

Research Article

Analysis of the Factors Affecting the Sustainable use of Wild Plant Resources in Jiangxi Province--based on the Manager's Perspective

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Abstract: This study uses principal component analysis method, starting from the perspective of managers, to analyze the importance of the factors on sustainable use of wild plants in order to provide theoretical support for the revision and improvement of relevant laws, regulations and policies of plant conservation and management and thus provide theoretical support for the revising and improving the relevant laws and regulations and policy of plant resources protection and management to meet the needs of the sustainable use and protection of plants resources.

Keywords: Analysis, sustainable use, wild plant resources

INTRODUCTION

China, with its vast territory and diverse climate, is one of the countries that boast of the most numerous wild plant resources and rich biodiversity (State Forestry Administration, 2010). In fact, all countries, be it developed or developing country, largely develop, use and sell their unique species with huge market potential during its economic development. In China, cultivation and management and utilization of wild plant resources has become an important way of resource production. However, under the stimulation of the huge economic benefits, wild plants are facing the dual pressures of over-exploitation and deteriorating living environment, resulting in its sharp decline in specie reserves and resources and there is a trend of further deterioration. It is estimated that there are about 4000 to 5000 kinds of endangered or near threatened higher plants, accounting for 15 to 20% of the total higher plants. And there are 1009 kinds of endangered species, accounting for 3.4% of the total; about 200 species have already become extinct, 5 to 10% higher than the world average. Protection and utilization of wild plants are complementary but also mutually contradictory, interdependent as well as interacts. Sustainable use of wild plants should not only protect but not exploit, otherwise it is impossible to give full play to the economic benefits of plants. However, there should not be utilization without protection, otherwise the plant resources will be destructed and thus result in resource depletion or deterioration of ecological environment (Luo, 2009). Therefore, it is important that we maintain a good relationship between protection and utilization to realize the goal of protect the long-term sustainable use of wild plants while reasonably appropriate development and use on the basis of effective

protection. The unique resources and ecological environment in Jiangxi Province has bred a lot of wildlife products. However, as the scope of the use of non-wood forest products continues to expand and people's pursuit of economic interests, wild plant products is facing the dual pressures of over-exploitation and the deterioration of the living environment species, resulting in a sharp decline in reserves and resources and there is a trend of further deterioration (Zhang and Ye, 2011). Excessive exploration will cause huge damage in plant resources and biodiversity and will affect the sustainable use of plant resources. How to handle the relationship between protection and use is the major problem currently plaguing the manager. One important reason for the confusing local plant management is the lack of highly targeted, clear vegetation management regulations.

Therefore, this study uses principal component analysis method, starting from the perspective of managers, to analyze the importance of the factors on sustainable use of wild plants in order to provide theoretical support for the revision and improvement of relevant laws, regulations and policies of plant conservation and management and thus provide theoretical support for the revising and improving the relevant laws and regulations and policy of plant resources protection and management to meet the needs of the sustainable use and protection of plants resources.

MATERIALS AND METHODS

Determine the factors that affect the sustainable use of wild plants: Factors affecting the framework of sustainable use of wild plants mainly includes five parts and 31 indexes: The first part is the laws and

Table 1: Factors affecting the framework of sustainable use of wild plants

Class	Specific indicator
Laws and regulations	Whether the filing and penalty standard is clear Safeguards mechanism of sustainable use Whether the protection scope and the protection level is single Corresponding supporting legal protection Supporting effective means of enforcement Whether the terms of the current period is applicable Consideration of the interests of the stakeholder Deal with the relationship between protection and utilization
Management system	The adequacy of the management staff The quality of management personnel Whether the administration and other supporting facilities is perfect Coordination of various departments Invasive species management Whether management approval system is reasonable The soundness of the laws and regulations Whether the financial support for protection and management is adequate
Economic factors	Macroeconomic situation Market size Market information transparency level Product price Whether the related industrial chain is perfect The level of local economic development Tax levels
Social factors	Traditional concepts Consumer attitudes Location Supporting infrastructure Government support
International factors	International regulations concerning the protection of wild plants Whether the international resources that can be shared become a wild plant protection state party

regulations factors, including eight factors such as whether the filing and penalty standard is clear, whether the terms of the current period is applicable, whether the scope of protection and the protection level is a single and so on. The second part is the management system factor, including eight factors such as the adequacy of the management staff, the quality of management personnel, whether the administration and other supporting facilities is perfect and soon; The third part is the economic factor, including seven factors such as the macro-transaction forms, market size, market information transparency degree and so on; the fourth part is the social factor, including five factors such as the traditional concepts, consumer attitudes, location and so on; the fifth part is the international factor, including three factors such as international regulations concerning the protection of wild plants, whether the international resources that can be shared become a wild plant protection state party. And the author uses the Five Point Likert Scale to divided the form into 5°, namely, very important, important, in general, not important, very not important, represented by the scores " 5, 4, 3, 2, 1" and ask the manager to value each factor. There is a total of 37 effective manager questionnaire (Table 1).

