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Construction of Ecological Protection and Assessment of Environmental Impact

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Abstract: *The establishment of ecological reserves plays a very important role in protecting the ecological balance of nature, promoting production, carrying out scientific research and tourism development. A reasonable establishment of nature conservation reserves can protect the ecological balance, strengthen the research of biological species and achieve the purpose of using species resources at the minimum cost. To sum up, taking Saihanba Forest Farm in China as an example, we established model analysis to solve the environmental conditions before and after Saihanba restoration, and quantitatively evaluated the number and scale of construction ecological zones at home and abroad. Finally, we put forward feasible plans and suggestions to establish ecological protection areas to APMCM.*

Keywords: *ecological environment, environmental pollution, evaluate and analysis*

1. Introduction

1.1 Problem background

China adhere to the concept of "green water is the jinshan yinshan", adhere to respect for nature, conform to nature, protect nature, resource conservation, environment, nature in the first place, in the implementation of sustainable development strategy, improve the overall coordination mechanism in the field of ecological civilization, build ecological civilization system, promote economic and social development to comprehensive green growth, build a beautiful country [1].The Chinese government has successively carried out afforestation, natural improvement of artificial forests, and near-natural ecological protection. Restore the ecological environment and strive to bring artificial forests closer to natural forests.Saihanba Forest Farm has recovered from the desert, and it has now become a green farm with stable sand prevention function and eco-environmental protection. By establishing an appropriate mathematical model, the dynamic assessment model of the level of Saihanba is analyzed [2] .

1.2 Issue posed

Analyze and summarize the questions, collect relevant data, combined with the problems that need to be solved:

Question 1: By collecting relevant data, the evaluation model of Saihanba impact on ecological environment is established. In order to quantitatively evaluate the environmental impact of Saihanba dam after restoration, that is, quantitative values are obtained and the environmental conditions before and after Saihanba restoration are compared.

Question 2: The restoration of Saihanba Forest Farm has played an important role in Beijing in resisting sandstorms. Select appropriate indicators and collect relevant data, establish a mathematical model to evaluate the impact of Saihanba on Beijing's sandstorm resistance capacity, and quantify the role of Saihanba in Beijing.

Question 3: Assuming the ecological protection model is extended to the country, establish appropriate mathematical models and collect data to determine which geographical location in China requires an ecological environment (i. e., ecological reservations) and determine the number or scope of ecological zones to be built; its impact on achieving carbon neutral goals in China is evaluated.

ISSN 2616-5872 Vol.4, Issue 4: 1-19, DOI: 10.25236/AJEE.2022.040401

Question 4: China's Saihanba ecological protection model has set an example for the Asia-Pacific region. Please select another country in the Asia-Pacific region, build a mathematical model, and collect the relevant data.Then discuss which geographical locations in the country require building ecoregions and determine the number or size of ecoregions.In addition, its impact on absorption of "greenhouse gases" and reduced "greenhouse effect" should be assessed.

Question 5: Write a non-technical report to the Organizing Committee of the Asia-Pacific Modeling Mathematical Competition, describing the model adopted, and making feasible plans and suggestions for the establishment of ecological reserves.

2. Problem analysis

2.1 Analysis of problem 1

In response to the problem 1, Saihanba has played an important role in resisting wind and sand, protecting the environment, and maintaining ecological balance and stability. In the national yearbook, regional environment and other official websites to collect relevant data, use the entropy method to collect each secondary and tertiary indicators data analysis and calculate the weight of the indicators, determine the indicators to choose, and then use the Topsis of the evaluation of all indicators of the annual overall evaluation score analysis, to quantitatively analyze the impact of various factors on Saihanba, compare the environmental conditions before and after Saihanba repair.

2.2 Analysis of question 2

For question 2, analyzing problem 2 can show that when quantitatively evaluating the impact of Saihanba on Beijing, the connection is indirect and cannot directly use and express the ability of Saihanba and Beijing. Therefore, the model in the first question cannot be applied, and it needs to be re-established to quantitatively evaluate it. Therefore, the correlation of innovative introduction is analyzed, and the ecological environment of Saihanba can indirectly affect the sandstorm resistance capacity of Beijing. Therefore, the correlation analysis model is established here to evaluate the role of Saihanba in resisting dust storms in Beijing.

When using the correlation model, conclude the relationship between forest factors and dust storms in Saihanba forest farm from the Beijing climate situation, the several factors affecting Beijing climate condition, and establish the correlation analysis model.

By establishing correlation analysis model, consult data to collect each index data, find the correlation coefficient between forest index and Beijing climate factors, get the effect of forest index changes on the sandstorm resistance, the correlation coefficient shows the influence of the factors on climate indicators, thus reflect the effect of Saihanba in Beijing.

2.3 Analysis of problem 3

In view of the problem 3, the promotion of ecological protection mode should be extended to the whole country to analyze which geographical locations need to build an ecological environment. Here, some regions should not simply intercept these individual cases such as three northeast provinces and five northwest provinces for analysis, but the establishment of this model should be extended to a nationwide analysis. Ecological reserves are established for carbon neutralization analysis, and analyzed here with carbon emissions and carbon absorption as ecosystems.

Based on this, it is necessary to calculate the coal emissions of each province, various energy consumption, and the data of each provincial ecological processed carbon for statistics and analysis. Based on this, the carbon emission coefficient of each provincial energy and the carbon absorption coefficient of each forest are calculated, and the carbon emission P and absorption I of each province are obtained. It should be noted that every five years as a collection, the above data need to do clustering model analysis, the classification, different provinces to establish ecological protection model for the same type of ecological protection, analyze ecological protection area, and analyze the establishment of ecological protection reserve, for the next period of carbon neutral forecast, before and after the comparison, can evaluate its impact on the realization of China's carbon neutral goal.

ISSN 2616-5872 Vol.4, Issue 4: 1-19, DOI: 10.25236/AJEE.2022.040401

2.4 Analysis of question 4

For question 4, select another country to collect data in the Asia-Pacific region, select countries with the same ecological protection mode as Saihanba as possible, select Nepal countries for analysis in geographical location and ecological environment, select ten cities with high air pollution index to find their latitude and longitude forest coverage and urban area. We then discuss which geographical locations in this country would require the construction of ecoregions and their size and assess its impact on the absorption of "greenhouse gases" and reducing "greenhouse effects".

2.5 Analysis of question 5

For Question 5, write a report describing the model adopted and propose feasible plans and suggestions to establish ecological reserves. First, mathematical statistics are needed to obtain comprehensive climate and environment data, comprehensive evaluation to obtain local environmental index; finally, the clustering algorithm is needed to analyze the same characteristics, regional geographical location, determine the specific coordinate location, and determine the number of each category and determine the number of different types of reserves. In the final unified writing, the following points are written: firstly follow the priority principle, that is, where poor governance; secondly, develop the basic objectives to achieve according to the actual situation, finally conduct scientific governance, and achieve the most rapid and effective development of the ecological environment in the long term.

