$GM = 1 - \sum_{i=1}^{n} f_i^2 / (\sum_{i=1}^{n} f_i)^2 \quad (1)$$

In the above formula, GM is diversification index; f_i is the area or percentage of land use type i. From the formula (1), we can find that if there is only one land type in certain region, then its diversification index is 0; if there are N kinds of land types, and the land is evenly distributed in each type, then its diversification index reaches 1. The smaller the diversification index value, the fewer the land use types in the region.

1.3.2 The centralization index of land use. Centralization index is an index to precisely measure and analyze land use centralization degree in the region. The smaller the centralization index value, the higher the centralization degree. The calculation formula of centralization index is as follows:

$$I_i = (A_i - R)/(M - R) \quad (2)$$

In the above formula, I_i is the centralization index of land in region i; A_i is the cumulative summation of percentage of all land types in region i; M is the cumulative summation of percentage when there is centralized land distribution; R is the cumulative summation of percentage of all land types in the higher-level region (here, it refers to Rong County); R is as the standard of measuring centralization degree. In Rong County, $R=665.12$, $M=800$. The centralization index of land use is calculated according to Table 1.

1.3.3 The combination coefficient of land use. The analysis of combination type of land quantity structure is to determine the characteristic of type and main types of land use structure. The quantity of land use combination type is to reflect the condition of holistic function in the region. In this paper, we adopt Weaver-Tomas combination coefficient method. This method is to compare the actual distribution of land (the actual percentage of relative area) and the assumed distribution of land (assumed percentage of relative area), and then gradually approach the actual distribution, so as to get an approximate distribution most close to the actual distribution. The combination type of this distribution is the combination type we want. The specific steps are as follows.

First, we array all kinds of land types, according to descending order of the relative proportion of area.

Second, if we allocate only one type to the land, the assumed distribution of this type is 100%, and the assumed distribution of other types is 0; if we allocate previous two types to the land, the assumed distribution of these two types is 50%, and the assumed distribution of other types is 0; the rest may be deduced by analogy, that is, if we allocate 8 types evenly to the land, then the assumed distribution is 12.5%.

Third, we calculate and compare the quadratic sum of difference between each assumer distribution and actual distribution (namely combination coefficient).

Fourth, we choose the assumed distribution combination type with the smallest quadratic sum of difference between each assumer distribution and actual distribution (the combination type corresponding to the smallest combination coefficient), and this combination type is the land combination type in the region. According to the foregoing method, we calculate the land use combination coefficient of Rong County and all towns, and determine the combination type based on this.

1.3.4 The location entropy of land use. Location entropy of land use (rate of specialization) is an overall index which is used to analyze geographic significance and specialization degree of land in one region. By calculating the location entropy of land use type of all towns, we can find out the advantageous land use type with certain status of this region in study area, and measure the rate of specialization, according to the location entropy value in this region. If the location entropy is greater than 1, the centralization degree of this land use type in this region is greater than the average of whole county. The greater the location entropy value, the higher degree of centralization of this land use type in this region, the bigger the comparative advantage. If the location entropy is smaller than 1 or equal to 1, it indicates that this land use type is not the advantageous land use type in this region.

$$Q_i = (f_i / \sum_{i=1}^{n} f_i) / (F_i / \sum_{i=1}^{n} F_i) \quad (3)$$

In the above formula, Q_i is the location entropy of land use type; f_i is the area of certain land use type in certain region; F_i is the area of land use type in whole region; $\sum f_i$ is the total area of land in this region; $\sum F_i$ is the total area of land in whole region.