Analysis of the main components of factors influencing the sustainable use of wild plants:

Principal component analysis theory: In practical problems encountered, different variables are not independent but share a certain correlation. As there are

some relevance between one variable and other variables, the complexity during the analysis of the problems is bound to increase. Therefore, a method to simplify the problem is needed: on the premise of little or no loss of the original variable information, convert the original larger number of factors and variables associated with each other into the new integrated uncorrelated variables with a small number but are independent of each other. Principal component analysis uses dimensional reduction thinking to reduce the various indicators into a few composite indexes. The formula of the principal component analysis method is as follows:

Assuming the research of one thing involves P indexes X_1, X_2, \dots, X_p . $X = (X_1, X_2, \dots, X_p)$, the random vector X is B and the covariance matrix is A, consider the following linear transformation:

$$Y_i = a_i' X = a_{1i}X_1 + a_{2i}X_2 + \dots + a_{ni}X_n \quad (1)$$

Y_i represents the i-th principal component, $a'_i = (a_{1i}, a_{2i}, \dots, a_{ni}) (i = 1, 2, \dots, n)$; a_{ij} represents the coefficient relationship between j-th variable and the i-th principal component; the correlation coefficient of Z_i 's variance $\text{Var}(Z_i) = a_i' A a_i$; Z_i, Z_j is:

$$\text{Cov}(Z_i, Z_j) = a_i' A a_j', (i, j = 1, 2, \dots, n) \quad (2)$$

Use the variance of Z_1 to represent the information of P variables, the larger $\text{VAR}(Z_1)$ is, the more

information it has, this is the first principal component. The rest may be deduced by analogy. With this method the dimension of the original factor can be reduced.

Calculation steps:

- Standardize the original P indexes variables to eliminate the variables' impact on the number of poles and the impact on the dimension and calculate the correlation coefficient matrix R.
- Calculate the characteristic root of the correlation coefficient matrix R and the corresponding unit eigenvectors orthogonal.
- Calculate the variance contribution rate and the cumulative contribution rate of each characteristic roots. According to the general principles of the cumulative contribution rate be not less than 60% to determine m (m<p), the number of principal components.
- Calculate the score of each main factor. Decided the main factor and combine the with professional knowledge to proper explain the information contained in the main component.

Use SPSS software to make principal component analysis. The SPSS 16.0 system default to calculate the main component from the correlation matrix of the original variables. Thus when the raw data is normalized, the following main components used in each principal components, characteristic root and eigenvector and the correlation value are standardized value.

RESULTS AND DISCUSSION

KMO and Bartlett sphericity test: Standardized method for the raw data, calculation of the eight values and eigenvectors, calculation of the factor contribution rate and cumulative contribution rate and the factor scores and total scores shall be completed automatically by spss16.0. It should be noted that before the principal component analysis, among the factor correlation matrix, many values in the first half of the table are close to 1 and many of the values in the second half are close to 0, illustrating that the 31 factors share close relativity and thus it is feasible to reduce dimension. From the test result of KMO and Bartlett, KMO test statistic is 0.801. Bartlett sphericity test p-value is 0, meaning that data in this model is suitable to conduct component analysis.

