Analysis and Research on the Value of Farmland Transfer Based on Environmental Protection Evaluation System

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Abstract. In order to coordinate the farmland transfer and the construction of the ecological environment, this paper first introduces the main work content and the main benefits of farmland transfer, and then separately elaborates the land leveling, farmland water conservancy, field roads and other projects in the process of farmland transfer. Value analysis of the impact on the ecological environment of farmland, and analysis of the problems existing in the value of farmland transfer: neglect of ecological environment protection, unreasonable arrangement planning and construction technology, lack of specific normative guidance for protecting the ecological environment during the arrangement process. The results of the study show that the evaluation of the ecological value of farmland can be used to guide the rational external transfer of farmland, which is beneficial to the protection of farmland. At the same time, it also has certain guiding significance for returning farmland to forests and lakes. Therefore, it is necessary to evaluate the ecological value of farmland.

Key words: Environmental Protection Evaluation System, Value of Farmland Transfer, Ecological Value of Farmland, Evaluation.

1. Introduction
Farmland is a very complex levelling of nature, ecology, and social economy. In the evaluation of farmland quality, not only the economic and social functions and value of farmland must be considered, but also the ecological functions and value of farmland must be fully considered. However, in the farmland quality evaluation work, due to the different objectives of the farmland quality evaluation and the limitations of basic data, funding and other conditions, the factors considered in the farmland quality evaluation cannot be comprehensive.

The current farmland quality evaluation work mainly focuses on the economic and social functions and quality of farmland, while ignoring the evaluation of ecological functions and quality [1]. Farmland is not only a land resource, but also an ecological environment resource. When farmland is converted or damaged, a scientific valuation theory and thinking system should be established to reasonably reflect the cost of the ecological environment utilization and protection of farmland.
resources. With the continuous development of China's social and economy, the available land resources are becoming less and less, and the ecological environment is not in good condition. For this reason, effective measures must be taken to improve the utilization of land resources and strengthen ecological environmental protection. In the process of implementing farmland transfer work, it is necessary to coordinate the relationship with ecological environmental protection. The importance of ecological environmental protection work must not be ignored, and the adverse impact of farmland consolidation on the ecological environment should be reduced as much as possible to improve benefits of farmland consolidation and guarantee the sustainable development of land resources.

2. **Connotation analysis of farmland value**

Farmland is not only the most basic means of production and living support for farmers, but also the fundamental need for the survival and development of the entire human society. It is a complex of nature, ecology and society. For a long time, people have insufficient understanding of the dual attributes of farmland as resources and assets, and there are cognitive defects in the composition of its value, which largely hinders the prosperity and development of the farmland market. The production function of farmland has always been valued by people, while other functions are often ignored [2]. Judging from the current status of farmland rights in China, farmland should have the value function of means of production, ecological value function, social security value function and social stability value function.

2.1. **Value function of production materials**

The land directly used for agricultural production is called agricultural land, and can be divided into farmland, forest land, garden land, pasture grassland, farmland water conservancy land, and breeding water surface according to its use. Farmland has dual attributes of resources and assets, and is a non-renewable precious resource. It has a production function, and can produce various crops under suitable natural and technical conditions to provide humans with various foods. In agricultural production, farmland is an indispensable and irreplaceable means of production.

2.2. **Ecological value function**

Farmland first appears as natural land, and in its essence, it is the most basic element of ecological environment. Its ecological value functions are specifically manifested as: (1) Conserve water; (2) Prevent soil erosion; (3) Adjust climate; (4) Purify water quality; (5) Purify air.

2.3. **Social security value function**

For farmers, farmland is the source of food and clothing and the foundation of survival. Its nurturing function, carrying function, accumulation and value-added asset function can be transformed into farmers' medical security, old-age security, employment security and life welfare. The social security function of farmland comes from its inherent natural and socio-economic characteristics, and is a derivative of the basic function of farmland [3]. For a long time, the weakness of my country's social security system in rural areas has made farmers' jobs and incomes mainly dependent on farmland.

