



The Situation, Problems, Reasons and Solutions of Rural Ecological Compensation Financing

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Abstract

The establishment of a system of paid resource use and ecological compensation, predicated on the valuation of ecological resources, constitutes an unavoidable consequence of market-oriented reforms. Nevertheless, the financial mechanism employed by China for rural ecological compensation has reached an impasse, with an excessive reliance on public fiscal expenditures. Despite the efforts of researchers and practitioners, this issue remains unresolved. Consequently, the development and promotion of market-oriented, sustainable financing models, particularly in addressing market-based financing challenges for ecological compensation projects in China's underdeveloped and unevenly developed rural areas, is of significant theoretical and practical importance. This paper analyzes the current state and underlying causes of financing for China's rural ecological compensation mechanisms. The analysis is based on public goods theory, externalities theory, and property rights theory. From the perspective of aligning capital returns with risks, it proposes feasible financing solutions by integrating the Clean Development Mechanism (CDM) with mature capital instruments. The primary contribution of this study is the identification of market-based financing options for China's rural ecological compensation mechanisms, with the objective of enhancing the sustainability of their operation.

1. Introduction

The rural ecological environment encompasses elements such as farmland, forest land, wetlands, and grasslands, which serve multiple functions, including biodiversity conservation, carbon sequestration and emission reduction, wind and sand prevention, water conservation, and cultural services. The ecological functions of ecosystems are of incalculable value. However, the rural ecological environment and ecosystems have suffered severe damage due to long-standing disregard for the ecological environment during agricultural production and rural industrialization, with widespread degradation of ecosystem functions. This has led to an exacerbation of the

contradiction between the people's growing need for a better life and the imbalanced and inadequate development.

In 2015, the Central Committee of the Communist Party of China and the State Council issued the "Overall Plan for Reforming the Ecological Civilization System," which explicitly called for innovation in the ecological compensation system and encouraged social forces to participate in ecosystem protection. The 2016 "National Ecological and Environmental Protection Plan for the 13th Five-Year Plan Period" further emphasized the development of ecological compensation mechanisms and the expansion of existing financing channels for ecological compensation. In 2019, the Ministry of Ecology and Environment issued the "Reform Plan for the Ecological and Environmental Damage Compensation System," proposing the establishment of a unified ecological and environmental damage compensation system. In 2020, the Ministry of Ecology and Environment, in conjunction with seven other departments, promulgated the "Guiding Opinions on Establishing and Improving the Green Ecological Compensation Mechanism." This document signified China's inaugural policy document that specifically addressed the establishment of an ecological compensation mechanism. The documents under consideration provide substantial evidence that policymakers attach great importance to implementing the ecological compensation system. However, due to the characteristics of ecological compensation projects—namely, their protracted construction cycles, minimal project returns, and extended investment recovery periods—they generally depend on government fiscal funding. This, in turn, increases fiscal pressure and results in underutilization of social capital. To address this financing gap, it is imperative to enhance existing ecological compensation financing solutions, align them with suitable operational projects, and implement reforms in the ecological compensation financing mechanism.

A review of extant literature reveals that scholars both domestically and internationally have conducted relatively thorough research on financing mechanisms for ecological compensation. Significant research outcomes have emerged regarding the deficiencies of these mechanisms. The extant literature suggests that the reforming of financing mechanisms necessitates the further leveraging of social capital through market-based approaches (Chen et al., 2021). It is broadly recognized that the low-return nature of ecological compensation projects undermines investment incentives for social capital (Liu et al., 2021, 2018; Thompson, 2023). However, extant research on financing solutions for ecological compensation projects primarily focuses on green bonds and public-private partnership (PPP) models. These approaches have not been effective in addressing the financing needs of rural ecological compensation projects, nor have they provided solutions for enhancing project returns. This paper builds upon these research advances and gaps by conducting a more in-depth exploration into optimizing financing solutions for ecological compensation.

A comprehensive review of the extant literature and a thorough data analysis have been conducted to formulate this paper's proposal for an optimized financing scheme for ecological compensation in rural areas. The scheme utilizes forest carbon sinks in the form of a fund. This approach is founded on three theoretical frameworks: public goods theory, externalities theory, and property rights theory. The paper proposes an enhanced financing scheme and operational model for rural ecological compensation. This enhanced scheme involves the introduction of a fund as a financing tool and carbon sink forests as operational projects. A thorough evaluation, analysis, and

comparative assessment of the optimized financing scheme indicates that the application of fund instruments and forest carbon sinks can reduce financing burdens in rural areas, improve the profitability of ecological compensation projects, and enhance the willingness of social capital to invest in such initiatives.

