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Article

Research on the Construction of Ecological Compensation Mechanism Under the Guidance of Agricultural Green Development

Shuai Yang and Lingyan Liu *

Academic Affairs Office, Hebei Agricultural University, Lianchi District, Baoding 071000, China

Abstract: Under the era-oriented background of agricultural green development, the ecological compensation mechanism is the key grasp to open up the transformation channel of "lucid waters and lush mountains are invaluable assets". Its core essence lies in resolving the coordination dilemma between ecological protection and agricultural production through scientific system design. Relying on three pillars—vertical fiscal compensation, horizontal inter-regional compensation, and market-oriented independent compensation—this mechanism constructs a classified compensation system targeting core ecological elements such as cultivated land conservation, river basin governance, and forest preservation. The purpose is to take economic incentives as the link to guide agricultural producers to actively adopt environment-friendly technologies, so as to realize the value of ecological products effectively. Based on this, this paper focuses on exploring the construction path of the ecological compensation mechanism under the background of agricultural green development, aiming to provide reference for practical work.

Keywords: agricultural green development; ecological compensation mechanism; construction path

1. Introduction

With the in-depth advancement of ecological civilization construction, agricultural green development has been firmly integrated into the national strategic layout, and the ecological compensation mechanism is the core institutional guarantee for the implementation of this strategy. At present, China's agricultural development is facing the practical dilemmas of tightening resource constraints and ecological degradation. It is urgent to convert the positive externalities brought by ecological environmental protection into tangible benefits through the establishment of a compensation mechanism, so as to fully mobilize the endogenous motivation of farmers to participate in ecological governance. From the perspective of policy practice, the official introduction of the "Regulations on Ecological Protection Compensation" and the pilot explorations carried out by various regions according to local conditions have clearly established the basic supporting role of ecological compensation in the green transformation of agriculture. The essence of this mechanism is to follow the basic principle of "beneficiaries of protection get rewards, users pay", re-sort out the interest distribution logic in agricultural ecological governance, and ultimately achieve the synchronous improvement of economic, social and ecological benefits.

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* Corresponding: Lingyan Liu (582039993@qq.com)

2. Core Elements of Agricultural Ecological Compensation

2.1. Core Principles

The two principles of "who protects, who benefits" and "who benefits, who pays" constitute the core cornerstone of the ecological protection compensation mechanism [1]. Their core goal is to internalize the externalities of ecological environmental protection into the development process through clear division of powers and responsibilities. These two principles clearly define the status of ecological protectors—such as local governments in key ecological function zones and farmers practicing green production models—as compensated subjects, and also clarify the compensation payment responsibilities of ecological beneficiaries—including regions, relevant enterprises and the general public who benefit from ecological improvement. The effective implementation of these principles is inseparable from the comprehensive consideration and accurate calculation of the direct costs of ecological protection, the loss of development opportunities, and the value of ecosystem services. It also requires legal means to consolidate the boundaries of rights and obligations of various subjects, stabilize the expectations of protectors, and gradually form a positive interaction pattern of "beneficiaries taking the initiative to pay and protectors receiving reasonable compensation" [2].

The combination of classified compensation and comprehensive compensation is the core path for the reform of the ecological protection compensation system [3]. The key of this path is to tailor differentiated compensation plans based on the differences in protection costs and the endowments of ecological service values of different ecological environment elements. Among them, classified compensation focuses on specific elements such as cultivated land, forests, water areas, wetlands, and grasslands. For example, the compensation standard for public welfare forests is dynamically adjusted according to actual protection needs, gradually increasing from the initial 5 yuan per mu to 16 yuan per mu; special subsidies are issued per mu to farmers who implement crop rotation and fallow of cultivated land and carry out green planting, so as to ensure that protection measures are effectively implemented. Comprehensive compensation, through the coordination of vertical transfer payments and horizontal consultation and cooperation between regions, strives to improve the level of public service guarantee in areas with important ecological functions. At the same time, it promotes the overall integration of various compensation funds, avoids the problems of duplicate subsidies and scattered funds, and ultimately maximizes the overall benefits of ecological protection.

