



ISSN: 2222-4955 (Print)
ISSN: 2222-4963 (Online)
CODEN: AMSDFK



ARTICLE

MEASUREMENT OF CHINESE FORESTRY HIGH-QUALITY DEVELOPMENT LEVEL AND ANALYSIS OF SPATIOTEMPORAL CHARACTERISTICS

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ARTICLE DETAILS

ABSTRACT

Article History:

Received 10 May 2022
Accepted 20 July 2022
Available online 26 July 2022

Based on the five dimensions of "economic vitality, innovation coordination, industrial structure, green resources, openness and stability", the principal component analysis method was used to construct an index of high-quality development level of Chinese forestry, and further analysis of spatiotemporal characteristics was carried out. The research results show that: at the overall level, the high-quality development level of China's forestry from 2012 to 2019 showed an upward trend in time series, with non-equilibrium characteristics in space; at the sub-regional level, the high-quality forestry level in North China and Northwest China was lower, while that in South China and Southwest China was high. Finally, based on the conclusions, relevant policy recommendations are put forward.

KEYWORDS

Forestry; High Quality; Principal Component Analysis; Spatiotemporal Characteristics

1. INTRODUCTION AND LITERATURE REVIEW

Since the 18th National Congress of the Communist Party of China, the construction of ecological civilization has been regarded as an important part of the five-in-one construction, and a series of important concepts and strategies have been put forward on this basis. The State Forestry and Grassland Administration put forward the "Guiding Opinions on Promoting the High-quality Development of the Forestry and Grass Industry", which pointed out that the forestry industry should be developed with high quality and the efficiency of forestry resource allocation should be optimized. Forestry, as an important basic industry in my country, is an important measure to build an ecological civilization and a major barrier against global climate change. However, at present, the problems of uneven distribution and insufficient development of my country's forestry industry are still prominent^[1], and my country is in the stage of rapid economic development to high-quality development, and the development of my country's forestry industry is bound to transform to high-quality development^[2]. The high-quality development of forestry is gradually derived from the process of implementing the "construction of ecological civilization" in Xi Jinping's new era of socialism with Chinese characteristics. Forestry high quality development should meet the huge demand for forestry ecological service products, make full use of the benefits of forest resources to contribute to the development of the new era of forestry. Therefore, this paper constructs an index system of high-quality forestry development, measures the high-quality development level of each province, explores the factors that restrict the high-quality development of forestry, and puts forward policy recommendations for promoting high-quality forestry development.

The concept of high-quality development was first proposed by General Secretary Xi at the 19th National Congress of the Communist Party of China. High-quality development has put forward higher requirements for the traditional development model. It no longer blindly pursues

the growth of scale, but pays more attention to the improvement of quality and efficiency. For the research on high-quality development of forestry, current scholars mainly carry out research from the aspects of quality, efficiency and sustainable development. First of all, from the perspective of quality, Bai (2021) proposed measures for the high-quality economic development of Henan Province from the analysis of the predicament of forestry development in Henan Province^[3]. Liu (2020) made an evaluation index system for high-quality forestry development and measured the high-quality development of forestry from four aspects: ecological indicators, quality indicators, cultural indicators, and security indicators^[4]. Ning (2020) proposed five high-quality development promotion strategies on the basis of reflecting on the traditional development model^[2]. Secondly, from the perspective of efficiency, many scholars have studied the input-output efficiency of forestry^[5,6], revealing the reasons for the low input-output efficiency of forestry, and some scholars have measured the green total factor productivity of forestry, furthermore, they studied its temporal and spatial characteristics and status transfer analysis to promote the balanced development of forestry industry among regions. Finally, based on the perspective of sustainable development, many scholars have proposed strategies for the sustainable development of forestry from a theoretical perspective. Xie (2021) clarified the importance of forestry resources to the ecological environment, and pointed out the difficulties faced by the current forestry development. Finally, some strategies for sustainable forestry development have been put forward in terms of publicity from the ecological environment, strengthening of joint protection of departments and the use of advanced technologies^[7].

Based on the existing research, it can be seen that the existing scholars have carried out relatively sufficient research on the forestry industry from the two aspects of efficiency and quality, which has laid a solid theoretical foundation for the research of this paper, but there is still room for further expansion. Existing research focuses on the theory of

high-quality forestry development, but there are few specific measures for high-quality forestry development. Second, the research on high-quality forestry development by domestic and foreign scholars is relatively one-sided, and there is no systematic definition of high-quality forestry development. Therefore, based on the research of related scholars, this paper takes 30 provinces in my country as the research object, measures the high-quality level of China's forestry, and analyzes the spatial and temporal characteristics of the high-quality development level of forestry based on the historical and spatial dimensions. Providing a reference strategies for sustainable forestry development.

