

China-NIAHS Perspective of Ancient Jujube Forest in Sichuan Plateau of Lingbao, Henan Province Study on the Characteristics of Landscape Spatial Pattern

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Abstract: Based on the research background of China's important agricultural cultural heritage perspective (China-NIAHS), this paper takes the landscape of the ancient jujube forest in Lingbao City, Henan Province as the research object, and uses the landscape pattern index analysis method in landscape ecology to analyze spatial pattern characteristics of the ancient jujube forest in Lingbao City. The results show that: (1) Jujube forest accounts for the largest proportion of all landscape types. Jujube forest, as the dominant landscape type in the study area, plays a supporting role in the study of landscape pattern characteristics in the whole area. (2) The spatial distribution of jujube forest is closely related to the distribution of roads and settlements in the study area. The jujube forest accounts for a large proportion of the total landscape area in the study area. From the characteristics of the number of patches, it can be seen that the jujube forest has low fragmentation and the landscape distribution is concentrated. (3) From the landscape shape index, it can be seen that the complexity of jujube forest patches is low, the artificial effect is obvious, and the shape is regular; in addition, from the analysis of the spatial adjacency characteristics of the landscape, the correlation between the distribution of jujube forest landscape and other landscape elements can also be proved again. The research results have certain guiding and reference significance for the protection and development of agricultural cultural heritage, the development and utilization of agricultural landscape resources and rural revitalization.

Keywords: China's important agricultural cultural heritage; Lingbao Chuanyuan ancient jujube forest; Landscape pattern index; Landscape patch characteristics.

1. Introduction

Agricultural heritage is a new type of industry. It is an agricultural production system created and applied in the long-term production and life practice of human beings and their environment. This unique system has immeasurable scientific value and practical significance for the continuation of agricultural culture, the improvement of agriculture and the innovation of agricultural technology. China has a history of more than ten thousand years of agricultural development. It is one of the important origins of world agriculture and has created a unique agricultural technology system and knowledge system. China's vast geographical area, the birth of a distinctive important agricultural cultural heritage, with high historical value and social value, for the study of China's agricultural heritage has laid a certain foundation.

With the rapid development of industrialization and urbanization, there are inevitably problems such as the destruction of agricultural biodiversity, the loss of traditional knowledge and technology systems, and the destruction of ecological and cultural landscapes. The sustainable development of agriculture has received widespread attention from countries around the world. The research on agricultural heritage has also set off a wave of upsurge. In 2002, the initiative launched by the FAO to protect agricultural heritage provided strategic support for the establishment of the Globally Important Agricultural Heritage Systems (GIAHS) [1]. In 2012, China's Ministry of Agriculture and Rural Affairs launched the excavation and protection of China's important agricultural cultural heritage (China-NIAHS), and the management and protection of GIAHS and China-NIAHS are increasingly standardized [2]. In the research progress of agricultural heritage in China, the research on 'rice-fish

symbiosis system ' reflects the important role of agricultural cultural heritage value in the protection and use of agricultural cultural heritage [3]. Under the background of new research, in the practice of agricultural cultural heritage protection, it is necessary to combine interdisciplinary comprehensive research, social science and natural science, theory and practice [4]. From 2010 to 2011, some agricultural heritage in Yunnan, Jiangxi and Guizhou provinces have also been listed as conservation pilots [5]. China's protection work is in a leading position in the world, and has made significant achievements in all aspects, especially in the solution of the three rural issues, which is reflected in the improvement of rural environmental quality, the improvement of farmers living standards, the adjustment of rural economic structure and the development of farming culture [6]. The protection of agricultural heritage is becoming more and more perfect, and the protection of agricultural heritage in China is valued at the grass-roots level, which also reflects the sense of belonging to traditional agricultural culture [7].

This paper takes the typical plain agricultural landscape-ancient jujube forest landscape in Lingbao Chuanyuan of Henan Province as the research object. Based on the principles and research methods of landscape ecology, from the perspective of global important agricultural cultural heritage, this paper analyzes the landscape spatial pattern characteristics of ancient jujube forest in Lingbaochuan tableland of Henan Province, the relationship between landscape resources and local farming culture, and explores the multiple values of agricultural cultural heritage of ancient jujube forest, in order to provide guidance for the protection and development of agricultural cultural heritage.

