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Typical Bamboo Habitat Ecological Factors Influence Evaluation

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Abstract. Ecological factors is generally refers to only important factor in a variety of biological impact of environmental factors and it is to determine the distribution of habitats. To analyze the Yunnan Bambusoideae affecting habitat distribution ecological factors principal component, first analyze the basic theory and geometric meaning of the Principal Component. Based on this analysis to determine the steps, we selected hollow bamboo genera hollow bamboo as a typical case of bamboo species for this analysis. The second to standardize ecological factors data, building Habitat distribution Factor correlation matrix to determine y1, y2, y3 as three main components. Evaluate the habitat distribution of hollow bamboo by principal component analysis.

Introduction

Habitat is generally refers to an individual, population or community living creatures geographical environment, it is mainly composed by necessary living conditions and ecological factors affecting the organism. Compared to the environment, the habitats of significance and the environment is different, habitat emphasized the ecological factors of the decision to biological survival, since the organisms has the characteristics to adapt to the habitat, but also has the characteristic to alter the habitat, so under normal circumstances, the organism can survive in a variety of habitats. To analyze the reason why distributed so many plant species of Yunnan Bambusoideae for further analyze the distribution characteristics of Yunnan Bambusoideae habitat, and for being able to more fully and accurately reflect the impact of the distribution of Bambusoideae's main habitats ecological factors, it is necessary to analyze the impact of multiple ecological factors of Bambusoideae Distribution, it also has a certain degree of correlation between these ecological factors. This paper is based on the thought of the dimensionality reduction of principal component analysis method to introduce the main component analysis method, and in maintaining the basis of the original variable ecological factors , the paper completed the typical characteristics of Bambusoideae Habitat Distribution analysis on the basis of the constructing the covariance matrix and correlation by the original variable .

1.Materials and Methods

In the empirical study of the influence of Yunnan Bambusoideae typical habitat distribution ecological factors, in order not to miss an influential ecological impact of each factor on the distribution of habitat, this paper introduces the principal component analysis which is mainly based on the thought of dimensionality reduction of the main ingredient analysis by a linear combination of the original variables to analyze the main features of Yunnan Bambusoideae habitats.
Supposing impact of Yunnan Bambusoideae typical habitat distribution ecological factors involving p indicators which were represented by $X_1, X_2, \cdots, X_P$, p - dimensional random vector which is constituted by the index p is $\mathbf{X} = (X_1, X_2, \cdots, X_p)'$. Suppose the mean value of the random vector X equal $\boldsymbol{\mu}$ and the covariance matrix equal $\boldsymbol{\Sigma}$. By Linear transforming of X, we can form a new integrated variable which is represented by Y, that is, the new variables can be expressed by the original linear variable which satisfy the following formula:

$$\begin{cases} Y_1 = u_{11}X_1 + u_{12}X_2 + \cdots + u_{1p}X_p \\ Y_2 = u_{21}X_1 + u_{22}X_2 + \cdots + u_{2p}X_p \\ \cdots\cdots\cdots \\ \mathrm{Y_p} = u_{p1}X_1 + u_{p2}X_2 + \cdots + u_{pp}X_p \end{cases} \qquad \cdots\cdots(1)$$

Since the original variables can be made above linear transformation arbitrarily, the statistical properties of composite variables $\mathbf{Y}$ by different linear transformation are not exactly the same. Therefore, in order to achieve better results, we always want the variance of $Y_i = \mathbf{u_i}'\mathbf{X}$ as large as possible and the factors between the Y_i are independent of each other, due $\mathrm{var}(Y_i) = \mathrm{var}(\mathbf{u_i}'\mathbf{X})$ and for any given constant c, there are $\mathrm{var}(c\mathbf{u_i}'\mathbf{X}) = c\mathbf{u_i}'\Sigma\mathbf{u_i}c = c^2\mathbf{u_i}'\Sigma\mathbf{u_i}$, therefore $\mathbf{u_i}$ without limit, can make $\mathrm{var}(Y_i)$ arbitrarily large, the problem will become meaningless. We will transform linear constraints under the following principles:

1. $\mathbf{u}_i{}'\mathbf{u}_i = 1$, which is: $u_{i1}^2 + u_{i2}^2 + \cdots + u_{ip}^2 = 1 \ (i = 1,2,....p)$ ....(2)

2. Y_i and Y_j independent of each other $(i \neq j;\ \ i, j = 1,2,....p)$

3. Y_1 is the maximum variance of all the linear combination between the factors which satisfy the principle from $X_1, X_2, \cdots, X_P$; Y_2 is uncorrelated with Y_1 and is the maximum variance of all the linear combination between $X_1, X_2, \cdots, X_P$ all linear combinations of the greatest variance; Y_p is uncorrelated with $Y_1, Y_2, \cdots, Y_{P-1}$ and is the maximum variance of all the linear combination between $X_1, X_2, \cdots, X_P$.