2. STUDY DESIGN

2.1 Establishment of indicator system

General Secretary Xi Jinping emphasized in the 19th National Congress that the development stage of my country's economy has changed from high-speed development to high-quality development, so the concept of high-quality development came into being. Scholars at home and abroad have conducted a lot of discussions on the concept of high-quality development in forestry. For the concept of high-quality development, there are mainly two views that are cited more frequently in the academic community. One is to use the five development concepts of innovation, coordination, green, openness, and sharing to interpret the connotation of high-quality development in combination with the main social contradictions [8]. And the other is to consider high-

quality development from the dynamic process and consequences of economic growth [9]. Regarding the concept of high-quality development of forestry, some scholars have adopted the concept of high-quality development of forestry based on the new development concept from five aspects: innovation-driven, coordinated development, green resources, openness, stability and harmonious sharing [10,11]. And some scholars have adopted the concept of high-quality forestry development based on the new development concept. What's more, based on Xi Jinping's thought on ecological civilization construction, the other scholars believes that the connotation of high-quality forestry development includes high-quality forestry ecological service products, high-level service objects, high-quality forestry governance system and governance capacity, and coordinated and harmonious development of ecological, economic, and social benefits in the forestry industry, etc. [12]. Based on the research of existing scholars, this paper mainly selects 15 secondary indicators from five aspects, including economic vitality, Innovation-driven, industrial coordination, green resources, openness and stability to establish an indicator system.

2.2 Research methods

In this paper, the principal component analysis method is used to evaluate the high-quality development level of forestry. The principal component analysis method mainly calculates the comprehensive coefficient by reducing the dimensionality of the original indicators. Its weight is determined by its own contribution rate, which belongs

Table 1: The Index System of High-Quality Forestry Development

Primary indicator	Secondary indicator	Symbol	Measurement method	Unit	Direction
Economic vitality	Per capita forestry output value	X1	Forestry output value/total population in the region	Yuan/person	+
	Forest output rate	X2	Gross forest output value/forest area	Yuan/ha	+
	Average annual salary of on-the-job workers in forestry system units	X3	-	Yuan	+
Innovation-driven	Forestry Station Training Number	X4	-	Person	+
	R&D investment intensity	X5	Forestry R&D expenditure/GDP	%	+
	Proportion of technical R&D units	X6	Number of technical R&D units/total number of system units	%	+
Industrial coordination	Proportion of forestry	X7	Gross output value of forestry/gross regional product	%	+
	Rationalization of forestry industry structure	X8	Forestry secondary and tertiary industry added value/primary industry	%	+
	Advanced forestry industry structure	X9	Forestry tertiary industry/total output value	%	+
Green resources	Forest coverage	X10	-	%	+
	Stock of living standing trees per capita	X11	Stock of living standing trees/total number of people in the area	M ³ /person	-
	Forest disaster victim rate	X12	Affected forest area/forest area	%	+
Oopenness and stability	Forest area per capita	X13	Forest area/total population in the area	M ² /person	+
	Number of foreign investment projects in forestry	X14	-	piece	+
	International popularity of Forest Park	X15	Number of foreign tourists to Forest Park/Total number of tourists to Forest Park	%	+

Table 2: Scores and Rankings of China's Forestry High-Quality Development Level

Rigion	City	2014	Rank	2016	Rank	2019	Rank
North China	Beijing	-1.80	26	-1.61	28	-1.35	26
	Tianjin	-3.33	30	-2.56	30	-2.93	30
	Hebei	-1.09	21	-1.15	23	-1.02	21
	Shanxi	-1.92	28	-1.41	25	-1.47	27
	Inner Mongolia	-1.42	22	-0.88	22	-0.76	20
	mean	-1.91	-	-1.52	-	-1.51	
North-east area	Liaoning	-0.23	13	-0.41	19	-0.49	17
	Jilin	0.64	8	1.02	7	0.68	10
	Heilongjiang	0.07	11	0.56	11	0.59	11
	mean	0.16	-	0.39	-	0.26	
	Shanghai	-0.72	16	-0.12	16	-1.21	22
East China	Jiangsu	1.39	3	-0.36	18	-0.21	15
	Zhejiang	1.08	5	1.18	6	0.49	13
	Anhui	-0.23	13	0.56	11	0.49	12
	Fujian	3.43	1	3.54	1	3.85	2
	Jiangxi	1.39	2	2.38	3	3.09	3
	Shandong	-0.97	19	-0.03	15	-0.66	19
	mean	0.77	-	1.02	-	0.83	
	Henan	-1.81	27	-1.51	27	-1.28	24
Central China	Hubei	-0.64	15	0.60	10	0.70	9
	Hunan	0.48	10	1.85	4	2.68	4
	mean	-0.66	-	0.31	-	0.70	
	Guangdong	0.98	6	1.32	5	1.14	7
South China	Guangxi	1.30	4	2.89	2	4.59	1
	Hainan	0.55	9	0.75	8	1.02	8
	mean	0.94	-	1.65	-	2.25	
Southwest Region	Chongqing	-1.03	20	-0.48	20	-0.52	18
	Sichuan	0.65	7	0.32	13	0.46	14
	Guizhou	-0.84	17	0.24	14	2.43	5
	Yunnan	-0.09	12	0.73	9	1.83	6
	mean	-0.33	-	0.20	-	1.05	
	Shaanxi	-0.93	18	-0.28	17	-0.23	16
	Gansu	-1.79	25	-1.46	26	-1.82	28
North-west region	Qinghai	-2.60	29	-2.41	29	-2.16	29
	Ningxia	-1.68	24	-1.18	24	-1.34	25
	Xinjiang	-1.56	23	-0.87	21	-1.25	23
	mean	-1.71	-	-1.24	-	-1.36	-
	National average	-0.42	-	0.04	-	0.18	-

