

Pathway Analysis for Improving the Ecological Protection Compensation Mechanism of Coastal Tidal Wetlands in Yancheng

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ABSTRACT

As one of the world's most important ecosystems, the coastal tidal wetlands of Yancheng serve as a critical stopover site for migratory birds and form a core component of the Yellow (Bohai) Sea Migratory Bird Habitats—China's World Natural Heritage site. In recent years, intensified human activities such as land reclamation, the invasion of *Spartina alterniflora*, and coastal industrial development have led to severe degradation of the wetland ecosystem. Although the government has implemented a series of protective measures, the ecological compensation mechanism still suffers from institutional shortcomings, a lack of diversified compensation approaches, and difficulties in policy implementation. Based on an analysis of the current state of Yancheng's coastal wetlands and the underlying causes of ecological degradation, this paper explores the practical challenges of ecological compensation and proposes improvement strategies. The goal is to promote a coordinated balance between ecological protection and regional economic development.

KEYWORDS

Yancheng wetlands; Ecological compensation mechanism; Pathway optimization; Tidal flat protection; Ecological governance

1 Introduction

Wetlands, often referred to as the "kidneys of the Earth," play an irreplaceable role in biodiversity conservation, water regulation, and climate moderation. The coastal tidal wetlands in Yancheng cover an area of over 4,500 km², accounting for approximately one-seventh of China's total tidal flat resources. These wetlands are critical breeding and resting grounds for rare and endangered bird species such as the red-crowned crane and the black-faced spoonbill. However, in recent years, the rapid industrialization and urbanization in the Yancheng region have posed serious threats to these fragile ecosystems. Establishing a scientific and systematic ecological compensation mechanism has become an urgent necessity for the effective protection of wetlands.

2 The ecological value and current status of Yancheng's coastal tidal wetlands

According to the article Analysis of the Current Situation and Protection Measures of Yancheng Coastal Wetlands, Yancheng possesses one of the longest coastlines in China, forming an expansive coastal wetland system. This system includes various typical wetland types such as tidal flats, intertidal zones, salt marshes, marsh wetlands, and artificial wetlands. These wetland resources are primarily distributed across the coastal counties (cities and districts) of Dongtai, Dafeng, Sheyang, Binhai, Xiangshui, and Tinghu, constituting a highly representative coastal wetland ecosystem. Yancheng's wetlands not only play a significant role in regional ecological balance but also hold a vital position in the global ecological security framework.

Yancheng's coastal wetlands are a key stopover site along the East Asian–Australasian Flyway, with over three million waterbirds migrating, resting, and overwintering in the region annually. Endangered and rare bird species under national first-class protection—such as the red-crowned crane, the black-faced spoonbill, and the spoon-billed sandpiper—rely on these wetlands for breeding and habitat. This supports a complex and diverse ecological community. In addition to birdlife, Yancheng's wetlands also host abundant plant communities and aquatic biodiversity. Statistics show that the area supports 559 species of wild plants, 285 species of fish, and 508 species of insects, demonstrating a remarkably high level of biodiversity.

Moreover, the ecosystem service functions of Yancheng's wetlands should not be overlooked. Acting as natural "filters" and "reservoirs," wetlands contribute significantly to water conservation, climate regulation, water purification, carbon sequestration, and wind and sand control. Against the backdrop of global climate change, these wetlands are irreplaceable in enhancing regional climate resilience and curbing ecological degradation.

The ecological value of Yancheng's wetlands is not only reflected in the preservation of natural systems but also in their substantial economic and social potential. In recent years, green industries such as ecotourism, science education, and ecological research—based on wetland resources—have gradually emerged, forming a development model that integrates ecology with the economy. In 2019, the Phase I of the Yancheng Yellow (Bohai) Sea Migratory Bird Habitat was successfully inscribed on the World Heritage List, marking international recognition of the area's global ecological significance and providing a higher-level policy platform for its conservation and sustainable use.

Nevertheless, despite the favorable natural conditions of Yancheng's wetlands, the ecosystem is now facing unprecedented pressure. In recent years, issues such as tidal flat reclamation, wind power construction, *Spartina alterniflora* invasion, and water pollution have persisted, causing various degrees of degradation and functional loss in parts of the original natural landscape. The reduction in wetland area not only directly threatens the habitats of plants and animals but also undermines the ecological security and sustainable development of the entire region. Therefore, while ecological protection must be strengthened, it is equally urgent to establish a sound ecological compensation mechanism to ensure the long-term sustainability of wetland conservation efforts in Yancheng.

