Environment, Resource and Ecology Journal (2022)
Clausius Scientific Press, Canada
DOI: 10.23977/erej.2022.060102
ISSN 2616-3756 Vol. 6 Num. 1

# *Research on Environmental Impact Assessment of Ecological Protection Based on Comprehensive Evaluation Model*

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***Keywords:*** Construction of Ecological Conservation, TOPISS model, DEA

***Abstract:*** This paper build the ecological impact evaluation model of the Saihanba. We applied a hierarchy of multi-level indicators, starting from vegetation impact, animal impact, climate impact, water resource impact, through statistical, clustering and gridding processes, while vegetation impact can be established with several low-level indicators such as plant abundance, total number of plants, plant cover area, etc. We used a combination of TOPISS model, fuzzy evaluation and DEA to derive a comprehensive evaluation. After the results were obtained, this paper used the gray correlation method to make the results more feasible. Finally, we calculated the evaluation index of the model before and after the renovation, and then compared the analysis.

## 1. Introduction

Since 1962, 369 young people with an average age under 24 have come to this wasteland filled with yellow sand. From then on, they dedicated their lives here, advanced wave upon wave, to planting seeds in the sand and planting green in the crevices of the stones, like nails fastening millions of acres of forest on the wasteland. Planting trees to fix the sand and conserve water sources, they build a green barrier to block wind and sand. Today, the forest coverage in Saihanba area has reached 80%. It supplies Beijing and Tianjin with 137 million cubic meters of clean water each year, sequesters 747,000 tons of carbon, and releases 545,000 tons of oxygen.

## 2. The comprehensive evaluation model

### 2.1 Steps Feature

The precipitation observation data were obtained from the Compilation of Climatic Factors in Sehanba Mechanical Forestry Field, Hebei Province, 1960-2011. The data for the years 1960-2011 were obtained from the Compilation of Climatic Factors in the Sehanba Mechanical Forestry Station, Hebei Province, due to the lack of measurements in 1962-1964. The precipitation observation data were obtained from the Compilation of Climatic Factors in Heibei Sehanba Mechanical Forestry Field 1960-2011. The data were obtained from the Compilation of Climatic Factors in the Sehanba Mechanical Forestry Field, Hebei Province, 1960-2011. The total number of months was 564. First, the multi-year average precipitation was calculated for all months, the monthly precipitation was subtracted from the multi-year average precipitation of that month to form the precipitation distance series of each month. This can also filter out the effect of the natural cycle of the year. This also filters out the effects of the natural cycle of the year. The annual precipitation and growing season precipitation data were similarly the same treatment was applied to the annual and growing season precipitation data. In order to reduce the influence of boundary effects at both ends, the precipitation data were to reduce the effect of boundary effects, the data were added at each end of the precipitation data [2], and the data were extended symmetrically by a factor of 1 at each end of the distance level. To reduce the effect of boundary effects at both ends of the precipitation data, the data were added outward at each end of the precipitation data [2]. The method is as follows.

Let the original data series be f(1), f(2), …, f(n).

Extend n points forward f(i+1), i= 0, 1, …, n−1.

Extend backward n points f(i+n) =f(n+1−i), i= 1, …, n.

The wavelet coefficients are obtained by the one-dimensional continuous wavelet transform with Morlet complex wavelets after normalizing the precipitation distance series data.

The wavelet variance test (α=0.05) was performed to determine the major period of each precipitation distance level series, and the wavelet variance graph was plotted. The wavelet variance Var(a) reflects the distribution of the energy of fluctuation with scale, and can determine the relative strength of various scale perturbations in the precipitation time series, and the scale at the corresponding peak is called the main time scale of the series, i.e., the main period. The wavelet variance is the integral of the square of the modal part of the wavelet transform coefficients over the time domain with respect to τ, which is calculated by the formula:

$$\mathrm{Var}(a) = \int_{-\infty}^{\infty} |C(a,\tau)|^2 d\tau \tag{1}$$

## 2.2 Model Building

The average of growing season precipitation in the Seyhanba area from 1965 to 2011 the average of growing season precipitation in the Sekhamba region from 1965 to 2011 was 377.6 mm, and the average of growing season precipitation to annual precipitation was 83.1%. The growing season precipitation was generally low from the late 1960s to the late 1980s, fluctuating in the early 1970s, and fluctuating in the 1990s. The growing season precipitation was generally low from the late 1960s to the late 1980s, fluctuated considerably in the early 1970s, and increased and then decreased in the 1990s. Precipitation increased and then decreased in the 1990s, and continued to show a decreasing trend after 2000. The minimum value was -176.1 mm in 1971 and the maximum value was 164.1 mm in 1973. The minimum range is-176.1 mm in 1971 and the maximum value is 164.1 mm in 1973. The growing season usually starts in mid-May and lasts until mid-September, and precipitation during the growing season is the growing season precipitation is important for plant growth. The growing season precipitation is important for plant growth.

