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Applying Ecological Service Value Evaluation Model in Land Projects

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ABSTRACT. *With the increasingly significant impact of human activities on the ecosystem, the governance of environmental degradation has become a hot issue. Scholar Costanza proposed the concept of ecosystem services, but the ecological service evaluation of land projects is still a gap. This paper proposes a series of solutions to apply the value of ecological services to land projects.*

KEYWORDS: *environmental protection; ecological service evaluation model; land use; the impact*

1. Introduction

The ecosystem composed of biosphere makes great contribution to human life. Human beings benefit a lot from ecosystem, including supply services, regulation services, cultural services and support services. However, with the rapid development of the scientific society, a series of problems have emerged, such as excessive consumption of energy. It leads to serious degradation of the ecosystem.

In view of these problems, Costanza proposed to collectively refer to the products and functions of ecosystem as ecosystem services. The evaluation of ecosystem services has gradually become one of the hot spots in the study of ecological economics. Where land use, as the most direct link between human and ecosystem, plays a direct role in ecosystem service value. It is also the basis of rational allocation of sustainable development planning.

However, the existing land projects usually do not take into account the ecosystem service factors, which will bring about negative economic costs. In order to carry out a reasonable evaluation of ecosystem services, it is necessary to evaluate the environmental costs of land use, and establish a comprehensive evaluation model for incorporating ecosystem services into the project cost-benefit ratio.

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2. Ecological service evaluation model

On the basis of Costanza's research, Xie gaodi[1] developed the equivalent factor table of the value of ecosystem services in China based on the field inVESTigation of China's actual situation, and determined that the yield equivalent of grain per hectare of farmland was 1. On this basis, we first measured the equivalent factor value of a single service function

$$P_a = \frac{1}{7}\sum_{i=1}^{n}\frac{A_i}{B_i} / n$$

Where A_i represents the grain crop yield per unit area in the research region in year I, and B_i Bi represents the unit area in the whole country in year IGrain crop yield, in the actual process of operation did not simplify the accounting, usually assume P_a is 1.Then the unit area value of integrated service functions on a certain land type is obtained,

$$P = Z \cdot P_a$$

After obtaining the value of a single unit service, the land use area of the studied region can be obtained based on remote sensing technology. The value of ecosystem services in a certain region can be evaluated according to the equivalent factor table of ecosystem service value formulated by Xie gaodi, and the ecosystem service evaluation model based on economic cost can be obtained:

$$ESV = \sum_{i=1}^{k}\left(S_k \cdot P_k\right) = s_1 p_1 + \ldots + s_k p_k = ESV_1 + \cdots + ESV_K = \sum_{i=1}^{K} sev_i$$

Where S represents the area of a certain land type in a region.

The ecological service value of a region can be evaluated by the comprehensive score of key indicators.

3. Model application

3.1 Selection of land use and development projects

Based on the value evaluation system of land ecosystem services established in this study, the ecosystem service values of land use and development projects of different scales were selected for estimation: Dujiangyan water conservancy project, Yangtze rivers delta cross-basin comprehensive treatment project, Changsha town regional comprehensive treatment project[2]. The results showed that the total value of the three

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ecosystem services corresponded to the large national project > midsize state project > small community project. The map of the three places is as follows[3].

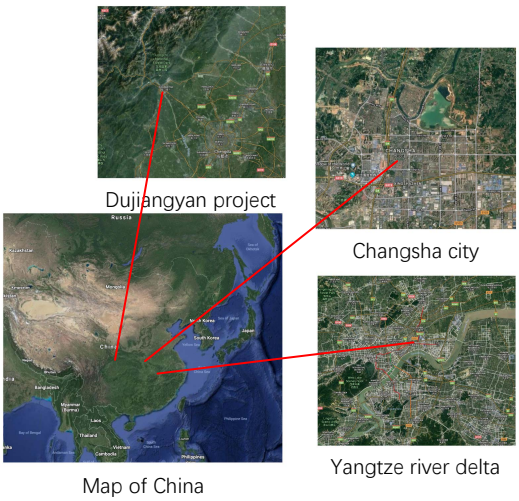

Fig.1 Maps of different scale land project

The three types of land use and development projects of different scales are all carried out from the following five aspects:

Farmland rectification project: adopt political and economic means to improve farmland output and utilization rate in the region (a)

Forest conservation project: to protect and rationally use forest resources, give full play to the role of forest water and soil conservation and environmental optimization (b)

Grassland conservation project: maintain grassland resources and prevent and control harmful organisms in grassland and pasture (c)

Desertification control project: protection and planned restoration of desert vegetation (d)

Water management project: to protect rivers, amber, channels and other waters (e)

3.2 Evaluation of project ecological service value

We first collected the land use area of three places. Based on the ecological service value scale, we calculated the ecological service value that each project can provide according to the ecological service evaluation model.

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Under the condition that the service value of unit area is known, the area of small community project, midsize state project and large national project under each land project can be obtained through GIS, and the formula can be solved to obtain the ecological service value results of land projects of different scales. The results are shown in Table 1.

Table 1 ecological service values of land projects of different scales

type	name	project	Z	P_i Yuan/ha	S_i Ha	ESV_i Yuan/year
Small community projects	Changsha town area comprehensive management	a	7.77	20654.37	4	82617.48
		b	19.71	52393.53	2	104787.06
		c	12.06	32058.11	2	64116.22
		d	0.68	1807.60	1	1807.6
		e	67.98	180705.80	6	1084234.8
		ESV summation	1337563.16			
Midsize state projects	Comprehensive management across river basins in the Yangtze river delta	a	14.11	21494.88	600	12896928
		b	23.39	54308.61	437	23732862.57
		c	15.21	35903.98	398	14289784.04
		d	0.51	1819.57	412	749662.84
		e	78.61	189447.23	633	119920096.59
		ESV summation	171589334.04			
Large national projects	Dujiangyan water conservancy project	a	5.54	5608.44	1560	8749166.4
		b	20.17	22648.01	1896	42940626.96
		c	8.16	8298.54	1420	11783926.8
		d	0.68	1317.38	1500	1976070
		e	70.94	68180.89	2100	143179869
		ESV summation	208629659.2			

According to the analysis of different land use types, the farmland, forest and water area projects are positively correlated with the project scale. Among the grassland and desert projects, the midsize state projects have the highest ecological service value in the comprehensive management of Yangtze river delta watershed.

4. The impact of the model on the people involved

Introduce land ecosystem value measurement, regularly evaluate the value of ecological services, improve the monitoring system, establish the supervision and incentive mechanism, and promote the intensive use of resources[4].

The evaluation of the value of ecological services needs data of different land types, and the land use type needs to be clearly classified.

Dividing the contribution of the evaluation index by the principal component analysis to the difference of the contribution index of the evaluation index, it is necessary to focus

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on the index factors that have a greater impact on the ecosystem service value of various land use types.

Strengthen the supervision and control of environmental costs, pay attention to the accounting and measurement of market costs and non-market costs, pay attention to the changes with the project, and modify the development plan at any time.

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