

Research Article

Analysis of the Industrial Distribution and Characteristics of China's Non-Wood Forest Product

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Abstract: At present, Non-Wood Forest Products industry (NTFP) is developing all over the country. But some provinces share some similarities in NTFP industry development. They have not make rational distribution of resources according to their endowment, location and industrial base, etc. Therefore, making a rational planning of NTFP in different provinces to identify each province's competitive industry, strengthening the study of NTFP distribution have an important guiding significance on giving full play to the advantages of each region, as well as better develop the economic, ecological and social benefits of non-wood forest products. This study, on the basis of the status of NTFP and the research of the type used, makes a summary of the characteristics of the distribution of non-wood forest products industry and makes some recommendations on the corresponding policies.

Keywords: Characteristics, distribution, layout, non-wood forest products

INTRODUCTION

At present, with the deepening of the social development and people's study of the natural resources, more attention and higher significance have been attached to non-wood forest products, which is a very important part of forest resources, such as herbs, wild vegetables, tea, edible fungi and wild animal protein, etc. Researches find out that 30% (1.2 billion hm²) of the forest resources are used for non-wood forest products production. We have been attaching huge importance to the development and use of non-wood forest products. "Forestry Executive Plan in 21 Century Agenda in China" emphasizes that China has rich non-wood forest resources and this has a significant economic value. This is also the important resource that is negative to the development of human life and social development. It also put forward the guiding ideology for the rational and effective use of non-wood forest resources. As far as China's policy is concerned, under the new status, especially after China carries out the natural forest protection project, the use of forest resource cannot merely rely on making interest by fell trees, which brings more attention to the development of non-wood forest products. In China, there is a more active phenomenon of the development of non-wood forest product trade in recent years, which has exceed 39.38 trillion USD in 2011. Chinese scholars often name the forest resources, except for wood, which rely on forest environment, rely on forest land and gained from planning and raising non-wood

forest products. Yin (1998) defined non-wood forest product as "tea, nuts, fruits, flowers, herbs, bamboo forest and its by-products and other non-wood forest resources."

Currently, NTFP are being developed all over China. But some provinces share some similarities in NTFP industry development. They have not make rational distribution of resources according to their endowment, location and industrial base, etc. Therefore, making a rational planning of NTFP in different provinces to identify each province's competitive industry, strengthening the study of NTFP distribution have an important guiding significance on giving full play to the advantages of each region, as well as better develop the economic, ecological and social benefits of non-wood forest products:

The classification of different types of the use of non-wood forest products: Current NWFP use type classification by social management department is mainly based on their usage, including medicinal products industry cultivation, food industry products cultivation, ornamental products cultivation as well as non-wood forest products trade.

On this basis, this study, in accordance with the utilization ways, divides non-wood forest products into three categories, namely, harvest utilization, cultivation utilization, processing utilization. In addition, the non-wood forest products, in addition to having economic value, also has recreational value and value in ornamental and science research and as people are

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Table 1: The classification of the utilization types of non-wood forest products

Utilization type	Classification	Content	Value
Harvest utilization	Eating	Potherb, wild fruit, edible mushrooms, etc.	Economic value
	Feeding	NTFP that can feed livestock	Economic value
Cultivation utilization	Ornamental	Ornamental NTFP	Economic value
	Greening	NTFP can be used for greening	Ecological value
	Environmental protection	Wind proof NTFP, water retain NTFP, etc.	Ecological value
	Germplasm	Decide the genetic information of organism and pass the information from parental generation to the filial generation	Ecological value
Processing utilization	Medical	NTFP that can be processed into all kinds of medicines	Economic value
	Food	Sugar, protein, lipid, pigment, etc.	Economic value
	Industrial	Wood, fiber, power, vegetable glue, aroma, dye, etc.	Economic value
Ornamental and scientific research	All NTFP may have		Ornamental, scientific research, and other social values

Table 2: The classification of non-wood forest products utilization industries

	Type of Industry	Name of type	Contents
NTFP utilization industries	First industry	NTFP harvest	Chinese medicine harvest
			Edible mushroom harvest
			Potherb harvest
	Second industry	NTFP cultivation	Flowers cultivation
			Chinese medicine cultivation
			Greening NTFP cultivation
Tertiary industry	NTFP processing and manufacture	Power NTFP cultivation	
		Chinese medicine production	
		Forest food processing	
Tertiary industry	NTFP service	Forest chemical engineering	
		Catering Industries taking NTFP as the target	
		Entertainment industry taking NTFP as the target	
			Industries that changes NTFP

taking more advantage of the of such value, especially the non-wood forest recreation industry are developing, therefore, recreation and scientific research should also be classified as the fourth type of non-wood forest utilization.