3. Model hypothesis

Suppose that the data found from the yearbooks of each province should meet the actual situation of the province;

Climate condition fluctuations used in Saihanba Forest Farm and Beijing City have remained within the error range of the investigation and research in recent decades;

Forget the impact of small values on the results during the calculation process;

Ignoring the impact of the finiteness and incompleteness of the information on the model;

4. Symbol description

symbol	meaning
i	Object indicators of the study
f_i	desired value
r	Correlation coefficient of the individual factors
Z	area of woods
X	The Co2 amount was not absorbed
v	Memean of AQI

5. Model establishment and solution

5.1 Question 1: Selection of evaluation index and entropy Topsis model based on entropy weight method

5.1.1 Selection of evaluation indicators

Referring to the environmental information of Saihanba forest farm, through the analysis of the existing ecological environment of Saihanba forest farm, you can build index factors about Saihanba forest farm, then select Saihanba forest farm ecological environment as the primary index, then you can summarize the environmental protection, maintain ecological balance, climate conditions of the three direct impact of the secondary index, in each secondary index, also has its corresponding tertiary index, build Saihanba forest farm ecological environment analysis framework, as shown in Figure 1:

ISSN 2616-5872 Vol.4, Issue 4: 1-19, DOI: 10.25236/AJEE.2022.040401

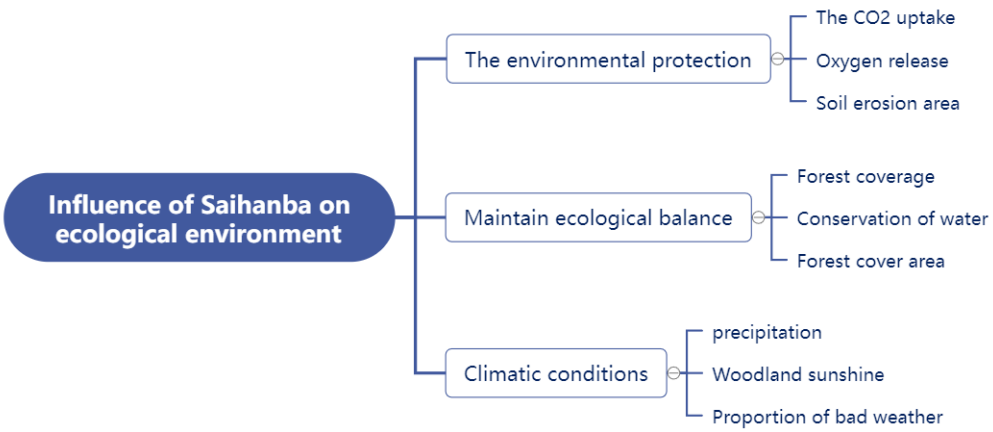

Figure 1: Framework of Ecological Environment Analysis of Saihanba Forest Farm

5.1.2 Data collection and preprocessing

Step 1: The original data of data collection comes from the statistical data and data of Saihanba Forest Farm Statistical Yearbook from 1962 to 1999,2018 Saihanba Forest Farm Statistical Bulletin, and the Data Open Platform of Saihanba Forest Farm. The index values were calculated accordingly to ensure the objectivity and accuracy of the index values.

Step 2: Data standardization.

Step 3: Normalization to transform the statistical index data values at all levels of Saihanba Forest Farm into the [0,1] interval. The model standardized the index data using the linear transformation method. Set it as a standardized indicator.

For the positive indicator:

$$a_{ij} = \frac{a_{ij} - \min(a_{ij})}{\max(a_{ij}) - \min(a_{ij})}$$

For the reverse indicator:

$$a_{ij} = \frac{\max(a_{ij}) - a_{ij}}{\max(a_{ij}) - \min(a_{ij})}$$

After data normalization using the above transformation method, the resulting processed data minimum is 0 and the maximum value is 1.

Step 4: Missing data estimation, this step uses the BP neural network to supplement the missing data collected by training and constantly modifying the weights and thresholds.

5.1.3 Overview and use of the entropy weight method

Enropy method is a method to determine the weight of index data according to the difference of index data between different schemes.According to the characteristics of the entropy, this paper uses the dispersion degree of the Saihanba ecological environment index, and it reflects the influence size of each index on the comprehensive evaluation results.The steps of the comprehensive evaluation using the entropy method are:

After standardizing the data of each index, the proportion of the i-object index value under item j index is calculated as follows:

$$y_{ij} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}} (0 \le y_{ij} \le 1)$$

Entered entropy and information utility were calculated for the term j index

$$e_{ij} = -k \sum_{i=1}^{m} y_{ij} \ln(y_{ij})$$

ISSN 2616-5872 Vol.4, Issue 4: 1-19, DOI: 10.25236/AJEE.2022.040401

Where k> 0, ln is the natural logarithm, 0. If all equal for a given j then

$$y_{ij} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}} = \frac{1}{m}$$

$$e_j = -k \sum_{i=1}^{m} \frac{1}{m} \ln \frac{1}{m} = k \ln m$$

The maximum is taken, that is, if k=1 is set, so 01, because the entropy is used to measure the utility value of the data of the indicators, when the information is completely disordered, =1, the utility value of the information for the comprehensive evaluation is 0. The information utility value defined as the item j indicator is =1, and the larger the more important. Define the weights:

$$w_j = \frac{d_j}{\sum_{j=1}^{n} d_j}$$

5.1.4 Analysis of index entropy values and weight results at each level

The collected data are calculated according to the calculation steps of the entropy method, the entropy and weight of the secondary index are shown in Table 1, and then the score and total score of each primary index are calculated in the Appendix, and the evaluation results of the entropy method are shown in Table 1:

Table 1: The entropy method assessment table

Secondary indicators	Level 3 indicators	weight	Entropy value
environmental protection	CO2 absorbed dose	0.126283	0.94378
	Oxygen release	0.098347	0.89237
	Soil erosion area	0.893247	0.87438
maintain ecological balance	land area covered with trees	0.102723	0.93487
	Water conservation	0.068923	0.78346
	coverage area	0.091728	0.87346
climatic conditions	precipitation	0.075372	0.77398
	sunshine	0.074684	0.73349
	The proportion of bad weather	0.086923	0.87665

Through simple weighted average analysis, it can be found that the number of secondary indicators with more than 0.099 accounted for 3 / 8 of the ratio of the total number of secondary indicators under each primary index, and environmental protection is the overall weight of the largest, indicating that in the three secondary indicators, environmental protection has the greatest impact on the overall level of ecological environment.

5.1.5 Establishment of the entropy weight Topsis method model

The TOPSIS method is applicable to order the proximity of finite evaluation objects and idealized goals, which is to evaluate the relative advantages of multiple secondary and tertiary indicators in the existing ecological environment of Saihanba Forest Farm.When choosing and using each index, choices are made according to its relative advantages and disadvantages. When quantitatively calculating its index value, we innovatively used the entropy right T opsis method to conduct the subjective and objective evaluation of the three-level indicators and establish the comprehensive weight of the evaluation indicators.The specific steps are as follows:

(1) Number forward forward processing:

If there is a delivery indicator in the data, you need to use data processing- -> the reverse energy processing of the generated variable turns the data into a positive indicator.The reverse data calculation formula is: (Max-X) / (Max-Min). It is obvious that after reversing the reverse indicators, the data becomes a positive indicator.

(2) Number standardization processing:

The purpose of standardizing the data is to solve the dimensionization problem.Common standardized processing methods are: normalization, interval mean value, etc.Normalization presses all data between 0 and 1; interval presses all data into its own set interval: mean = current value / average.Of course, you can also consider naturalization, let the data all between 0-1.There are many specific and standardized processing methods, which can be selected in combination with the literature

ISSN 2616-5872 Vol.4, Issue 4: 1-19, DOI: 10.25236/AJEE.2022.040401

and their own data. Different processing methods will certainly bring different results, but there will be no much bias in the conclusion.

(3) Weight seeking by power filling method:

The newdata newdata is obtained using the weight and teaching evidence; this step is changed to SPSSAU, the weight output by default and the newdata is calculated in the internal algorithm.