The Integrated variable $Y_1, Y_2, \cdots, Y_P$ which are determined by above three principles are called the first, second, ..., p -th principal component . Wherein each integrated variable of the total variance in proportion is in a descending order, in the actual study, just pick the first few of the biggest variance principal component, thereby to simplify the system structure, grasp the essence of the purpose of the issue.

Habitats data is mainly obtained through China Meteorological Data Sharing Service System and the System is mainly composed of eight international weather stations, namely: Kunming, Chuxiong, Lancang, Lijiang, Lincang, Mengzi, Simao, Tengchong. The main data range is from 1951 to 2013 that a total of 52 years of meteorological data; In a total of 20 kinds of selected 14 kinds of ecological factors as the main impact of the habitat distribution factor, namely: altitude, extreme minimum pressure, extreme minimum temperature, extreme maximum pressure, extreme maximum temperature, precipitation, average temperature, average vapor pressure, mean Relative humidity, the average minimum temperature, the average maximum temperature, daily precipitation> = 0.1mm number of days, hours of sunshine, minimum relative humidity.

2.Result analysis

The meteorological data is mainly come from the eight international weather stations . Monthly average data of ecological factors from those 8 places are in the following table.

Table 1 Monthly ecological factor data

Sites	Kunming	Chuxiong	Lancang	Lijiang	Lincang	Mengzi	Simao	Tengchong
Altitude	1895	2916	1054	2418	1460	1307	1302	1640

Extreme minimum pressure	18286	18643	19279	18006	19192	18624	18767	19602
Extreme minimum temperature	6	7	8	9	10	11	12	13
Extreme maximum pressure	18362	18716	19348	18078	19255	18706	18834	19657
Extreme maximum temperature	25	26	27	28	29	30	31	32
Precipitation	818	703	1332	799	961	694	1234	1242
Average temperature	15	16	17	18	19	20	21	22
Average vapor pressure	125	127	174	98	145	155	166	137
Mean Relative humidity	72	69	78	63	72	71	79	78
The average minimum temperature	10	11	12	13	14	15	16	17
The average maximum temperature	21	22	23	24	25	26	27	28
Daily precipitation> = 0.1mm number of days	11	10	14	11	14	11	13	15
Hours of sunshine	286	287	288	289	290	291	292	293
Minimum relative humidity	153	155	162	147	159	152	158	155

In the above table, According to the statistics of Yunnan Bambusoideae specimens, we found that the hollow bamboo genus hollow bamboo in Yunnan Province has a fairly wide distribution, In addition to Lijiang and Mengzi have no distribution, in the other 6 weather stations are distributed, therefore we selected hollow bamboo as a typical analysis object and principal component analysis, the first make standardized treatment of the monthly data of ecological factors of the hollow bamboo distribution, the results of treatment is shown in the following table.

Table 2.The distribution of monthly mean ecological factor standardized data

Sites	Chuxiong	Lancang	Lincang	Simao	Tengchong
X_1	1.70857	-0.85374	-0.29504	-0.51246	-0.04734
X_2	-1.15947	0.46624	0.24386	-0.84251	1.29188
X_3	-1.15662	0.48236	0.24118	-0.85061	1.28369
X_4	-1.1767	-0.78446	0	0.78446	1.1767
X_5	-1.1767	-0.78446	0	0.78446	1.1767
X_6	-1.1767	-0.78446	0	0.78446	1.1767
X_7	-1.1767	-0.78446	0	0.78446	1.1767
X_8	-1.1767	-0.78446	0	0.78446	1.1767
X_9	-1.51009	0.9167	-0.51468	0.5386	0.56947
X_{10}	-1.6636	0.4159	0.4159	-0.10398	0.93578
X_{11}	-1.15645	1.22746	-0.24346	0.82169	-0.64924
X_{12}	-1.39688	0.63085	-0.72097	0.85615	0.63085
X_{13}	-1.1767	-0.78446	0	0.78446	1.1767
X_{14}	-0.94929	1.42393	0.40684	0.06781	-0.94929

As shown in the above table, by using SPSS statistical analysis software to calculate, we can obtain the correlation coefficient matrix. In general, most of the high correlation coefficient of variables will enter the same main ingredient, but not entirely, in addition to the correlation coefficient, the decision variable factors in the status of distribution of the main components include the structure of data. The

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correlation coefficient matrix has the reference value to the principal component analysis, after all, the principal component analysis is started from the eigenvalue which are calculated by the correlation coefficient matrix. Hollow bamboo habitat distribution factor correlation coefficient matrix is shown in the following table.