Table 2 Classification of land use degree

Land use classification	Land use type	Classification index
Non-use	Untapped land and other agricultural use land	1
Low-degree use	Woodland and water conservancy use land	2
Moderate use	Farmland and garden plot	3
High-degree use	Settlements and mining use land, and transportation use land	4

1.3.5 Composite index of land use degree. The quantification of land use degree is established on the basis of the limit of land use degree. The upper limit of land use is that the use of land resources culminates, and in general, mankind cannot further use and develop these land resources; the lower limit of land use is the starting point of people's development and use of land resources. Thus, we can express the land use degree as a discontinuous function form and we stipulate the ideal state of land use as four levels of land use. Then we assign the value of their own type to four levels of land use, so we can get the index of four levels of land use degree, which can be seen in Table 2. Four levels of land use are ideal, and in the actual state, the four types are mixed in the same area, having different proportions of area. Four levels of land use make corresponding contributions for the land use degree in local areas, according to their own weight. Based on this, the composite quantified index of land use degree must go through mathematical integration, so as to form one composite index with continuous distribution from 1 to 4. The value of this composite index mainly reflects the land use degree in the region comprehensively. This composite index is a Weaver index. The calculation formula is as follows:

$$L_a = 100 \times \sum_{i=1}^{n} A_i \cdot C_i \quad (4)$$

In the above formula, L_a is the composite index of land use degree; A_i is level i hierarchical index of land use degree; C_i is level i hierarchical percentage of area of land use degree.

The composite quantification index of land use degree is an index which changes continuously from 100 to 400. As the composite index of land use degree is a continuous function with a value interval [100, 400]. In a certain area, the size of the composite index reflects the level of land use degree. Based on this, the land use degree of any region can be obtained by calculating the size of the composite index.

2 Results and analysis

2.1 The analysis of diversification degree, centralization degree and combination type of land use

2.1.1 The analysis of diversification degree and centralization degree of land use. The land use of Rong County shows the prominent characteristic of diversification, high completeness degree of land use type, relatively low overall centralization degree, and great similarity among towns. From Table 3, we know that the average of diversification index of land use in Rong County is 0.758, close to the theoretical maximum value of 0.875, indicating that the diversification degree of land use (the completeness degree of land use) in whole county, on the whole, is relatively high. In the light of all towns in this county, the diversification index of land use of most of towns is over 0.600. Xuyang Town has the biggest value of 0.792, and Dongxing Town has the smallest value of 0.567, with slight difference. The centralization index of land use of all towns in this county is all relatively small, ranging from −0.155 to −0.438, with slight difference each other.

2.1.2 The analysis of combination type of land use. As can be seen from Table 3, in Rong County, on the whole, the combination type is mainly farmland-woodland-other agricultural use land. The quantity of combination of land use type is small, and the proportion of farmland area is big, with prominent dominant position of agriculture. There are 7 towns with at least 2 kinds of combination number, and there are only Zhengzi Town and Baohua Town with at most 5 kinds of combination number, while the most universal combination number is 3 kinds, with 15

towns, and the three kinds of land type is farmland, woodland and other agricultural use land. The land use type in 21 towns of whole county is mainly farmland and the farmland area accounts for 40.09% of total area of land in Rong County; the woodland area accounts for 21.13% of total area of land in Rong County; the area of other agricultural use land accounts for 18.84% of total area of land in Rong County. This indicates that the farmland is the primary land use type in this county.

2.1.3 The analysis of correlation of diversification index, centralization index and combination type of land use. The towns with prominent characteristics of diversification of land use in Rong County have low degree of centralization of land use, and relatively big combination number of land use type, while the towns with inconspicuous characteristics of diversification of land use in Rong County have high degree of centralization of land use, and relatively small combination number of land use type. As can be seen in Table 3, the diversification index of Xuyang Town is 0.792; the diversification index of Zhengzi Town is 0.657; the diversification index of Laimou Town is 0.718; the diversification index of Tiechang Town is 0.760. The diversification index of these towns is relatively big. The centralization index of Xuyang Town is −0.142; the centralization index of Zhengzi Town is −0.155; the centralization index of Laimou Town is −0.003; the centralization index of Tiechang Town is −0.004. The combination number of these towns is 4, 5, 4, and 3 respectively. The diversification index of Shuangshi Town is 0.606; the diversification index of Wangjia Town is 0.611; the diversification index of Guoshui Town is 0.596; the diversification index of Dongxing Town is 0.567. The diversification index of these towns is relatively small. The centralization index of Xuyang Town is 0.438; the centralization index of Zhengzi Town is 0.397; the centralization index of Laimou Town is 0.355; the centralization index of Tiechang Town is 0.357. The centralization index of these towns is relatively big. The combination number of these towns is all 2.

