Analysis of Land Use Change and Driving Factors in Mojiang County Based on PLUS Model

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Abstract [**Objectives**] To explore the characteristics of land use change and its main influencing factors in Mojiang County from 2000 to 2020, and try to provide a scientific reference for alleviating the contradiction between man and land in Mojiang County and realizing the sustainable development of regional land resources. [**Methods**] Based on the land cover data and socio – economic data of Mojiang County from 2000 to 2020, the dynamic degree of land use, land use transfer matrix and center – of – gravity transfer model were calculated, and the temporal and spatial change characteristics and driving factors of various types of land use were calculated by PLUS model. [**Results**] From 2000 to 2020, the area and proportion of grassland, waters and construction land in Mojiang County showed an upward trend, while the area and proportion of cultivated land and forest land showed a downward trend. Among them, cultivated land was mainly converted into forest land and grassland, and some were converted into waters and construction land; forest land was mainly converted into cultivated land and grassland, and part of it was converted into waters and construction land. From 2000 to 2020, the center – of – gravity of cultivated land, forest land and construction land in Mojiang County moved to the southeast of the county, and the moving rates were 0.66, 1.97 and 10.58 km/yr, respectively; the center – of – gravity of grassland and waters moved to the southwest of the county, and the moving rates were 1.30 and 20.20 km/yr, respectively. Distance from road, distance from government and distance from waters are the main driving forces affecting land use change in Mojiang County; the forecast shows that in 2040, the area of grassland and forest land in Mojiang County will continue to decrease, the area of cultivated land will turn to rise, and the area of waters and construction land will continue to rise. [**Conclusions**] Reasonable planning and optimizing the allocation of cultivated land and forest land structure and strict control of the expansion scale of construction land are necessary measures to ensure the coordinated development of regional land rational use and economic construction.

Key words Land use change, Comparative analysis, Center of gravity, Prediction, PLUS model

1 Introduction

At present, the contradiction between human and land has become increasingly prominent, and the obvious reason for the change in regional land use pattern is the intensification of urban expansion. The most direct manifestation of human socio-economic activities is land use change. At the same time, land use change also reflects the interaction between human and nature. Exploring the characteristics and driving factors of land use pattern change in Mojiang County is of great significance to coordinating the contradiction between human and land in Mojiang County. According to Liu Chunhui's research[1], regional construction and cultivated land expansion are interdependent, and disorderly expansion will have an impact on regional agricultural development and grain output, and vice versa; based on multi-source remote sensing data, Ma Caihong *et al.*[2] found that ecological land was obviously occupied by production land and living land along the Yellow River Economic Belt in Ningxia. At present, land use change models mainly include Markov model, SD model, CA model, SLEUTH model, CLUE-S model, FLUS model and PLUS model[3]. Land use/land cover change has an important impact on the distribution of land resources and even social and economic development[4–5], while the limited number of land resources makes people feel a need for choosing a reasonable land use mode, fully understanding the change law of regional land use pattern and existing problems, and finding out the reasons to ensure the coordinated development of social and economic construction and sustainable land use. Based on the remote sensing images and socio-economic data of Mojiang County in 2000, 2005, 2010, 2015 and 2020, this paper discusses the characteristics and driving factors of land use change in Mojiang County in recent 20 years, and predicts the land use status in Mojiang County in 2040, which provides a theoretical basis for rational utilization and protection of land resources and mitigation of the contradiction between human and land in Mojiang County.

2 General situation of the study area and data sources

2.1 Overview of the study area Mojiang Hani Autonomous County is located in the south of Yunnan Province and the east of Pu'er City (22°51′ – 23°59′ N, 101°08′ – 102°04′ E). The county covers an area of 5 262.9 km^2, and the mountainous area accounts for 99.98%. Mojiang County has high mountains and deep rivers. The mountains in the territory are part of the Ailao Mountains, with the highest altitude of 2 278 m and the lowest al-

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titude of 440 m. The forest coverage rate is 66.29%, the annual average temperature is 18.2 ℃, the annual average rainfall is 1 322.7 mm, and the annual average number of sunshine hours are 2 129. In 2021, the resident population of Mojiang County was 276 600, and Hani accounted for 61.8% of the total population.