2. Research Question

In the course of economic development, there has been a proliferation of two widespread phenomena: the excessive exploitation of natural resources and the neglect of environmental protection (Cutcu et al., 2025; Usman and Balsalobre-Lorente, 2022). This has resulted in severe ecological damage and poses significant threats to people's quality of life (Yuan et al., 2018). If the adverse externalities arising from economic development are not effectively mitigated, they may precipitate ecological crises (Farley and Voinov, 2016) and social issues (Cumming and von Cramon-Taubadel, 2018; Qaim et al., 2020), then endangering people's daily life (Nasir et al., 2019), and legitimate ecological rights (McCartney et al., 2023). Consequently, the implementation of a rigorous ecological compensation system is imperative for achieving China's economic restructuring, transformation, and sustainable development. However, the Chinese ecological compensation system is confronted with an unsustainable financing dilemma, characterized by a significant disparity between the supply and demand for project funds allocated to ecological compensation (Xu et al., 2025), a discrepancy that is particularly evident in rural regions.

Rural ecological compensation is defined as a systematic undertaking. Since the implementation of the 13th Five-Year Plan, the Five-Sphere Integrated Approach, and the ecological civilization initiatives, China has allocated a significant financial resource to rural areas, amounting to over 25.8 billion yuan, with the objective of developing ecological compensation mechanisms. However, the implementation of ecological compensation in rural regions is currently confronted with two major challenges. Firstly, there is a considerable distribution of projects, which complicates the coordination and management of the initiative. Secondly, there are significant governance difficulties, which hinder the effective execution of the program. These projects are comprehensive in nature, encompassing all aspects of rural production and daily life. Implementation of these projects necessitates substantial financial resources. Conversely, fiscal budget support remains deficient.

A review of the extant literature reveals two primary reasons for the ineffectiveness of rural ecological compensation mechanisms. First, there is a significant funding gap in financing these mechanisms. Second, there are limited financing channels and unsustainable capital flows. Rural ecological compensation projects encompass a wide array of activities, including the management of pollution from rural living and production, the treatment of industrial pollution in townships, and the provision of technical services and consulting for pollution control equipment. This necessitates that financing for rural ecological compensation mechanisms meet the requirements of large sums and sustainability. Furthermore, given the nature of the ecological environment as a quintessential public good with strong positive externalities, ecological compensation projects generally entail substantial one-time capital investments, protracted construction cycles, and gradual returns on investment. This has led to a marked diminution in the enthusiasm of enterprises and public investors, resulting in market failure with regard to financing ecological compensation mechanisms.

Consequently, there is an intensification of reliance on government finances, which further erodes the sustainability of financing for these mechanisms.

3. Current Situation

As a public good, the protection and restoration of the ecological environment can generate significant positive externalities. Concurrently, ecological compensation initiatives frequently encounter significant professional impediments, marked by protracted implementation cycles and considerable capital demands. Consequently, government fiscal allocations have long played a dominant role in China's ecological compensation financing mechanisms. In practice, it is necessary to encourage specialized ecological conservation and restoration companies to participate in ecological compensation projects. To this end, public-private partnerships and analogous models can facilitate the effective implementation of ecological compensation initiatives on a nationwide scale, thereby contributing to the realization of the objective of establishing an "ecological environment characterized by lucid waters and lush mountains."

Nevertheless, the long-term reliance of ecological compensation initiatives on financial resources stands in opposition to the objective of sustainable development. The primary rationale for this phenomenon is attributable to the inherent characteristics of these projects, which are characterized by protracted implementation cycles, substantial investment requirements, and modest returns. This is in direct opposition to the scarcity of fiscal resources, which results in a reduction of the capacity to support other areas related to people's livelihoods. In summary, China's current ecological compensation funding sources primarily face three challenges: The financing mechanism is characterized by a government-dominated approach, accompanied by a single-source structure and a high degree of risk. The participation rate remains relatively low, and there is a noticeable absence of enthusiasm from social capital. Furthermore, there is an evident lack of sufficient application of financial instruments.

