Study on the Impact of Land Use Change on Ecosystem Services in the Water Source Area of the Middle Route Project of S-N Water Diversion

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Abstract. The South-to-North Water Diversion Project, a major project in China, is of great significance to alleviate the shortage of water resources in the north, and the ecological environment in the middle water source area has the most critical impact on water quality safety. As a natural resource and asset, ecosystem services in the water source area of the Middle Route of the South-to-North Water Diversion Project not only provide important resources and services for human beings but also are the necessary basis for the survival and development of other organisms on the earth.As an integral part of the earth's economy, the value of ecosystem services in the water source area of the Middle Route of the South-to-North Water Diversion Project directly or indirectly contributes to human welfare. Scientific use of land resources can promote the upgrading and transformation of ecosystem services in the water source area of the Middle Route of the South-to-North Water Diversion Project. Based on this, this paper focuses on the impact of land use change on ecosystem services in the water source area of the middle route of South-to-North Water Diversion and its prevention strategies.

Keywords: Land use change, Water source area of the Middle Route of the South-to-North Water Diversion, Ecosystem services, Study on impact.

1. An overview of ecosystem services in the water source area of the Middle Route of the South-to-North Water Diversion Project

More than 70% of the water source area of the Middle Route of the South-to-North Water Diversion Project is covered by forests, shrubs, and grasslands, and 15% is farmland and construction land. There is a large amount of natural vegetation here, which is scarcely affected by human activities. There is a relatively good ecological environment here, which is conducive to ensuring the water quality of the water source. From 2023 to 2019, the forest coverage rate here has been greatly improved, the farmland area is decreasing, and the construction land has increased to a certain extent. The total area of the forestreached 6.699 million hm2 in 2019, and the coverage rate also reached 63.2%, whilethe farmland area decreased by 156.7 hm2.The ecological environment there is getting better. Human activities in this area are mainly mountain agriculture. Under the guidance of the policy of returning farmland to forest and the influence of regional economic development, the agricultural population gradually moves to cities, resulting in the continuous reduction of cultivated land area. However, influenced by natural geographical factors, the main distribution area of farmland here is still in the ridges and valleys. During this period, the area of farmland decreased significantly in areas with a slope of more than 6 degrees. In addition, the cultivated land in these areas slightly decreased.The soil erosion problem in this area is mainly mild or moderate, and the erosion area is reduced to a certain extent. Soil erosion has been improved. In 2015, soil erosion decreased by 1.551 million hectares compared with 2013, with a significant decline, which is mainly affected by changes in land cover.

2. Effects of land use change on ecosystem services in the water source area of the Middle Route of South-to-North Water Diversion Project

Ecosystem services in the water source area of the Middle Route of South-to-North Water Diversion Project refer to various economic, social and ecological functions provided by natural

ecosystems for human beings, including water supply, food production, climate regulation, soil conservation, natural disaster prevention, etc. Ecosystem services are critical to human survival and development because they provide a variety of resources and services to support economic activities and social well-being. However, influenced by human activities and climate change, ecosystem services are facing serious threats and damage, and measures need to be taken to protect and restore ecosystem services.

Under the background of social development in the new era, to achieve higher land use efficiency, people adopt various forms and channels to use various land resources and carry out long-term, cyclical and rational management of local land resources. This process can be regarded as the transformation of land use. In this context, how to avoid the impact of land use change on ecosystem services in the water source area of the Middle Route of the South-to-North Water Diversion Project is of great significance. At this stage, each region should conduct a comprehensive and in-depth analysis and evaluation of the environment by combining its own land resources and the main way of land use, aiming to create a high-quality land use model that can effectively protect the ecological environment. Meanwhile, to further ensure the significant improvement of the utilization level of land resources, it is necessary to make rational use of various scientific and technological means. There is a vast territory and an extremely complex geographical environment in China, and there are significant differences in land use transformation models and strategies in different climatic conditions and different regions. Besides, due to the significant differences in regional economic levels, there are some differences in the technical methods and implementation approaches used in the process of land use transformation in each region. Before comprehensively promoting the transformation of land use patterns in various regions, it is necessary to carry out in-depth and detailed investigation and researchand carry out scientific and rational development of land resources in combination with local actual conditions and relevant data.