(4) Calculculation using the TOPSIS method

This step is automatic processing of SPSSAU and output TOPSIS related index results by default.

Comprehensive scores are obtained by simple weighting based on the weights of each index

$$\int i = \sum_{i=1}^{n} w_i x_{ij}$$

The advantages and disadvantages of the study subject i (i=1, …, m) from the size of the index, obviously, the larger, the better the evaluation effect of the sample.

It is worth noting that the entropy right TOPSIS is actually the new data after the entropy right method, and then studied with the new data for the TOPSIS method.

5.1.6 Quantitative assessment of the environmental impact of Saihanba after its restoration

Since the Saihanba Forest Farm ecological environment has improved from the desert since 1962, compared based on previously calculated entropy values and weights around 1962, and then compared with entropy weights based on total evaluation scores around 1962,

It was calculated to be f_{i1}=68.2359, before repair and f_{i2}=85.4857after repair.

It can be concluded that the environmental conditions after the restoration of Saihanba have been greatly improved, specifically manifested in its increase of about 8 percentage points in terms of environmental protection, maintaining ecological balance, and climate conditions.

5.2 Question 2: the choice of the correlation model affecting the dust storms

When quantitatively evaluating the impact of Saihanba on the anti-sandstorm capacity in Beijing, it should not directly use and express the relationship between Saihanba and Beijing anti-sandstorm capacity. Therefore, the model in the first question cannot be applied. Therefore, we need to re-establish the model to evaluate it quantitatively. The quality of the ecological environment of Saihanba can indirectly affect the ability of resisting dust storms in Beijing, so the correlation analysis model is established here to evaluate the size of the role of Saihanba in resisting dust storms in Beijing.

By establishing a correlation analysis model, the correlation coefficient between forest indicators and Beijing climate factors, respectively, shows that the effect of forest index changes on the ability of Beijing sandstorm resistance, the numerical size of the correlation coefficient shows the influence of various factors on climate indicators, thus reflecting the effect of Saihanba in Beijing.

5.2.1 Forest index factor affecting dust storm

For Saihanba forest land, the area of its forest determines the degree of its greening and its overall sand resistance strength. The number and density of trees within a unit area within its forest area, that is, the actual coverage rate of the forest, is an important causal factor for the formation of dust storms. Therefore, the overall area of dust prevention is the forest and the actual forest coverage of Saihanba.

5.2.2 Determination of Beijing climate factor indicators

To explore the size of the role of Saihanba in fighting against sandstorms in Beijing, then it depends on the actual climate of Beijing. At this time, we need to find out several factors related related to the climate of Beijing. Usually, the air quality in the region, the frequency of major pollution or sandstorms are several very important factors. Closely related to the occurrence of sandstorm is the average wind speed size in the region. At this time, three climate factors in Beijing can be summarized as follows:

(1) The air quality in Beijing

(2) Average wind speed in the Beijing area

(3) Frequency of major pollution occurring

ISSN 2616-5872 Vol.4, Issue 4: 1-19, DOI: 10.25236/AJEE.2022.040401

5.2.3 Data preparation and model calculation

(1) Data preprocessing

The data corresponding to the overall area of the forest and the actual forest coverage of Saihanba are counted through the Saihanba Forest Farm, the Saihanba Forest Farm and the Saihanba Forest Farm Data Open Platform.

The frequency of the average wind speed of major pollution in Beijing is calculated through the Beijing Statistical Yearbook, the Beijing Industrial Statistical Yearbook and the weather quality in Beijing.

(2) Calculate the correlation coefficient

The correlation coefficient between distance variables is commonly used by Pearson coefficient, Saihanba forest index X and Beijing climate factor index Y, so the correlation coefficient can be calculated as follows:

$$r(X,Y) = \frac{Cov(X,Y)}{\sqrt{Var[X]Var[Y]}}$$

Then:

$$r(X,Y) = \frac{\sum_{i=1}^{n}(x_i - \bar{x})\,(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2 \sum_{i=1}^{n}(y_i - \bar{y})^2}}$$

The closer the correlation coefficient r is to-1 or + 1, the stronger the corresponding correlation coefficient is, the greater the effect of Saihanba in Beijing; the closer the value is to 0, the weaker the correlation coefficient is.If r = -1 or-1., the two phenomena are completely directly linear correlated, namely, Saihanba plays a decisive role in resisting dust storms in Beijing.If it is equal to 0, it means that the two phenomena are completely unrelated, indicating that Saihanba plays no role in Beijing, and that Saihanba woodland has no connection to Beijing's protection against dust storms.

(3) Significance test of the correlation coefficient

H_0 When the null hypothesis is: =0, n 50, the test statistic is:

$$Z = \frac{r\sqrt{n-1}}{1-r^2}$$

$$Z = \frac{r\sqrt{n-1}}{1-r^2}5 - 2$$

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}(df = n-2)$$

In formula, r is a simple correlation coefficient; n brings the above collected data into the spss software, and the variables are selected into the Variables box.

All the obtained correlation coefficients were graded, and the partition results are shown in Table 2:

Table 2: Classification degree of correlation coefficient level

r scope	grade
0≤|r|＜0.2	weak
0.20≤|r|＜0.4	same as
0.40≤|r|＜0.6	stronger
0.60≤|r|＜0.8	stubborn
0.80≤|r|＜1.0	Very strong

5.2.4 Correlation analysis of the model

Through the above model, the forest coverage, Beijing air quality, average wind speed in Beijing, and frequency of major pollution, are calculated to evaluate the role of Saihanba in resisting dust storms in Beijing.

(1) Correlation between forest coverage and mean wind speed

ISSN 2616-5872 Vol.4, Issue 4: 1-19, DOI: 10.25236/AJEE.2022.040401

Table 3: Correlation of forest coverage and mean wind speed

Correlation of forest coverage and mean wind speed			
		land area covered with trees	mean wind speed
land area covered with trees	Pearson's correlation	1	-0.487
	Sig.(Double tail)		0.001
	Number of cases	43	43
mean wind speed	Pearson's correlation	-0.487	1
	Sig.(Double tail)	0.001	
	Number of cases	43	43

After solving the above model, the correlation coefficient of forest coverage and the average wind speed value can be obtained from Table 3, r= -0.487, because r than zero shows that the forest area is negatively related with the air quality value, and the absolute value is equal to 0.487 is strong, while the average wind speed value is small, the smaller the average wind speed value, the forest coverage on the average wind speed, reducing the impact of the sandstorm on the Beijing climate, indicating that Saihanba plays a great role in resisting dust storms in Beijing.

(2) Correlation between forest coverage rate and the frequency (number of days) of major pollution occurrence

Table 4: Correlation between forest coverage and the frequency (number of days) of major pollution

Correlation between forest coverage and the frequency of major pollution occurrence			
		land area covered with trees	Frequency of major pollution occurring
land area covered with trees	Pehrson relativity	1	-0.791
	Sig. (Double tail)		0.000
	Number of cases	43	43
Number of windy days	Pehrson relativity	-0.791	1
	Sig. (Double tail)	0.000	
	Number of cases	43	43

After solving the model in the above steps, the correlation coefficient between the forest coverage rate and the frequency value of major pollution can be obtained from Table 4. Since r= -0, r is less than zero shows the frequency value of major pollution, and the absolute value equal to 0 shows its strong intensity level, the larger the forest area, the less the frequency of major pollution, reducing the impact of dust storms on Beijing climate, indicating that Saihanba plays a great role in resisting sandstorm in Beijing.