3.1 Funding Sources Are Relatively Limited

Rural ecological compensation projects have historically relied on government allocations for financing, resulting in a single-source funding structure that is unsustainable. From a macro perspective, China's ongoing efforts to conserve and restore its ecosystems are confronted with a substantial funding deficit. From the perspective of funding demand, there remains an absence of accurate and comprehensive national statistical data regarding the financial requirements for ecological conservation and restoration projects. From the perspective of funding supply, China's current ecological compensation financing mechanisms are supported by two primary sources: central government expenditures and local government expenditures. The allocation of government fiscal expenditures to address the identified funding gap would invariably result in substantial fiscal strain on both central and local governments. This, in turn, would curtail their capacity to allocate financial resources to investments in science and technology, education, culture, and public welfare.

Despite the government's endeavors to address the financial requirements of the ecological compensation system through transfer payments and bond issuances by urban investment companies, China's ecological compensation financing mechanism remains deficient in meeting the funding needs of current and future ecological compensation projects. By 2017, China's total investment in environmental pollution control had surpassed RMB 1 trillion, constituting 1% of

GDP. From 2007 to 2017, the total investment in environmental pollution control nationwide surged rapidly from RMB 366.88 billion to RMB 953.90 billion. Notwithstanding this considerable growth rate in total investment, it remains inadequate in addressing the associated financing demands. The evidence of this disparity can be observed in the relatively low proportion of fiscal expenditure on ecological and environmental protection relative to GDP during the same period, amounting to only 1.15%. International experience indicates that annual societal investment in environmental protection and restoration should amount to at least 1%-1.5% of GDP to effectively curb environmental degradation (Xiao-fei, 2005). To achieve substantial enhancements in environmental quality, it is imperative to augment this ratio to 2%-3% (Qin and Wang, 2022). This suggests that China's present level of investment in ecological compensation initiatives necessitates augmentation. However, reliance on government fiscal support to fund ecological compensation projects and "infuse capital" into the financing mechanism will intensify fiscal pressures on the government and diminish its capacity to deliver social services. Concurrently, the exclusive reliance on market economy mechanisms as the primary source of funding for ecological compensation initiatives impedes the mitigation of risks for individual projects and the entire system, consequently diminishing the social efficacy of the policy in its entirety (Gao et al., 2020).

3.2 Low Participation of Social Capital

The predominant source of funding for ecological compensation in rural areas is currently government fiscal allocations. However, this approach exhibits deficiencies in the utilization of social capital and consequently falls short of ensuring financial sustainability. In accordance with China's prevailing ecological compensation financing mechanism, the involvement of social capital in ecological compensation initiatives is predominantly facilitated through indirect investment mechanisms, namely green credit and green bonds. However, due to the high-investment, low-return nature of ecological compensation projects and their susceptibility to government policies and other external factors, the current scale of investment support from green credit and green bonds for ecological protection and compensation remains relatively small. Moreover, the implementation of green credit entails the establishment of rigorous requirements for borrowers, yet rural regions have encountered challenges in obtaining green credit assistance. Concurrently, rural collectives have also failed to meet the criteria for issuing green bonds.

From a holistic perspective, the financing sources for ecological conservation and restoration projects have undergone a shift from primarily relying on government fiscal funds to government-guaranteed loans, with relatively limited direct investment from social capital. Moreover, social capital inputs such as bank credit and bond financing are inadequate to address the fiscal funding gap in the short term. Additionally, these inputs are ineffective in resolving resource allocation issues between enterprises and financial institutions within ecological compensation mechanisms. Consequently, enterprises across the entire ecological industry chain cannot be fully integrated, which limits investment to specific ecological compensation projects. This phenomenon contributes to the persistent absence of sustainable industrial pathways and effective investment return mechanisms for China's ecological compensation projects. Concurrently, this issue has the effect of diminishing the enthusiasm of social capital to participate in the financing mechanisms for ecological compensation. Consequently, the effective attraction of social capital to participate in ecological compensation projects in rural areas has become an urgent issue that must be addressed for the in-depth and effective advancement of China's ecological conservation and restoration

efforts.

3.3 Insufficient Application of Financial Instruments

In the context of the prevailing ecological compensation financing framework, rural financing strategies continue to be contingent upon specific individual ecological compensation projects. To date, no comprehensive plan has been formulated to establish an industrialized approach that would enable a virtuous cycle of funds within the ecological compensation financing mechanism. For governments that function as public goods providers, the majority of their funding is derived from fiscal transfers between administrative levels and indirect financing channels involving multiple intermediaries, such as bank loans and corporate bonds obtained through entities like urban investment companies. This approach engenders relatively high opportunity costs for capital. However, given the social management and service functions of governments, their investment objectives do not prioritize the pursuit of excess profits. Consequently, economic efficiency and profitability are not typically primary considerations in their decision-making or market activities.