Use the principal component analysis to get the mean and standard deviation of the 37 samples, as is shown in Table 2 and 3: We can see from Table 4 that the value of characteristic root extracted is greater than 1, that is, for the first five principal components

Table 2: Describe the statistics

Index	Mean	Standard
X1	4.14	0.899
X2	4.00	1.15
X3	3.71	0.76
X4	4.28	0.76
X5	4.28	0.76
X6	4.28	0.76
X7	4.42	0.53
X8	3.86	0.69
X9	3.57	0.98
X10	3.85	0.69
X11	3.57	0.98
X12	3.85	0.69
X13	4.00	0.82
X14	3.71	0.49
X15	3.28	1.11
X16	4.00	0.82
X17	3.71	0.49
X18	4.14	0.90
X19	4.00	0.82
X20	4.29	0.95
X21	4.14	0.90
X22	3.86	1.07
X23	3.29	1.25
X24	3.57	0.79
X25	3.71	0.76
X26	4.29	0.76
X27	3.57	0.98
X28	4.14	0.90
X29	3.57	0.98
X30	3.14	1.07
X31	3.14	1.07

Table 3: Community

Original	Extract
1	0.999
1	0.972
1	0.967
1	0.996
1	0.965
1	0.947
1	0.922
1	0.978
1	1
1	0.999
1	1
1	0.995
1	0.982
1	0.997
1	0.958
1	0.988
1	0.995
1	0.992
1	0.99
1	0.997
1	0.952
1	0.934
1	0.985
1	0.995
1	0.995
1	0.993
1	0.996
1	0.986
1	0.996
1	0.997
1	0.997

extracted, the characteristic roots of the five main components were 15.083, 7.214, 3.868, 2.452, 1.847. As is shown in Table 4, we can see the cumulative

Table 4: Total variance explained

Content	Original			Extract and load		
	Total	Variance %	Accumulate %	Total	Variance %	Accumulate %
1	15.083	48.656	48.656	15.083	48.656	48.656
2	7.214	23.271	71.926	7.214	23.271	71.926
3	3.868	12.476	84.402	3.868	12.476	84.402
4	2.452	7.910	92.312	2.452	7.910	92.312
5	1.847	5.959	98.272	1.847	5.959	98.272
6	0.536	1.728	100.000			

Table 5: Rotated component matrix^a

Component	1	2	3	4	5
x1	-0.167	0.915	-0.300	0.171	-0.122
x2	0.867	0.325	0.160	0.188	-0.234
x3	0.444	0.681	0.291	0.282	-0.377
x4	0.026	0.853	0.064	-0.510	0.052
x5	0.547	0.802	-0.087	-0.063	-0.101
x6	0.390	-0.067	0.828	0.297	-0.126
x7	0.002	0.122	0.937	0.173	0.003
x8	0.797	0.280	-0.402	0.240	-0.210
x9	0.824	0.324	0.350	0.266	0.150
x10	0.892	0.325	0.187	-0.179	0.180
x11	0.743	0.507	0.366	-0.148	-0.189
x12	0.387	0.190	0.436	0.785	0.046
x13	0.607	-0.194	0.632	0.398	-0.137
x14	0.089	0.081	0.953	0.270	0.043
x15	0.798	0.189	-0.026	0.334	-0.416
x16	0.681	0.248	0.319	0.598	-0.067
x17	0.811	0.134	0.048	0.535	-0.172
x18	0.343	0.906	0.024	0.226	0.048
x19	0.255	0.904	0.320	-0.003	0.076
x20	0.016	0.978	-0.109	0.074	0.148
x21	0.139	0.141	0.341	0.850	-0.272
x22	0.387	-0.285	0.424	0.724	-0.005
x23	0.795	0.099	0.564	0.149	0.055
x24	0.577	0.270	-0.458	0.525	0.321
x25	0.299	0.474	-0.105	-0.011	0.819
x26	-0.055	0.436	-0.272	-0.731	-0.437
x27	0.940	-0.084	0.086	0.006	0.313
x28	-0.095	0.949	0.151	-0.150	0.177
x29	0.940	-0.084	0.086	0.006	0.313
x30	0.880	-0.090	0.121	0.442	0.073
x31	0.880	-0.090	0.121	0.442	0.073

Extraction Method: Principal Component Analysis; Rotation Method: Varimax with Kaiser Normalization

Table 6: Composition score covariance matrix

Component	1	2	3	4	5
1	0.810	0.330	0.307	0.375	-0.002
2	-0.085	0.884	-0.287	-0.358	0.025
3	-0.494	0.283	0.793	0.169	-0.139
4	0.277	-0.165	0.441	-0.812	0.204
5	-0.125	0.053	0.029	0.206	0.969

Extraction Method: Principal Component Analysis; Rotation Method: Varimax with Kaiser Normalization

contribution rate of five main components can reach 98.272%, meaning that these five factors compromise a lot of information and can better represent the overall situation of all factors. Therefore, the former 31 factors are reduced into these five factors and according to the contribution rate they are divided into the most important factor, important factor, general factor, not important factor and least important factor. Figure 1 shows that the first principal component has the maximum contribution rate and from the seventh factor, the curve has become gentle and combined analysis of