(3) Correlation between forest coverage rate and air quality

Table 5: Correlation between forest coverage and air quality

Correlation between forest coverage and air quality			
		land area covered with trees	air quality
land area covered with trees	Pearson's correlation	1	-0.951
	Sig.(Double tail)		0.000
	Number of cases	43	21
air quality	Pearson's correlation	-0.951	1
	Sig.(Double tail)	0.000	
	Number of cases	21	21

After solving the model in the above steps, the correlation coefficient between the forest coverage and air quality value can be obtained from Table 5, r= -0. Since r is less than zero shows that the forest coverage and air quality value are negatively correlated, and the absolute value of 0 is very strong, indicating that the greater the forest coverage rate, the better the air quality, which reduces the impact of dust storms on Beijing climate, indicating that Saihanba has a great role in resisting dust storms in Beijing.

(4) Correlation between forest area and average wind speed

After the solution of the above steps, the correlation coefficient of forest area and the average wind speed value, r= -0, because r is less than zero means that the forest area is negatively related to the average wind speed, r absolute value equal to 0 is strong intensity level, indicating that the larger the overall forest area, the smaller the average wind speed, reduce the impact of sandstorm on Beijing climate, indicating that Saihanba has a great role in resisting sandstorm in Beijing.

ISSN 2616-5872 Vol.4, Issue 4: 1-19, DOI: 10.25236/AJEE.2022.040401

Table 6: Correlation of forest area and mean wind speed

Correlation of forest area and mean wind speed			
		area of woods	mean wind speed
area of woods	Pearson's correlation	1	-0.487
	Sig.(Double tail)		0.001
	Number of cases	43	43
mean wind speed	Pearson's correlation	-0.487	1
	Sig.(Double tail)	0.001	
	Number of cases	43	43

(5) Correlation between the forest area and the number of gale days

Table 7: Correlation of forest area and the frequency (number of days) of major pollution

Correlation between forest area and the frequency (number of days) of major pollution			
		area of woods	Frequency of major pollution occurrence (days)
area of woods	Pearson's correlation	1	-0.791**
	Sig.(Double tail)		0.000
	Number of cases	43	43
Number of windy days	Pearson's correlation	-0.791	1
	Sig.(Double tail)	0.000	
	Number of cases	43	43

Table 7 can derive the correlation coefficient between the frequency of major pollution, r= -0, because r less than zero indicates a negative correlation between the forest area and the mean wind speed, r absolute value is equal to 0.791, its strong intensity level, indicating that the larger the overall forest area, the less the frequency of major pollution, reducing the impact of dust storm on Beijing climate, indicating that Saihanba plays a great role in resisting sandstorm in Beijing.

(6) Correlation between forest area and air quality

Table 8 shows that the correlation coefficient of forest area and air quality value, r= -0, because r is less than zero indicates that the forest area and the absolute value of r is equal to 0.951, and its intensity level is very strong, indicating that the larger the overall forest area, the better the frequency of air quality, reducing the impact of dust storms on Beijing climate, indicating that Saihanba has a great role in resisting dust storms in Beijing.

Table 8: Correlation between forest area and air quality

Correlation between forest area and air quality			
		area of woods	air quality
area of woods	Pearson's correlation	1	-0.951
	Sig.(Double tail)		0.000
	Number of cases	43	21
air quality	Pearson's correlation	-0.951	1
	Sig.(Double tail)	0.000	
	Number of cases	21	21

After the comparison and explanation of the above six pictures, the ecological restoration of Saihanba Forest Farm has reduced the average wind speed of 0.3 and the number of days when major pollution occurred in 15 days, and reduced the value of the air index, indicating that Saihanba has a great role in resisting dust storms in Beijing.

5.3 Problem 3: Establishment of cluster model analysis method

5.3.1 Data pre-statistics

To promote the mode of Saihanba ecological protection to the whole country, the analysis of a specific geographical location needs to build a specific ecological environment.Here, the establishment of this model is extended to the nationwide analysis, and then the ecological environment data from various provinces and regions of the country is needed.The most direct, the most effective is the use of the energy consumption (carbon emissions) of each province and the forest area (greening situation) of each province.Ecological reserves are established for carbon neutralization analysis, and analyzed here with carbon emissions and carbon absorption as ecosystems.

First of all, consulting the yearbooks of the national provinces, the energy consumption and the forest area of each province are shown in Table 9.

ISSN 2616-5872 Vol.4, Issue 4: 1-19, DOI: 10.25236/AJEE.2022.040401

Table 9: Energy consumption and forest area of all provinces

province	Consumption of energy (Unit / ten thousand ton)	area of woods (Unit / 10 thousand ha)
Hebei Province	24225.68	930
Shanxi International Gong and Drum Festival	24000	545
Liaoning Province	22103	606.79
Jilin Province	7132	785
Heilongjiang Province	5471.3	2181.9
Jiangsu Province	31000	1260
Zhejiang Province	22392.77	2500
Anhui Province	13869.73	1387
Fujian Province	13718.31	2400
Jiangxi Province	9665.2	1805
a folk art form popular in Shandong	41390	1452.8
Henan Province	12148	604.7
Hubei province	14159.66	2104
Hunan Province	8220	1200
Guangdong Province	31012	3102
Hainan Province	2264.39	450
Sichuan Province	16382.2	1926
Guizhou Province	10074.7	1300
Yunnan Province	14014.3	359
Shaanxi Province	13478.06	1451
Gansu Province	7818.02	609.58
Qinghai Province	4235.23	500.4
the Nei Monggol Autonomous Region	25345.57	700.5
the Guangxi Zhuang Autonomous Region	11270.05	148.4
the Ningxia Hui Autonomous Region	144	66
the Xinjiang Uygur Autonomous Region	12669.13	450
Beijing Municipality	7132.84	743.6
Tianjin Municipality	8261	222.39
Shanghai Municipality	11696.46	170
Chongqing City	7452.72	732

The role of forests can make oxygen, purify air, filter dust, etc., which can be summarized here as the ability to absorb carbon dioxide.After finding relevant information, 1 hectare of forest can usually consume 1,000 kilograms of carbon dioxide to release 730 kilograms of oxygen a day.

Table 10: Various energy carbon emission reference coefficient and calculation methods and formulas

Energy name	Average low calorific value	Conversion coefficient of standard coal	Carbon content per unit calorific value (ton carbon / TJ)	Carbon oxidation rate	Carbon dioxide emission coefficient
raw coal	20908kJ/kg	0.7143kgcc/kg	26.37	0.94	1.9003kg-co2/kg
coke	28435kJ/kg	0.9714kgcc/kg	29.5	0.93	2.8604kg-co2/kg
crude oil	41816kJ/kg	1.4286kgcc/kg	20.1	0.98	3.0202kg-co2/kg
fuel oil	41816kJ/kg	1.4286kgcc/kg	21.1	0.98	3.1705kg-co2/kg
gasoline	43070kJ/kg	1.4714kgcc/kg	18.9	0.98	2.9251kg-co2/kg
kerosene	43070kJ/kg	1.4714kgcc/kg	19.5	0.98	3.0179kg-co2/kg
diesel oil	42652kJ/kg	1.4571kgcc/kg	20.2	0.98	3.0959kg-co2/kg
liquefied petroleum gas	50179kJ/kg	1.7143kgcc/kg	17.2	0.98	3.1013kg-co2/kg
The refinery is dry	46055kJ/kg	1.5714kgcc/kg	18.2	0.98	3.0119kg-co2/kg
Oil field natural gas	38931kJ/kg	1.3300kgcc/m 3	15.3	0.99	2.1622kg-co2/m3