to an objective weighting. The advantage of the principal component analysis method is that it can retain the information of the original data as much as possible. Through SPSS software, the data is firstly processed without dimension, then each component vector is calculated, and finally multiplied by the variance percentage and summed to obtain the comprehensive index of high-quality forestry development.

2.3 Data sources

Starting from the principle of data availability and long-term research, the article selects 30 provinces in China from 2012 to 2019 as the

research objects. The data selected in the article come from the "China Statistical Yearbook", "China Forestry Statistical Yearbook", and the social big data statistical platform, EPS database, and provincial statistical yearbooks, etc., due to the lack of Tibetan data, the article does not include it in the ranking when calculating the index, and other missing data are processed by interpolation.

3. ANALYSIS OF SPATIOTEMPORAL CHARACTERISTICS OF FORESTRY HIGH-QUALITY DEVELOPMENT LEVEL INDEX

3.1 Analysis of timing characteristics

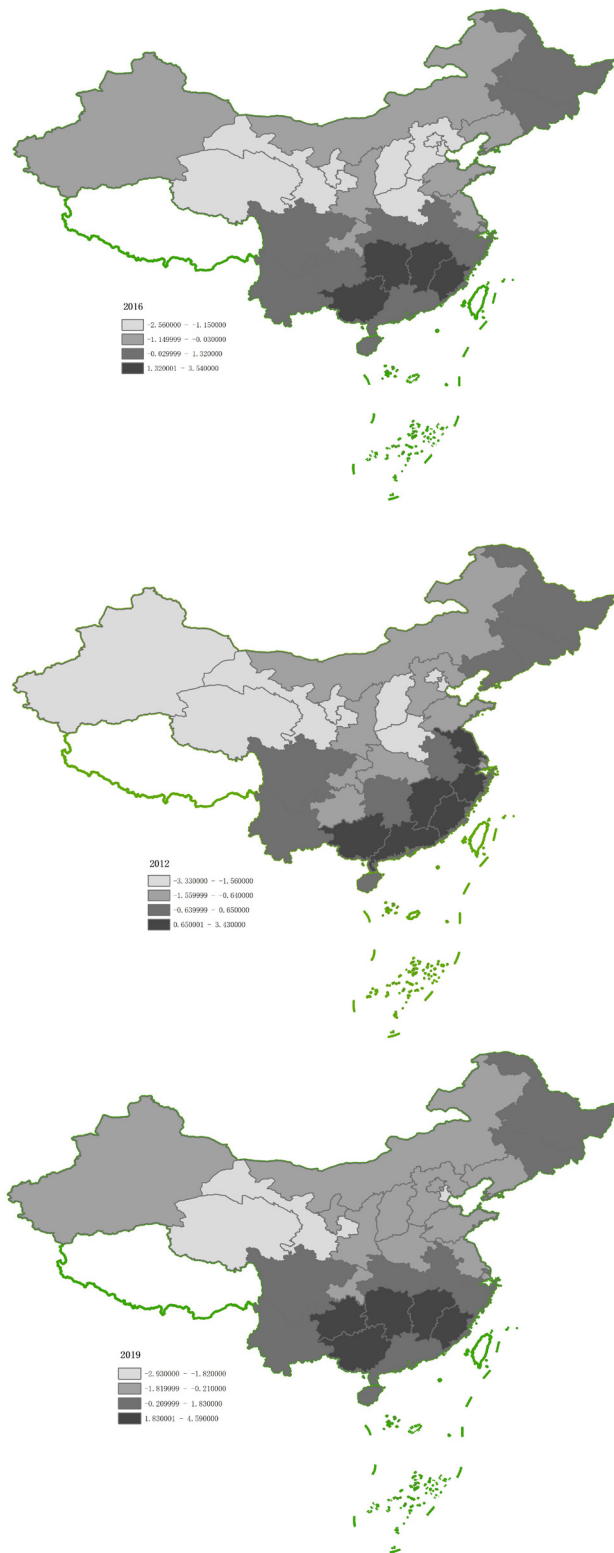


Figure 1: Spatial Distribution Map of High-Quality Forestry Development in China

As shown in Table 2, the comprehensive scores and rankings of China's forestry high-quality development level in 2014, 2016, and 2019 are listed respectively. From the national level, the average value of China's forestry high-quality development level shows a rising trend, which may be due to after the 18th National Congress of the Communist Party of China, my country has implemented the guiding ideology of ecological civilization proposed by General Secretary Xi, implemented major ecological protection and restoration projects, promoting the sustainable development of forest resources. After the 19th National Congress of the Communist Party of China, General Secretary Xi pointed out in the conference on ecological and environmental protection that it is necessary to speed up the construction of an ecological civilization system and establish an ecological economic system with industrial

ecologicalization and ecological industrialization as the main body. These policy have laid a solid foundation for the improvement of the quality of forestry industry development. From a regional perspective, the high-quality development level of forestry in Central China, South China and Southwest China continued to rise. Among them, the growth base of high-quality forestry development index in Southwest China was the largest. In addition, it can be seen from Figure 1 that from 2012 to 2019, the regional gap in the high-quality development level of China's forestry industry has been narrowing, and the forestry development level of cities such as Henan and Shanxi have been continuously improved.

3.2 Spatial feature analysis

In order to have a clearer understanding of the spatial distribution of China's forestry high-quality development index, the data in 2012, 2016 and 2019 were selected, and the ArcGIS software was used to visualize and analyze them, and the natural segment breakpoint method was used to divide them into four echelons.

First of all, from the overall point of view, the high-quality development level of China's forestry shows a distribution trend of "high in the south and low in the north, and high in the northeast", showing an obvious spatial agglomeration effect. Most of the high-quality forestry areas are distributed in sheets, The main reason is related to the geographical location environment.