Based on the above analysis, non-wood forest products utilization types can be divided into four categories, harvest utilization, cultivation utilization, processing utilization and recreation utilization, ornamental and scientific research utilization. Among them, harvest utilization; refers to those non-wood forest products which can be used by simple process after the picking and digging the whole plant or some organs of the plant; cultivation utilization refers to the non-wood forest products which yield economic interests by keeping good living conditions through a variety of tending measures; processing utilization refers to the non-wood forest product which can get or extract chemical substance or active ingredients by a variety of processes from the raw material; ornamental and research utilization refers to the non-wood forest products which is mainly used for ornamental recreation, scientific research. As it is hard to get the statistics for recreation, ornamental and scientific research utilization non-wood forest products, in this study, this part of analysis will be omitted and only describes harvest utilization, cultivation utilization and

process utilization. NTFP use types are divided as follows in Table 1 above.

Analysis of the utilization of non-wood forest products in China: Zhang *et al.* (2000a) developed a clarify standard which divided the utilization of non-wood forest products industry into first industry, secondary industry and tertiary industry, as is shown in the following Table 2, namely products derived from nature sector belong to the first industry; processing the primary products is the second industry; and providing services for the production and consumption is the tertiary industry. The above classification is based on the utilization process of non-wood forest products. Because in the classification there are many overlaps between non-wood forest products and non-wood forest products, based on this, according to the utilization processes, this study divides the utilization types of NTFP as “collection-sale”, “harvest-processing-sale”, “cultivation (cultivated planting)-sale”, “cultivation (cultivated planting) processing-sale”.

Analysis of the characteristic of the layout of the non-wood forest products industry: From the above analysis, it can be seen that different regions have their own competitive industries and different non-wood forest products has a strong regional characteristic in the region in distribution. While analyzing the spatial

layout of the provinces, the paper mainly uses SPSS 16.0 software and adopts mean correspondence analysis method to analyze the distribution characteristics of the non-wood forest products in China.

Based on the correspondence analysis principles and procedures of numbers:

There are many sayings of the origin of correspondence analysis. Now it is generally believed that correspondence analysis is originated from some independent literature in the 1930s and 1940s, such as Young and Reichenbach (1987), Zhang and Kant (2005) and Zhang *et al.* (2000b). So it is hard to say who the founder of this method is. Due to its many sources, this method is also known as homogeneity analysis or quantitative methods, etc. In the essence, correspondence analysis is converting the cross table rows, columns variable into a scatter plot, which means showing the associated information by the form of spatial relationships. The specific steps include the following steps:

- Start from the original data matrix, calculate the normalized matrix P:

$$P = (P_{ij}) = \left(\frac{x_{ij}}{T} \right)$$

- Calculate transition matrix Z_{ij} :

$$Z_{ij} = \frac{x_{ij} - x_i x_j / T}{\sqrt{x_i x_j}}$$

Among them, $i = 1, 2, \dots, n$
 $j = 1, 2, \dots, m$

- Factor analyzes. Mainly R-factor, Q-factor.

R-factor analyze: Covariance the characteristic roots in matrix A $\lambda_1 > \lambda_2 > \lambda_3 \dots \lambda_p$, determine the dimensions $m_1, m_2, m_3 \dots m_m$ according to the cumulative contribution rate of more than 85%. Take the first m eigenvalues dimensions and calculate the corresponding unit eigenvectors, denoted as $u_1, u_2 \dots u_m$ and then gets R-type factor loading matrix and do take the variable factor axis in the scatter plot:

$$F = \begin{bmatrix} U_{11}\sqrt{\lambda_1} & U_{12}\sqrt{\lambda_2} & \dots & U_{1m}\sqrt{\lambda_m} \\ U_{21}\sqrt{\lambda_1} & U_{22}\sqrt{\lambda_2} & \dots & U_{2m}\sqrt{\lambda_m} \\ \dots & \dots & \dots & \dots \\ U_{p1}\sqrt{\lambda_1} & U_{p2}\sqrt{\lambda_2} & \dots & U_{pm}\sqrt{\lambda_m} \end{bmatrix}$$