Table 3 Diversification index, centralization index and combination type of land use in Rong County and other areas

Unit	Diversification index	Centralization index	Combination index	Combination number	Combination type
Rong County	0.758	0	545.8	3	Farmland-woodland-other agricultural use land
Xuyang Town	0.792	−0.142	464.7	4	Farmland-woodland-other agricultural use land-settlements and mining use land
Shuangshi Town	0.606	0.438	1 056.8	2	Farmland-other agricultural use land
Wangjia Town	0.611	0.397	1 002.7	2	Farmland-other agricultural use land
Dingxin Town	0.729	0.003	486.9	3	Farmland-woodland-other agricultural use land
Lede Town	0.698	0.154	949.9	3	Farmland-other agricultural use land-woodland
Hekou Town	0.720	0.143	413.9	3	Farmland-woodland-other agricultural use land
Guwen Town	0.733	0.080	348.8	2	Farmland-other agricultural use land-woodland
Guoshui Town	0.596	0.355	1 344.3	2	Farmland-other agricultural use land
Xinqiao Town	0.675	0.270	1 061.5	3	Farmland-other agricultural use land-untapped land
Zhengzi Town	0.657	−0.155	753.6	5	Farmland-other agricultural use land-woodland-garden plot-settlements and mining use land
Dujia Town	0.731	0.001	632.6	4	Farmland-woodland-other agricultural use land-untapped land
Dongjia Town	0.724	0.153	749.6	3	Farmland-other agricultural use land-untapped land
Changshan Town	0.745	0.025	440.8	3	Farmland-woodland-other agricultural use land
Baohua Town	0.734	0.029	715.6	5	Farmland-other agricultural use land-woodland-untapped land-settlements and mining use land-woodland
Liujia Town	0.742	0.033	677.7	3	Farmland-other agricultural use land-woodland
Laimou Town	0.718	−0.003	995.9	4	Farmland-other agricultural use land-settlements and mining use land-woodland
Shuanggu Town	0.741	0.042	451.5	3	Woodland-farmland-other agricultural use land
Guanshan Town	0.651	0.173	864.3	2	Woodland-other agricultural use land
Gaoshan Town	0.748	0.024	792.6	4	Farmland-other agricultural use land-woodland-untapped land
Dongxing Town	0.567	0.357	1 509.8	2	Woodland-farmland
Tiechang Town	0.760	−0.004	455.1	3	Woodland-farmland-other agricultural use land
Jinhua Town	0.660	0.297	731.7	3	Woodland-farmland-other agricultural use land
Leiyin Town	0.709	0.143	439.1	3	Woodland-farmland-other agricultural use land
Gujia Town	0.745	0.049	444.3	3	Farmland-woodland-other agricultural use land
Yujia Town	0.738	0.038	520.9	3	Farmland-other agricultural use land-woodland
Fuxing Town	0.700	0.121	789.8	2	Farmland-other agricultural use land
Molin Town	0.656	0.269	1 065.7	3	Woodland-farmland-other agricultural use land

2.2 The analysis of geographic significance of land use

The combination type of the land structure is to analyze the holistic function of land from the internal structure of the region, but it cannot reflect the geographic significance of land in this region. The significance of using location entropy to analyze the land is that it can reflect the relative aggregation degree of various kinds of land in one region relative to that of the higher-level regions. As can be seen in Table 4, Rong County has abundant agricultural resources with geographic significance. Amid 27 towns in Rong County, the farmland in 15 towns, such as

