Category Analysis of Management and Development of Low Hilly Red Soil: A Case Study of Lishui City, Zhejiang Province

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Abstract: In order to improve the level of management and development of low hilly red soil, through sharing regional infrastructure, optimizing land development mode and achieving efficient, intensive and rational utilization, it is necessary to analyze the types of management and development. Lishui City, Zhejiang Province, has relatively little early development and insufficient investment. It is a key area for the control and development of low hilly red soil during the 13th Five-Year Plan period. Based on the principal component analysis of the area of crop species and their influencing factors in the low hilly red soil of the region, it is concluded that grain and cash crops are the main development directions, and they are the local superior products such as tea, camellia and Orange citrus, as well as the main characteristic agricultural development directions.

1. Introduction

Since the last century, scientists of various disciplines have carried out extensive research on land change and cover from the perspective of their own disciplines, showing a trend of multi-disciplinary and multi-field cooperation.

With the rapid development of economic construction and the rapid growth of population, the number of cultivated lands in Zhejiang Province has been decreasing. Due to the restriction of economic and technological conditions at that time, many low hilly red soil areas have been developed, with weak infrastructure and unreasonable utilization methods. In order to further improve the comprehensive utilization rate of low hilly red soil resources, and thus to improve the ecological environment, agricultural comprehensive productivity and water and soil conservation capacity of low hilly red soil areas, it is necessary to conduct in-depth study on the driving factors of the management and development of low hilly red soil in Zhejiang Province.

2. Method

2.1 Research Area

Based on the results of the land resources survey in Zhejiang Province, this study used the data of agricultural production resources of various counties and cities directly to analyze and evaluate the potential of land development and utilization and management, so as to provide decision-making basis for better rational utilization of red soil resources in low hills.

The research scope covers the key areas of the management and development of red soil in low hills in Zhejiang Province. There are 9 counties and cities under the jurisdiction of Lishui City, including Liandu District, Qingtian County, Jinyun County, Suichang County, Songyang County, Yunhe County, Qingyuan County, Jingning County and Longquan City.

2.2 Data Collection

The statistical yearbook of Lishui City in 2014 was selected as the basic data source, and the index of agricultural planting area data in the study area was selected as the social and economic

factors affecting the change of management and development of low hilly red soil. The main components were reflected by principal component analysis.

2.3 Data Audit and Screening

In order to ensure the quality of the data and lay a foundation for further analysis and collation, it is necessary to audit the statistical data first. The integrity and accuracy of the original data obtained by direct investigation should be examined. Integrity audit is mainly to check whether the units or individuals should be investigated have omissions, whether all the survey items or indicators are completed, etc. Accuracy audit mainly includes two aspects: one is to check whether the data truly reflects the objective reality and whether the content conforms to reality; the other is to check whether the data is wrong and whether the calculation is correct. The main methods of checking data accuracy are logical checking and computational checking. Logical checking examines whether the data conforms to logic, whether the content is reasonable, and whether there are contradictions between the various phenomena, which is suitable for the audit of qualitative data. Calculating and checking is to check whether the data in the questionnaire have errors in the calculation results and calculation methods, which is suitable for the verification of quantitative data（Yuan Wei,2015）.

2.4 Sample Descriptive Statistics

Based on the data of regional grain and sown area of main cash crops, the main influencing factors of cultivated land development were analyzed quantitatively in order to study the change of utilization and quality of low hilly red soil, so as to better guide the management and development of low hilly red soil, and to achieve high-efficiency and sustainable utilization of cultivated land while improving the productivity of hilly red soil. It provides scientific basis for the sustainable development of regional social economy. As shown in Table 1, the mean, maximum, minimum and standard deviation of grain and major cash crops planted area in the sample area are calculated.

3. Principal Component Analysis

The results of principal component analysis of driving factors for management and development of low hilly red soil are as follows:

3.1 Standardization of Evaluation Indicators

Because many factors such as grain, vegetable, fruit and other cash crops are included in the evaluation index system, these data have different dimensions. In order to evaluate each index comprehensively, it is necessary to deal with the data dimensionlessly.

3.2 Extraction of Indicator Principal Components

Taking 9 counties as samples, such as Liandu District, Qingtian County, Jinyun County, Suichang County, Songyang County, Yunhe County, Qingyuan County, Jingning County and Longquan City, and taking the standardized data of indicators in the table as evaluation data, data analysis software was used to process the data, and the correlation coefficient matrix, the characteristic value of the matrix, the variance contribution rate and the factor load matrix of the indicators were obtained. The principal component is extracted by the cumulative contribution rate of the eigenvalue. The principal component can contain a large amount of information of the original variables. The standardized data in the table are transformed into correlation coefficient matrix, variance of each eigenvalue, cumulative contribution rate and factor load matrix after factor analysis.