Explain:

Fuel with low (bit) calorific heat equal to 29,307 kilocoke (kJ) is called 1 kg of standard coal (1kgce)

The first two columns in the above table are derived from the General Rules for Comprehensive Energy Consumption Calculation

The last two columns in the above table are from the Guide of Provincial Greenhouse Gas List

Calculation method of "carbon dioxide emission coefficient":

ISSN 2616-5872 Vol.4, Issue 4: 1-19, DOI: 10.25236/AJEE.2022.040401

Take "raw coal" as an example of 1.9003=20908 * 0.0000000001 * 26.37 * 0.94 * 1000 * 3.66667

After the above calculation, the CO2 emission amount and the CO2 absorption amount can be calculated to obtain the CO2 absorption / emission situation of each province as shown in Table 11:

Table 11: The absorption / emission status of CO2

province	CO2 discharge	absorbed dose	CO2 uptake / emission
Hebei Province	46028.792	33945	0.737473189
Shanxi International Gong and Drum Festival	45600	19892.5	0.436239035
Liaoning Province	41995.7	22147.835	0.527383399
Jilin Province	13550.8	28652.5	2.114450807
Heilongjiang Province	10395.47	79639.35	7.660966748
Jiangsu Province	58900	45990	0.780814941
Zhejiang Province	42546.263	91250	2.144724203
Anhui Province	26352.487	50625.5	1.921090028
Fujian Province	26064.789	87600	3.360855904
Jiangxi Province	18363.88	65882.5	3.587613293
a folk art form popular in Shandong	78641	53027.2	0.674294579
Henan Province	23081.2	22071.55	0.956256607
Hubei province	26903.354	76796	2.854513976
Hunan Province	15618	43800	2.804456396
Guangdong Province	58922.8	113223	1.921548195
Hainan Province	4302.341	16425	3.817689021
Sichuan Province	31126.18	70299	2.258516786
Guizhou Province	19141.93	47450	2.478851401
Yunnan Province	26627.17	13103.5	0.492110127
Shaanxi Province	25608.314	52961.5	2.068136934
Gansu Province	14854.238	22249.67	1.497866804
Qinghai Province	8046.937	18264.6	2.269758046
the Nei Monggol Autonomous Region	48156.583	25568.25	0.530939872
the Guangxi Zhuang Autonomous Region	21413.095	5416.6	0.252957361
the Ningxia Hui Autonomous Region	273.6	2409	8.804824561
the Xinjiang Uygur Autonomous Region	24071.347	16425	0.682346526
Beijing Municipality	13552.396	27141.4	2.00270122
Tianjin Municipality	15695.9	8117.235	0.517156391
Shanghai Municipality	22223.274	6205	0.279211785
Chongqing City	14160.168	26718	1.886842021

Facilitate clustering, the last two decimal places are taken here, and the results are presented in Table 12.

Table 12: Simplified values

province	Co2 uptake / emission	province	Co2 uptake / emission
Hebei Province	0.73	a folk art form popular in Shandong	0.67
Shanxi International Gong and Drum Festival	0.43	Henan Province	0.95
Liaoning Province	0.52	Hubei province	1
Jilin Province	1	Hunan Province	1
Heilongjiang Province	1	Guangdong Province	1
Jiangsu Province	0.78	Hainan Province	1
Zhejiang Province	1	Sichuan Province	1
Anhui Province	1	Guizhou Province	1
Fujian Province	1	Yunnan Province	0.5
Jiangxi Province	1	Shaanxi Province	1
Gansu Province	1	the Xinjiang Uygur Autonomous Region	0.68
Qinghai Province	1	Beijing Municipality	1
the Nei Monggol Autonomous Region	0.53	Tianjin Municipality	0.5
the Guangxi Zhuang Autonomous Region	0.25	Shanghai Municipality	0.27
the Ningxia Hui Autonomous Region	1	Chongqing City	1

5.3.2 System (hierarchy) clustering

The merging algorithm of system clustering calculates the distance between the two types of data points, combines the two types of closest data points, and repeatedly iterates the process until all data points synthesize one class, and generates a cluster lineage map to cluster the CO2 absorption / emission data of each province. The implementation steps are shown in Figure 2:

ISSN 2616-5872 Vol.4, Issue 4: 1-19, DOI: 10.25236/AJEE.2022.040401

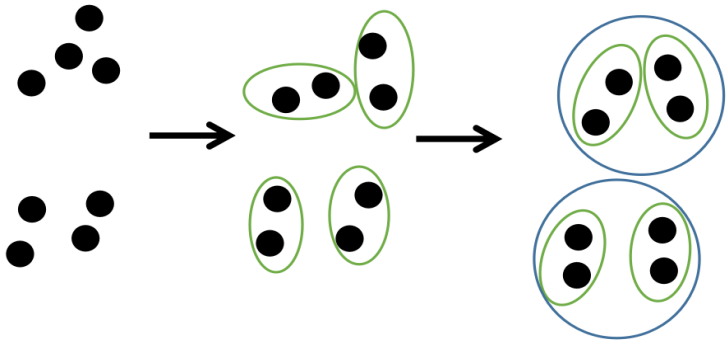

Figure 2: Schematic representation of the clustering

Finally, systematic clustering using the Spass software implementation yielded the results shown in Figure 3:

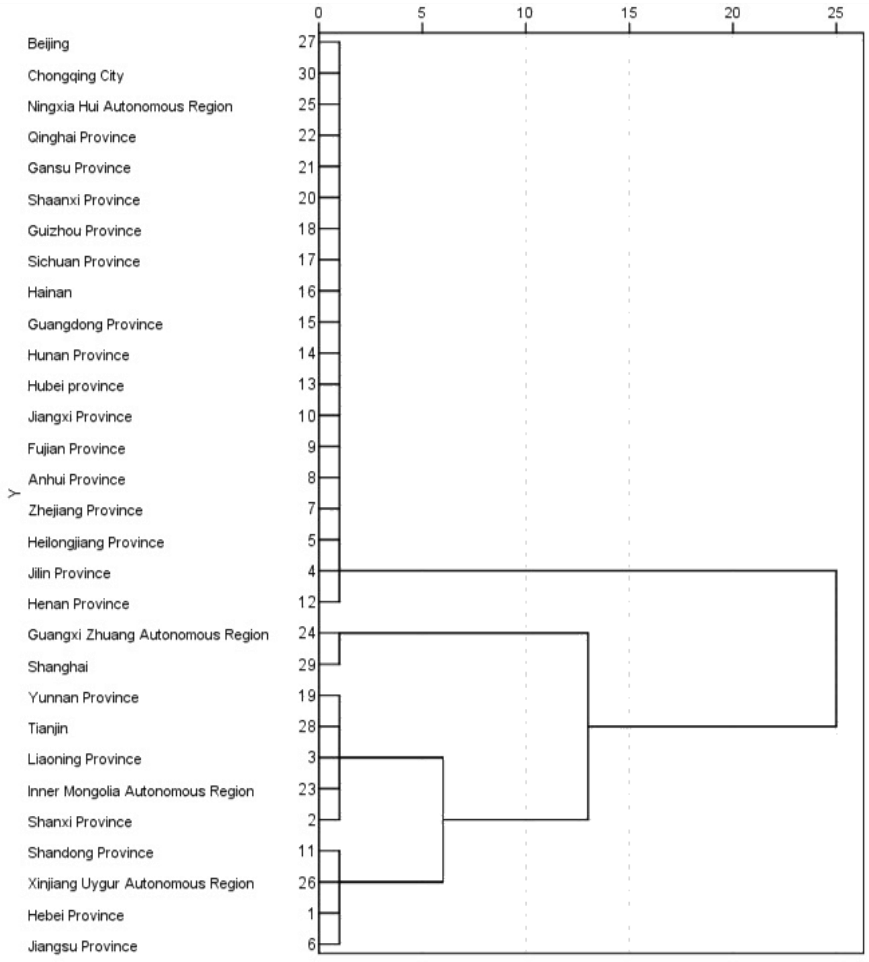

Figure 3: shows systematic clustering

According to the results of systematic clustering, Yunnan, Tianjin, Liaoning, Inner Mongolia, Shanxi, Shandong, Xinjiang, Hebei and Jiangsu need to build an ecological environment.