2.2 Data sources Land use data, soil type, population and GDP come from Resources and Environmental Science and Data Center of Chinese Academy of Sciences. After mask extraction and reclassification in ArcGIS 10.8 using Mojiang County vector data, the land use data of Mojiang Hani Autonomous County with spatial resolution of 30 m in 2000, 2005, 2010, 2015 and 2020 were obtained. According to the present situation of Mojiang County and research needs, the land use types are divided into five categories: cultivated land, forest land, grassland, waters and construction land. Social and economic data (boundary and administrative area, water system, traffic) come from the National Geographic Information Resource Catalogue Service System. Follow-up data processing was carried out in ArcGIS 10.8, and eight driving factors (distance from waters, distance from road, distance from government, GDP, soil type and population) were calculated by Euclidean distance. In order to ensure the normal operation of data in PLUS, the spatial resolution of all raster data was determined to be 30 m × 30 m, and the data were processed by unifying coordinate system and unifying column numbers.

3 Research methods

3.1 Dynamic degree of land use Dynamic degree of land use: It is used to quantitatively describe the quantitative dynamic changes of a certain land use type in the study area in a specific time range[6].

$$K = \frac{U_b - U_a}{U_a} \times \frac{1}{T} \times 100\% \quad (1)$$

where K represents the dynamic degree of land use change of a certain land use type; U_b and U_a represent the area (km^2) of the land use type after and before change, respectively; T represents the duration of the study (years).

3.2 Transfer matrix of land use types Land use transfer matrix[7-10] is to express the land use transfer area with matrix.

Based on this matrix, the mutual transformation between land use types is visualized, and the trend of area transfer is more obvious. It is mostly used to analyze the direction of land change. The mathematical form of the transfer matrix is as follows:

$$S_{ij} = \begin{vmatrix} S_{11} & S_{12} & \cdots & S_{1n} \\ S_{21} & S_{22} & \cdots & S_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ S_{n1} & S_{n2} & \cdots & S_{nn} \end{vmatrix} (ij = 1, 2 \cdots n) \quad (2)$$

where S is the area; i and j are the land use types at the initial stage and the end stage of the study, respectively; S_{ij} represents the area transferred from land i to land j.

ArcGIS 10.8 and Excel were used to process the data of land use types in five periods (raster to polygon, superposition analysis and pivot table), so as to establish the land use transfer matrix in five periods.

3.3 Land use center-of-gravity transfer model The land use center-of-gravity transfer model[11-13] is based on the principle of population and economic center-of-gravity. This paper uses this model to calculate the longitude and latitude, distance and transfer rate of the center-of-gravity of each land use type in Mojiang County in 2000, 2005, 2010, 2015 and 2020, to reflect the process, direction and speed of land use change in Mojiang County in the order of temporal and spatial change.

The calculation formula is as follows:

$$X_t = \frac{\sum_{i=1}^{n} (C_{t,i} \times X_{t,i})}{\sum_{i=1}^{n} C_{(t,i)}} \quad (3)$$

$$Y_t = \frac{\sum_{i=1}^{n} (C_{t,i} \times Y_{t,i})}{\sum_{i=1}^{n} C_{(t,i)}} \quad (4)$$

where X_t, Y_t are the longitude coordinates and latitude coordinates for center-of-gravity of a certain land use type in period t, respectively; n is the total number of patches of a certain land use type in period t; $C_{t,i}$ is the area of the land i in period t; $X(t, i)$, $Y_{(t,i)}$ are the longitude coordinates and latitude coordinates of land i in period t, respectively.

The calculation formula for measuring the transfer distance of center-of-gravity of a certain land use type in different periods is as follows:

$$D_{(i,b-a)} = [(X_{(i,b)} - X_{(i,a)})^2 + (Y_{(i,b)} - Y_{(i,a)})^2]^{1/2} \quad (5)$$

where $D_{(i,b-a)}$ is the transfer distance of the center-of-gravity of land use type i from period b to period a; $(X_{(i,b)} - X_{(i,a)})$, $(Y_{(i,b)} - Y_{(i,a)})$ is the coordinates for center-of-gravity of land use type i from period b to period a;

The calculation formula of center-of-gravity transfer rate of a certain land use type in different periods is as follows:

$$V_{(i,b-a)} = \frac{D_{(i,b-a)}}{(t_b - t_a)} \quad (6)$$

where $V_{(i,b-a)}$ represents the transfer rate of the center-of-gravity of land use type i; t_b, t_a represent the final stage of the study and the early stage of the study, respectively.