2. Overview of the study area

Lingbao Chuanyuan ancient jujube forest is located in Dawang Town, Lingbao City. Dawang Town of Lingbao City is located in the monsoon climate zone. The precipitation is concentrated in summer and autumn. From the perspective of agricultural production, the climate conditions basically meet the needs of local jujube growth. The jujube garden in the study area is mainly composed of the ancient jujube forest in the Ming and Qing Dynasties. The jujube garden is scattered behind the villagers' houses. The jujube garden is mainly distributed in the ancient battlefield and the surrounding township areas. Dawang Town is the origin and main producing area of Lingbao jujube. The area of the topography of Lingbao City and its proportion in the total land area are detailed (Table 1). The surface morphology of the study area is high in the south and low in the north. Affected by the geological movement, the surface morphology of Lingbao City is mainly composed of mountains, soil and river terraces, and the geomorphological characteristics show 'seven mountains, two plains and one river'.

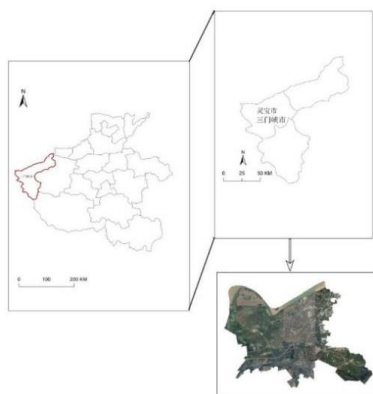


Fig. 1 Location of study area

Table 1. The area and proportion of each terrain in Lingbao City

Terrain	Land area (square kilometers)	Proportion of total land area (%)
Mountain	1481	49.2%
Hills	1208	40.1%
Plain	322	10.7%

2.1. Research Methods and Data Processing

2.1.1. Data Sources and Processing

The data used in this paper mainly include the spatial data of jujube forest distribution in Dawang Town, Lingbao City, terrain data, vector data, RS data, and derived GIS data. Combined with quantitative analysis, image analysis and landscape index analysis, the landscape spatial pattern of ancient jujube forest was analyzed from the perspective of quantity and space. The study used the land use map of Dawang Town in Lingbao City in 2020 and the landscape pattern index calculated by fragstats software provided by the geographical condition's detection cloud platform as the basic data.

2.1.2. Selection of landscape pattern index

The landscape pattern index is used to reflect the composition of the landscape and the spatial characteristics of the landscape pattern. In fact, the numerical value is used to reflect the spatial information of the landscape and analyze the spatial characteristics of the landscape pattern. This paper cites the following landscape pattern index to illustrate the layout characteristics of the ancient jujube forest landscape in Lingbao City (Table 2). Different landscape types were divided, and the landscape of Lingbao City was divided into six landscape types: jujube forest, construction land, water area, grassland, woodland and farmland by referring to the commonly used classification system of land use status and combining with the specific situation of ancient jujube forest in Sichuan Plateau of Lingbao City (Fig.2).

Table 2. Pattern index and its ecological significance

Indicators	English abbreviation	unit	Ecological significance
Plaque area percentage	PLAND	%	Advantage types in index landscape
Number of plaques	NP	-	Indicates the fragmentation of the landscape --
Plaque edge	PD	/1000hm2	Indicates the degree of landscape fragmentation
Plaque edge density	ED	m/hm2	It indicates the difference between landscape types and the degree of landscape agglomeration and fragmentation.
Average plaque area	AREA-MN	hm2/	Indicates the dispersion degree of patch type
Average nearest distance	ENN-MN	M	The larger the value, the higher the agglomeration degree of the patch.
Agglomeration degree	AI	%	Indicates the complexity of landscape patch shape
Landscape shape index	LSI	-	Number of ancient jujube forest patches in unit ancient jujube forest
Distance index	E	-	

In the index system, CA is the total area of ancient jujube forest in the study area, A is the total area of the study area, and NP is the number of patches of ancient jujube forest in the study area. PLAND represents the proportion of the ancient jujube forest area in the total area of the study area, which reflects the scale level of the ancient jujube forest in this study. PD represents the distribution of jujube forest per unit area in the study area, which reflects the degree of dispersion and agglomeration of ancient jujube forest in the study area. The larger the value of PD, the denser the spatial distribution of ancient jujube forest in the area. AREA-MN is used to represent the average size of the ancient jujube forest patches

in the study area, and also reflects the degree of agglomeration to a certain extent; the distance index (E) is the number of ancient jujube forest patches per unit of ancient jujube forest, and also reflects the size of ancient jujube forest area from the side. The agglomeration degree AI of ancient jujube forest indicates the agglomeration status between each ancient jujube forest patch and adjacent patches in the study area. The higher the value, the more concentrated the distribution state. See Table 2.