Shuangshi Town, Wangjia Town, Lede Town, Guoshui Town and so on, has relative geographic significance; the garden plot in 11 towns, such as Xuyang Town, Changshan Town, Laimou Town, Shuanggu Town and so on, has relative geographic significance; the woodland in 11 towns, such as Dingxin Town, Hekou Town, Guwen Town, Changshan Town and so on, has relative geographic significance; other agricultural use land in 13 towns, such as Shuangshi Town, Wangjia Town, Lede Town, Hekou Town and so on, has relative geographic significance; the untapped land in 9 towns, such as Xuyang Town, Lede Town, Xinqiao Town, Zhengzi Town and so on, has relative geographic significance. This indicates that as big agricultural county, Rong County has the advantages of land resources conducive to the development of all forms of agricultural production, and the great development potential of diversified agricultural management.

2.3 Comprehensive analysis of land use degree The aim of comprehensive analysis of land use degree is to determine the composite characteristics of land use degree in the region. In the light of the calculation results in Table 3, the land use degree in all towns of Rong County is not high, and the composite index of all towns of Rong County is not more than 300. Meanwhile, the county still has abundant untapped land that needs to be developed. The area of untapped land in Rong County accounts for 7.39% of the total area of land in Rong County, which indicates that the supply of untapped land in Rong County in the next period of time is sufficient. The ratio of untapped land in 9 towns is greater than the average of Rong County, especially Xinqiao Town, Dujia Town, Dongjia Town, Baohua Town and Gaoshan Town. The location entropy of land use type of Xinqiao Town is 1.66; the location entropy of land use type of Dujia Town is 1.71; the location entropy of land use type of Dongjia Town is 2.34; the location entropy of land use type of Baohua Town is 1.42; the location entropy of land use type of Gaoshan Town is 1.49. The area of land that is yet to be developed and used in Xinqiao Town, Dujia Town, Dongjia Town, Baohua Town and Gaoshan Town accounts for 12.23%, 12.21% , 17.30%, 10.49% and 11.02%, of the area of respective region. This provides the corresponding data basis for conducting land development and land use in order to complement insufficient land resources.

Table 4 The location entropy and overall index of land use type in Rong County

Unit	Farmland	Garden plot	Woodland	Other agricultural use land	Settlements and mining use land	Transportation use land	Water conservancy use land	Untapped land	Composite index
Rong County	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	235.30
Xuyang Town	0.93	1.20	0.90	0.92	1.47	0.97	2.67	1.13	241.60
Shuangshi Town	1.45	0.29	0.08	1.15	1.49	0.93	1.51	0.42	261.65
Wangjia Town	1.38	0.04	0.13	1.18	1.37	0.47	0.24	0.96	250.92
Dingxin Town	0.93	0.80	1.30	0.84	0.99	0.64	2.14	0.96	234.48
Lede Town	1.22	0.51	0.66	1.02	0.89	0.94	0.72	1.06	240.16
Hekou Town	1.04	0.20	1.06	1.15	0.82	0.53	0.10	0.78	230.12
Guwen Town	0.95	0.16	1.06	1.26	1.02	0.55	0.16	0.81	227.33
Guoshui Town	1.47	0.68	0.13	0.91	1.30	0.68	1.52	0.87	261.02
Xinqiao Town	1.30	0.24	0.22	1.10	0.99	0.80	0.71	1.66	238.26
Zhengzi Town	1.02	4.10	0.63	0.96	0.96	1.15	0.87	1.03	244.22
Dujia Town	1.05	0.44	0.84	0.91	0.94	1.14	0.62	1.71	231.36
Dongjia Town	1.16	0.23	0.35	1.03	0.91	0.52	0.56	2.34	227.26
Changshan Town	0.90	1.28	1.36	0.88	1.11	0.91	0.36	0.64	238.77
Baohua Town	1.05	0.45	0.65	1.15	1.16	0.51	0.47	1.42	232.19
Liujia Town	1.00	1.52	0.58	1.43	1.10	0.69	1.61	0.75	231.99
Laimou Town	1.17	2.41	0.50	0.96	1.24	2.36	0.86	0.75	253.82
Shuanggu Town	0.73	2.46	1.80	0.83	0.65	1.06	0.05	0.62	228.08
Guanshan Town	1.21	1.21	0.44	1.29	1.05	0.71	1.64	0.58	242.40
Gaoshan Town	1.09	0.74	0.62	1.08	1.02	0.43	1.43	1.49	232.85
Dongxing Town	0.38	0.51	2.95	0.48	0.51	2.59	0.91	0.78	213.36
Tiechang Town	0.73	1.06	1.69	0.84	0.82	1.27	0.98	1.08	224.02
Jinhua Town	0.66	0.75	2.35	0.73	0.55	0.57	1.65	0.31	222.76
Leiyin Town	0.85	0.35	1.79	0.77	0.69	2.13	0.30	0.68	230.03
Gujia Town	0.98	1.24	1.18	0.96	0.82	0.45	0.44	0.87	233.20
Yujia Town	0.96	1.46	0.68	1.51	0.89	1.28	0.81	0.77	225.39
Fuxing Town	1.08	3.08	0.45	1.46	1.03	0.09	0.53	0.28	240.29
Molin Town	0.51	0.41	2.53	0.66	0.49	2.99	0.94	0.83	214.67