Table 3.Habitat distribution factor correlation matrix

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}
X_1	1.00	−0.52	−0.45	−0.52	−0.45	−0.88	−0.45	−0.84	−0.80	−0.45	−0.45	−0.83	−0.45	−0.74
X_2	−0.52	1.00	0.46	1.00	0.46	0.58	0.46	0.08	0.46	0.46	0.46	0.88	0.46	0.15
X_3	−0.45	0.46	1.00	0.46	1.00	0.54	1.00	0.07	0.64	1.00	1.00	0.66	1.00	−0.27
X_4	−0.52	1.00	0.46	1.00	0.46	0.58	0.46	0.09	0.46	0.46	0.46	0.88	0.46	0.15
X_5	−0.45	0.46	1.00	0.46	1.00	0.54	1.00	0.07	0.64	1.00	1.00	0.66	1.00	−0.27
X_6	−0.88	0.58	0.54	0.58	0.54	1.00	0.54	0.77	0.97	0.54	0.54	0.79	0.54	0.51
X_7	−0.45	0.46	1.00	0.46	1.00	0.54	1.00	0.07	0.64	1.00	1.00	0.66	1.00	−0.27
X_8	−0.84	0.08	0.07	0.09	0.07	0.77	0.07	1.00	0.72	0.07	0.07	0.41	0.07	0.86
X_9	−0.80	0.46	0.64	0.46	0.64	0.97	0.64	0.72	1.00	0.64	0.64	0.70	0.64	0.35
X_{10}	−0.45	0.46	1.00	0.46	1.00	0.54	1.00	0.07	0.64	1.00	1.00	0.66	1.00	−0.27
X_{11}	−0.45	0.46	1.00	0.46	1.00	0.54	1.00	0.07	0.64	1.00	1.00	0.66	1.00	−0.27
X_{12}	−0.83	0.88	0.66	0.88	0.66	0.79	0.66	0.41	0.70	0.66	0.66	1.00	0.66	0.36
X_{13}	−0.45	0.46	1.00	0.46	1.00	0.54	1.00	0.07	0.64	1.00	1.00	0.66	1.00	−0.27
X_{14}	−0.74	0.15	−0.27	0.15	−0.27	0.51	−0.27	0.86	0.35	−0.27	−0.27	0.36	−0.27	1.00

Table 4.Table analysis of habitat distribution

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.731	62.366	62.366	8.731	62.366	62.366
2	3.426	24.469	86.835	3.426	24.469	86.835
3	1.506	10.758	97.592	1.506	10.758	97.592
4	.337	2.408	100.000			
5	3.826E-16	2.733E-15	100.000			
6	2.643E-16	1.888E-15	100.000			
7	1.035E-16	7.393E-16	100.000			
8	2.103E-17	1.502E-16	100.000			
9	−5.908E-18	−4.220E-17	100.000			
10	−4.069E-17	−2.906E-16	100.000			
11	−5.124E-17	−3.660E-16	100.000			
12	−1.513E-16	−1.081E-15	100.000			
13	−2.027E-16	−1.448E-15	100.000			
14	−7.671E-16	−5.480E-15	100.000			

As shown in the table above the first three principal components explained 97.592% of the variance of all, which contains 97.592% of the total amount of original information, behind the characteristic value contribution is less and less, We selected the eigenvalue greater than 1 as the extraction condition of principal component eigenvalue extraction, the characteristic values were: 8.731, 3.426, 1.506. The eigenvalues gravel is shown below.

