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Research Progress on Multifunctional Cultivated Land Use

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ABSTRACT

As a scarce land resource, cultivated land is the foundation for human survival, and the core element of regional food security and sustainable development. The protection of cultivated land is the basis for the survival and development of the country. The research on multifunctional utilization of cultivated land is of great significance to improve the comprehensive utilization efficiency of cultivated land and promote the sustainable use of cultivated land. We used the literature research method and the summary and induction method to review the research on the multifunctional use of cultivated land. The results show that (1) There are three main types of classification systems for cultivated land multifunctional use, ecological classification system, demand classification system, comprehensive supply and demand classification system; (2) The evaluation indexes of multifunctional cultivated land use were mainly selected from production, life and ecological function. The entropy method, fuzzy analytic hierarchy process (FAHP) and other methods were used to determine the weight of the evaluation index. (3) The value accounting of cultivated land resources is mainly calculated from economic value, social value and ecological value. (4) The management of multifunctional cultivated land is based on the characteristics of cultivated land joint production and cultivated land multi-functionality, and internalizes the externalities through institutional design to guide the rational competition of cultivated land functional utilization.

KEYWORDS

Cultivated land use; Multi-function; Evaluation; Asset value; Management

1. INTRODUCTION

Cultivated land is the basic resource and material guarantee for human survival, an important carrier of agricultural civilization, and the main substrate of rural landscape [1]. As one of the important attributes of cultivated land, the optimal allocation of cultivated land can effectively enhance the advantages of cultivated land resources. Cultivated land function is the product of the combination of cultivated land ecosystem and cultivated land use mode in a specific institutional and market environment. That is the link between the output (or service) of cultivated land and the activities related to cultivated land use. Cultivated land is based on natural ecosystems and has the functions of maintaining biodiversity, regulating climate and atmospheric composition, regulating hydrology, and ecological isolation [2]. At the same time, cultivated land is also an important cultural landscape,

which not only provides farming scenery and employment opportunities, but also inherits agricultural culture and rural customs. That is the basic element to realize the harmonious development of man and nature and improve the social and cultural environment of human settlement.

In recent years, the study of multifunctional cultivated land use has become an important topic in the field of land science and sustainable development. With the deepening of social and economic development and scientific research, people's demand for cultivated land has changed from a simple agricultural product supply model to a new model of production, life and ecological compound development. Cultivated land not only produces food, but also provides ecological services, conserves biodiversity, promotes social and cultural inheritance, and promotes rural economic development. The research on cultivated land multi-function is mainly carried out in the context of functional division, functional evaluation, and functional management.

2. THE CLASSIFICATION OF MULTIFUNCTIONAL CULTIVATED LAND USE

The ecological classification system is based on ecosystem services, including production (food, energy, and fiber supply), wildlife habitat (maintaining natural processes and providing and supporting habitat for wildlife species), and recreation (recreational benefits to humans), etc..

The demand classification system is based on the needs orientation of residents, including production service functions (production of agricultural products and light industrial raw materials), ecological services.

The integrated supply and demand classification system is based on the perspective of supply and demand. It includes production function (agricultural products and raw materials, food security), economic function (national economic contribution, family economic contribution), social function (social stability maintenance, basic living security, employment security), ecological function (protection of ecological diversity, conservation of water resources, recycling of water resources and regulation of climate), landscape cultural function (aesthetic function and cultural leisure), etc. [2-4].

3. THE EVALUATION OF MULTIFUNCTIONAL CULTIVATED LAND USE

Many scholars have conducted research on the multifunctional evaluation methods of cultivated land. Xin et al. established a set of process-based multi-functional evaluation index system of cultivated land relying on the theoretical framework of "index-process-function-demand". Wu et al. used the entropy method to determine the weight of the evaluation index, constructed a multi-functional evaluation index system, and used 3S technology to express it spatially, and explored the multi-functional evaluation method of cultivated land at the county scale. Zeng used the full arrangement polygon diagram method and the systematic clustering method to measure the multifunctional intensity of cultivated land in various counties and districts of Hunan Province in 2018. Wang et al. used the entropy-weighted TOPSIS model to conduct an in-depth evaluation of cultivated land function from the perspectives of time and space. Li et al. used the administrative village as the basic unit to determine the weight of the evaluation index by using the improved Fuzzy Analytic Hierarchy Process (FAHP) and the entropy method. At the same time, they used the spatial autocorrelation method to deeply analyze the improvement potential of cultivated land multi-function, and on this basis, they reasonably divided the remediation area.

The multi-function of cultivated land has the characteristics of scale, and the evaluation index of cultivated land multi-function will be different from different scales such as cities and counties, villages and towns, and grid units.