Q-type factor analyze: Calculate the matrix B corresponding unit feature vector according to the above m $\lambda_1, \lambda_2, \lambda_3 \dots \lambda_m$. $V_1 = Zu_1, V_2 = Zu_2, \dots, V_m = Zu_m$, then get Q-type factor loading matrix:

$$G = \begin{bmatrix} V_{11}\sqrt{\lambda_1} & V_{12}\sqrt{\lambda_2} & \dots & V_{1m}\sqrt{\lambda_m} \\ V_{21}\sqrt{\lambda_1} & V_{22}\sqrt{\lambda_2} & \dots & V_{2m}\sqrt{\lambda_m} \\ \dots & \dots & \dots & \dots \\ V_{p1}\sqrt{\lambda_1} & V_{p2}\sqrt{\lambda_2} & \dots & V_{pm}\sqrt{\lambda_m} \end{bmatrix}$$

Finally, make a factor load analysis diagram, which determines the distribution of the distance factor loadings associated with each scatter diagram between points and then make further analysis.

Analysis of the characteristics of the layout of the non-wood forest product industry in China:

Select seven categories of non-wood forest products for analysis, X1: Forest planting and collection; X2: flowers planting; X3: terrestrial wildlife breeding and utilization; X4: bamboo reed palm and rattan products manufacturing; X5: forest chemical products; X6: non-wood products processing industry; X7: forest tourism and leisure services. All the data are from China Statistical Yearbook of Forestry. Despite the lack of data may lead to one-sided analysis of the whole industry, we can still analyze the relationship between related industries and based on this, we can get some characteristics of the industrial layout of China's non-wood forest products utilization. Referring to the Statistical Yearbook of China's Forestry, the relevant data can be summarized in Table 3.

Normalized probability matrix P:

As can be seen from the normalized probability matrix P, among the non-wood forest products related industries, the proportion of forest planting and collection (25%) is slightly higher than other industries, the rest of the industrial proportion is 12.5%. Using SPSS16.0 software to calculate covariance matrix and its eigenvalues, we can get the results in Table 4 below.

As can be seen from the cumulative contribution rate of eigenvalues, the former two cumulative contribution rates reaches 67%, indicating that the former two dimensions with the main information of the original data is representative. The first dimension accounted for 38.6% and the second dimension accounted for 28.4%.

Calculate R-type and Q-type factor loadings matrix:

As can be seen from correspondence analysis (Table 4), the cumulative contribution rate of the former four dimensions has reached 90.6%, bigger than 85%. Therefore, the eigenvalue of the former four dimensions are selected to calculate the R-type and Q-type factor load matrix, which can be shown in Table 5 and 6.

Make a factor loading plot:

Based on the above R-type and Q-type factor analysis, using statistical software SPSS16.0 to make the structure factor loading table of the seven categories of non-wood forest

Table 3: Status of the value of non-wood forest products (10 thousand yuan)

No.	District	Planting and harvest of forest products	Flowers planting	Terrestrial wildlife breeding and utilization	Bamboo reed palm and rattan products manufacturing	Forest chemical products	Non-wood products processing industry	Forest tourism and leisure services
1	Beijing	444185	155508	8886	0	0	0	296508
2	Tianjin	105423	24546	318	0	0	0	14765
3	Hebei	3315697	263548	19359	14561	17195	702200	171478
4	Shanxi	1236486	25658	2717	50	948	362892	41439
5	Inner Mongolia	247422	15991	11610	271	890	4509	113829
6	Liao Ning	4024936	735413	1116737	16078	3472	462829	889617
7	Jilin	1387424	125112	399947	435	27544	2352483	564213
8	Heilongjiang	1233483	35257	77360	5449	11446	93552	520370
9	Shanghai	216346	54137	453	0	119635	85018	8170
10	Jiangsu	1658773	1593516	42926	177229	807782	576645	902021
11	Zhejiang	3701972	379164	238031	1008043	152946	1679905	2000940
12	Anhui	1787136	269695	58709	612077	63928	559298	994071
13	Fujian	3215990	422358	32480	1247951	598209	3601945	322627
14	Jiangxi	2490638	675134	138209	122258	357227	589650	1877233
15	Shandong	7735914	745013	95021	132838	25318	958907	844616
16	Henan	2512546	900409	148130	33795	21304	482762	451540
17	Hubei	2390694	307185	50577	64847	35457	528725	879684
18	Hunan	2081487	477638	103282	322254	982885	448044	2181207
19	Guangdong	2767631	758181	16215	259900	664269	90081	588451
20	Guangxi	2867525	140894	36450	103159	1390512	474871	259396
21	Hainan	2130132	130666	31882	2557	2879	283537	62636
22	Chongqing	896671	250601	14091	57009	12774	99426	439318
23	Sichuan	3060266	532182	89801	133061	21182	131284	2997899
24	Guizhou	768043	88742	8647	8883	18737	72307	654809
25	Yunnan	3600855	204357	47798	3290	388463	255365	164534
26	Tibet	21639	192	73	35	0	0	0
27	Shanxi	2214365	45680	3386	6109	0	11196	66087
28	Gansu	1314345	14620	5374	734	0	3412	24786
29	Qinghai	67852	5302	0	0	0	0	1412
30	Ningxia	509938	14344	765	0	0	176258	76176
31	Xinjiang	3133738	6059	1091	0	0	199546	159455