The minimum value of annual precipitation and growing season precipitation scale parameter is 2 years, and the maximum value is set to 32(25) years; the minimum value of monthly precipitation scale parameter is 2 months, and the maximum value is set to 512(29) months. The complex wavelet coefficients are output, and the wavelet coefficients are interpolated by the square of the mode part to form a wavelet coefficient mode square contour map (wavelet energy map).

## 2.3 Determination of evaluation value of each index

The actual value of Pk is determined based on the actual survey and data collected on forest management indicators, and the reference value is determined based on the idea of sustainable forest use, the Regulations on the Implementation of the Forestry Law, and domestic and foreign indicators on sustainable forest management. If the development target is clearly defined in the existing national, provincial or municipal forestry plans, the development target is used as the reference value; the reference value of economic and social indicators is determined according to the local average level. Finally, the evaluation value of each indicator is calculated by the integrated index method. The evaluation value Dk indicates the extent to which the actual value Pk is close to the reference value Sk. When the 10th power of Dk is calculated, the indicator is considered to be in its ideal state, and the value is 1.0. The evaluation indicators are divided into positive and negative indicators according to their influence on forest management. In this paper, the inverse indicators include annual forest growth rate, average annual incidence of forest pests and diseases and forest fire index, and the rest of the indicators are positive indicators. The calculation method is:

Positive indicator evaluation value: $D_{k1}=P_k/S_k$.

Reverse indicator evaluation value: $D_{k2}=S_k/P_k$.

The calculation results of the evaluation values of each index are as follows.

(1) Proportion of ecological public welfare forest area Di

(2) Biodiversity D2

(3) Forest cover ratio D3

(4) Nature reserve area proportion D4

(5) Forest land utilization rate D5

(6) Storage volume per unit area of forested land D6

(7) Annual forest growth rate D7

It is calculated that the uniformity index of the forest age group is:

$$P_a = (\sum P_{ai} \mathrm{Ln}\, P_{ai})/(\mathrm{Ln}(1/n)) = 0.997 \quad (2)$$

The uniformity index of the forest age group was calculated is:

$$P_b = (\sum P_{bi} \mathrm{Ln}\, P_{bi})/(\mathrm{Ln}(1/n)) = 0.634 \quad (3)$$

## 2.4 Conclusion analysis

According to the results of forest resources inventory since the establishment of Seyhanba in 1962, the forest area and live wood accumulation in Seyhanba Forestry

Park have been steadily increasing. The dynamic trends of forest resources in the successive inventories of Seyhanba. From 1962 to 1982, the forestry area of the forestry plantation was on a large scale, and the forestry area was on a straight line, mainly pure larch forests. The main work in this stage is to carry out forest nurturing, improve forest quality and enhance ecological stability of forests.

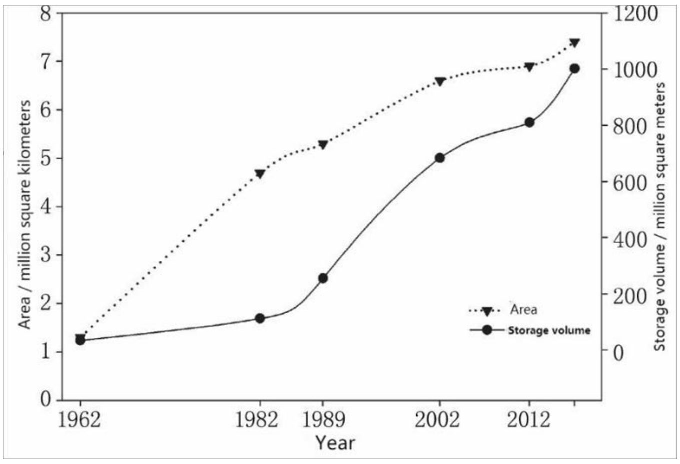


*Figure 1: The dynamic changes of forest area and volume*

The idea of forest management in Seyhanba has gradually shifted from timber use to ecological protection and landscape recreation; the disappearance of charcoal forests shows that, with the development of the times, the way of heating in Seyhanba and the surrounding areas has changed, and the era of relying on wood for heating and cooking has passed.