3 Challenges facing the ecological compensation mechanism for Yancheng's wetlands

As one of China's most important coastal wetland ecological zones, Yancheng plays a crucial role in maintaining regional ecological security and promoting green development. The establishment of a sound ecological compensation mechanism is therefore of great significance. However, in practice, Yancheng's ecological compensation system still faces numerous challenges, mainly reflected in the following aspects:

3.1 Incomplete policy and regulatory framework

Currently, ecological compensation efforts in Yancheng rely largely on national or provincial policies related to forestry and water conservation. There is still no independent and systematic legal framework specifically tailored to the ecological compensation of coastal wetlands. This form of policy "attachment" has resulted in a lack of dedicated institutional support and legal enforcement for wetland protection. Policy objectives are often vague, responsible entities are unclear, and implementation tends to be arbitrary. Furthermore, the management of wetlands involves multiple government departments with insufficient coordination, making it difficult to form a unified approach and limiting the long-term effectiveness of the compensation system.

3.2 Single source of funding

The implementation of wetland ecological compensation in Yancheng relies heavily on government fiscal appropriations, primarily through special funding from various levels of government. However, due to increasing fiscal pressure and the long timeframes needed for ecological benefits to materialize, funding is often unstable and unsustainable. Meanwhile, participation from private capital, environmental organizations, and ecological industries remains low, owing to a lack of effective incentives and engagement mechanisms. As a result, the funding channels for ecological compensation are overly narrow, and the financial support for ecological protection is insufficient to meet the long-term needs of wetland restoration and compensation.

3.3 Unclear compensation standards

Establishing compensation standards requires a robust evaluation of ecological value and quantification of ecosystem services. Yet the current compensation mechanism in Yancheng remains relatively weak in this regard. Due to the absence of a unified and scientific ecological valuation system, compensation practices tend to rely on generalized, fixed-rate subsidies. This approach overlooks the significant differences among various wetland types, their ecological functions, and the extent of degradation. Consequently, compensation amounts often fail to reflect actual ecological losses or contributions, undermining the fairness of the policy and weakening its capacity to incentivize protective behavior.

3.4 Weak implementation and oversight mechanisms

Although both national and local governments have expressed support for ecological compensation policies, local implementation often lacks enthusiasm. Many efforts focus on procedural tasks such as fund applications and project completion metrics, with little attention given to substantive or long-term outcomes. Moreover, oversight mechanisms are lacking, with no effective system in place to monitor fund allocation, compensation effectiveness, or project performance. In some areas, issues such as "compensation without protection" or "funding delays and shortfalls" have arisen. There are also risks of fund misappropriation or misuse. These issues not only erode public trust in ecological compensation programs but also hinder the long-term recovery and sustainability of wetland ecosystems.

4 Pathway analysis for improving the ecological compensation mechanism of Yancheng's coastal tidal wetlands

As ecological pressures on Yancheng's coastal wetlands continue to intensify, relying solely on government-led and traditional protection measures is no longer sufficient to address the increasingly complex environmental risks and governance challenges. The establishment of a more comprehensive, systematic, and sustainable ecological

compensation mechanism is essential to ensure the continued functioning of wetland ecosystems and to promote the coordinated development of environmental protection and regional economic growth. To this end, systematic improvements are required in areas such as policy and legal frameworks, funding mechanisms, evaluation systems, and public participation.

4.1 Improving legal and policy frameworks

At present, Yancheng lacks targeted and enforceable local regulations specific to ecological compensation. Relevant legal bases are scattered across higher-level laws and departmental rules, such as the Wetland Protection Regulation and the Nature Reserve Regulation, without a dedicated system for coastal and tidal wetland compensation. Therefore, it is recommended that Yancheng develop specific regulations, such as the Yancheng Wetland Ecological Compensation Management Measures or the Coastal Wetland Protection and Compensation Ordinance, to clarify key elements including responsible entities, scope of compensation, assessment standards, compensation methods, and fund supervision mechanisms.

In addition, departmental coordination must be strengthened. Departments such as ecological environment, finance, forestry, agriculture, and water resources should establish information-sharing and joint governance mechanisms to prevent policy fragmentation and overlapping responsibilities. Issues related to land use changes, ecological resettlement, and industrial restrictions should be managed and resolved through the ecological compensation framework to ensure smooth institutional integration and resource alignment.

4.2 Building diversified and sustainable funding channels

Financial support is the foundation of an effective ecological compensation mechanism. Currently, compensation funding in Yancheng relies heavily on earmarked allocations from central and local governments, which are often limited and constrained by annual budget cycles, leading to instability and unsustainability. It is therefore imperative to develop diversified and sustainable funding sources.