3.4 PLUS model PLUS model is a patch-level land use change simulation model, which is different from the previous cellular automata model. PLUS model is based on raster data, using random forest classification (RFC) algorithm to explore the contribution of various driving factors to the change of different land types, and deeply analyze the transformation rules of land use types. The PLUS model includes land expansion analysis strategy (LEAS) and CA model based on multi-type random patch seeds (CARS)[14-16].

3.4.1 Land expansion analysis strategy (LEAS). This strategy extracts the part of land use expansion between the two periods of land use change, takes samples from the added part, and explores the factors of land use expansion and driving force one by one by using RFC, so as to obtain the development probability of various land use types and the contribution of driving factors to land use expansion in this period.

The formula is as follows[17-19]:

$$P^{d}_{i,k(x)} = -P^{d}_{i,k(x)} = \frac{\sum_{n=1}^{M} I(h_n(x) = d)}{M} \quad (7)$$

where $P^{d}_{i,k(x)}$ is the development probability of land k in unit i; d has a value of 0 or 1, 1 indicates that there are other land use types changed to land use type k, and 0 indicates other transitions; x is a vector composed of multiple driving factors; i is the indicator function of the decision tree; $h_{n(x)}$ is the prediction type of decision tree n of vector x; M is the total number of decision trees.

3.4.2 CA model based on multi-type random patch seeds (CARS). In accordance with random seed generation and threshold decreasing mechanism, under the constraint of development probability, the automatic generation of patches is dynamically simulated in time and space[25].

The formula is as follows:

$$OP^{d=1,t}_{i,k} = P^{d}_{i,k(x)} \times \Omega^{t}_{i,k} \times Z^{t}_{k} \quad (8)$$

where $\Omega^{t}_{i,k}$ indicates the impact of future demand for the use of land k; Z^{t}_{k} represents the neighborhood effect of unit i, the neighborhood factor parameter is [0, 1], and the land expansion ability is directly proportional to the neighborhood factor.

The formula for neighborhood weight is as follows:

$$W_i = \frac{TA_i - TA_{min}}{TA_{max} - TA_{min}} \quad (9)$$

where W_i is the neighborhood weight of land use type i; TA_i is the expansion area of land type i in a certain period of time; TA_{max} and TA_{min} are the maximum and minimum values of the expansion area of all land types, respectively.

The neighborhood factor parameters of land use types in Mojiang County are as follows: cultivated land 0.27; forest land 1; grassland 0.84; waters 0.33; construction land 0.

3.4.3 Markov chain simulation prediction. Markov model[17] assumes that the land use type in period $t+1$ is only affected by the land use type in period t in the study of land use change, so as to simulate and predict.

The formula is as follows:

$$S_{t+1} = P_{ij} \times S_t \quad (10)$$

where S_t and S_{t+1} represent the current situation of land use in period t and period $t+1$, respectively; P_{ij} is a state transition probability matrix, which represents the probability that land type i will be transferred to land type j.

3.4.4 Accuracy verification. *Kappa* coefficient and *FOM* index are used to verify and evaluate the simulation results in 2040. In this paper, the Kappa coefficient is used to evaluate classification accuracy, and *FOM* is used to quantitatively test the simulation accuracy at the cell scale. The larger the value, the higher the accuracy.

The *FOM* value is generally 0.01 - 0.25, and the formula is as follows[20]:

$$FOM = \frac{B}{A+B+C+D} \quad (11)$$

where A = changed but wrongly changed; B = changed and correctly changed; C = predicted to be changed but actually unchanged; D = predicted to be unchanged but actually changed.