3.3 Factor Analysis

Fourteen variables, including total sown area of crops, total area of grain, total area of legumes, potatoes, rapeseed, medicinal materials, vegetables, watermelon, mulberry garden, tea garden, orchard, citrus orchard, peach orchard and so on, were used as analysis indicators. They are representative to some extent. The specific situation is shown in Table 1.

After input the above variables by SPSS statistical analysis software, the correlation coefficient matrix between these original variables is obtained, and the correlation analysis results have different degrees of correlation. The correlation coefficients between other factors are in different distributions.

Table 2 gives the commonalities of 14 original variables. Variable commonality can reflect the dependence of multiple variables on all common factors extracted. From Table 1, except for variables X1, X2, X4, X6, X7, X8, X10, X12 and X13, the commonalities of all variables are less than 90% and higher than 56%. This fully shows that the common factors extracted below can contain most of the information of the original variables, and the extraction effect will be very ideal.

Table 1. Common degree of variables

	Initial	Extract
X1	1.000	.901
X2	1.000	.935
X3	1.000	.804
X4	1.000	.901
X5	1.000	.560
X6	1.000	.926
X7	1.000	.995
X8	1.000	.917
X9	1.000	.885
X10	1.000	.912
X11	1.000	.803
X12	1.000	.914
X13	1.000	.922
X14	1.000	.844

Extract method: principal component analysis

According to the requirement of principal component analysis, the principal component can be selected as long as the eigenvalue is greater than 1 and the cumulative contribution rate is higher than 80%. From the column of eigenvalues and cumulative contribution rate of variance in table 2, we can see that the cumulative contribution rate of the first four factors has reached 87.283%. Therefore, this part chooses four principal components, i.e. the first, second, third and fourth common factors. The factor load matrix column gives the variance contribution rate of the extracted four principal components after rotation. It can be seen that although the contribution rate of the four common factors has changed after rotation, the total cumulative variance contribution rate of the four factors has not changed, which is still 87.283%.

According to the previous results, because the contribution rate of the first common factor is particularly large, the public factor (the first principal component) is significant in the indicators X1 total crop area, X2 grain area, X3 grain area, X7 medicinal plant area and X8 vegetable area. The above indicators are mainly cultivated land, especially grain crops. Therefore, in the process of harnessing and opening red soil in low hills of Lishui City, cultivation is necessary. The types of land planning should not be neglected.

Table 2. Cumulative contribution of eigenvalue and variance

Component	Initial eigenvalue			Extraction of sum of squares		
	Total	Variance %	Cumulative%	total	Variance %	Cumulative %
1	5.026	35.899	35.899	5.026	35.899	35.899
2	3.574	25.528	61.427	3.574	25.528	61.427
3	2.379	16.990	78.418	2.379	16.990	78.418
4	1.241	8.865	87.283	1.241	8.865	87.283
5	.734	5.246	92.528			
6	.474	3.383	95.911			
7	.400	2.860	98.771			
8	.172	1.229	100.000			
9	2.212E-16	1.580E-15	100.000			
10	1.592E-16	1.137E-15	100.000			
11	6.453E-17	4.609E-16	100.000			
12	1.672E-17	1.194E-16	100.000			
13	-2.388E-17	-1.706E-16	100.000			
14	-3.293E-16	-2.352E-15	100.000			

Extract method: principal component analysis.

The second common factor (the second principal component) was significant in index X10 mulberry orchard area, X11 tea orchard area, X12 orchard area and X13 citrus area, all of which were economic trees and fruits. Lishui city is mountainous, low hilly red soil distributes at relatively high altitude and large slope, so the development of economic forests and fruits still needs attention. The third common factor (the third principal component) was significant in the index X4 bean area, X6 rape area and X9 watermelon area; the fourth common factor (the fourth principal component) was significant in the index X14 peach orchard area. The third and fourth factors include both cultivated land and economic forest and fruit, which shows that in the process of management and development of low hilly red soil in Lishui City, besides cultivated land and economic forest and fruit, there are other components in it. Therefore, attention should also be paid to other types of cultivated land. The factors covered by these four principal components basically coincide with the previous qualitative analysis.

4. Analysis and Discussion

Based on the above analysis, the main types of land development in the main distribution areas of low hilly red soil in Zhejiang Province are as follows:

From the cluster analysis, we can see that Lishui City has relatively little early development and insufficient investment. This region is the key area of red soil treatment and development in the 13th Five-Year Plan period. According to the principal component analysis, the factors affecting the management and development of low hilly red soil in Lishui City are more complex than those in the other two cities. Therefore, the cultivation of arable land and cash crops need to be paid more attention to. At the same time, the development of agriculture with Lishui characteristics should be focused on and supported in tea, camellia oil and potato orange and other local superior products.

