

Research on the Evaluation Selection Ecological Civilization Based on Fuzzy Evaluation and Linear Regression

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Abstract. Ecological civilization is the industrialized countries' reflection and criticism of industrial civilization development model since mid-twentieth century. It emphasizes that we should treat the nature with the civilization and rational attitude and opposes the extensive use of resources. Walking the road of ecological civilization is the trend of the civilization development of the world. This paper processes the investigation of the ecological problems through the linear regression theory. It judges ecological civilization using multiple linear regression and fuzzy evaluation method and studies influence of various factors on the ecological civilization evaluation. Research shows that the ecological damage factors include extensive use of steel and building materials and excessive discharge of waste. The comprehensive evaluation results show that China's ecological damage is more serious. Therefore, We suggest to establish ecological civilization concept which is respect nature, conform to the nature and protect the nature in the serious problems such as resource constraints, serious environmental pollution and ecological deterioration of the situation. China will integrated ecological civilization into the modernization of China's construction, built the beautiful Chinese and realised the sustainable development of China.

Introduction

In recent months, "beautiful China" has become the hot word of the Chinese government and people. China suggest to establish ecological civilization concept which is respect nature, conform to the nature and protect the nature in the serious problems such as resource constraints, serious environmental pollution and ecological deterioration of the situation. We will built the beautiful Chinese and realised the sustainable development of China. At the end of 2012, at the opening ceremony of international cooperation on environment and development committee, vice premier Keqiang Li pointed out that China will get rid of the "first pollution, after management" approach of industrialized countries. He advocated to integrate ecological civilization into the modern construction which is developing in protection, the protecting in development. It can realize win-win economic development and ecological protection.

The interpretation of ecological civilization and connotation

Ecological civilization involves two aspects: ecology and civilization. Ecology is the study domain of natural science category which refers to the biological, between organism and environment of the state and the relationship between competition, symbiosis, and regeneration of evolution, and holding time, space, quantity, structure and sustained order and harmonious function. In 1962, marine biologist Rachel Carson of United States published "Silent Spring" which elaborated the harm to human beings of pesticide abuse using shocking events and the industrial revolution of the environmental crisis is alarmed. Japanese scholars Tadao Umesao studies human civilization and published papers using ecological history. He points out that the natural environment and ecological conditions play an important role on the process of civilization [1].

(1) In 1971, British female economists Barbara Ward submitted the background report "only one earth" of human environment meeting which called on human give humanistic care and maintenance to the small asteroids. Since then, in 1972, Dennis Meters of the Massachusetts technology institute wrote "the limits to growth - the club of Rome about human dilemma report" which puts forward,

“The earth is limited, and any human activity is more close to the earth’s support, the balance of factors which can not be attentted at the same time becomes more evident and can’t be solved. The report stressed "if the trends of world population, industrialization, pollution, food production and resources consumption aspects are continue, the growth limit of this planet will happened one day in the future 100 years. The most likely outcome is quite suddenly and uncontrollable recession of population and industrial productivity.”

(2) The United Nations held the first meeting---"human and environmental conference" in Stockholm in history which signed “the human environment declaration” .It has opened the prelude of the common humanity to protect the environment. In November 1983, the United Nations founded the world environment and development committee. In 1987 the commission put forward sustainable development model in the report of "our common future" . In 1992, the United Nations conference on environment and development signed “the 21st century agenda " which focused on the understanding of the sustainable development theory. In 2002 the summit meeting of world on sustainable development in Johannesburg confirmed contactation of economic development, social progress and environmental protection which constitute the three pillars of sustainable development and deepen the understanding of sustainable development. The use of ecological civilization is no long .The former Soviet union environmental expert published “foster personal way of ecological civilization in the mature socialist conditions” in “Moscow university journal • scientific communism, 1984, 2”which used this word first time. He thinks that human development must pay attention to ecological condition and ecological civilization is the ascension of ecological culture and ecological culture [2].

(3) In China, ecologists Qianji Ye use ecological civilization concept first time in 1987 .He thinks that ecological civilization is a that the human profit in nature and also pay back to the nature. We should protect the nature when reform nature .The relationship between man and nature is harmonious and unified. The American scholars Roy Morrison really traet ecological civilization as a civilization form after industrial civilization[3]. In 1995,he published the modern sense of ecological civilization concept in "ecological democracy".

(4)In 1997, China science and technology press published “the concept of ecological civilization and Chinese sustainable development " which suggested that "ecological civilization is an advanced civilization form after the agricultural civilization and industrial civilization ". Ecological civilization has narrow sense and broad sense. Narrow sense of ecological civilization requires to improve the relationship between man and nature, treats the nature with civilized and rational attitude , opposes the extensive use of resources and construct and protect the ecological environment .