This has led to a lack of consideration for financing costs in rural areas during the implementation of ecological compensation financing activities. External oversight mechanisms, such as performance evaluations, prioritize the completion of ecological compensation projects while neglecting to explore optimal financing solutions and the maintenance and improvement of project quality. Consequently, financing for ecological compensation projects in rural areas has received scant attention with regard to the utilization of existing financial instruments or the optimization, innovation, and exploration of financing solutions.

In summary, as a provider of public goods, the government's investment activities in ecological compensation projects often fail to adequately prioritize the cultivation and development of the ecological conservation and restoration industry. Despite the fact that social capital primarily relies on bank loans and bonds for financing, followed by equity capital, its relatively brief capital turnover cycle does not fully align with the long-term nature of ecological compensation projects. Moreover, the pursuit of profit in the social capital sector has led to a lack of incentive to invest in the industrialization of the ecological conservation and restoration sector, which offers low returns and high risk. The absence of fiscal funds to subsidize social capital renders the achievement of a virtuous cycle for capital markets within the ecological compensation financing mechanism a formidable challenge.

4. Analysis of Causes

4.1 Inconsistent Institutional Standards

The present rural ecological compensation system is characterized by the absence of uniform standards, resulting in considerable regional disparities. These disparities contribute to the augmentation of verification costs during implementation. Six provinces, including Jiangsu, Shandong, and Hubei, have compensation rates that exceed 1,500 yuan per mu. In contrast, provinces such as Henan, Hunan, and Guizhou primarily set rates between 500 and 800 yuan per mu. This discrepancy has also given rise to a "neighborhood effect," which, to a certain extent, has diminished farmers' enthusiasm for participation.

Additionally, there are notable inadequacies in interdepartmental coordination. For instance, the

absence of congruence between the Ministry of Ecology and Environment's initiative to convert farmland into forests and the Ministry of Agriculture's policy on crop structure adjustment has led to elevated transition costs for farmers. A survey of farmers revealed that over 85% of respondents reported experiencing conflicts between departmental policies. This phenomenon invariably results in an increase in the costs associated with institutional transactions related to financing rural ecological compensation.

4.2 Low Level of Marketization

Presently, China has yet to effectively establish a market-driven green finance and carbon credit trading system. Government-led public forest management is heavily reliant on fiscal subsidies and exhibits an absence of a sustainable, stable profit model. Guizhou Province offers an illustrative case study. The majority of government-led multi-tiered ecological projects in this province are still in the investment phase and have not yet achieved commercial operation. This stands in stark contrast to the effective implementation of payments for environmental services (PES) mechanisms in developed countries, which have successfully limited the sustained investment of social capital.

4.3 Insufficient Motivation for Farmer Participation

The prevailing ecological subsidy standards are inadequate, leading to actual benefits received by farmers falling considerably below the anticipated income from market-oriented agriculture. According to field surveys conducted by Sun Yat-sen University, over 68% of farmers believe that current ecological subsidies fail to fully compensate for their income losses. This dynamic has the potential to diminish farmers' motivation to engage in ecological initiatives. Additionally, the absence of transparency in the allocation of ecological incentive funds has been shown to diminish farmers' subjective perception of the program's effectiveness. Ensuring transparency is imperative for the stabilization and perpetuation of farmer participation.

4.4 The Regulatory System Has Loopholes

The current system for allocating ecological compensation funds is characterized by a lack of authoritative third-party audit oversight, a factor that contributes to the occurrence of implementation deviations and corruption. The establishment of a standardized governance system tailored to local conditions is an urgent challenge. For instance, the quality assessment of ecological projects primarily relies on self-regulation by government departments, which inevitably leads to subjective randomness in project selection and effectiveness evaluation. In a similar vein, the autonomy and social credibility of third-party assessment companies are also subject to scrutiny. This has the effect of exacerbating information asymmetry and moral hazards in the ecological compensation financing process.

The preceding analysis indicates that the prevailing constraints impeding financing for rural ecological compensation mechanisms are predominantly attributable to systemic barriers, government and market failures, and misaligned incentives among participating entities. This necessitates a broader perspective to re-examine the institutional environment with Chinese characteristics and the behavioral logic of stakeholders, thereby establishing a systematic solution.