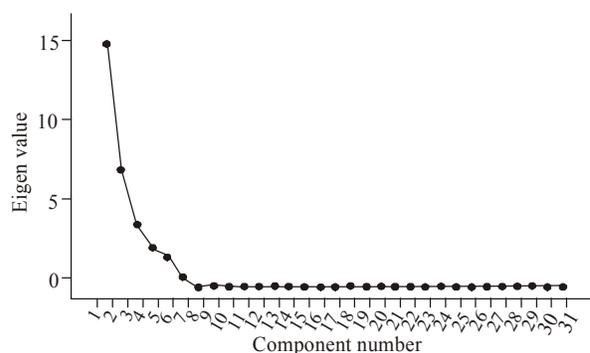


Fig. 1: Gravel figure

the table we can see the five main ingredients extracted are scientific and reasonable.

Result analysis: Table 5 is the principal component value matrix rotation. Table 6 is the Composition score covariance matrix. According the factor indicators in the Table 5 and 6, we can extract five factors, Y₁, Y₂, Y₃, Y₄, Y₅, representing the most important factor, important factor, general factor, not important factor and least important factor. They're factor formula are: Composite factor score coefficient:

$$F = 48.656F1 + 23.271F2 + 12.476F3 + 7.910F4 + 5.959F5$$

CONCLUSION

We should not only protect but also reasonably use wild plant resources to provide financial support for the protection of wild plant and promote the sustainable development of wild animals by effective protection:

Further strengthen the protection and management of wild plants and coordinate the relationship between the various departments: Make clear the department attribution of orchids, vines and other plants. Formulate regulations and protection list of the province's wild plants to provide the basis for the protection and management of wild plants. Strengthen law enforcement, timely organize special action to crack down criminal acts that destruct wild plant resources. Further clarify the responsibilities of the various management departments. Reduce management

defects of law enforcement agencies caused by local protectionism, weak protection awareness and other causes.

Strengthen the cultivation and utilization of wild plants: Due to the lack of the study of wild plant cultivation, the development of wild plant cultivation industry is slow, resulting in a huge dependence on wild resources. For example, most of the wild orchid plants sold locally are obtained from the wild. Although there are orchid cultivation base, the seeds are obtained from the wild (Liu, 2007). Therefore, it is recommended to strengthen cooperation with domestic and foreign research institutes, research orchids and other wild plants cultivation techniques and vigorously promote the promotion of wild plant cultivation techniques, thereby contributing to artificially propagated wild plants and to a certain extent protect wild plants. In addition, strengthen research on the use of wild plants, intensify efforts to develop deep processing products, extend wild plants processing chain so as to promote the use of local wild plants in the formation of industrialization.

Encourage the rational use of wild plants: It is recommended to strengthen policy guidance for the use of wild plants, encourage the use and cultivation of wild plant resources without damaging the resources. Timely monitor the wild plant stocks and the amount of cultivated wild plant resources, encourage the use of those wild plants with a large wild stock and cultivated stock while limit the use of the wild plant with a small stock.

In addition, while encouraging the rational use of wild plants, we should learn from the successful experience of Ningxia, Shaanxi and other provinces in exploring the industrial development of medicinal

plants, encourage a variety of business models and conduct the "Company + farmers", "company + base + farmers", "professional technology association + farmers" and other development models (Zhao and Shi, 2005) to link the cultivation of wild plants and the use of organic base, thus promote the rapid development of industrialization wild plants.

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REFERENCES

- Liu, J., 2007. Current situation and countermeasures of wild plants protection [J]. *Planning*, 6(3): 132-135.
- Luo, Y., 2009. Industrial use and countermeasures of wild plants in China [D]. Ph.D. Thesis, Beijing Forestry University, Beijing, China.
- State Forestry Administration, 2010. Wild Plant Resource. [EB/OL]. Retrieved form: <http://www.forestry.gov.cn//portal/main/s/1078/content-115092.html>
- Zhang, S. and K. Ye, 2011. Wildlife utilization and industrial development strategies in Wuwei town. *Anhui Agric. Sci.*, 12(15): 153-154.
- Zhao, X. and D. Shi, 2005. Guangdong vegetable industry business model and development countermeasures [J]. *Guangxi Agric. Sci.*, 36(1): 88-90.