2.2. Compensation Objects and Scope

The ecological protection compensation mechanism accurately targets core groups such as cultivated land guardians, farmers in the upper reaches of river basins, and operators in ecologically fragile areas as the core of compensation. The core goal is to convert the positive externalities generated by the ecological protection behaviors of these subjects into actual benefits through economic incentives. In practice, financial subsidies are provided to farmers who implement crop rotation and fallow in heavy metal-contaminated areas, and corresponding subsidies are given to subjects who carry out the conversion of slope farmland to forests; through the ecological compensation mechanism for the whole river basin, funds are inclined to the upper reaches that are responsible for water conservation; for protection subjects in key ecological function areas, reasonable compensation standards are formulated considering multiple factors such as actual investment in ecological protection and loss of development opportunities, so as to fully mobilize their enthusiasm for participating in ecological protection and ensure the sustainability of protection behaviors.

3. Existing Policies for Agricultural Ecological Compensation

3.1. Vertical Compensation

Vertical compensation is an ecological protection transfer payment system with central finance as the core. Through special funds such as transfer payments for key ecological function zones, it effectively improves the ability of local governments to carry out ecological governance and guarantee basic public services. This mechanism adopts a formula-based distribution method, taking the standard fiscal revenue and expenditure gap, the area of ecological protection red lines, forest coverage rate, and the results of ecological environment quality

monitoring and evaluation as core parameters to implement differentiated subsidies; fixed-quota compensation is implemented for prohibited development zones, and the subsidy standard in some regions has reached 3.9 million yuan per zone. The relevant funds do not set specific scope of use, and are coordinated and allocated by provincial governments, focusing on ecological protection and people's livelihood improvement. At the same time, a supporting assessment, evaluation and reward-punishment linkage mechanism is established to form a vertical compensation pattern with equal emphasis on incentives and constraints [4].

3.2. Horizontal Compensation

Horizontal compensation is an important market-oriented path to solve the coordination problem of cross-provincial river basin ecological protection. Upstream and downstream provinces reach legally binding compensation agreements through consultation, taking key indicators such as the water quality category of cross-border sections and pollutant concentration as the compensation benchmark, and clarifying the calculation standard of compensation amount. For example, in the basic water quality compensation, the single compensation amount is determined according to the change range of water quality category; for characteristic pollutants, each change of a certain percentage in their concentration index corresponds to a corresponding compensation adjustment value [5]. This quantitative compensation mechanism clearly conveys the orientation of "protectors benefit, beneficiaries compensate", and effectively promotes upstream and downstream provinces to form a joint force for coordinated river basin governance.

4. Construction Path of Ecological Compensation Mechanism under the Guidance of Agricultural Green Development

4.1. Classified Compensation Mechanism

4.1.1. Cultivated Land Ecological Compensation

Cultivated land ecological compensation is a special economic incentive for environment-friendly agricultural practices such as cultivated land fertility conservation, crop rotation and fallow, and pollution remediation. The formulation of its compensation standard comprehensively considers the actual investment in ecological protection, the opportunity cost of farmers abandoning conventional planting, and the inherent value of cultivated land ecosystem services. In practice, the subsidy for cultivated land fertility protection can reach 120 yuan per mu, and the subsidy standard for specific crop rotation modes such as rice-oil crop rotation is 150 yuan per mu; the ecological compensation standard for permanent basic farmland has been increased year by year, from the initial 212 yuan per mu to 268 yuan per year. At the same time, special subsidy funds are accurately invested in the remediation of heavy metal-contaminated or ecologically degraded cultivated land. Through this way of internalizing external incentives, it promotes the coordinated improvement of the "trinity" of cultivated land quantity, quality and ecological functions.