4 Results and analysis

4.1 Change characteristics and dynamic degree of land use composition and structure from 2000 to 2020 Table 1 shows the area of each land use type in Mojiang County from 2000 to 2020. Table 2 shows the dynamic degree of land use change in Mojiang County from 2000 to 2020. From Tables 1 and 2, it can be seen that forest land and cultivated land were the main land types in Mojiang County from 2000 to 2020, followed by grassland, waters and construction land. Among them, the area and proportion of grassland, waters and construction land were on the rise, while the area and proportion of cultivated land and forest land were on the decline. From 2000 to 2020, the dynamic degree of land use change in Mojiang County was relatively high in waters and construction land, followed by grassland, forest land and cultivated land. From 2000 to 2005, the dynamic degree of land use change in Mojiang County was relatively high in construction land, followed by grassland, cultivated land, waters and forest land; from 2005 to 2010, the dynamic degree of land use change in Mojiang County was relatively high in grassland and construction land, followed by forest land, cultivated land and waters; from 2010 to 2015, the dynamic degree of land use change in Mojiang County changed slightly, and the increase or decrease of area in various land types did not change significantly; from 2015 to 2020, the dynamic degree of land use change in Mojiang County was relatively high in waters and construction land, followed by forest land, grassland and cultivated land. In 2016, the water area increased significantly with the construction of water source projects and "Five-Small Water Conservancy Projects" in Mojiang County.

Table 1 Area of land use type in Mojiang County from 2000 to 2020 (km^2)

Land use type	2000	2005	2010	2015	2020	Fitted equation
Cultivated land	1 362.3	1 346.9	1 344.2	1 343.9	1 337.0	$Y = -5.36X + 1\,362.9$ $R^2 = 0.82$
Forest land	3 474.6	3 471.0	3 411.9	3 412.5	3 399.8	$Y = -20.81X + 3\,496.4$ $R^2 = 0.84$
Grassland	421.4	437.0	496.8	496.5	485.4	$Y = 18.75X + 411.17$ $R^2 = 0.69$
Waters	0.7	0.7	0.7	0.7	30.0	$Y = 5.86X - 11.02$ $R^2 = 0.50$
Construction land	4.0	7.3	9.4	9.4	10.7	$Y = 1.55X + 3.51$ $R^2 = 0.87$

4.2 Land use transfer matrix from 2000 to 2020 Table 3 shows the land use transfer matrices for 2000 - 2005, 2005 - 2010, 2010 - 2015, 2015 - 2020 and 2000 - 2020.

From 2000 to 2020, all land types were transferred to each other to varying degrees in Mojiang County, with the outflow of cultivated land and forest land, and the inflow of grassland, waters and construction land. The cultivated land was mainly converted into forest land, followed by grassland, waters and construction

Table 2 Dynamic degree of land use change in Mojiang County from 2000 to 2020 (%)

Year	Cultivated land	Forest land	Grassland	Waters	Construction land
2000 – 2005	–0.2	–	0.7	0.1	16.7
2005 – 2010	–	–0.3	2.7	–	5.8
2010 – 2015	–	–	–	–	–
2015 – 2020	–0.1	–0.1	–0.4	894.5	2.9
2000 – 2020	–0.1	–0.1	0.8	224.2	8.6

Table 3 Land use transfer matrix in Mojiang County (km^2)