Table 4: Correspondence analysis summary table

Dimension	Singular value	Inertia (Eigen values)	Inertial contribution rate		Singular value confidence interval	
			Variance contribution rate	Cumulative contribution rate	Standard error	Inter dependency
1	0.952	0.906	0.386	0.386	0.000	0.247
2	0.816	0.666	0.284	0.670	0.000	
3	0.610	0.371	0.158	0.829		
4	0.425	0.181	0.077	0.906		
5	0.321	0.103	0.044	0.949		
6	0.259	0.067	0.029	0.978		
7	0.227	0.052	0.022	1.000		
Sum.		2.346	1.000	1.000		

Table 5: Row summary table

NTFP	Mass	Q Loading matrix				Characteristic
		1	2	3	4	
Economic forestry planting and collecting	0.250	0.133	-0.143	0.069	-0.082	0.039
Flower planting	0.125	-0.397	0.148	0.097	-0.23	0.075
Bamboo reed palm and rattan products manufacturing	0.125	-0.615	0.184	0.683	-0.677	0.171
NTFP processing industry	0.125	-0.967	2.25	0.191	0.356	0.643
Forest chemical products	0.125	-1.811	-0.817	-0.856	-0.222	0.54
Terrestrial wildlife breeding and utilization	0.125	-0.932	-0.821	1.736	0.649	0.428
Forest tourism and leisure services	0.125	-1.256	-0.17	-0.717	0.65	0.294
Sum.	1					2.346

products industry, as is shown in Table 7. Liaoning Province is closer to the terrestrial wildlife breeding and utilization industry, but farther away from other industries, indicating the development of NTFP in Liaoning mainly focuses on terrestrial wildlife reproduction and utilization, while development of other industries are poor; Jilin, Sichuan, Hainan, Chongqing mainly focus on forest cultivation and

collection industries; Anhui, Jiangsu, Inner Mongolia, Hebei, Heilongjiang, Shanxi mainly focus on flower cultivation industry; Hubei, Guangdong, Guangxi, Shanghai, Shandong mainly focus on bamboo, rattan, plam, reed products manufacturing industry; Beijing, Tianjin, Zhejiang, Jiangxi mainly focus on non-wood forest products processing industry; Fujian, Hunan, Yunnan mainly focus on forestry chemical products

Table 6: Line summary table

Province	Mass	R Loading matrix				Characteristic value
		1	2	3	4	
1	0.032	0.745	-0.056	-0.198	-0.036	0.023
2	0.032	0.841	-0.116	-0.295	0.238	0.030
3	0.032	0.377	-0.043	-0.322	0.174	0.016
4	0.032	0.685	-0.116	-0.384	0.324	0.022
5	0.032	0.811	-0.074	-0.279	0.184	0.026
6	0.032	-1.320	4.239	0.501	0.519	0.542
7	0.032	-0.657	1.302	-0.649	1.157	0.115
8	0.032	0.589	0.184	-0.199	-0.019	0.015
9	0.032	0.731	-0.207	-0.070	0.366	0.022
10	0.032	-0.821	-0.508	1.729	-0.425	0.122
11	0.032	-2.324	-0.172	-1.244	-0.845	0.215
12	0.032	-0.745	-0.451	-0.838	-0.585	0.050
13	0.032	-3.144	-1.640	-1.513	1.118	0.439
14	0.032	-0.475	0.164	0.659	-0.833	0.030
15	0.032	-0.344	0.222	-0.150	-0.618	0.047
16	0.032	0.060	0.482	0.111	-0.365	0.023
17	0.032	0.222	0.028	-0.185	-0.355	0.006
18	0.032	-1.108	-0.584	1.582	-0.442	0.112
19	0.032	-0.418	-0.650	1.081	-0.123	0.045
20	0.032	-0.581	-1.016	2.253	1.494	0.177
21	0.032	0.630	-0.007	-0.273	0.189	0.015
22	0.032	0.565	-0.111	-0.190	-0.210	0.013
23	0.032	-0.172	0.244	0.181	-2.108	0.074
24	0.032	0.679	-0.102	-0.164	-0.234	0.018
25	0.032	0.293	-0.186	0.548	0.424	0.017
26	0.032	0.878	-0.153	-0.288	0.231	0.030
27	0.032	0.783	-0.117	-0.247	0.088	0.023
28	0.032	0.830	-0.120	-0.264	0.166	0.026
29	0.032	0.879	-0.157	-0.282	0.220	0.030
30	0.032	0.796	-0.156	-0.317	0.217	0.026
31	0.032	0.712	-0.126	-0.292	0.088	0.024
Sum.	1.000					2.346