In the process of urbanization, unreasonable land development and utilization is one of the important reasons for the declined service value of the land ecosystem. For example, in some areas, to develop the economy, some forests, grasslands, and rivers are blindly developed, resulting in the continuous reduction of ecological land and the destruction of the ecological environment. How to realize the rational development and utilization of land resources and reduce the declined service valueof ecosystems in the water source area of the Middle Route of the South-to-North Water Diversion has become an important problem that needs to be solved urgently in land use planning and management.Therefore, it is necessary to analyze the changesin the ecological value of land from the perspective of the service value of the ecosystem, and incorporate the service value of the ecosystem of the water source area of the middle route of South-to-North Water Diversion into the consideration of land development and utilization to solve the regional ecological environment problems.

3. Coping strategies of land use change on ecosystem services in the water source area of the Middle Route of the South-to-North Water Diversion Project

(1) Establish the concept of ecosystem services and rationally plan land resources

In the process of ecosystem services in the water source area of the Middle Route of the South-to-North Water Diversion Project, we should deeply understand and learn General Secretary Xi Jinping's idea of ecological civilization, always adhere to the principle that lucid waters and lush mountains are invaluable assets, and insist the principle of ecological civilization in land use work. Meanwhile, we should strengthen the publicity and education of land use, enhance the crisis awareness of the whole society, and improve the level and quality of land use. There are many ways to promote education, including education, literature, art and so on. The concept of ecological civilization is promoted through television, radio, Internet, newspapers, and other means so that people can realize the importance of innovative land use governance, enhance the awareness of

relevant personnel, and transform these concepts into their own behavior to cultivate civilized and healthy living habits. Moreover, moderate consumption and green consumption should be advocated, extravagance and waste should be resolutely resisted, people's frugal, civilized, and rational consumption habits should be cultivated, land use control methods should be innovated, and the quality of ecosystem services in the water source area of the Middle Route of the South-to-North Water Diversion Project should be improved.

(2) Improve land transformation management system and legal system

The process of land use should be based on the land system science, and through strengthening the system control, it should be connected with the development goal of urban and rural integrationto meet the actual needs of the ecosystem services in the water source area of the Middle Route of the South-to-North Water Diversion Project. In this regard, the land system can use advanced technologies such as artificial intelligence, geographic exploration, and big data to achieve functions such as dynamic monitoring, early warning, and problem tracking. Based on the transformation of land use form, and taking space use conflict as the foothold, measures such as land use supervision and market supervision should be taken to ensure the scientific allocation of land, thereby achieving the goal of three-dimensional control of transformation and good operation of land system.In addition, the current land legal system is not perfect enough, and there is still room for improvement in agricultural land protection, land resource compensation, and incentives. It should be based on the current situation of rural land use, the detailed configuration should be carried out according to the region and functionto ensure the orderly development of land use; the land compensation incentive system should be implemented andthe compensation should be appropriately increased to stimulate farmers' enthusiasm, thereby laying a solid foundation for subsequent land use. It can be seen that in the process of land use transformation, only by ensuring the soundness of relevant policies and systems andthe implementation of various measures can they play a practical role and effectively improve the existing land use effect.

(3) Strengthen the long-term planning and management of land resources

Under the background of the new era, the state attaches great importance to improving the intensity and level of long-term management of land resources in various places. Especially with the continuous advancement of ecosystem services in the water source area of the Middle Route of the South-to-North Water Diversion Project, the rational use of various land resources has become one of the most important tasks at present. To make full use of valuable land resources, it is necessary to formulate long-term development plans and precise management strategies to ensure that the ecosystem services in the water source area of the Middle Route of the South-to-North Water Diversion Project can be comprehensively improved and promoted based on theory and practice.Especially in the current process of rapid urbanization in rural areas, the speed of rural land transfer has accelerated significantly, which has brought a series of related problems, the most significant of which is the major conflict between land use rights and land owners. In the current practice of land use transformation in China, the imbalance between land use rights and land ownership is a major contradiction and problem that needs to be paid attention to and solved urgently. This phenomenon will not only affect the adjustment of the local rural economic structure but also result in a declined efficiency of ecosystem services in the water source area of the Middle Route of the South-to-North Water Diversion Project.Therefore, local land use agencies must attach great importance to and timely take effective, reasonable, and comprehensive regulatory measures and means to ensure that the legitimate rights and interests of farmers can be protected to the best extent. Besides, relevant managers also need to maximize the efficiency of local land use by taking the scientific and effective use of land resources as the fundamental starting point and foothold.