4.1.2. River Basin Ecological Compensation

The river basin ecological compensation has established a constraint mechanism of two-way linkage of water quality between upstream and downstream, taking the water quality category of cross-border sections and the concentration of characteristic pollutants as the core assessment basis, and forming a two-way responsibility system of "if the water quality meets the standard, the downstream compensates the upstream; if the water quality exceeds the standard, the upstream compensates the middle and downstream". Specifically, if the water quality category of a section is better than the established target once, the downstream region shall pay 1 million yuan of compensation funds to the upstream of the river basin; on the contrary, if the water quality is worse than the target, the upstream shall pay corresponding compensation to the middle and downstream, and most regions will set an annual compensation ceiling of 5 million yuan. The mechanism implements a management model of monthly assessment and annual settlement, accurately fulfills rewards and punishments, effectively achieves the incentive compatibility goal of "protectors benefit, beneficiaries compensate", and promotes joint river basin ecological governance.

4.1.3. Forest/Grassland Compensation

The forest and grassland ecological compensation mechanism achieves a win-win situation between ecological protection and economic benefits through paths such as dynamically raising the compensation standard for public welfare forests and exploring the market-oriented trading of carbon sink rights and interests. Taking national public welfare forests as an example, the central financial compensation standard for national public welfare forests owned by collectives and individuals has gradually increased from the initial 5 yuan per mu per year to 16 yuan per mu per year; some regions have further increased support. For example, Anhui raised the compensation standard for non-state-owned public welfare forests to 18 yuan per mu per year in 2023. In terms of grassland ecological protection, the grazing prohibition subsidy standard is 7.5 yuan per mu, and the grass-livestock balance reward is 2.5 yuan per mu. Explorations in the field of carbon sink trading have also achieved remarkable results. Zhangzhou, Fujian, has completed 33 carbon sink transactions with a total transaction volume of 3.5 million yuan through the development of forestry carbon sink projects, successfully integrating forestry carbon sink rights and interests into the market-oriented trading system and injecting market-oriented vitality into ecological compensation.

4.2. Diversified Compensation Methods

4.2.1. Government-led Compensation

In the government-led ecological compensation framework, fiscal transfer payment has always played the role of core policy tool. Through channels such as transfer payments for key ecological function zones, the central finance incorporates objective indicators such as the standard fiscal revenue and expenditure gap and the area of ecological protection red lines into the formula-based accounting system to accurately determine the amount of fund allocation. Such funds do not preset specific usage scenarios, and are coordinated and allocated by provincial governments, focusing on improving the capacity of basic public services and ecological environmental protection. To ensure the efficiency of funds, relevant policies clearly define the scope of fund use, focus on solving prominent ecological problems, and prohibit the use of funds for non-ecological expenditures such as office buildings and halls, so as to ensure that funds are accurately invested in key areas of ecological protection.

4.2.2. Market-Participated Compensation

The market-participated mechanism transforms ecological environment elements into quantifiable and tradable market assets by cultivating market-oriented paths such as water use rights, emission rights, and carbon sink trading, guiding the iterative optimization of resource allocation towards green and low-carbon directions. Specifically, water use rights trading takes “yuan per cubic meter” as the core pricing unit, realizing cross-regional resource allocation relying on the national water rights trading system; emission rights trading sets benchmark prices for key pollutants such as chemical oxygen demand and ammonia nitrogen—for example, the benchmark price of ammonia nitrogen is 5400 yuan per ton, and conducts public bidding or agreement transfer through trading platforms; carbon sink trading converts forest carbon sequestration into tradable carbon sink rights and interests through the development of forestry carbon sink projects, promoting the transformation of the ecological protection model from “blood transfusion-type” passive compensation to “blood-making-type” active value conversion, and injecting sustainable market-oriented momentum into ecological protection.