2.4. **Social stability value function**

First of all, farmland is used as a means of production to be used in agricultural production, which solves the employment problem of a large part of our country's population and allows people to depend on their lives and live on. There will be no social unrest due to the lack of the most basic living elements. Second, food security is the strategic basis for ensuring national security. The food and agricultural sideline products produced on farmland are the basis for industrial development and the basis for the survival and development of cities. Therefore, farmland has an important social stability value function.
3. Analysis of ecological environment value of farmland transfer

3.1. Research methods
Both CA and Markov are dynamic models, both of which have their own limitations. The Markov model can simulate the changes in the area between different types of land use, but cannot be specific to the spatial distribution of each type; the CA model has a strong spatial relationship and simulation the ability to dynamically evolve in space and time, but the evolving rules have greater human factors. The evolution rules of the CA model are formulated through Logistic regression analysis, and the combination of the three can objectively predict the land use change in terms of quantity and space. Based on the known areas of various types of land use, the system can be used to calculate the value of ecosystem services in Shanxi Province. The formula for calculating the value of ecosystem services is:

\[ E_{sv} = \sum \left( A_i \times V_{ci} \right), E_{sv} = \sum \left( A_k \times V_{cv} \right) \]  

(1)

Where \( E_{sv} \) is the ecosystem service value; \( E_{sv} \) is the nth service value in the ecosystem; \( A_i \) is the area of the i type land use type; \( V_{ci} \) is the ecosystem service value coefficient, and \( V_{cv} \) is the nth service value of the i-type land use type coefficient.

3.2. Result analysis

3.2.1. Analysis of land use change
According to the agricultural economic information platform data, the changes in land use types from 2009 to 2019 are calculated. The area of water and construction land has increased in land use types, while the farmland, forest land, grassland, and unused land have decreased. From 2009 to 2019, the construction land changed the most, with an annual change rate of 10.81%; followed by water and unused land, with annual change rates of 7.3% and -8.29%, respectively. The annual change rate of farmland and forestland was small. During the 10 years, the area decreased by 36.20hm² and 22.21hm² respectively. During the period from 2009 to 2019, the area of unused land first increased slightly and then decreased significantly[4].

3.2.2. Simulation of land use change
Based on the 2014 land use classification, the binary values of each category were extracted, and 14 driving factors were standardized. Farmland, forestland, water area, construction land, and unused land were used as dependent variables, and 14 standardized driving factors were used as the independent variables were analyzed by binary logistic regression, and the results are shown in Table 1. The ROC test values of the 6 regression results are all greater than 0.8, indicating that the selected driving factors can effectively explain the spatial distribution of each category.
Table 1. Logistic regression coefficients and ROC test results of various land use types

| Driving factor                  | farmland | Forest land | Waters | Construction land | Unused land |
|--------------------------------|----------|-------------|--------|-------------------|-------------|
| DEM                            | -0.358   | 0.906       | -0.682 | -0.227            | -0.804      |
| Measurements                   | -0.240   | 0.302       | 0.121  | -0.002            | -0.001      |
| Distance to cultivated land    | -2.381   | 2.133       | 0.886  | 0.894             | 0.555       |
| Distance from forestland       | 1.819    | -3.689      | 0.768  | 0.156             | -0.324      |
| Distance from water            | 0.424    | 0.067       | -2.354 | -0.006            | 0.073       |
| Distance to construction land  | 0.270    | 0.193       | 0.111  | -1.276            | 0.477       |
| Distance to unused land        | 0.039    | 0.154       | 0.145  | -0.324            | -1.568      |
| Distance to railway            | 0.409    | -0.611      | -0.150 | -0.227            | 4.973       |
| Distance from road             | 0.119    | -0.332      | 0.304  | -0.094            | 1.501       |
| Distance to river              | 0.338    | -0.372      | 0.556  | -0.182            | 3.207       |
| To all towns                   | -0.008   | 0.121       | 0.529  | 0.094             | -1.485      |
| From the administrative centre| -0.161   | 1.020       | -0.087 | 0.461             | -6.243      |
| GDP                            | -0.572   | -0.145      | -0.166 | 0.370             | -0.406      |
| The population density         | 0.303    | 0.252       | 0.017  | 0.364             | 0.046       |
| constant                       | -1.268   | 0.207       | -5.337 | -3.747            | -9.046      |
| Regression value deviation     | 0.918    | 0.929       | 0.896  | 0.877             | 0.844       |

According to the coefficients obtained by Logistic regression, the CA-Markov model conversion rules are formulated to predict the distribution of land use types in 2021. The Kappa coefficient of the Logistic-CA-Markov model for the simulation of land use changes in 2021 is 0.878, which is greater than 0.85; the point-to-point accuracy is 82.35%, greater than 75%, the simulation results have high credibility and can be used to further predict the land use pattern [5].