The production function is the most basic and core function of cultivated land, which reflects the capacity of cultivated land resources in grain output. At present, most studies measure the output capacity of crops by their yield, but some studies believe that the cultivation status such as multiple cropping index and land reclamation rate can also reflect the level of production capacity from the side.

Life function is one of the most important derivative functions of cultivated land, which is mainly reflected in two aspects: food security and rural stability [5]. The food security function is calculated with reference to international practice, with 400 kg of food per capita per year as the benchmark value. To maintain the function of rural stability, three indicators can be selected to measure the proportion of employees in the primary industry, the per capita cultivated land operating area, and the proportion of cultivated land output value.

More and more attention has been paid to ecological functions, which reflect the ability of cultivated land to maintain biodiversity, maintain farmland landscape pattern, and affect farmland ecological environment. It is not only related to the ecological background attributes of the cultivated land resource system, but also affected by typical human agricultural activities such as the application of chemical fertilizers. Therefore, the proportion of sown area of different food crops and cash crops, the number of cultivated land patches, the cultivated land area, and the chemical fertilizer use intensity of the cultivated land area were selected for calculation.

4. THE ASSET VALUE ACCOUNTING OF CULTIVATED LAND

4.1. Economic Value Accounting

The economic value of cultivated land can be characterized by the early payment of annual economic benefits.

4.2. Social Value Accounting

The social value of cultivated land resources can be divided into three aspects: social stability, social security and public services. The social stability value mainly refers to the contribution of cultivated land resources to national food security, narrowing the income gap between urban and rural areas, and social and public security [6]. The value of social security mainly refers to the employment security and old-age security for the rural population. The value of public services refers to the contribution of cultivated land resources to rural medical and health care, education, transportation and rural culture.

4.3. Ecological Value Accounting

Cultivated land resources have six ecological service functions: carbon sequestration and oxygen release, soil conservation, water conservation, atmospheric environment purification, biodiversity conservation, and landscape recreation. The carbon sequestration and oxygen release function of cultivated land refers to the photosynthesis of crops to collect and fix carbon dioxide, thereby reducing carbon dioxide in the air and releasing oxygen, as well as soil carbon sequestration [7]. The value of maintaining soil function is composed of three parts: soil consolidation, sediment reduction and soil nutrient conservation. The function of water conservation mainly refers to the interception and storage of precipitation by cultivated land ecosystems. The function of purifying the atmospheric environment mainly refers to the absorption of harmful gases and the blocking effect of dust on the cultivated ecosystem. Biodiversity conservation function refers to the cultivated land ecosystem that provides habitat for some organisms [8]. Landscape recreation value refers to the value generated by the cultivated land ecosystem to provide leisure and recreation places for human beings. The ecological loss value of cultivated land resources is composed of two parts: the value of

environmental pollution loss and the value of land quality loss. The ecological value of cultivated land resources is the value of ecological services minus the value of ecological loss.

5. THE MANAGEMENT OF MULTIFUNCTIONAL CULTIVATED LAND USE

Cultivated land function management is a process of manual intervention in the use of cultivated land function and the changes caused by cultivated land function through the formulation, implementation, supervision and coordination of policies. The management of multifunctional cultivated land is based on the characteristics of cultivated land joint production and cultivated land multi-functionality, and internalizes the externalities through institutional design to guide the rational competition of cultivated land functional utilization. First of all, the multifunctional value of cultivated land should be manifested, and the gradual overall reform of the rural land system and land market should be promoted [9]. Secondly, it is necessary to effectively protect the rights and interests of peasants and promote gradual and overall changes in the rural land system and the peasant social security system. Next, implement multi-functional stratification of cultivated land and classified management of land system, and build a comprehensive management system of multi-functional cultivated land [10]. Then, strengthen social supervision and sustainable impact assessment to ensure reasonable competition in the functional use of cultivated land.

6. CONCLUSION

The main conclusions are as follows:

(1) There are three main types of classification systems for cultivated land multifunctional use, ecological classification system, demand classification system, comprehensive supply and demand classification system;

(2) The evaluation indexes of multifunctional cultivated land use were mainly selected from production, life and ecological function. The entropy method, fuzzy analytic hierarchy process (FAHP) and other methods were used to determine the weight of the evaluation index.

(3) The value accounting of cultivated land resources is mainly calculated from economic value, social value and ecological value.

(4) The management of multifunctional cultivated land is based on the characteristics of cultivated land joint production and cultivated land multi-functionality, and internalizes the externalities through institutional design to guide the rational competition of cultivated land functional utilization.

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