5.3.3 Determine the scope of the constructed ecological zones

From the above topic, we can conclude that Yunnan, Tianjin, Liaoning, Inner Mongolia, Shanxi, Shandong, Xinjiang, Hebei and Jiangsu nine regions need to build an ecological environment. Therefore, this question determines the scope of the ecological zone in the above nine areas. At this time, the central points of nine provinces and cities are taken for the second clustering model analysis, and the latitude and longitude of the nine provinces are as follows:

ISSN 2616-5872 Vol.4, Issue 4: 1-19, DOI: 10.25236/AJEE.2022.040401

Table 13: determines the central point latitude and longitude of the region of the constructed ecoregion

province	longitude	latitude
Yunnan	102.21	25.10
Tianjin	117.2	39.12
Liaoning	120.1	40.52
Nei Monggol	116.21	45.01
Shanxi	111.51	37.54
Shandong	119.47	36.1
Xinjiang	85.01	44.77
Hebei	114.56	37.53
Jiangsu	119.15	32.46

The data were clustered here using the method of K-means clustering.

Assuming a given data sample X, containing n objects, X represents-

$$--X = \{X_1, X_2, X_3, \cdots, X_n\}$$

Each object has properties of m dimensions. The goal of the Kmeans algorithm is to cluster n objects into the specified k class cluster based on the similarity between the objects, with the minimum distance per object to the center of the cluster.

Given the k value and k initial cluster center points, each point is divided into the class cluster represented by the nearest cluster center point, and after all the points are assigned, the average of the distance from all the points within a cluster is updated by multiple iterations.

Then, the k cluster centers are first initialized$\{C_1, C_2, C_3, \cdots, C_K\}, 1 < j \leq n$

The Euclidean distance from each object to each cluster center was then calculated

$$dis(X_i, C_j) = \sqrt{\sum_{t=1}^{m} (X_{it} - C_{jt})^2}$$

After converting the latitude and longitude in the above table into plane coordinates, it were solved using MATLAB to obtain the cluster diagram as follows:

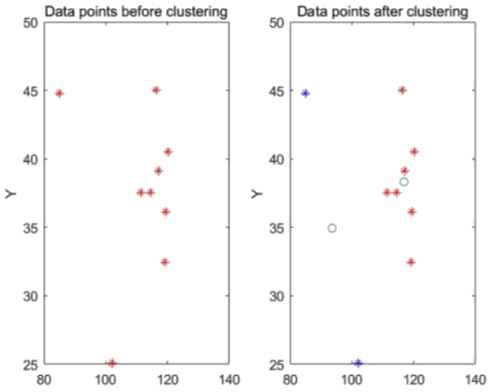

Figure 4: Clustering Fig

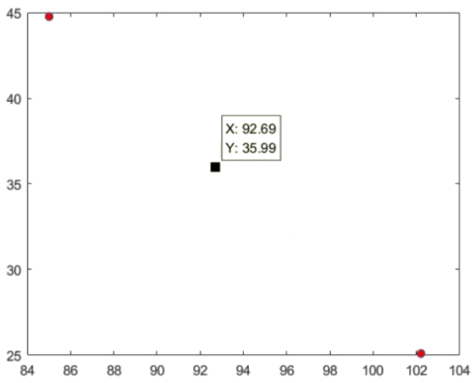

Figure 5: Category 1

ISSN 2616-5872 Vol.4, Issue 4: 1-19, DOI: 10.25236/AJEE.2022.040401

After clustering, it can be divided into two categories as shown in the figure. The location of ecological protection areas can be determined separately. The results of the distance and minimum point of each category are Figure 5 and Figure 6.

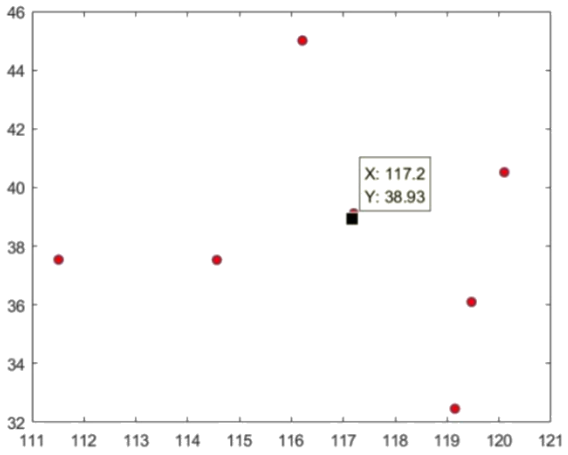

Figure 6: Category 2

The latitude and longitude of ecological protection areas for the first class of province and city is (92.69,35.99)

The location of ecological protection areas for the second category of province and city is (117.2,38.93)

In order to achieve carbon neutralization, the forest area required for CO2 complete absorption of unabsorbed CO2 is now solved, and the CO2 incomplete absorption in the two categories is calculated to be X and the required forest area is Z, available by search data, and the annual absorption of CO2 is 365 tons per hectare,

The calculation formula is as follows:

Forest area =CO2 unabsorbed / CO2 per hectare

Z=X/365T

The forest area required for complete carbon neutralization of category 1 is 1,050 million hectares, and the forest area required for complete carbon neutralization of category 2 provinces and cities is 100,000 hectares.

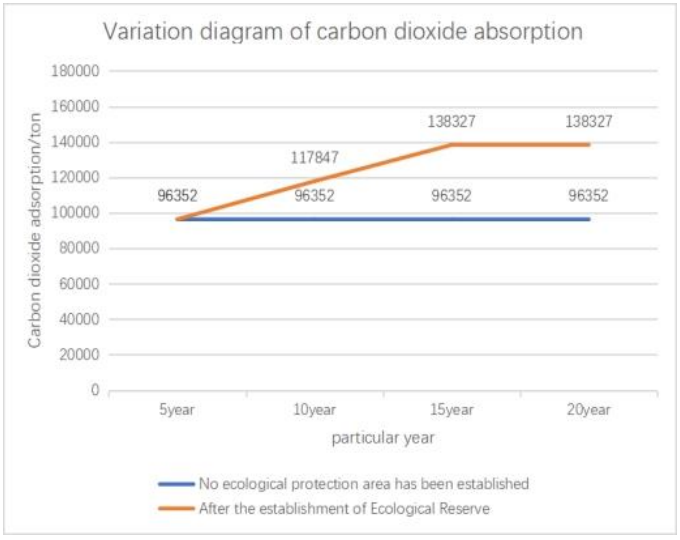

Figure 7: Predicts the amount of CO2 absorption

As shown in Figure 7, the final prediction of CO2 absorption increased by 214.95 million tons after ten years, and by 419.75 million tons after fifteen years, and finally remained unchanged.

