



Analysis of agricultural land classification results supported by GIS--Tabai County, Baoji City as an example

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Abstract: GIS has powerful ability to process spatial data and attribute data. The application of GIS technology to agricultural land classification can not only reduce a lot of tedious calculation work, but also greatly improve the speed and accuracy of classification. Based on GIS, the results of agricultural land classification in Taibai County of Baoji City are used as an example to illustrate the process of agricultural land classification and to analyze the reasons why agricultural land in Taibai County is mostly concentrated in 9th and 13th class.

Keywords: Agricultural land classification; Telfer method; natural quality score; classification unit.

1. Introduction

Agricultural land grade evaluation refers to the process of using multiple factors to comprehensively assess and grade the characteristics of agricultural land in a specific region. Agricultural land ranking can provide a basis for agricultural policy making, agricultural land development and finishing, arable land balance in land management and its agricultural tax reform. This paper takes Taibai County in Shaanxi Province, where agricultural land is graded, as the research object, and combines ArcGIS software to explore the county agricultural land grading method and result analysis.

2. Overview of the study area

Taibai County is located in the southeast of Baoji City, named after the main peak of the Qinling Mountains, Taibai Mountain, which is located in its territory. The geographical coordinates are between 107°03′-107°46′40 "E and 33°38′13"-34°09′55 "N. It is located in the middle and high mountains of the Qinling Mountains. It is located in the middle and high mountains of the Qinling Mountains and straddles two major water systems, the Yangtze River and the Yellow River. It borders Meixian, Zhouzhi and Foping in the east, Yangxian and Liuba in the south, Fengxian in the west, and Chencang, Qishan and Weibin in the north. The total length from east to west is 66.7 kilometers, and the width from north to south is 53.4 kilometers. The total population is 52,521 and the arable land is 105,555.0 mu, with 2.0 mu per capita.

3. Technical methods and routes

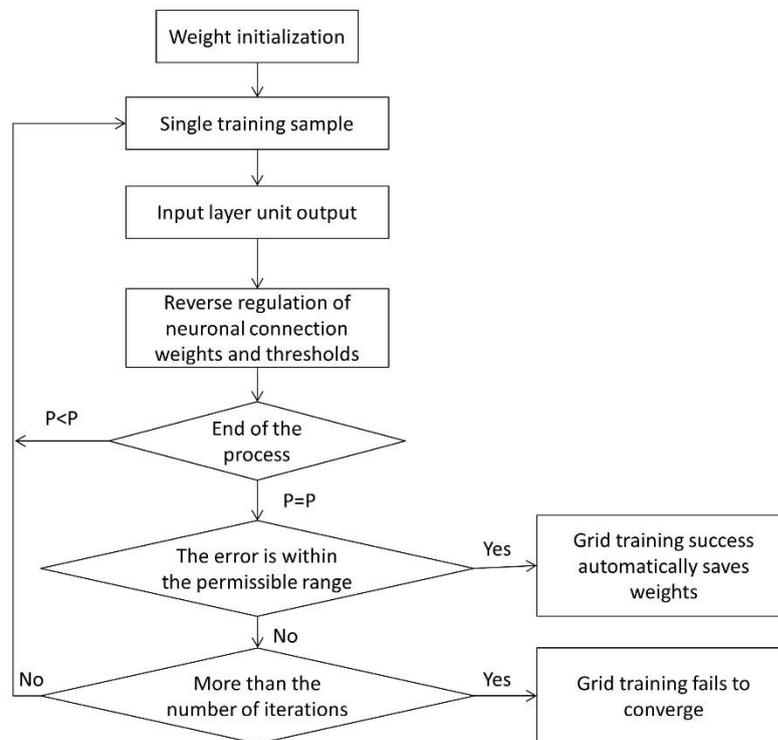


Figure 1 Technical roadmap for agricultural land classification in Taibai County

4. Determination of grading-related parameters

4.1 Division of the index area

Taibai County is located in a region where the national level indicator area is Loess Plateau area, the national level 2 indicator area is Fenwei Valley area, and the level 3 indicator area in Shaanxi Province is Guanzhong Weihe Plain area.

4.2 Baseline crops and farming system

The designated crops in Taibai County are still the same as the designated crops in the last round of agricultural land classification, which are: winter wheat and summer corn [1]. The standard farming system is "winter wheat-summer corn", and the replanting type is "one year, two years".

4.3 Determination of grading factors and their weights

The weighting system of cropland classification factors of designated cropland in each index area in Shaanxi Province is determined by using the Tel illegal. The classification factors and their weights of designated cropland in Guanzhong Weihe Plain, where Taibai County is located, are shown in Table 1.