The fuzzy evaluation of ecological civilization

From the first five-year plan in 1953, China started to the way of industrialization. China is still in the middle of industrialization after the development of industrial civilization of more than half a century. After the reform and opening, it has become the world's second largest economy entity after 30 years of rapidly growth of economy. At the same time, the ecological environment China faced is more and more severe. Shortage of resources, limited environmental capacity had become the new basic national conditions and the "short board" of development. The extensive development pattern which relies on high consumption, high pollution, high cost and low efficiency leads to the increasingly prominent contradiction among population, resources and environment . The alarm of the energy crisis has sounded. Ecological environment questionnaire data of our country is shown in Table 1. The contrast of ecological damage factors are shown in Figure 1.

TABLE I. THE INVESTIGATION OF ECOLOGICAL DAMAGE

Ecological damage	The percentage of the world
Steel consumption	12%
The quantity of building materials	21%
Waste discharge	32%

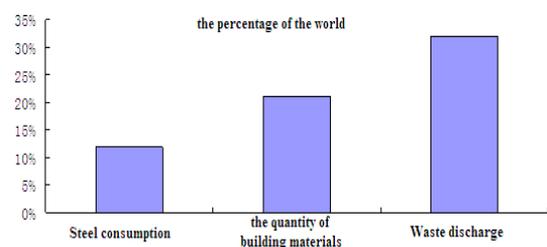


Figure 1. The contrast of ecological damage factors

Through the survey data, we can evaluate ecological problems. We can study the influence of all kinds of factors on ecological civilization evaluation through linear regression processing and multiple linear regression of these data. First we introduce linear regression formula[4]:

$$Y_i = \hat{Y}_i + X_i = a_0 + a_1x_{i1} + \dots + a_nx_{in} + X_i \quad (1)$$

In this formula, Y_i can be divided into two parts. \hat{Y}_i is estimate which will change with the change of the independent variable. X_i is residual which is the difference between Y_i and \hat{Y}_i [5]:

$$C = \sum_{j=1}^n (Y_i - \hat{Y}_i)^2 = \sum_{j=1}^n Y_i - [(a_0 + a_1x_{i1} + \dots + a_nx_{in})] \quad (2)$$

Through the linear processing of the data, we finally get evaluation weight which is shown in Table 2.

TABLE II. THE ECOLOGICAL DESTRUCTION WEIGHT INDEX

Evaluation factors	Weight
ecological balance destroy P1	0.20
Resource consumption P2	0.50
Pollution P3	0.30

We can use the comprehensive fuzzy evaluation model to evaluate the problem of ecological damage. The basic process is shown in Figure 2.

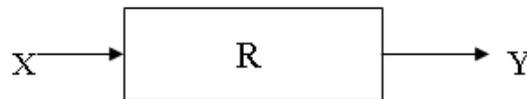


Figure 2. The comprehensive evaluation transformation

In Figure 2, X and Y are two matrices. X is influencing factors matrix. R is weight coefficient. Y is comprehensive evaluation results. The result can be calculated by using $X \cdot R = Y$.

Weight coefficient can be written as $R = \{R_1, R_2, \dots, R_n\}$. Evaluation matrix is [6]:

$$P = \begin{bmatrix} r_{11} & r_{12} & \dots & r_{1n} \\ r_{21} & r_{22} & \dots & r_{2n} \\ \vdots & \vdots & \dots & \vdots \\ r_{m1} & r_{m2} & \dots & r_{mn} \end{bmatrix} \quad (3)$$

B is membership degree matrix. If $D = \{d_1, d_2, \dots, d_n\}$ meets $\sum_{i=1}^n d_i = 1$

.After synthesized: $B = D \cdot R = (Y_1, Y_2, \dots, Y_n)$ (4)

We can get evaluation level after Normalized processing of formula (4).

Assuming that ecological damage grade F is divided into three levels: very serious, serious and general. $F = \{R_1, R_2, R_3\}$. Score is $F = \{90, 80, 70\}$. Table 3 and get through the scores of 100 experts :

TABLE III. THE GRADE OF ECOLOGICAL DAMAGE

Evaluation factor	Marking number(R1, R2, R3)		
P1	30	50	20
P2	45	35	20
P3	35	25	40

Transformation matrix can be calculated according to Table 3.

$$R = \begin{bmatrix} 0.3 & 0.5 & 0.2 \\ 0.45 & 0.35 & 0.2 \\ 0.35 & 0.25 & 0.4 \end{bmatrix} \quad \Psi = \Pi \cdot P = [0.2 \ 0.5 \ 0.3] \cdot \begin{bmatrix} 0.3 & 0.5 & 0.2 \\ 0.45 & 0.35 & 0.2 \\ 0.35 & 0.25 & 0.4 \end{bmatrix} = [0.39 \ 0.35 \ 0.26]$$

Comprehensive score is $\hat{Y} = Y \cdot F = [0.39 \ 0.35 \ 0.26] \cdot \begin{bmatrix} 90 \\ 80 \\ 70 \end{bmatrix} = 81.3$

Through the comprehensive evaluation, we can conclude that the ecological damage is more serious.