3 Conclusion and discussion

First, the land use in the study area shows the prominent characteristics of diversification, and the completeness degree of land use type is relatively high. The average of diversification index of land use in Rong County is 0.758, close to the theoretical maximum of 0.875, and the diversification index of land use in most of the towns is more than 0.6. The centralization degree of land use in the study area is relatively low, but there is a great similarity among all towns. The centralization index of

land use of all towns in Rong Town is all relatively small, ranging from −0.155 to −0.438, and there is a slight difference among them. The towns with prominent characteristics of diversification of land use in Rong County have low degree of centralization of land use, and relatively big combination number of land use type, while the towns with inconspicuous characteristics of diversification of land use in Rong County have high degree of centralization of land use, and relatively small combination number of land use type. There is small quantity of combination types of land use in the study area. On the whole, the combination type of land use is farmland-woodland-other agricultural use land. The land use type in 21 towns of Rong County is mianly the farmland, and the area of farmland has a large proportion, accounting for 40.09% of the total area of land in Rong County, with outstanding dominant position of agriculture.

Second, there are abundant types and amount of agricultural land resources in the study area with the geographic significance, and there is ample untapped land. Amid 27 towns in Rong County, the farmland in 15 towns, such as Shuangshi Town, Wangjia Town, Lede Town, Guoshui Town and so on, has relative geographic significance; the garden plot in 11 towns, such as Xuyang Town, Changshan Town, Laimou Town, Shuanggu Town and so on, has relative geographic significance; the woodland in 11 towns, such as Dingxin Town, Hekou Town, Guwen Town, Changshan Town and so on, has relative geographic significance; other agricultural use land in 13 towns, such as Shuangshi Town, Wangjia Town, Lede Town, Hekou Town and so on, has relative geographic significance; the untapped land in 9 towns, such as Xuyang Town, Lede Town, Xinqiao Town, Zhengzi Town and so on, has relative geographic significance. But the composite index of land use in all towns is all smaller than 300, the comprehensive land use degree is not high and the holistic function of land is relatively fragile.

Therefore, the quantified analysis results of characteristics of land use structure in this paper can provide the scientific basis for the rational use of land resources and formulation of relevant policies in Rong County, and meanwhile, be of significance in guiding practice to much extent in some similar regions.

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sustainable development of forest. The sustainable development of forest needs to intensify forest operation, improve forest quality and promote carbon absorption. The scientific measures should be adopted to guarantee the healthy and sustainable development of forest, for example, by using the durable wooden products to replace the energy intensive materials; reusing the residues of cutting; controlling illegal cut; protecting wetland and forestry soil; well planning the cut and planting of trees; orderly planting trees; rationally cutting tress; promoting the benign circulation of forest. Besides, it should develop ecological tourism of forest and fully tap the ecological value of forest.

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