ISSN 2616-5872 Vol.4, Issue 4: 1-19, DOI: 10.25236/AJEE.2022.040401

5.4 Problem 4: Cluster model establishment and analysis

Select another country for data collection in the Asia-Pacific region, select countries with the same ecological protection mode as Saihanba as possible, select Nepal countries for analysis in geographical location and ecological environment, select ten cities with high air pollution index for research, and find their latitude and longitude forest coverage and urban area.

After searching relevant information, data from ten urban areas with high Supor air pollution index are as follows:

Table 14: Data for the ten urban areas with a high Supor air pollution index

area	AQI price	area (square kilometre)	forest fraction of coverage	longitude	latitude
Bilatnatagar (Biratnagar)	232	58.48	0.17	101.78	36.62
Kirtipur	122	60.21	0.175	118.78	32.09
Kathmandu (Kathmandu)	111	395	0.18	119.09	32.14
Budwall (Butwal)	107	100.54	0.19	101.56	26.68
Dangarhi (Dhangadhi)	98	3235	0.19	102.46	27.97
Birganj	76	98.21	0.21	104.56	27.98
Mahendrananaga (Mahendranagar)	74	1610	0.21	120.59	31.38
Narayani (Narayani)	70	78.54	0.24	107.3	24.88
Janakpur (Janakpur)	69	900	0.26	120.01	30.28
Boka (Pokhara)	65	55.66	0.27	113.13	27.81

Among them, the AQI is the air quality index.

After converting the latitude and longitude in the above table into plane coordinates, it were solved using MATLAB to obtain the cluster diagram as follows:

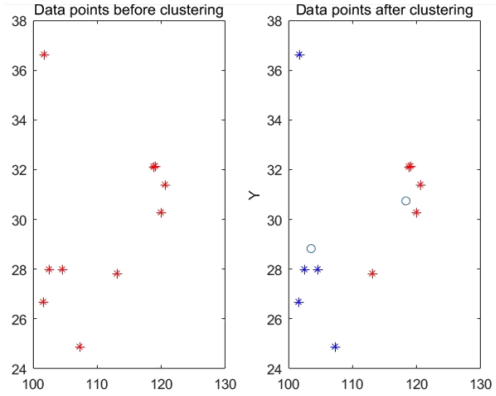

Figure 8: Clustering Fig

After clustering, it can be divided into two types of city clusters as shown in the figure. The location of the ecological reserve is determined respectively. The figure of the distance and minimum point results from each category to each region are as follows:

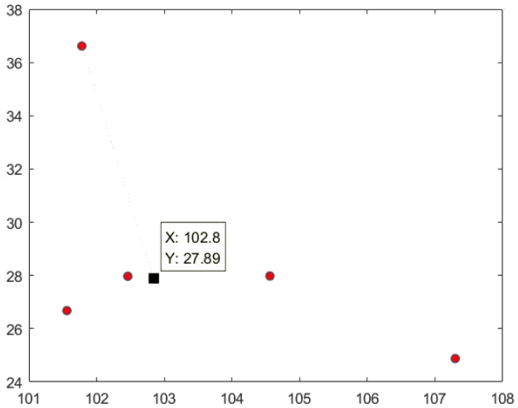

Figure 9: Category 1

ISSN 2616-5872 Vol.4, Issue 4: 1-19, DOI: 10.25236/AJEE.2022.040401

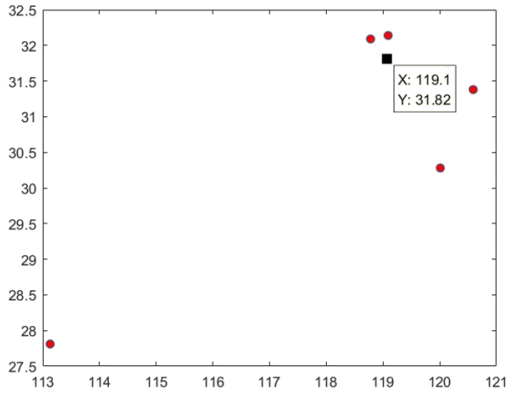

Figure 10: The second class

The latitude and longitude of the first class ecological protection zone is (102.8,27.89), and the latitude and longitude of the second class ecological protection zone is (119.1,31.82).

After searching for relevant information, a forest coverage rate in a country reached 30%, and the air quality index was close to good. According to the ecological environment of the ten cities in Nepal, in order to achieve a good air quality index, the forest coverage rate of these ten cities must reach 30%, set as the forest coverage rate of the city i, the percent air quality of the i th city, the area of the i th city, the A QI value of the i th city, and v is the average of the A QI of the ten cities.

$$w_i = \frac{v_i - \mathrm{v}}{v_i} \times 100\%$$

$$\Delta s = s_i * h_i(1 + w_i) - s_i \mathrm{h}_i = s_i \mathrm{h}_i w_i$$

Judging from the formula above formula:

The forest area required for the first class of urban agglomeration is 390.40 square kilometers

The forest area required for the second type of urban agglomeration is 250.49 square kilometers

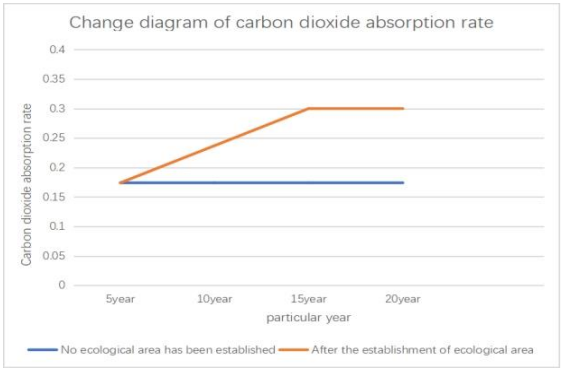

Figure 11: Greenhouse gas-predicted absorption rate

By comparing the absorption amount before and after the establishment of ecological areas, it increases the absorption rate of these urban greenhouse gases by 13%, thus reducing the carbon emissions.

5.5 Question 5: Basic ideas of report writing

5.5.1 Main body adopts the method

Write a non-technical report to the Organizing Committee of the Asia-Pacific Modeling Mathematical Competition, describing the models adopted, and making feasible plans and recommendations for the establishment of eco-reserves.This paper mainly uses the following methods, using mathematical statistical method to obtain comprehensive climate environment data, comprehensive evaluation, objectively obtain local environmental index; finally, the clustering algorithm is needed to use the same characteristics, the quantitative analysis, determine the specific coordinate location, and determine the number of each class and determine the number of different types of reserves.