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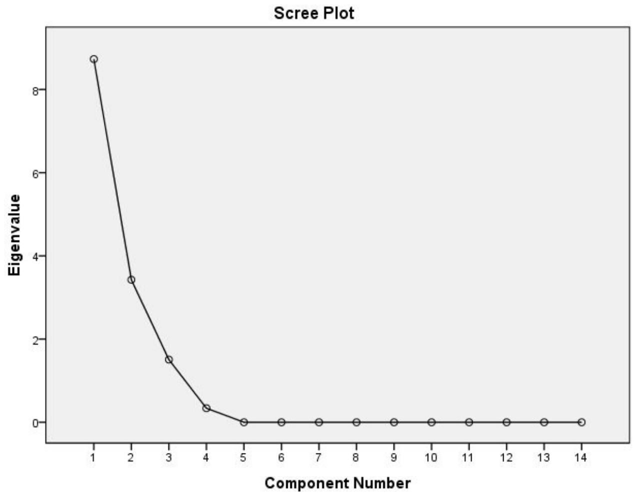

Fig.1 Habitat distribution eigenvalues scree plot

As shown above, it suggests that the habitat distribution of the first 3 principal components on behalf of the original 8 indexes of hollow bamboo is reasonable, assuming that three principal components were used as y1, y2, y3 to be represented, Through the SPSS calculation we can get three eigenvalue eigenvector as shown in the following table.

Table 5.Calculation results of feature vector

Component Matrix[a]			
	Component		
	1	2	3
X_1	-.728	-.647	.102
X_2	.682	.169	.709
X_3	.917	-.373	-.133
X_4	.677	.177	.711
X_5	.917	-.373	-.133
X_6	.802	.525	-.097
X_7	.917	-.373	-.133
X_8	.354	.832	-.427
X_9	.827	.363	-.267
X_{10}	.917	-.373	-.133
X_{11}	.917	-.373	-.133
X_{12}	.883	.293	.336
X_{13}	.917	-.373	-.133
X_{14}	.076	.962	-.076

Inear combination from the table, we can draw the three main components are as follows:

$$y1=-0.728x1+0.682x2+0.917x3+0.677x4+0.917x5+0.802x6+0.917x7+0.354x8+0.827x9 +0.917x10+0.917x11+0.883x12+0.917x13+0.076x14$$

$$y2=-0.647x1+0.169x2-0.373x3+0.177x4-0.373x5+0.525x6-0.373x7+0.832x8+0.363x9 -0.373x10-0.373x11+0.293x12-0.373x13+0.962x14$$

$$y3=0.102x1+0.709x2-0.133x3+0.711x4-0.133x5-0.097x6-0.133x7-0.427x8-0.267x9 -0.133x10-0.133x11+0.336x12-0.133x13+-0.076x14$$

In the above formula, X3, X5, X7, X10, X11, X13 coefficient is much larger than the coefficient of other variables, therefore, y1 is mainly reflected by six indicators that the extreme minimum temperature, extreme maximum temperature, average temperature, average minimum temperature, average maximum temperature and sunlight hours , which to some extent represents the ecological factors characteristic of hollow bamboo distribution. As by the y1 to evaluate habitat factors characteristic hollow bamboo distribution has a 62.34 percent certainty, it can be said that six indicators reflect the main indicators of habitat factors characteristic distribution of hollow bamboo. At the same time by a linear combination of the six indicators in the comprehensive factor y1 apparent indicators these six factors is essential; y2 is mainly a comprehensive reflection of the minimum relative humidity and average vapor pressure, which represents the minimum relative humidity level of hollow bamboo habitat environment and the average vapor pressure; y3 is mainly reflect a comprehensive response to the extremely high pressure and extremely minimum air pressure, which can explain the extreme maximum and minimum pressure on habitat control group distribution is relatively significant; From the three aspects of the factors can make a scientific evaluation on the application of hollow bamboo habitat, 3 indicators of the hollow bamboo habitat distribution evaluation accuracy rate can reach 97.592% reliability

3.Summary

Application of principal component analysis completed hollow bamboo genera ecological factors principal component hollow bamboo habitat distribution analysis, it make a significant evaluation to the greatest impact on the distribution of ecological factors. Through the hollow bamboo 14 ecological factors principal component analysis, the first principal component is the greatest impact on the habitat distribution, through habitat distribution analysis can be found, the confidence level reached 62.34%, the second main ingredient confidence reached 86.835 %. It can be said that it is the main indexes to reflect the habitat distribution characteristics of hollow bamboo, and It can also draw on the distribution of the lowest temperature, extreme maximum temperature, average temperature, average minimum temperature average maximum temperature and sunshine significantly affected the hollow bamboo.

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