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Study on Eco-environmental Impact of Saihanba Based on Correlation and Cluster Analysis

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Abstract: *China has always attached great importance to respecting, protecting and restoring nature. The construction of the index system of Saihanba is an important part of exploring its impact on the ecological environment. In order to make the plantation closer to the natural forest, it is necessary to quantitatively evaluate the impact of Saihanba on the ecological environment. In this paper, air velocity, frequency / year of major pollution and air quality index are taken as direct impact indicators, and forest cover area and forest coverage as indirect indicators. The correlation coefficient between direct index and indirect index is calculated by correlation analysis method, the corresponding correlation coefficient matrix is listed, and the thermal map and column chart are made. Finally, according to the cluster analysis, the provinces are clustered every year, and the ecological model is established for the same kind of provinces. The correlation coefficient matrix is calculated according to the correlation coefficient formula, and the correlation coefficient matrix is drawn into a cluster diagram by using MATLAB.*

Keywords: *Saihanba Forest Farm; Cluster Analysis; Correlation Analysis*

1. Introduction

We should not only obtain rich material wealth through economic development, but also maximize the protection of the ecological environment. With the help of the Chinese government, China's Saihanba Forest Farm has recovered from the desert and has now become an eco-friendly green farm [1] with stable sand prevention and fixation functions. As a result, the Saihanba people now have a higher goal, that is, ecological restoration. Since the 18th CPC National Congress, they have successively launched three major projects: afforestation, natural improvement of artificial forest and near-natural cultivation of natural forest, and they have tried to make the artificial forest closer to the natural forest. On the whole, the average temperature in Hebei Province shows an upward trend [2-4], in which the contribution of winter temperature is the greatest, and the temperature will continue to rise in the coming period of time; the average precipitation decreases gradually, especially in summer, and the precipitation is likely to continue to decline for a period of time in the future. In recent years, under the background of global warming, the precipitation in Hebei Province has decreased obviously, and the problem of shortage of water resources has become increasingly prominent, which has caused a serious negative impact on the life, production and ecological problems of the region, so if measures are not taken in time, the problem will get worse and worse.

2. Correlation Analysis

The data after data preprocessing is:

Table 1: Preprocessed data

Year	Forest coverage	Coverage area / 10000 mu	Average air quality index	Average wind speed/ M / S	Frequency of major air pollution / year
2014	75.52	105.73	125.42	2.10	0.32
2015	76.70	107.39	121.50	2.10	0.32
2016	77.89	109.05	113.17	2.10	0.30
2017	78.93	110.50	102.25	2.10	0.21
2018	79.82	111.74	87.00	2.00	0.11
2019	80.66	112.93	86.50	2.10	0.10

Let the random variables X, y, then the covariance is:

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$$Cov(X,Y) = E(X - EX)(Y - EY) \quad (1)$$

The correlation coefficient is:

$$\rho_{XY} = \frac{Cov(X,Y)}{\sqrt{DX}\sqrt{DY}} \quad (2)$$

The correlation level is:

Table 2: Correlation grade

Range	$0 \le \|R\| \le 0.2$	$0.2 \le \|R\| \le 0.4$	$0.4 \le \|R\| \le 0.6$	$0.6 \le \|R\| \le 0.8$	$0.8 \le \|R\| \le 1$
Grade	Irrelevant	Weak	Commonly	Strong	Very strong

Therefore, a correlation model is established. According to the relevant literature, the forest coverage rate and forest coverage area directly [5] affected by Saihan dam are selected as indicators. According to the formation principle of dust storm, the annual average wind speed, major pollution frequency / year and air quality index are selected as indicators to calculate the correlation coefficient between them [6].