Land use type	Grassland	Cultivated land	Construction land	Forest land	Waters	Area decrease
2000 – 2005						
Grassland	417.5	1.1	0.1	2.6	–	421.4
Cultivated land	13.9	1 338.1	2.2	8.1	–	1 362.2
Construction land	–	–	3.9	–	–	4.0
Forest land	5.6	7.7	1.1	3 460.3	–	3 474.6
Waters	–	–	–	–	0.6	0.7
Area increase	437.0	1 346.9	7.3	3 471.0	0.7	5 262.9
2005 – 2010						
Grassland	430.3	3.7	0.5	2.6	–	437.0
Cultivated land	18.3	1 306.9	2.2	19.5	–	1 346.9
Construction land	0.1	0.1	5.6	1.3	–	7.3
Forest land	48.1	33.4	1.0	3 388.5	–	3 471.0
Waters	–	–	–	–	0.6	0.7
Area increase	496.8	1 344.2	9.4	3 411.9	0.7	5 262.9
2010 – 2015						
Grassland	492.3	1.9	–	2.6	–	496.8
Cultivated land	1.8	1 332.5	–	9.8	–	1 344.1
Construction land	–	–	9.3	0.1	–	9.4
Forest land	2.4	9.4	0.1	3 400.0	–	3 411.9
Waters	–	–	–	–	0.6	0.7
Area increase	496.5	1 343.9	9.4	3 412.5	0.7	5 262.9
2015 – 2020						
Grassland	437.9	19.5	0.4	27.0	11.8	496.5
Cultivated land	19.8	1 211.0	1.2	104.4	7.5	1 343.9
Construction land	0.1	0.5	8.2	0.6	–	9.4
Forest land	27.6	106.0	1.0	3 267.7	10.1	3 412.5
Waters	–	0.1	–	0.1	0.5	0.7
Area increase	485.4	1 337.0	10.7	3 399.8	30.0	5 262.9
2000 – 2020						
Grassland	368.4	19.0	0.9	21.7	11.3	421.4
Cultivated land	45.6	1 193.1	5.0	111.3	7.2	1 362.3
Construction land	0.1	0.3	2.3	1.2	–	4.0
Forest land	71.2	124.5	2.6	3 265.5	10.9	3 474.6
Waters	–	0.1	–	0.1	0.5	0.7
Area increase	485.4	1 337.0	10.7	3 399.8	30.0	5 262.9

land; forest land was mainly converted into cultivated land, followed by grassland, waters and construction land. Comprehensive analysis shows that there was a strong mutual transfer process among cultivated land, forest land and grassland in Mojiang County from 2000 to 2020, which indicates that it was greatly influenced by the policy of "returning farmland to forest land and grassland". Due to the continuous advancement of urbanization and poverty alleviation, grassland, cultivated land and forest land have been continuously transferred into construction land in recent 20 years. From 2015 to 2020, in order to effectively solve the problem of drinking water safety for the poor, the Zhongye reservoir and Jingping reservoir were mainly implemented for the water source project construction in Mojiang County, and the Shanzhashu dam and "pond" projects were mainly implemented for the construction of the "Five-Small Water Conservancy Projects" in Mojiang County. The waters changed significantly, and the main sources of waters were cultivated land, forest land and grassland. From 2000 to 2020, the area of forest land and cultivated land in Mojiang County seriously decreased. Therefore, while paying attention to the effective connection between consolidating the achievements of poverty alleviation and difficulties tackling and rural revitalization, we should make steady progress in strict accordance with the requirements of ecology first, cultivated land second and economic development third, that is, "protection" – "survival"-"development", formulate scientific and rational land use plan, improve land use efficiency and realize sustainable development and utilization of land resources.

4.3 Characteristics of center-of-gravity transfer of land use types in Mojiang County from 2000 to 2020 Table 4 shows the coordinates for center-of-gravity of various land use types in Mojiang County from 2000 to 2020. 4 is the transfer rate and distance of center-of-gravity of various land use types in Mojiang County from 2000 to 2020. From Tables 4 and 5, it can be seen that from 2000 to 2020, the center-of-gravity of cultivated land, forest land and construction land in Mojiang County moved to the southeast of the county, and their moving rates were 0.66, 1.97 and 10.58 km/yr, respectively; the center-of-gravity of grassland and waters moved to the southwest of the county, and their moving rates were 1.30 and 20.20 km/yr, respectively. From 2000 to 2005, the transfer distance of center-of-gravity of construction land in Mojiang County was the largest, reaching 76.8 km, followed by grassland and forest land in turn; from 2005 to 2010, the transfer distance of center-of-gravity of construction land was the largest, reaching 96.9 km, followed by grassland, forest land and cultivated land; from 2010 to 2015, the transfer distance of center-of-gravity of forest land was the largest, reaching 2.2 km, followed by grassland and cultivated land; from 2015 to 2020, the transfer distance of center-of-gravity of waters was the largest, reaching 403.7 km, followed by construction land, forest land, cultivated land and grassland.