(4) Improve the land resources system management system

In land use, to better control the impact of land use on ecosystem services in the water source area of the Middle Route of the South-to-North Water Diversion Project, relevant departments need to formulate reasonable policies and plans based on the requirements and actual conditions of land use, and then strengthen land use transformation from the perspective of management and supervision. In

land use, land use planning must be carried out under the management rules, reasonably simplify the land management process, and promote the effective implementation of management work.Under the new situation,the region needs to change and innovate the methods and means of land use according to the actual situation, aiming to better realize the utilization and protection of land resources. Meanwhile, regular surveys can also be conducted to implement the responsibilities of employees in daily management. Moreover, land use also needs to well supervise the implementation process. At present, the abuse of land cases occur frequently, and some people violate the provisions of the abuse of land.The relevant departments of the state must attach enough importance to this problem, establish a monitoring and supervision mechanism, actively carry out land use inspection and verification, and severely investigate and punish illegal land use and abuse of land to avoid excessive loss of land resources. There are many types of land resources in China, with a complex use situation, because there are agricultural land, forestry land, and fishery and animal husbandry land. Meanwhile, there is also a situation that many departments are responsible for land management, and their management content and functions are different. In practical work, it is easy to encounter problems that do not clearly belong to a certain department, so the poor macro-control ability and the mutual shirking of responsibilities of some departments have affected the smooth progress of land management.Therefore, it is necessary to establish and improve the land use system, clarify the responsibilities of various departments, and achieve coordinated leadership and unified management among departments. Local governments should take the lead in setting up land use institutions to realize the unified management and coordinated allocation of land resources. In practical work, based on the division of labor of departments, the regional land resources should be classified and managed according to the plan to realize the one-stop service of land use and promote the standardized management of land use, transaction, bidding, and so on.

(5) Strengthen the analysis of the ecological benefits of land use

The study on ecosystem service function in the water source area of the Middle Route of the South-to-North Water Diversion mainly evaluates the value of ecosystem service function, including the role of ecosystem service function in maintaining natural environment, regulating climate, purifying air, maintaining species diversity, preventing natural disasters, reducing pests and diseases, and maintaining social development. In the past period, to promote social and economic development, China's construction land has increased year by year, and a large number of ecological land has been occupied, such as various forests, gardens, grasslands, etc., which has caused damage to the ecological environment and affected the sustainable development of our society.In land use planning and management, it is necessary to well evaluate the value of land ecosystem services, analyze the ecological benefits of different types of land, and compare them with other benefitsto provide effective data support for decision-making. In ecological city construction, the ecological benefits and construction costs of different types of land should be evaluated, and the land use types with high ecological benefits and low construction costs should be selected. For example, the petrochemical industry has high energy consumption and high emissions.In the process of ecological city construction, it is necessary to promote the transformation or relocation of the petrochemical industry, promote the development of high-energy-consuming industries to ecological industries, and carry out a series of ecological restoration projects, such as the construction of artificial wetlands, ecological landscape gardens, etc., aiming to improve the ecological benefits of the land. When carrying out land use planning, evaluating the value of ecosystem service can balance the economic, ecological, and social benefits of land use under different scenarios, thereby formulating scientific land use planning and improving land use management level.

4. Conclusion

In summary, land is the basis for farmers' survival. In the development of ecosystem services in the water source area of the Middle Route of the South-to-North Water Diversion Project, it is very critical to solve the problems of planning, management, and transformation of land resources. By

referring to the theory of land system science, the object, content, and function of land use transformation should be clarified. Then by improving the management system and legal system of land use transformation, the land planning scheme should be prepared to strengthen supervision, open resources, reduce costs, and re-plan and re-manage idle land, thereby promoting use efficiency. Besides, the division of labor among departments should be clarified, and the supervision of illegal projects should be supervised, aiming to avoid and reduce land waste and promote the smooth and efficient completion of land use ecosystem services in the water source area of the Middle Route of the South-to-North Water Diversion Project.

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