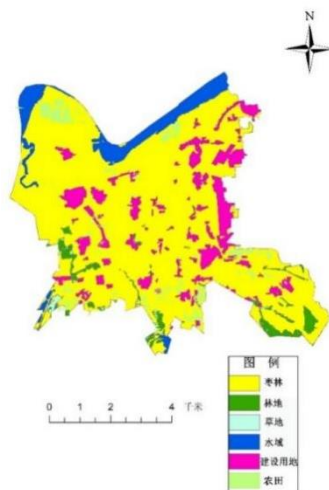


Fig.2 Landscape classification map of Dawang Town, Lingbao City

3. Analysis of effect

3.1. Relationship between landscape distribution and geographical factors of jujube forest

The distribution of ancient jujube forest landscape is related to the distribution of village settlements and roads. The following specific analysis is made by referring to the image map and GIS vector data map:

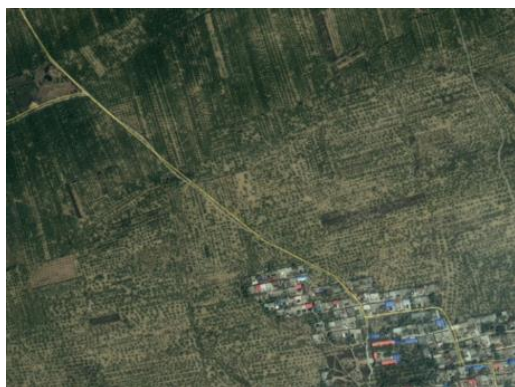


Fig. 3 The distribution image of local ancient jujube trees in Dawang Town

3.1.1. Relationship between landscape distribution of jujube forest and residential area

'The house is built around the jujube tree, and the people rely on the jujube tree.' This idiom shows the distribution characteristics of local landscape types. From the image map, it can be seen that the distribution position of the ancient jujube forest is located around the village, which is dotted. The green spots around the village are the ancient jujube forest, and the overall area is far more than the village area. The distribution of jujube trees affects the form of local villages, the layout of road systems, and the construction of public infrastructure, forming a unique landscape pattern in which the village is in the forest and the forest is in the village. It fully reflects the integration of ancient jujube forest and local residents' life, giving Lingbao a unique style of residential settlements. Such a distribution pattern is formed in the practice of long-term production and life. The agricultural landscape of ancient jujube forest has had a profound impact on the shaping of local residential forms. Such a distribution pattern fully reflects the spirit of local

agricultural culture. Jujube people rely on jujube trees to survive and regard jujube trees as life, which proves that jujube forests occupy an important position in local spiritual civilization.

3.1.2. Relationship between jujube forest landscape distribution and road system

Accessibility plays an important role in agricultural development. Traffic is an important factor for agricultural products to enter the market to realize their value. Therefore, the sustainable development of agricultural cultural heritage is also inseparable from convenient traffic conditions. The development trend of agricultural modernization is prominent. Leisure agriculture puts forward higher requirements for traffic conditions in development. The villages under the jurisdiction of Dawang Town rely on convenient traffic conditions to develop tourism service industry, guide local industrial upgrading, realize local economic structure upgrading, and promote the development of ancient jujube forest tourism industry on the basis of the development of jujube garden industry. Therefore, it is necessary to continue to improve the infrastructure in the region, build characteristic industries, introduce advanced science and technology, combine agriculture with science and technology, and build a personalized ancient jujube forest tourism base. It can be seen from the jujube garden landscape in the area that the roads distinguish different jujube gardens, and the roads also serve as the boundary of the jujube forest, so that the landscape distribution pattern of the jujube garden presents a regular trend and spreads along the traffic line. The roads in the area connect the village settlements with the jujube garden, which facilitates the planting, management and picking of jujube trees, facilitates the entry of vehicles and the outward transportation of products, and is also conducive to the development of the ancient jujube forest tourism service industry.