4.4 Patch-generating land use simulation (PLUS)

4.4.1 Driving factor analysis. Fig. 1 shows the contribution of driving factors of various land use types in Mojiang County. The land use data of 2000 and 2020 and 8 driving factors are used for land expansion analysis strategy (LEAS) analysis. The number of decision trees is 20, the sampling rate is 0.01, the number of features of RF training is 8, and the number of parallel threads is 1[20–21]. It can be seen from Fig. 1 that from 2000 to 2020, the driving factors that contributed greatly to land use change in Mojiang County were socio-economic factors: distance from road, distance from government and distance from waters. The reason may be that the areas around the government, on both sides of roads and near waters are usually the most active areas for population. Due to the intensification of urbanization, the trace of human activities must have an impact on the temporal and spatial evolution of land use. In the past 20 years, grassland, cultivated land and forest land in Mojiang County have been continuously transferred into construction land, and the center-of-gravity of cultivated land and construction land has gradually shifted to the southeast of the county, which also confirms the action intensity and mode of human-land relationship on the regional scale[22-23].

Table 4 Coordinates for center-of-gravity of various land use types in Mojiang County from 2000 to 2020 (°)

Year	Latitude and longitude	Cultivated land	Forest land	Grassland	Waters	Construction land
2000	East longitude	101.580	101.646	101.655	101.650	101.516
	North latitude	23.350	23.346	23.317	23.432	23.418
2005	East longitude	101.580	101.646	101.656	101.650	101.576
	North latitude	23.350	23.345	23.311	23.432	23.370
2010	East longitude	101.582	101.647	101.647	101.650	101.646
	North latitude	23.347	23.339	23.307	23.432	23.303
2015	East longitude	101.583	101.648	101.645	101.650	101.646
	North latitude	23.347	23.341	23.307	23.432	23.303
2020	East longitude	101.589	101.645	101.645	101.577	101.654
	North latitude	23.341	23.311	23.299	23.035	23.266

Table 5 Transfer rate and transfer distance of center-of-gravity of various land use types in Mojiang County from 2000 to 2020

Land use type	Transfer rate//km/yr					Transfer distance//km			
	2000-2005	2005-2010	2010-2015	2015-2020	2000-2020	2000-2005	2005-2010	2010-2015	2015-2020
Cultivated land	-	0.72	0.20	1.70	0.66	-	3.6	1.0	8.5
Forest land	0.20	1.22	0.44	6.02	1.97	1.00	6.1	2.2	30.1
Grassland	1.22	1.96	0.40	1.60	1.30	6.10	9.8	2.0	8.0
Waters	-	-	-	80.74	20.20	-	-	-	403.7
Construction land	15.36	19.4	0	7.60	10.58	76.80	96.9	-	37.9