3. Correlation Analysis Problem Solving

Using MATLAB software, input data and finally get the correlation coefficient as follows:

$$|\rho| = \begin{bmatrix} 1.0000 & 1.0000 & 0.9738 & 0.3967 & 0.9316 \\ 1.0000 & 1.0000 & 0.9734 & 0.3952 & 0.9312 \\ 0.9738 & 0.9734 & 1.0000 & 0.5508 & 0.9848 \\ 0.3967 & 0.3952 & 0.5508 & 1.0000 & 0.5565 \\ 0.9316 & 0.9312 & 0.9848 & 0.5565 & 1.0000 \end{bmatrix} \quad (3)$$

It can be seen from the correlation coefficient that there is a great correlation between the forest coverage rate and the average air quality index and the number of major air pollution, and the correlation coefficient is 0.5 9738 and 0 9316, the forest coverage area also has a great correlation with the average air quality index and the number of major air pollution, and the correlation coefficient is 0 9734 and 0 9312. This shows that the ecological measures of Saihan dam are helpful to improve air quality and effectively reduce the number of major pollution in the air.

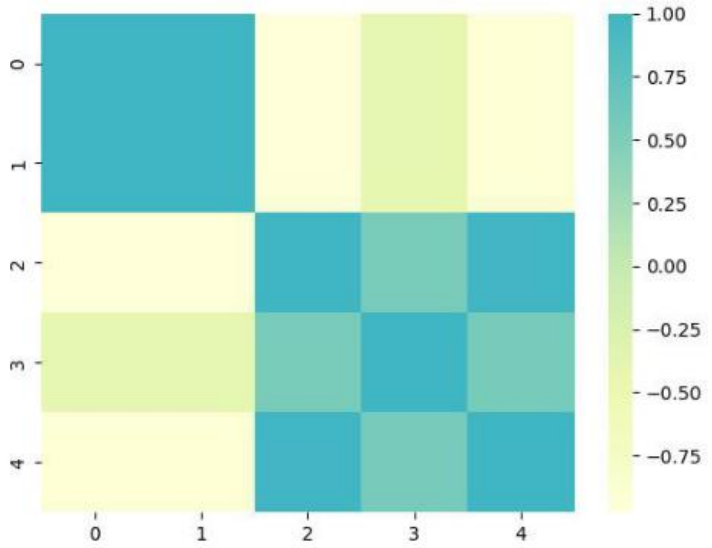

Figure 1: Thermal map result

The darker the color, the greater the correlation coefficient. The grid coefficients of row 3, column 0 and 1 and row 3, column 0 and 1 are negative, and the color is darker.

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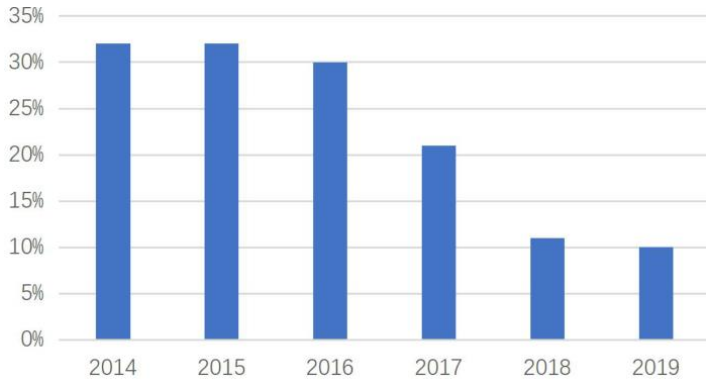

Figure 2: Frequency of major pollution

From the above model, we can see that the forest area has a strong correlation with air quality and the frequency of major pollution. Therefore, in order to prevent wind and sand fixation, protect the environment and maintain ecological balance and stability, the government should take corresponding measures to increase the forest area. Trees can not only absorb carbon dioxide, but also emit a lot of oxygen, It is conducive to better improve the ecological environment and air quality, so as to reduce the frequency of major pollution, prevent wind and fix sand and maintain the stability of the ecological environment. At the same time, the actual forest coverage has a strong correlation with air quality and the frequency of major pollution. In order to further improve the quality of ecological environment, we should not only take measures to increase the forest area, but also increase the actual forest coverage. By increasing the actual forest coverage, the above-mentioned improvement of air quality and reduction of major pollution frequency will be significantly improved, which will play a greater role in the improvement of ecological environment and produce more significant practical effects, and really play the role of preventing wind, carrying sand and maintaining ecological balance.