Table 1 Table of factors and weights of designated crop grades in Taibai County

Factors Crop	Effective soil thickness	Surface soil texture	Soil organic matter content	PH value	Topographic slope	Irrigation guarantee	rate Rock outcrop degree
Winter wheat	0.27	0.09	0.21	0.07	0.24	—	0.12
Spring corn	0.28	0.08	0.23	0.06	0.24	—	0.11

4.4 Establishment of database

Based on the 2010 land use status map and the land use change database, the GIS professional software ArcMap was used to extract arable land from the land use change survey database, add basic element layers such as administrative boundaries and line features, and add attributes (village name, township name and county name) to the element layers in combination with the 2010 administrative division map of Taibai County, and add In the same way, we extracted village and township residential land from the 2010 land use status map; finally, we added map names, legends, compasses, location maps and other finishing elements and exported the map as the base map of the arable land classification unit. The working base map of the arable land classification unit is chosen at a scale of 1:10,000, which is consistent with the accuracy of the current land use survey.

4.5 Determination of grading units

The plot method is to divide the relatively homogeneous plots into closed plots with obvious features and tenure boundaries on the base map, i.e. the evaluation unit of agricultural land classification. The arable land plots on the status quo map of the 2010 Land Use Status Change Survey were used as the grading units for this grading of arable land, with a total of 9,452 grading units. The total area of agricultural land classification unit is the sum of the area of the spot class and the area of fragmented features of arable land, totaling 28,600.66 hectares.

5. Calculation of grading index

5.1 Calculation of natural quality score of agricultural land

The designated crops in Taibai County are winter wheat and summer corn, and the effects of the eight selected grading factors on their yields are basically the same. The weighted average method was used to calculate the natural quality score of agricultural land for the designated crops in each sub-grade unit.

5.2 Calculation of land use coefficients in Taibai County

Land use coefficients were calculated in administrative villages. Three sample points were set up in administrative villages according to good, medium and poor land, and the actual yields of designated crops in each point were counted, and the land use coefficients of designated crops in each point were calculated first. The highest yields of designated crops in the Weihe Plain area of Guanzhong, where Taibai County is located, were 550 kg/mu for winter wheat and 650 kg/mu for summer corn [2]. Based on the calculation results of land use coefficients of designated crops at various points within administrative villages, the arithmetic average method was used to calculate the land use coefficients of designated crops for each administrative village again.

Table 2 Summary results of agricultural land classification area in Taibai County

Rank	Total	
	Area(h)	Ratio(%)
9	10348.08	36.18%
10	6.36	0.02%
11	878.41	3.08%
12	3189.67	11.15%
13	9635.13	33.69%
14	4543.01	15.88%
Total	28600.66	100.00%

5.3 Calculation of land economic coefficients in Taibai County

The land economic coefficient is also calculated by administrative villages. Three sample sites were set up in administrative villages according to good, medium and poor land, and the actual input of each designated crop was counted at each site, i.e., the actual cost. First, the "yield-cost" index of each designated crop was calculated, and then the land economic coefficient of the designated crop was calculated. The maximum "yield-cost" index of designated crops in the Weihe Plain of Guanzhong County, where Taibai County is located, is 0.84 for winter wheat and 1.13 for summer maize, and the economic coefficient of designated crops in each administrative village is calculated by arithmetic average based on the results of the economic coefficients

of designated crops in each administrative village. Finally, the economic coefficients of the designated crops in each administrative village were calculated by arithmetic average.

6. Conclusion

According to the above results, it can be seen that the total area of agricultural land in Taibai County is 28,600.66 hectares, and according to the final classification results, the grade of agricultural land ranges from 9 to 14, among which the proportion of 9-class land is larger, with a total area of 10,348.08 hectares, accounting for 36.18% of the total arable land in the county; the areas of 10, 11, 12 and 14-class land are 6.36, 878.41, 3189.67 and 4543.02 hectares, accounting for 0.02%, 3.08%, 11.15% and 15.88% of the county's total arable land area; and 9,635.13 hectares of 13th-class land, accounting for 33.69% of the county's total arable land area. The spatial distribution of arable land quality in Taibai County shows that the arable land with higher grade is mainly distributed in the alluvial plain area where the terrain is flat and along the river. Because the arable land in this area has a strong ability to retain water and fertilizer, fertile soil, abundant water resources and a high guarantee rate of irrigation, more watered land is distributed; moreover, because there are often roads extending near this area, convenient transportation, complete ditch support facilities, high agricultural production input and high production motivation of farmers, the natural quality, utilization and economic grade of arable land are relatively high. In contrast, the southern Loess Plateau and Qinling Mountain areas are not only affected by the natural environment, but also by economic and regional constraints, and the quality of arable land is generally not high. Most of the arable land of low grade is located in places with sloping terrain and poor irrigation conditions, which are not conducive to the growth of crops due to the lack of water resources and are controlled by the terrain, resulting in insufficient inputs and low utilization of agricultural production and incompletely developed production capacity. In addition, there are also some places where the phenomenon of abandoning cultivation of abandoned arable land has occurred. As farmers' enthusiasm for production decreases, the investment in arable land and its infrastructure also decreases, resulting in a decline in the quality of arable land compared with before, and will continue to decline even in the future. Finally, after field verification, the grading results are more in line with the objective reality of Tai Bai County.

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