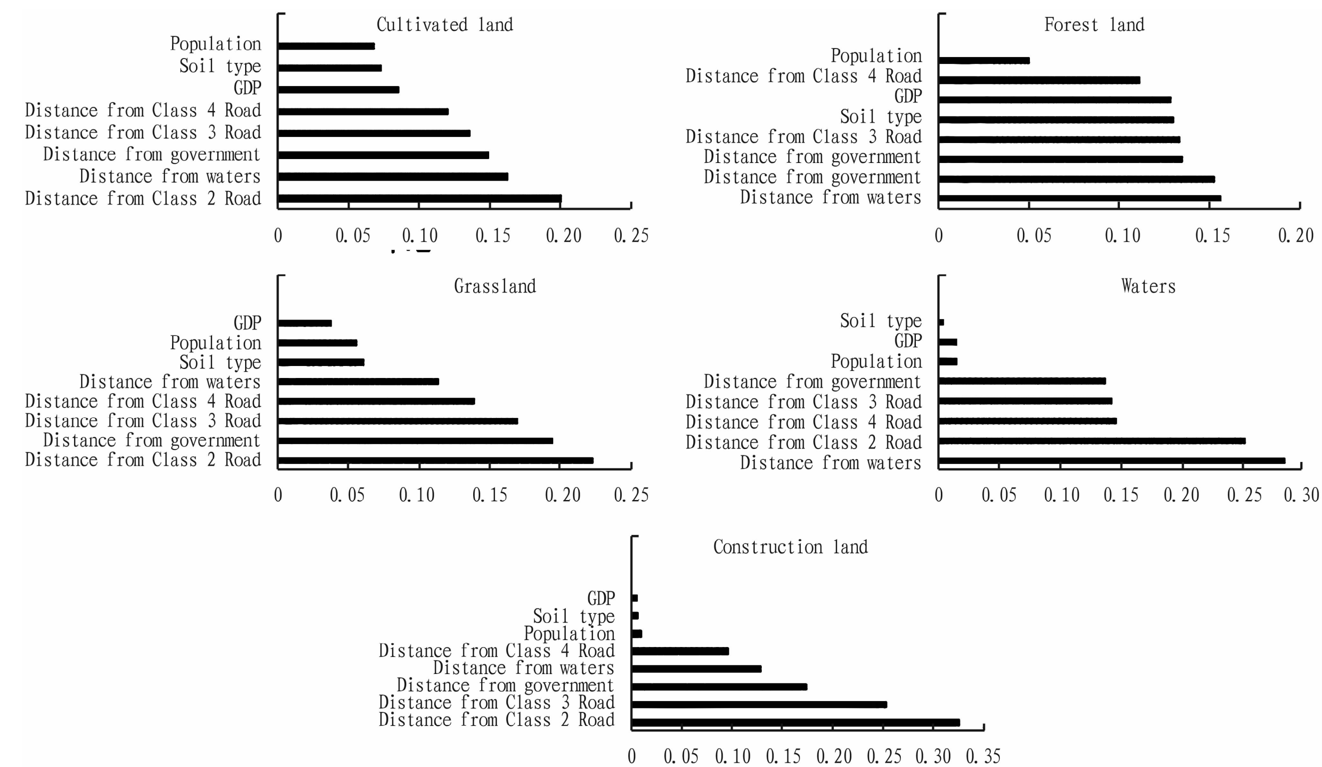

Fig. 1 Contribution of driving factors of various land use types in Mojiang County

4.4.2 Simulation results and evaluation. Using two periods of land use data in 2000 and 2020 to simulate 2040, the overall accuracy is 93.1%, *Kappa* = 0.863; in FOM, $A = 399\ 225$, $B = 77\ 677$, $C = 4\ 302$, $D = 78$, $FoM = 0.161$, the user accuracy is 0.947, the producer accuracy is 0.161, indicating that the land use data in 2040 simulated by PLUS model has high accuracy. Table 6 shows the area of various land use types in Mojiang County in 2020 and 2040. It can be seen from Table 6 that in 2040, the area and proportion of grassland and forest land in Mojiang County show a downward trend, while the area and proportion of cultivated land, waters and construction land show an upward trend; compared with the land use situation in 2020, the land use structure will be relatively stable.

Table 6 The area of various land use types in Mojiang County in 2020 and 2040 (km^2)

Year	Cultivated land	Forest land	Grassland	Waters	Construction land
2020	1 337.0	3 399.8	485.4	30.0	10.7
2040	1 502.4	3 385.2	305.5	55.2	14.7

5 Conclusion

Based on PLUS model, this paper uses ArcGIS to measure the dynamic degree of land use, land use transfer matrix, land use center-of-gravity transfer and change, and constructs a driving factor mining framework for analysis. The results show that the dynamic degree of cultivated land and forest land was negative from 2000 to 2020, indicating that the area of cultivated land and forest land decreased continuously in the past 20 years, and then there was a sharp transformation for cultivated land and forest land, and both of them were transferred out in turn by transforming into grassland, waters and construction land; the transfer rate and transfer distance of the center-of-gravity of waters and construction land changed significantly; the distance from road, distance from government and distance from waters contributed a lot to the change of land use type in Mojiang County; compared with 2000, forest land area will decrease by 14.6 km^2 in 2040, grassland area will decrease by 179.9 km^2, indicating that the forest land and grassland show a continuous decline trend in the next 20 years, the waters and construction land continued to expand, and the decline trend of cultivated land slowed down and turned into a significant increase. By summarizing and analyzing the land use change law and simulation prediction in Mojiang County from 2000 to 2040, it is found that the transformation from grassland and forest land to construction land, cultivated land and waters is still the main direction of land use change in Mojiang County in the next 20 years. There is still a risk that the contradiction between social and economic development and nature protection will intensify in Mojiang County. Slowing down the degradation rate of forest land and grassland, controlling the expansion scale of construction land and preventing the use of cultivated land for non-agricultural purposes are still important means to ensure the coordinated development of rational land use and economic construction in Mojiang County.

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