3.2. Analysis of the overall distribution characteristics of landscape pattern

3.2.1. Analysis of various landscape patch characteristic

(1) The total area of the ancient jujube forest landscape in the Sichuan Plateau of Lingbao City is 11717.19 hm². Among these landscape types, the jujube forest accounts for the largest proportion of the total area, exceeding 1/2 of the total area, accounting for 78 % of all landscape types. The largest patch index (LPI) reached 76.56 %, indicating that the degree of fragmentation of the jujube forest was low. The proportion of other land types is: forest land 3 %, construction land 11.5 %, water area 6.8 %, grassland 0.7 %. It can be seen that the dominant types in many landscapes are jujube forest and construction land, and other landscapes are more fragmented and dispersed. Jujube forest is in an absolute advantage in all landscape types in the study area. In the landscape pattern of Dawang Town, the distribution characteristics of various land types are highly correlated with jujube forest.

(2) From the characteristics of the number of patches, it can be seen that the number of patches of grassland is the largest, accounting for 41 % of the total, and its patch density is also the largest. The number of patches of other land types is less than 100. Among all landscape types, the distribution of jujube forest landscape is the most concentrated. The number of patches is 23, and the patch density is 0.1963. It ranks the second from the bottom in the patch density of each landscape type, and the average patch area is large, indicating that the distribution of jujube forest landscape in Dawang Town is

relatively complete and concentrated. As for the distribution of forest land, farmland and construction land, the total distribution is more dispersed than that of jujube forest.

(3) It can be seen from the characteristics of landscape shape index that the level of fractal dimension has a certain relationship with the complexity of patch shape. The higher the value, the higher the complexity, showing a significant positive correlation. The terrain of Dawang Town is relatively flat and is not greatly affected by terrain undulation. According to the fractal dimension value of the study area, it can be arranged as follows: grassland, construction land, farmland, forest land, jujube forest and river. The fractal dimension of jujube forest is 1.2984, which is the second from the bottom in the research scope, and the fractal dimension of construction land is 1.3242, which shows that the shape of jujube forest and construction land and the complexity of landscape pattern are low, and the landscape shape is obviously affected by human transformation.

(4) From the adjacency percentage and aggregation degree of landscape element types, the agglomeration status of landscape elements can be obtained. The index value is negatively correlated with the degree of dispersion of plaque types. The larger the value, the more dispersed, and the smaller the value, the more concentrated. In the whole landscape type, the similar adjacency percentage and aggregation index of jujube forest are the largest, reaching 97.4 %, which fully shows that the agglomeration degree of jujube forest is high, the patch distribution is concentrated, the spatial connectivity is good, and the patch distribution is flaky. Followed by construction land and forest land, due to the correlation between the distribution of residential land and jujube forest in the local area, the choice of residential location is highly dependent on jujube orchard, so the construction land of Dawang Town is also relatively concentrated.

Table 3. Pattern indicators of landscape patch types in Lingbao City

Type	CA (hm ²)	NP(No.)	PD (No.; /hm ²)	ED(m/hm ²)	LPL (%)
Rivers	794.79	20	0.1707	3.9122	4.2891
Jujube forest	9143.19	23	0.1963	24.3181	76.5606
Construction land	1344.6	68	0.5803	14.8423	1.6875
Forest land	353.16	70	0.5974	7.1152	0.6928
Grassland	81.45	131	1.118	3.8764	0.2181
Farmland	324.12	69	0.4234	9.5642	1.1302
Rivers	5.9521	94.6721	93.6644	39.7395	1.2725
Jujube forest	9.0376	97.4682	97.1622	397.53	1.2984
Construction land	12.5306	90.4674	89.7256	19.7735	1.3242
Forest land	12	82.0513	80.7339	5.0451	1.3832
Grassland	12.8033	58.8336	56.8508	0.6218	1.4319
Farmland	11.323	70.2353	86.5354	15.236	1.3565

3.2.2. Analysis of spatial adjacency characteristics of landscape

From table 4, we can see that the spatial djacency length between river waters and forest land is 43.2, and the adjacency length between river waters and jujube forest is 30.2, which can explain the influence of rivers on the distribution of forest land and jujube forest, and the distribution of jujube forest has an adjacency relationship with these two landscape elements. The adjacent length of jujube forest and construction land is the largest, followed by rivers, farmland, woodland and grassland, indicating that jujube forest and construction land are closely related in

landscape composition and functional structure, indicating that the distribution of jujube forest is not only affected by natural conditions. The impact of human activities on the distribution of jujube forest in the study area is dominant. Affected by human transformation activities, the spatial layout of jujube forest appears to be relatively regular, and the road divides different jujube gardens. At the same time, it is proved again from the data that jujube forest is the key reason affecting the distribution of residential land, and there is a large correlation between the two. There is a two-way interaction between the distribution of jujube forest and the layout of residential areas.