4. Cluster Analysis

4.1. Data Preprocessing

As there are many sources of energy in our country, the consumption of each energy is different, and the energy consumed by each industry is also different. Therefore, according to the provincial statistical yearbook and the national statistical yearbook, we select the various energy consumption and forest resources of each province, and first preprocess the above data.

4.2. Calculation of Carbon Conversion

Set carbon emission as U and carbon absorption as P

Then the carbon conversion is: h=U/(P*10000).

4.3. Cluster Analysis

In the cluster analysis of variables, the correlation of variables should be determined first. The most used is the correlation coefficient matrix. If the value of the variable JX is set, the sample correlation coefficient of the two variables can be used as the correlation.

$$r_{jk} = \frac{\sum_{i=1}^{n}(x_{ij} - \overline{x_j})(x_{ik} - \overline{x_k})}{\left[\sum_{i=1}^{n}(x_{ij} - \overline{x_j})^2 \sum_{i=1}^{n}(x_{ik} - \overline{x_k})^2\right]^{\frac{1}{2}}} \quad (4)$$

The correlation coefficient matrix is calculated according to the correlation coefficient formula, and the correlation coefficient matrix is drawn into a cluster diagram by using MATLAB.

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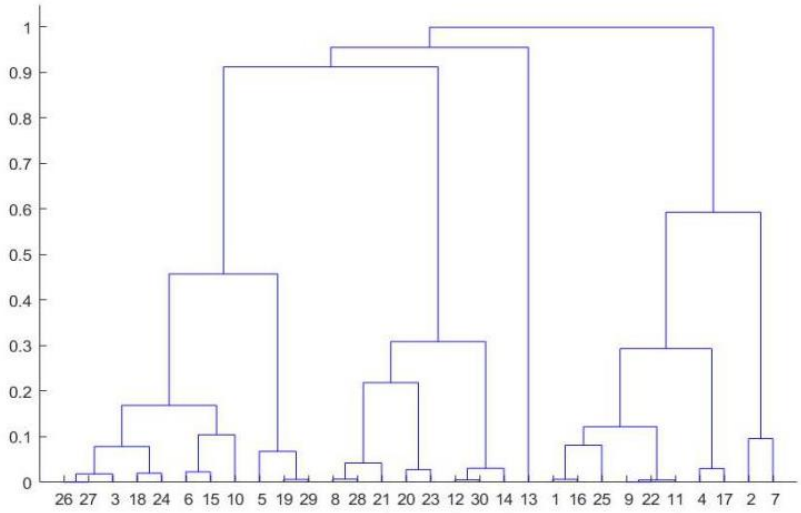

Figure 3: Cluster analysis results

5. Conclusion

This paper makes a quantitative analysis of Saihanba Forest Farm, based on the determined air velocity, major pollution frequency / year and air quality index as direct impact indicators, forest cover area and forest coverage as indirect indicators. By using the correlation analysis method to calculate the correlation coefficient between the direct index and the indirect index, it is concluded that with the increase of the year, the forest cover area is getting larger and larger, the forest coverage rate is getting higher and higher, the air quality index in Beijing is getting higher and higher, and the wind speed is getting smaller and smaller. the frequency of major pollution is getting lower and lower, and the effect of the state's protection measures on Saihanba has gradually improved the ecological environment in Beijing. In the future, it will also have a good effect on the ecological environment of other surrounding cities. In order to determine which geographical locations in China need to build ecological areas (that is, ecological protected areas), according to the cluster analysis, the provinces are clustered every year, and the correlation coefficient matrix is drawn into a cluster diagram by using MATLAB.

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