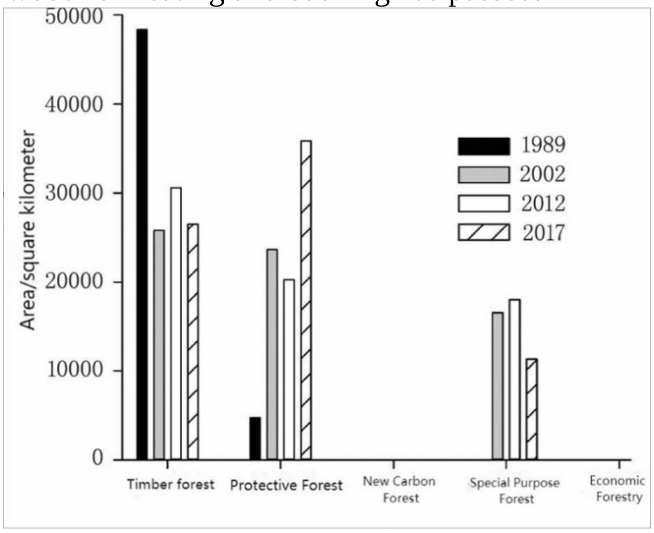


*Figure 2: Area changes of forest types*

## 3. Comparative Analysis

### 3.1 Model Building

Based on the magnitude of wavelet variance, the first main cycle of the monthly and annual precipitation variance series in Zhengzhou from 1965 to 2011 can be determined as 4 years, the second main cycle as 18 years, and the main cycle of monthly precipitation as 16 months. The first main cycle of 1965-2011 is 4 years, the second main cycle is 10 years, and the third main cycle is 8 years. The annual precipitation variation is dominated by growing season precipitation. The wavelet transform of annual precipitation and seasonal precipitation in Zhengzhou in 1955 and 2000 using the Mexican cap wavelet function shows that the annual precipitation and seasonal precipitation have a cycle feature on the scale of 8-12 years, and the cycle feature is also obvious on the time scale of 4-6 years, and the summer precipitation dominates the annual precipitation variation. The process lines at typical scales (main cycle) can reveal the abrupt changes of precipitation variation and reflect the multi-scale analysis and prediction function of wavelet transform. The wavelet coefficients of each precipitation level at typical scales are plotted (Figure 3) to observe the abrupt change of wavelet coefficients and predict the trend of change. It can be clearly observed that the monthly and annual precipitation at 4-year and 18-year scales.

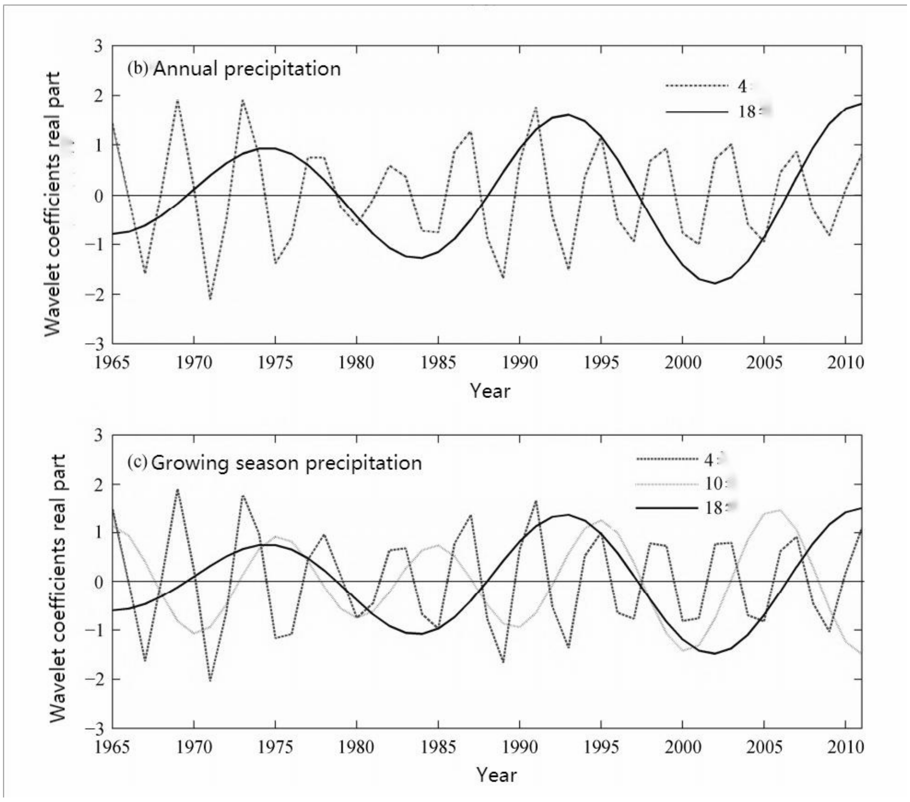


*Figure 3: Line diagram of the variation process of the real part of wavelet coefficients of typical scales of Zhenghe precipitation distance level series.*

### 3.2 Results

Since the answer to this question is already presented above, here we only need to evaluate the program model.

GM(1,1) is also a non-linear prediction based on data, however, based on the shortcomings of its own function, the GM(1,1) method is not effective in predicting the inflection point, and the world's carbon emission values may show an accelerated upward trend at a certain stage for which GM(1,1) cannot predict accurately. The model can be evaluated in three specific points.

1. Applying the GM(1,1) model to forecast the carbon emissions of Zhengzhou, the prediction accuracy is level 2, and the correlation mean squared error ratio and the probability of small errors are level 1, and the discrepancy between the prediction results and the actual values is small. The GM(1,l) model is feasible for carbon emission prediction, and it can provide scientific basis for future environmental planning.

2. The gray GM(1,1) model is suitable for short- and medium-term forecasting with high accuracy. For long-term forecasting, the accuracy of forecasting will be reduced due to the influence of future disturbances.

3. According to the GM(1,1) model, the global carbon emissions will exceed 53,896 MtC by 2030, which will cause huge environmental pollution due to the rapid development of Zhengzhou and the rapid increase of energy demand, resulting in the rapid increase of carbon emissions.

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