Secondly, from a regional perspective, Table 2 shows that the high-quality development level of forestry in North China and Northwest China ranks low. The reason for the low quality of Northwest China may be limited by funds, talents and forestry development technology, while North China may be limited by forest land resources and the crowding out of other resources, leading to lower quality forestry development. The high-quality development level of forestry in central China is relatively low. Most of these regions have relatively developed industries and tertiary industries, which not only squeeze most of the financial funds, but also squeeze some innovative talents, and innovative talents are an important driving force for high-quality forestry [10]. The quality level of forestry development in South China and Southwest China is relatively high. First of all, these two regions have unique natural advantages and large forest areas. Moreover, our country implements strict control of logging and ecological compensation policies for public welfare forests, and implements quota logging for commercial forests. With market regulation policies, the sustainable development of forestry land in these regions is effective. For example, Jiangxi Province and Fujian Province are the major forestry provinces in my country, and the total forestry output value ranks among the best in the country, so it is easier to attract forestry-related talents and local government funds. Therefore, the quality of forestry development is high.

4. CONCLUSION AND SUGGESTION

This paper establishes an evaluation index system from five aspects: economic vitality, innovation drive, industrial coordination, green resources, openness and stability, and uses the principal component analysis method to measure the high-quality development level of my country's land forestry from 2012 to 2019, and further analyze its temporal and spatial characteristics, drawing the following conclusions: the overall level, the high-quality development level of my country's forestry shows an upward trend in time series, and spatially non-equilibrium characteristics, showing a distribution trend of "high in the south and low in the north, and high in the northeast". The gap is shrinking. At the sub-regional level, the high-quality development level of forestry in Central China, South China and Southwest China continues to rise, and there is no significant change in other regions. The high-quality development level of forestry in North China and Northwest China is low, ranking at the bottom, and the forestry in South China and Southwest China has a high level of development. The quality is high.

In order to promote the high-quality development of forestry in my country and speed up the sustainable development of forestry, the following policy suggestions are put forward: First, promote the development strategy of the northwest and the revitalization strategy of the northeast, introduce outstanding innovative talents in forestry, improve forestry policy support and infrastructure construction, implement the policy of introducing human resources and information

technology from the eastern region to the central, western and northeastern regions, to improve the inter-regional forestry industry chain and narrow the development differences between regions. The forestry industry structure is guided by the combination of forest and grass, forestry and farmers, and green development, and develops efficient forestry and forestry complex economy. At the same time, it also promotes the integrated development of forestry industry and multi-industry, transforms resource advantages into industrial advantages, and makes full use of talents and technologies, actively develop new forestry products, improve the depth of wood processing, strengthen brand building, and promote the high-quality development of regional forestry.

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