4. Research on the effective model of farmland transfer based on the ecological environment protection of farmland

4.1. Construction of an effective model system for farmland transfer based on farmland protection

Because of the important significance of farmland protection in the farmland transfer and the conflicts between the two, how to coordinate the contradictions between the two is of fundamental significance to better promote the farmland transfer. Based on the coordination of the contradiction between farmland transfer and farmland protection, and alleviating the pressure on farmland protection caused by farmland transfer, the author constructed an effective model system for farmland transfer (Figure 1). Strive to use urbanization to raise funds for farmland transfer and related farmland protection, and through a series of mechanisms such as: farmland protection opportunity cost compensation mechanism, relying on farmland transaction institutions to expand the "occupation-compensation balance" regional scope mechanism, farmland transfer and rural homestead reclamation projects support mechanisms, market competition mechanisms are introduced, and land price evaluation systems are improved [6]. Finally, farmland transfer and farmland protection are mutually complementary.
4.2. Discussion on the opportunity cost compensation mechanism of farmland protection

The opportunity cost of a certain resource for a particular purpose is the best benefit that the resource can obtain for another optimal purpose. For farmland, the opportunity cost of using it to produce food in the farmland transfer is the best benefit that the land can get from the transfer. However, the opportunity cost of food production is a social cost, and compensation for it is a social compensation. Therefore, in the process of farmland transfer, in order to make the opportunity cost of food production better compensated by the society, it is necessary to make this opportunity cost achieve monetization performance through a complete price evaluation system, and ultimately make the protection of untransferred farmland less. Other benefits from the transfer of farmland that have already been transferred and the benefits of rapid urbanization are compensated. The income gap between farmland protection and farmland transfer is the direct cause of increasing pressure on farmland protection in the process of farmland transfer. After the opportunity cost of farmland protection is compensated, the pressure of farmland protection in the process of farmland transfer will be greatly eased. At the same time, maintaining an appropriate income difference will also help farmers to actively carry out farmland transfer based on the protection of farmland.

5. Conclusion

The transfer value of farmland is mainly reflected in the value of the means of production, that is, the farmland transfer has changed from the decentralized and small-scale management of the farmland to the unified and large-scale management mode, forming a number of efficient agricultural parks and industrial parks. Cultivated a group of large farmer-households who manage land, which has brought about an improvement in the overall efficiency of agriculture and increase of farmers’ income. Therefore, the value of the means of production after the farmland transfer has been better realized. The value of farmland transfer is mainly reflected in promoting land contiguity, realizing large-scale management, reducing land abandonment, and improving use efficiency and ecological environment of farmland. The compensation for the farmland transfer household should also consider the long-term
life, production and social security issues of the farmland transfer household. Therefore, a reasonable value of farmland transfer should be better realized through value compensation for all aspects of farmland transfer. The farmland transfer model system based on farmland protection is of great significance to alleviate the contradiction between farmland transfer and farmland protection, and speed up the reasonable farmland transfer.

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References
[1] Ren, Y., Huang, K., Yu, Y., & Hu, J. Inter-Regional Agricultural Virtual Water Flow in China Based on Volumetric and Impact-Oriented Multi-Regional Input-Output (MRIO) Approach. Water, 12 (1) (2020) 251-255.
[2] De Girolamo, A. M., Bouraoui, F., Buffagni, A., Pappagallo, G., & Lo Porto, A. Hydrology under climate change in a temporary river system: Potential impact on water balance and flow regime. River Research and Applications, 33 (7) (2017) 1219-1232.
[3] Di, D., Wu, Z., Guo, X., Lv, C., & Wang, H. Value stream analysis and emergy evaluation of the water resource eco-economic system in the Yellow River Basin. Water, 11(4) (2019) 710-715.
[4] Ustaoglu, E., & Collier, M. J. Farmland abandonment in Europe: an overview of drivers, consequences, and assessment of the sustainability implications. Environmental Reviews, 26(4) (2018) 396-416.
[5] O'Brien, G. C., Dickens, C., Hines, E., Wepener, V., Stassen, R., Quayle, L., ... & Landis, W. G. A regional-scale ecological risk framework for environmental flow evaluations. Hydrology and Earth System Sciences, 22(2) (2018) 957-975.
[6] Yue, S., Li, H., Cheng, B., & Gao, Z. The value of environmental base flow in water-scarce basins: a case study of Wei River Basin, Northwest China. Water, 10(7) (2018) 848-856.