5. Solutions

The establishment of the rural ecological compensation financing fund and its parent fund is

spearheaded by local governments, with the winning asset management company functioning as the primary investor. Local governments, through urban investment companies, collaborate with rural entities, insurance companies, and commercial banks as subordinated limited investors to establish the parent fund and issue it. Social capital, comprising securities firms and individual investors, engages in ecological compensation initiatives by acquiring shares of the parent fund, thereby assuming the role of senior limited investors in the financing fund. The Build-Operate-Transfer (BOT) model is a viable option for the implementation of rural ecological compensation projects. The operational process of the rural ecological compensation financing fund can be divided into the following five stages.

The preliminary phase entails project identification. The process is comprised of two distinct phases: project screening and project evaluation. As a market-oriented financial instrument, the Rural Ecological Compensation Financing Fund is designed to generate profit and utilizes the fund manager's professional investment expertise and technical capabilities. Consequently, this platform can be employed to screen and identify projects or entities undertaking ecological compensation initiatives, thereby leveraging the fund's risk identification and mitigation capabilities. A comprehensive feasibility assessment is conducted, encompassing technical, market, and operational dimensions. This multifaceted approach is undertaken to mitigate investment risks and ensure the viability of the project. Concurrently, the fund's profit-driven nature facilitates the selection of project types and investment targets, thereby safeguarding returns for fund investors.

In the subsequent phase, preparations for establishing a Special Purpose Vehicle (SPV) company commence. Subsequent to satisfying the Ministry of Finance's inclusion criteria, government departments are tasked with formulating an implementation plan and conducting a project tender through relevant procurement procedures to select a suitable asset management company. The Rural Ecological Compensation Financing Fund (RECF) has the potential to establish a consortium with multiple asset management companies. This consortium would then be able to negotiate with the government and participate in ecological compensation project bidding activities. Subsequent to the bidding process, all parties will engage in negotiations concerning investment methods, operational management approaches, profit distribution mechanisms, and exit strategies, while concurrently enhancing risk management and undertaking other advisory tasks. Consequently, they will establish the Special Purpose Vehicle (SPV) company to realize a cooperative model of "shared risk and shared returns" between the transacting parties. Furthermore, negotiations regarding investment and financing will be conducted with the company that has been entrusted with the construction of the ecological compensation project. The following subjects will be addressed in these negotiations: the total amount of investment, construction timeline, project quality standards, and acceptance criteria.

The third phase involves the launch and issuance of the Ecological Compensation Financing Fund. The SPV company will collaborate with qualified securities fund companies to co-hold the fund with social capital through a master-feeder fund structure. It has been demonstrated that government credit has the capacity to enhance the creditworthiness of a fund during the fund issuance process, thereby increasing the fund's attractiveness to potential investors and potentially leading to an influx of social capital. During the construction phase, idle capital from the parent fund will generate returns for sub-fund investors. Concurrently, the sub-funds will invest in the construction and operation of specific rural mining area ecological compensation projects through

equity investments. At this stage, the SPV company must actively facilitate the listing of sub-funds on securities exchanges. This will allow for the leveraging of capital markets to reduce investor exit costs and achieve risk-return alignment.

In the fourth phase, the Special Purpose Vehicle (SPV) company will select qualified ecological compensation project contractors with relevant construction credentials through competitive bidding for project implementation. The SPV will utilize its professional resources to oversee the implementing enterprises from technical, financial, and legal perspectives, ensuring specialized and standardized project execution. Following the establishment of the carbon sink forest, the SPV will assume responsibility for the operation and management of the forest under government-granted concessions. This will be achieved through either bidding processes or the utilization of its own qualifications. The revenues associated with the forest carbon sink will support the sub-funds, thereby increasing the fund's net asset value.

The fifth stage of the project management process is the planning and execution of the project handover. In the event that the concession period or project contract term has elapsed, the SPV company is obligated to transfer ownership and operational rights of the project to the concession authority without compensation, as stipulated in the project contract. The SPV company is also required to initiate liquidation procedures. During the handover phase, the government must evaluate the construction and operational quality of the transferred project. Typically, the transferred project must demonstrate fully functional systems, well-maintained facilities and equipment, and comprehensive engineering documentation to ensure continued normal operation after the SPV's liquidation.

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