ISSN 2616-5872 Vol.4, Issue 4: 1-19, DOI: 10.25236/AJEE.2022.040401

5.5.2 Pre-collection and collation of the data

First of all, comprehensive climate and environmental data are obtained by finding relevant data. We can conclude that Saihanba Forest Farm is located in Saihanba National Nature Reserve, and there are no large pollution enterprises under the jurisdiction of the forest farm, and few living residents in the forest farm.The forest farm area is rich in forest resources and has good forest growth conditions. The forest land area reaches 68842.5hm2, accounting for more than 70% of the total area, and the forest coverage rate is about 80%.The forest park has many rivers, crisscross, seven Star Lake, Taifeng Lake, Sun Lake and other large lakes.In recent years, by sealing the mountains and cultivating the forests, the wildlife resources are more abundant, the air negative oxygen ion content is very high, and the original forest is also naturally combined with artificial forests, with a beautiful natural environment.The Saihanba Forest Farm is located in the Saihanba National Nature Reserve.[3]But the forest farms and the surrounding countryside are surrounded.Sewage and sewage treatment, due to the lack of waste treatment equipment and sewage treatment equipment.If too late, some parts will discharge directly into lakes and rivers, causing regional pollution.In addition, in recent years, tourists have increased with its popularity in recent years.Automobile exhaust emissions and household garbage emissions are having increasingly serious short-term and regional effects, which can be basically carried out through the own supervision and purification functions of the forest.Saihanba Forest Farm is located in the northernmost part of Mongolian Autonomous County. The total field has 6 sub-farms, including Daegu, Sanyan River in Sanxiang, Beimandian, QianLami Nanban and Sanhekou, with a total of 30 forest areas.The total land area of the station is 92634.7 hectares, forest forest area is 83677.8 Hm2, of which forest area is 67822.8 Hm2, accounting for 98.52% of the forest area.[4]The total product of whole standing wood was 8106388m3, with a total woodland product of 8099222 M ', accounting for 99.91% of the total product and a forest coverage of 75.5%.Saihanba forest area belongs to the cold temperate continental monsoon climate zone.[5]Winter temperature is low and cold, dry and windy in spring, and strong sunshine in summer.The average annual sunshine is 2548.7 hours.The average annual air temperature is 1.2℃, the coldest in January and an extreme minimum of 43.3 degrees; July is the hottest month with an extreme maximum of 33.4℃ (2000).The frost free period is short with an average of 59 days.Frosting often occurs during the plant growing season.The average annual precipitation is 452 mm, mainly in June-August, accounting for 67.6% of the average annual precipitation[6].The distribution of water sources varies widely in forest areas.Swamp and rivers are distributed in the east and central regions, sand dunes in the west, and severe soil erosion.Rivers include the Galaxy River, Yison River, Tugan River, etc [7].

The comprehensive evaluation can be obtained. From the perspective of ecosystem subsystem, the evaluation indicators are from high to low: forest productivity index (0.917), forest health index (0.883) and forest ecosystem stability index (0.767).Among them, the forest ecosystem stability index is the lowest, because the forest farm natural forest area is small, mostly artificial forest, forest farm has been to larch, birch and Mongolian red pine for three afforestation species, mixed forest in the low proportion of plantations, so the biodiversity index is low, only 0.501, reduce the evaluation value of the forest ecosystem stability index [8].But the forest productivity index is high and in a strong sustainable state.The main reason is that, due to the implementation of afforestation and fence project in the forest farm, barren mountainous areas and areas suitable for forest area reduction, forest area increased, especially the area of wood forest increased rapidly, promote the improvement of the forest productivity, forest resources reserves sufficient, forest fire pest control has made effective progress [9].

Second, we need to scientific governance, ecological protection and restoration work adhere to the principle, protection priority, natural recovery to firmly establish and practice the green mountains is jinshan yinshan concept, respect nature, conform to nature, protect nature, like protect the eyes to protect the ecological environment, like treat life to ecological environment.Follow the law of natural ecosystem succession, give full play to nature's self-repair ability, and avoid excessive human intervention in the ecosystem [10].

5.5.3 Specific recommendations

The following points are the benchmarks for governance:

(1) Priority principle, that is, where the poor governance and where

(2) Quantify the principle, and formulate the basic goals needed to be completed according to the actual situation

(3) Scientific governance, determine the governance level according to the comprehensive value

ISSN 2616-5872 Vol.4, Issue 4: 1-19, DOI: 10.25236/AJEE.2022.040401

evaluation, and conduct joint governance of similar areas, so that on the one hand, it can get the fastest and the most effective governance in the short term, and on the other hand, it can get the good development of the ecological environment in the long term [11].

Specific measures are as follows:

(1) We will make unified planning and overall consideration, highlight key and difficult points, and focus on improving the quality of the Beijing-Tianjin-Hebei ecological security barrier system, national priority ecological function zones, red lines for ecological protection, and nature reserves [12].

(2) Promote scientific management and comprehensive measures.We will improve the ideology of protecting the community of life, improve ecological quality on the ecological basis and the ecological system of enjoying nature, emphasize the response to ecological risks, and strengthen scientific and technological support [13] .

(3) Reform and innovation, improve the construction and management system, adhere to the management in accordance with the law, deepen the reform of the ecological protection and restoration field, release policy dividends, expand the channels of investment and financing, innovate and improve the ecological protection compensation system, improve the national awareness of ecological protection, and form an ecological protection and restoration efficiency system led by the government and participated by multi-dimensional subjects [14] .

(4) Adhere to the basic view of "forest is an important part and an important resource of the land ecosystem, and an important guarantee for human survival and development", and take the forest and grassland ecosystem, three stages and surrounding areas as the core to promote natural recovery.

(5) In view of the needs of forests, grasslands, deserts, rivers, lakes, marshes and other ecosystems, we will guide the comprehensive development and natural recovery of forests, grasslands and desert ecosystems around the needs of the joint development of Harbin, Beijing and Tianjin.We will promote the construction, restoration of degraded grasslands, the comprehensive control of soil erosion, the control of Gongjin temples, and the clearing of woodlands and grasslands, and carry out the restoration of rivers and lakes, wetlands, ecological restoration of mines, land clearing, and comprehensive cleaning.We will further improve the vegetation coverage rate of forests, grasslands, windproof slopes, soil, and water conservation, and organisms, enhance diversity, enhance the quality and stability of natural ecosystems, and build a solid ecological security barrier in the north.

(6) Green wall system construction, natural forest protection, reclaimed forest settlement, grassland protection and restoration, comprehensive control of soil erosion, sand land protection, river and wetland restoration, comprehensive treatment of super strong groundwater —— mining, large-scale restoration of mining ecology, land improvement, etc.We will combine aquatic afforestation with cultivated forage grass, and carry out large-scale afforestation and extensive restoration of degraded forests nationwide [15].

6. Evaluation, improvement and promotion of the model

6.1 Advantages of the model

(1) This paper mainly uses the entropy power method and the Topsis method to evaluate the problem one and make the evaluation model more reasonable.

(2) Various index factors are introduced to visualize the supplier evaluation model data to facilitate the analysis and solution.

(3) When exploring and predicting data rules, the concept of gradient weight is added combined with the actual situation of ecological environment changes to make the data more reasonable and convincing.

6.2 Disadvantages of the model

(1) The big data needs to be handled in this question, so with direct multi-data and multiple information processing, the comprehensive evaluation may not be very friendly to the slightly weak programming ability;

(2) Useless data is not considered, which may cause errors in results and predictions.

ISSN 2616-5872 Vol.4, Issue 4: 1-19, DOI: 10.25236/AJEE.2022.040401

6.3 Model improvements

Before the model establishment process, the outliers detection based on the wavelet analysis can be used to preprocess the data, and then conduct the data analysis processing and prediction.

6.4 Extension of the model

(1) The model can be closely linked to the actual situation and can be generally applicable to the ecological environment in other regions and its quantitative assessment problems, which is closer to the actual ecological environment problems, with strong universality and portability;

(2) Due to the large amount of data processing of the ecological environment model and the high accuracy of the comprehensive evaluation, this model is suitable for the processing, large-scale data and many aspects of the ecological environment evaluation.When the data volume increases and multiple information will improve, the application and accuracy of this model will be further improved.

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