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Evaluation Model of Ecological Environment of Saihan Dam

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Abstract: Aiming at the evaluation of the impact of Saihan dam on ecological environment construction, this paper selects several representative indicators to evaluate the ecological environment through the ECCI evaluation system, and judges the impact degree of Saihan dam by establishing the relevant model of the impact of Saihan dam on ecological environment construction. Based on the existing evaluation system of ecological civilization construction in China, by collecting various data and consulting relevant literature, three categories and seven indicators with great correlation before and after the restoration of Saihan dam are selected, and the judgment matrix is constructed by analytic hierarchy process, so as to obtain the weight value of each index. The factor analysis is carried out by constructing the matrix, and the vector is normalized, The consistency is used to test the indicators, and then the data before and after the restoration of Saihan dam are substituted for comparative analysis.

Keywords: Saihan dam ecological environment; Analytic hierarchy process; Evaluation model

1. Problem restatement

1.1 Problem background

With the help of the Chinese government and after more than half a century of struggle, the world's largest artificial forest has been built on the land of Saihan dam. China's Saihan dam forest farm has been restored from the desert and has become an eco-friendly green farm with stable sand prevention function. The builders have been working hard for many years on the plateau wasteland 400 kilometers north of Beijing, creating a green ocean.

1.2 Problems to be solved

Saihan dam plays an important role in resisting wind and fixing sand, protecting environment and maintaining ecological balance and stability. In order to quantitatively evaluate the impact of Saihan dam on the environment after restoration, please select appropriate indicators, collect relevant data, and establish an evaluation model for the impact of Saihan dam on the ecological environment, that is, to compare and analyze the environmental conditions before and after the restoration of Saihan dam.

2. Problem analysis

For the problem, it is mainly to understand the existing relatively sound evaluation system for the construction of ecological civilization, establish an appropriate evaluation system for the ecological environment of Saihan dam, select appropriate evaluation indicators, and compare and analyze the environmental conditions before and after the restoration of Saihan dam. Through literature review, we found the existing Provincial Ecological Civilization Construction System (ECCI) in China. After collecting relevant data and combined with the standards of ecological civilization construction system, we selected 7 appropriate evaluation indexes. Using analytic hierarchy process, the corresponding judgment matrix is established, and the corresponding values are obtained by calculating the factors. Further, the consistency of the calculation matrix is checked, and the data before and after the restoration of Saihan dam are substituted for solution and comparative analysis.

3. Basic assumptions of the model

3.1 It is assumed that the data collected are true and valid

3.2 It is assumed that the interaction between the indicators for evaluating the ecological environment is ignored

4. Definition symbol description

A_{ij}、B_{ij}	Score of factor I over factor j
M、N	Judgment matrix
CR、CI、RI	Consistency inspection index

5. Model establishment and solution

Based on the above analysis and preparation, we will gradually establish the following mathematical model to further elaborate the establishment and solution process of the model.

Firstly, based on the analysis of the ecological civilization construction system (ECCI) and the collected relevant data, seven appropriate indicators are selected from the three aspects of ecological vitality, environmental quality and social development, including forest coverage rate, vegetation coverage index, biodiversity types, water conservation, carbon dioxide absorption, oxygen

release and per capita GDP, The correlation of 7 types of data is analyzed by analytic hierarchy process.

Construct the judgment matrix, determine the appropriate scale through the pairwise comparison between various factors, and fill the values a_{ij} obtained by the pairwise comparison of different factors (factor I and factor j) into the positions of row I and column J of matrix M.

According to the selected indicators, the evaluation system of Saihan dam's impact on ecological environment is constructed, and the eigenvalue obtained from the above judgment matrix is the weight of each indicator.

Then the judgment matrix is

$$M = \begin{pmatrix} A_{11} & A_{12} & \cdots & A_{17} \\ A_{21} & A_{22} & \cdots & A_{27} \\ \vdots & \vdots & \cdots & \vdots \\ A_{71} & A_{27} & \cdots & A_{77} \end{pmatrix}$$

Table 2 Evaluation index and weight of Saihan dam's impact on ecological environment

Evaluation of Saihanba's impact on ecological environment	Ecological vitality	forest coverage	0.208
		area	0.208
		Biodiversity species	0.146
	environmental quality	Water conservation	0.12
		Carbon dioxide absorption	0.12
		Oxygen release	0.099
	social development	Per capita GDP	0.099

Table 3 Evaluation grade and classification of ecological construction development level of Saihan dam

Scoring criteria	A	B	C	D	E
Evaluation score	>80	70< £80	60< £70	30< £60	<30
Evaluation classification	Beet	Good	Middle	Common	Poor

Calculation factor

The matrix is constructed for factor analysis, the vector is normalized, and the index formula is adjusted by consistency:

$$CR = \frac{CI}{RI}$$

Through inspection, the calculated Cr is 0.093 < 0.1, which is within the acceptable range, so the matrix passed the consistency test.

Analyze the data and score range, and establish the scoring standard of 5 grades

According to the above scoring criteria, the grade score of ecological civilization construction before and after the restoration of Saihan dam is obtained. The score of ecological civilization construction of Saihan dam in the 1970s is 10.68. After the efforts of Saihan dam people for more than half a century, the Saihan dam in the 21st century has taken on a new look. By 2020, the score of ecological civilization construction of Saihan dam has reached 89.58 points. It can be seen that the great changes before and after the restoration of Saihan dam have led to the rapid progress of ecological civilization.

The following is the change curve drawn by collecting relevant data and various data of ecological environment in Saihan dam area from 1962 to 2021

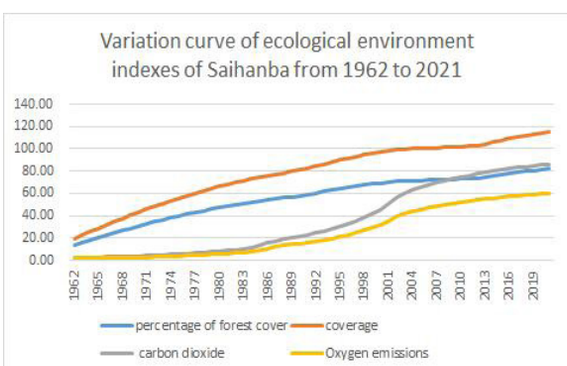

Figure Variation curve of ecological environment indexes of Saihan dam from 1962 to 2021

6. Evaluation and improvement of the model

The construction idea is simple and easy to understand. The relationship size can be obtained through the weight size. The higher the weight, the higher the importance. Analytic hierarchy process, entropy method and other methods are used to calculate the weight. The data of each province are more objective and comprehensive.

References:

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