a. Symmetrical normalization

Table 7: The distribution of the non-wood forest products utilization Industries in China

Category	Contents	Districts
1	Economic forestry planting and collecting	Jilin, Sichuan, Hainan, Chongqing
2	Flower planting	Anhui, Jiangsu, Inner Mongolia, Hebei, Heilongjiang, Shanxi
3	Bamboo reed palm and rattan products manufacturing	Hubei, Guangdong, Guangxi, Shanghai, Shandong
4	NTFP processing industry	Beijing, Tianjin, Zhejiang, Jiangxi
5	Forest chemical products	Fujian, Hunan, Yunnan
6	Terrestrial wildlife breeding and utilization	Liaoning
7	Forest tourism and leisure services	Henan, Shanxi, Guizhou

industry; Henan, Shaanxi, Guizhou mainly focus on forestry tourism and leisure services industries. Tibet, Gansu, Qinghai, Ningxia, Xinjiang do not appear in Table 7, which shows these several provinces is not developed in NTFP industry.

Suggestion of the policy: First, give full play to the unique regional NTFP industries and promotes the development of other related industries. Jiangxi Province develop their own development strategies according to local conditions based on different urban forest resource endowments, forestry investment environment and the domestic market and other aspects of diversity. At present, Jiangxi Province has developed strategic layout, divided the province into different urban sectors and position each sector according to its development advantages so as to improve the level of non-wood forest products industry development characteristics of each urban area. In the future, the

government should further guide the formation of non-wood forest products industry cluster, promote the development of industry demonstration base and cooperation projects of non-wood forest products and further develop the dominant industries, so as to generate a demonstration effect on the surrounding area and other related industries, thus boosting economic growth and expanding social benefits.

Second, coordinate the common development of different regions, share resources and make reasonable labor division. The differences in forest resources, labor, technical labor results in differences in the NTFP. To seek a balance in the regional competitiveness, it is necessary to coordinate the development of different industries and make them closely related. In the industrial chain, different NTFP should play different role, play their respective advantages and avoid disadvantages, promote the complementary combination of the resources, form different

comparative advantages between different urban areas, make up the sectors that needs to be improved in other regions. All regions should fully share resources, labor and technical to form a stable industrial chain, reduce vicious competition of homogeneous products, make active efforts to produce a relatively high value-added niche products, it is necessary to avoid a waste of resources in the region, as well as maximize the benefits of their own advantages.

Third, improve the competitiveness of non-wood forest products calls for greater government support. Government support should first invest funds and introduce preferential policies, as well as increase technical support level. High tech level is an effective means to improve productivity. Currently, among the various urban areas in Jiangxi Province, in general the technical level of non-wood forest industry is not high, thus the development of non-wood forest products enterprise scale is also very limited. Thus, it is necessary to strive to improve the technology content of non-wood forest product development so as to improve productivity.

Fourth, forest resource endowments are fundamental and the material basis for the development of non-wood forest products. Without forest resources, there is no raw material, which will limit the development of non-wood forest products industry. Overall, though in recent years, NWFP in Jiangxi Province boasts of rich forest resources and good development, there are still many problems. Therefore, we should gradually improve the quality of forests and forestry production and management efficiency, providing a rich and high quality of forest resources for the development of local non-wood forest products industry.

Fifth, actively promote progress of NTFP cooperation projects. By attracting investment, actively

promoting and other methods to introduce projects with huge potential in various urban regions, expand the investment channels and prepare the ground for implementation of the project work, formulate supporting policies to attract multi-funded integration, encourage a high level, deep processing of investment projects and expand the scale of construction base.

All in all, each region should coordinates the regional development, develop its favorable industries, increase the investment fund and expand investment channels, guide the industry cluster, promote cooperation and exchange, fully develop the NTFP industry with regional characteristics and create each region's own competitive industries.

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