Ecological civilization is the inevitable result of human civilization development

This paper evaluated ecological civilization and found ecological civilization problems, from the angle of the comprehensive fuzzy evaluation. Ecological civilization is the reflection of development and the inheritance and transcendence of agricultural civilization and industrial civilization. It is not only a research topic in the field of ecological environment but also is the new sign of the era which refers to the relationship coordination, collaborative evolution, to achieve a virtuous circle of people and nature, people and people, people and society and economy and environment. The road of ecological civilization is the general trend of development of today's civilization.

Human history is not only a history of civilization and progress but also a history of man and nature. The relationship between man and nature is the basic problems influenced human survival development. The person and the natural harmonious development is natural material conditions of all the civilizations . Man is the product of nature . Human developed together with the surrounding. Nature is the basic condition of human survival and performance . People use natural and transform the nature that not only meet the survival needs also created civilization. It also makes the change of nature at the same time. The relationship between human and nature is mutual. Human, nature and environment were influenced each other from the nomadic civilization development to the agricultural civilization and from agricultural civilization to industrial civilization development.

Since twenty century, the international community began to think about "limits to growth", "only one earth" and propose circular economy, green development and ecological civilization. Paying attention to the ecological environment problems, coordinating the relationship between economic development and environmental protection and walking the way of sustainable development gradually become the consensus of all human beings. Humans are transfer from industrial civilization which is conquer ,plunder and pollute the nature to the ecological civilization which is environment friendly, resource saving and appropriate consumption . The United Nations has held four conference on environment and development which achieved the consensus of sustainable development and climate change .It has gradually transformed into national action. Ecological civilization is the inheritance and innovation of agricultural civilization and industrial civilization.It is in line with the direction of the development of human civilization.

The opinion and suggestion of ecological civilization construction

There is no precedent in human history to realize modernization in China which is a country with a population of more than 1.4 billion. It needs more wisdom to protect ecological environment in vast land . We must set up the concept of respect for nature, conform to the nature, protecte the natural ecological civilization . We should merge the construction of ecological civilization into the whole modernization and realize economic development and Livelihood improvement, ecology protection.

First of all, optimizing the national spatial development pattern. According to the balanced principle of population, resources and the environment, we can arrange the layout of the production space, living space and ecological space and realize the organic unity of economic benefit, social benefit and ecological benefit. We should control development intensity, adjust the space structure of natural and leave more space to repair for nature.

Secondly, comprehensively promoting resource saving. According to the low per capita occupancy of energy, we must control the total energy consumption, strengthen energy saving, reduce consumption , support energy saving ,low carbon industry and new energy. According to the shortage of water resources, we must promote water recycle and construct water-saving society . According to the deficiency of the cultivated land resources, we must control the use of land strictly. According to the low resource utilization rate, we must develop circular economy.

Thirdly, increasing the efforts of natural ecological system and environmental protection . According to the environmental problems of blind development, excessive development, disordered development and scattered development we must implement restoration and reconstruction of ecology. According to the emissions are more than environmental carrying capacity, we must strengthen prevention and control of water, air and soil . According to China's large greenhouse gas

emissions and the increasing per capita emissions ,we must control greenhouse gas emission in a planned way.

Finally, strengthening the ecological civilization system construction. We should put the resource consumption and environmental damage, ecological benefit into the evaluation system of economic and social development . We should protect nature reserve, the world cultural and natural heritage, scenic spots, forest park and geological park. We should establish the compensation systems for use of resources and the ecological compensation system, strengthen environmental supervision and improve the ecological environment protection compensation system.

Conclusion

Through the linear regression theory, this paper investigated the ecological problems .It used multiple linear regression and fuzzy evaluation method to judge ecological civilization. And we studied the influence of various factors on the ecological civilization evaluation. The result showed that the ecological damage factors includes the following aspects: extensive use of steel and building materials and excessive discharge of waste. The comprehensive evaluation results showed that China's ecological damage is more serious. From above analysis, we suggestes that ecological civilization concept should be established, which respects nature, conforms to the nature and protects the nature in the serious problems such as resource constraints ,serious environmental pollution and ecological deterioration of the situation.

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