In the next stage of management and development of low hilly red soil, emphasis should be laid on strengthening the development of cash crops and economic trees and fruits, enhancing

agricultural output and improving the comparative benefits of management and development of low hilly red soil.

Table 3. Factor load matrix

	Component			
	1	2	3	4
X1	-.646	.218	-.515	-.412
X2	.866	.367	.218	.050
X3	-.695	.563	.067	-.019
X4	-.250	.216	.887	.075
X5	-.424	-.334	-.065	.514
X6	.385	-.547	.683	.113
X7	.727	.405	-.469	.287
X8	.922	-.163	.079	.183
X9	-.193	.618	.681	-.033
X10	-.316	.843	.305	.090
X11	-.228	.701	.480	-.173
X12	.446	.672	-.489	.155
X13	.350	.620	.362	-.533
X14	-.383	.221	.571	.568

Extract method: principal component analysis

A. Four components have been extracted.

4.1 Raise the Standard of Construction Funds Subsidy

Agricultural financial subsidy is mainly used to strengthen infrastructure construction and agricultural production subsidy for farmers in low hilly red soil region. In addition to improving field irrigation and road system, the construction of land facilities in low hilly red soil should be planned to build a number of facilities related to agricultural products sales and circulation, such as vegetable fresh storage, grain storage, wholesale and trade center of agricultural products, etc. To mobilize the enthusiasm of farmers in the low hilly red soil region to participate in the construction of farmland water conservancy, land improvement and land conversion, to establish a labor accumulation mechanism for farmers to work, and to stimulate the enthusiasm of farmers in the low hilly red soil region to pay attention to agriculture and develop agriculture.

4.2 Improving the Infrastructure of Farmland and Water Conservancy

We should work out and improve the planning of farmland water conservancy construction in the low hilly red soil region, and promote the construction and management of farmland water conservancy projects in the low hilly red soil region as a whole. Subsidy funds for small-scale irrigation and water conservancy projects will be substantially increased, and the transformation of the last canal system and the construction of small-scale drainage facilities in large and medium-sized irrigation areas will be included in the scope of the subsidy. Focusing on rainwater harvesting and utilization, a small-scale drought-resistant water source project in low hilly red soil region was constructed. In the form of rewards and subsidies, farmers will be mobilized to construct small-scale farmland water conservancy projects. Encourage farmers to apply advanced water-saving irrigation technology, guide and support farmers to develop water-saving agriculture, and change the traditional practices of serious waste of water resources such as flooding irrigation. Promote the

property right system reform of small-scale farmland water conservancy projects in low hilly red soil region, explore the management system reform methods of non-profit rural water conservancy projects in low hilly red soil region, and clarify the main body of construction and responsibility of management and protection.

4.3 Promoting the Application of Agricultural Machinery and Equipment

Promoting Agricultural Mechanization in low hilly red soil region is an urgent need to change the mode of agricultural production, and provides an important opportunity for the revitalization of agricultural machinery industry. We will accelerate the mechanization of grain crop production throughout the process and steadily develop the mechanization of crop production and aquaculture in the low hilly red soil region. It is urgent to strengthen the research and development of advanced and suitable agricultural machinery for production, focusing on accelerating its popularization and application in major grain producing areas. Supporting the development of agricultural machinery farmers, Agricultural Machinery Cooperatives and agricultural machinery professional service companies in the low hilly red soil region. Strengthen the supervision of agricultural machinery safety.

4.4 Implementing Agricultural Ecological Protection and Construction

In-depth implementation of low hilly red soil regional agricultural ecological protection and other projects. We should improve and perfect the management methods of various kinds of funds for ecological compensation in low hilly red soil region, implement the performance evaluation system and audit system, and assess and audit the use of ecological compensation funds in low hilly red soil region, so as to ensure the safety and effectiveness of funds. In order to stimulate the internal motive force of cadres and masses at all levels to protect the ecological environment, the index of ecological protection in low hilly red soil region should be included in the comprehensive evaluation system of economic and social development and the comprehensive assessment and evaluation system of leading cadres.

4.5 Promoting the Development of Agricultural Land Consolidation Project

Land development and consolidation refers to the use of special financial funds to reclaim unused land and abandoned land suitable for agriculture in rural areas, and to carry out comprehensive consolidation of fields, water, roads, forests and villages in order to increase the area of effective cultivated land and improve the quality of cultivated land. Through the implementation of the land development and consolidation project in the low hilly red soil region, the effective cultivated land area will be continuously increased, the comprehensive agricultural production conditions will be improved, and the new rural construction and local economic and social development will be promoted. Through the method of regional consolidation of low hilly red soil, leveling and construction of field water conservancy facilities, field roads and field shelter forests were carried out in the low hilly red soil area, which met the requirements of field formation, canal connection, road connection, forest formation, irrigation and drainage, and improved farmland production conditions.

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