Firstly, a dedicated ecological compensation fund should be established to provide long-term financial support for conservation efforts, drawing from government allocations, project revenues, and green bonds. Secondly, market-based mechanisms should be introduced and expanded—such as carbon trading, water rights trading, and ecosystem product valuation—to monetize wetland ecological services. Moreover, private investment should be encouraged, involving businesses, financial institutions, environmental NGOs, and the general public through instruments such as green bonds, ecological crowdfunding, and environmental public welfare funds.

Flexible funding models like “reward instead of subsidy” and “build first, compensate later” should also be explored to enhance funding efficiency and ensure that conservation efforts yield sustained ecological and social benefits.

4.3 Establishing a scientific and robust evaluation system

A sound evaluation system is the foundation of an effective compensation mechanism. Currently, the ecological value of Yancheng’s wetlands is typically assessed based on area and administrative boundaries, with limited attention to functional differences and service values. This hampers accurate reflection of ecological contributions and rational compensation allocation. Therefore, a multidimensional ecological compensation evaluation system tailored to coastal wetlands should be established.

This includes developing a classification of ecosystem services, quantifying functions such as biodiversity conservation, water regulation, climate moderation, and ecotourism, which can serve as the basis for assessment and compensation. Innovative methodologies such as ecological product value assessment and natural capital accounting should be adopted to monetize the value of different wetland types and guide compensation fund distribution. Additionally, a dynamic evaluation mechanism should be integrated to regularly update assessments based on wetland conditions, conservation outcomes, and external environmental changes, ensuring that compensation standards remain scientifically valid and adaptive over time.

To support implementation, data infrastructure and technical capabilities must be enhanced. Remote sensing, geographic information systems (GIS), and ecological modeling should be leveraged to enable precise monitoring and evaluation of wetland health and conservation effectiveness.

4.4 Strengthening public participation and oversight mechanisms

Ecological compensation for wetlands is not solely a government responsibility but a collaborative process involving all sectors of society. Promoting broad public participation can enhance transparency, build trust, and foster shared stewardship of ecological resources.

First, public participation mechanisms should be established to facilitate open channels for public opinion, reporting,

and involvement in decision-making. This may include creating online platforms for publishing ecological data, compensation fund use, and performance evaluations, thereby inviting public scrutiny and engagement. Second, the involvement of environmental NGOs, research institutions, and universities should be encouraged in the design, implementation, and assessment of compensation projects, taking advantage of their expertise in technology, advocacy, and independent evaluation.

Furthermore, ecological compensation should be integrated into community governance systems. Local villages and farmers near wetlands should be incentivized to participate in conservation through measures such as ecological protection agreements, employment in ecological posts, and community co-management models. By linking compensation benefits with community development and livelihood improvement, grassroots participation and responsibility can be enhanced, contributing to a governance model characterized by "government leadership, market participation, and public collaboration."

5 Conclusion

As one of the most representative coastal wetland ecosystems in China, the coastal tidal wetlands of Yancheng play a critical role not only in biodiversity conservation but also in water resource regulation, climate buffering, and ecological tourism. However, with the intensification of regional economic development, these ecosystems are facing increasing degradation risks, and the pressure on wetland resource protection continues to rise.

Through a systematic review of the current status and ecological value of Yancheng's coastal tidal wetlands—alongside an analysis of the challenges facing its ecological compensation mechanism—it becomes clear that, although a policy foundation and some practical exploration already exist, the overall system remains underdeveloped. The funding structure is relatively narrow, the compensation standards lack scientific rigor, and oversight as well as public participation mechanisms are not yet well established. These issues limit the effectiveness of ecological compensation in guiding and incentivizing conservation behavior.

To address these challenges, this paper proposes several actionable pathways, including improving the legal and policy framework, diversifying funding sources, establishing scientific evaluation standards, and strengthening public engagement and supervision. These recommendations are not only practical but also offer valuable insights for the development and refinement of ecological compensation mechanisms in Yancheng and other coastal wetland areas. By continuously optimizing compensation policies and translating ecological value into tangible economic benefits, it is possible to significantly enhance both the motivation and sustainability of ecological protection efforts—ultimately achieving a win-win outcome for wetland conservation and regional green development.

Looking ahead, under the guidance of national-level planning, Yancheng should accelerate the localization of its wetland ecological compensation system, enhance cross-regional collaboration and international cooperation, and promote the transformation of compensation mechanisms from pilot initiatives to institutionalized practice. In doing so, Yancheng can contribute a replicable "Yancheng model" to the broader endeavor of building China's ecological civilization.

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