Table 4. Adjacency length between patches in ancient jujube forest landscape in Dawang Town, Lingbao City

Type	Rivers	Jujube forest	Construction land	Forest land	Grassland	Farmland
Rivers	-	30.2	6.2	43.2	12.16	36.25
Jujube forest	25.3	-	59.2	2.1	0.6	20.36
Construction land	10.1	65.2	-	0.45	0.32	13.54
Forest land	11.3	0.8	0.71	-	2.31	0.64
Grassland	0.85	0.69	1.42	23.1	-	0.36
Farmland	12.36	28.36	15.32	0.25	0.56	-

4. Conclusion and Discussion

From the perspective of China 's important agricultural cultural heritage, this paper analyzes and studies the relationship between the landscape spatial pattern of the ancient jujube forest in Lingbao City and the related landscape elements, the patch characteristics of the landscape

elements and the spatial adjacency characteristics of the landscape. The conclusions are as follows:

(1) In the landscape system of Dawang Town, the dominant landscape jujube forest shows good continuity in layout, and plays a supporting role in the landscape types of the whole study area. The proportion of jujube forest landscape area is the largest, followed by construction land, and the number of

patches of construction land is in the second place, indicating the characteristics of scattered layout of local residential areas.

(2) From the analysis of the relationship between jujube forest and related landscape elements, it can be known that the spatial distribution of jujube forest is related to the location of waters and settlements in the study area, and the relationship between them can also be proved by the adjacency characteristics of landscape space. The reason is that there are many processes of jujube planting and cultivation, which need the real-time attention of local residents. Therefore, the residential areas in the study area are built along the jujube forest. The road traffic system is very important for the development of the jujube industry. The distribution of jujube trees in the study area is directly related to the distribution of roads.

(3) According to the analysis of patch characteristics and spatial adjacency characteristics of landscape pattern, the jujube forest landscape is in an absolute dominant position in the study area of this paper, and the patch area exceeds 1 / 2 of the total area. The jujube forest landscape layout in this area is relatively regular, and the spatial connectivity is good. The jujube garden is distributed in patches and has a high degree of agglomeration, showing good continuity.

It is worth pondering that based on the continuous deepening of the current agricultural cultural heritage protection work, with the help of various research techniques and research methods, and a high degree of social attention, the content of agricultural cultural heritage protection is more and more comprehensive, and various influencing factors can be comprehensively considered. In addition, when analyzing the landscape of agricultural cultural heritage, it is necessary to comprehensively consider various factors that may affect the landscape, find out the driving factors and dominant factors, and analyze the correlation between various landscape elements, so as to provide a basis for further research on agricultural cultural heritage. In the future, in the study of ancient jujube forest landscape in Chuanyuan, the research focuses on the multiple values of jujube forest landscape and the realization of values. For example, jujube forest landscape plays a positive role in the realization of ecological and environmental values, agricultural and forestry economy and health care values, tourism values, spatial reconstruction and other values in the study area. As well as the comprehensive utilization of the multiple values of the ancient jujube forest landscape, it should also be paid attention to. Using the existing basic conditions and resource conditions, the development of rural ecological leisure tourism industry, cultural heritage experience tourism and other new economic formats around the ancient jujube forest should be carried out, and the development of the forest

economy should be committed to. The focus is also on the practical significance and value of the protection and development of ancient jujube forests, which plays an important role in solving the problems of agriculture, rural areas and farmers, rural revitalization, industrial restructuring, urban-rural integration and increasing farmers' income. The protection and development of ancient jujube forests also has inestimable practical significance for improving the high-quality development of the ecological environment and the three-dimensional economic development of the Yellow River Basin. Finally, it is expected to provide a model for the protection and development of agricultural cultural heritage with historical value and ecological significance.

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