4.2.3. Social Coordinated Compensation

The social coordinated mechanism extensively guides social capital and the public to deeply participate in ecological compensation through the dual drive of green finance empowerment and ecological industry co-construction [6]. Remarkable achievements have been made in the field of green finance. As of the end of the second quarter of 2025, the balance of green loans in China has reached about 42.4 trillion yuan, and the balance of green bonds has exceeded 2.2 trillion yuan. Financial institutions provide precise financial support for ecological protection projects through innovative tools such as ESG-linked loans and ecological industrial chain

finance. Ecological industry co-construction strives to build a positive cycle of "protectors benefit, beneficiaries compensate". Taking the EOD (Ecology-Oriented Development) model as an example, this model organically integrates environmental governance with industrial development. As of 2024, more than 100 EOD projects have obtained 2.164 trillion yuan of credit from financial institutions, successfully realizing the coordinated appreciation of ecological and economic benefits and fully releasing the multiple values of ecological protection.

4.3. Scientific Standards and Monitoring System

4.3.1. Quantification of Compensation Standards

The core of the quantitative accounting of compensation standards lies in introducing the gross ecosystem product (GEP) accounting system, converting the material products supplied by the ecosystem, regulatory services such as water conservation and carbon sequestration, and intangible values such as cultural services into monetizable measurement indicators, so as to provide a scientific pricing basis for ecological compensation. This accounting process needs to integrate multi-source data such as remote sensing monitoring, ecological positioning observation and statistical survey: for example, accurately calculating the carbon sink scale based on net primary productivity, evaluating water conservation efficiency combined with runoff coefficient and evaporation capacity, and dynamically calibrating with the multi-coefficient model in the "Technical Guidelines for Determining Ecological Compensation Standards for Ecological Protection Red Lines", and finally realizing the accurate connection between compensation standards and the actual costs of ecological protection, the importance of functions and the loss of regional development opportunities.

4.3.2. Dynamic Adjustment Mechanism

The dynamic adjustment mechanism is the key to ensuring the scientificity of ecological compensation standards. Its core logic is to conduct periodic revisions based on the dynamic changes of ecosystem service values, ecological protection costs and regional development opportunity costs, so as to ensure that the compensation intensity is reasonable and appropriate, and can effectively stimulate protection motivation. This mechanism usually takes 3 to 5 years as an evaluation cycle, comprehensively uses mature models such as the opportunity cost method and GEP accounting, and incorporates key parameters such as price index and land rent volatility for standardized calibration, ultimately forming a floating compensation standard deeply linked to the improvement level of ecological benefits and the economic and social development status, and effectively improving the accuracy and long-term implementation efficiency of compensation policies.

4.3.3. Smart Monitoring Platform

The smart monitoring platform constructs an integrated "sky-air-ground" ecological monitoring network by integrating multi-source remote sensing data, Internet of Things sensing technology and artificial intelligence analysis algorithms, realizing dynamic tracking, evaluation and visual precise management and control of ecological protection effects. Relying on 30-m resolution satellite remote sensing for land use change monitoring, UAV aerial inspection and real-time data collection by ground sensor networks, the platform continuously obtains indicators such as vegetation coverage, core water quality parameters and biodiversity on a weekly or monthly basis, and then quantifies ecological benefits combined with GEP accounting models and big data analysis technology, providing solid data support for the accurate implementation and dynamic optimization of compensation policies.

5. Conclusions

In conclusion, the construction of the ecological compensation mechanism under the guidance of agricultural green development is not a simple task that can be accomplished overnight, but a systematic project that requires long-term and persistent efforts. Its continuous improvement is inseparable from the solid legal guarantee, the coordinated efforts of the policy system and the innovative empowerment of the market mechanism. In the future, the core lies in solving practical obstacles such as insufficient scientificity of

compensation standards and low level of market-oriented participation, promoting the transformation of the compensation model from "blood transfusion-type" passive support to "blood-making-type" active empowerment, and realizing the deep integration and mutual promotion of ecological industry cultivation and agricultural green development.

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