

Review

# Development and Challenges of China's Ecological Non-Commercial Forest Certification Policy

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**Abstract:** Since its implementation in China, ecological non-commercial forest certification (ENCFC) has achieved certain ecological, social, and economic effects. In this study, we review domestic and foreign literature to examine the development of ENCFC in China, which is led and enforced by the Chinese government. We found that the ENCFC program is facing several key challenges, including insufficient compensation, single compensation fund sources, and a lack of post-certification evaluation and supervision systems. The government should introduce market mechanisms to optimize ENCFC and consider whether it is necessary to continue to expand the ENCFC program. In addition, more research is needed on the performance evaluation of ENCFC implementation.

**Keywords:** ecological non-commercial forest; forest certification; forest ecological compensation; China

## 1. Introduction

To better balance the ecological and economic benefits of forested areas, the Chinese government divides forests into commercial forests and ecological non-commercial forests (or ecological public welfare forests). Ecological non-commercial forests aim to maintain and improve the ecological environment and provide public welfare products and services. In contrast, commercial forests provide economic benefits [1–4]. To better allow ecological non-commercial forests to perform ecological service functions, such as water source cultivation, windbreaking and sand fixation, climate regulation, soil and water conservation, disaster prevention and mitigation, and biodiversity maintenance, China formulated the ecological non-commercial forest certification (ENCFC) policy.

Unlike the Forest Stewardship Council (FSC), which promotes responsible management through voluntary certification schemes and third-party (independent) assessments [5], China's ENCFC policy emphasizes the adoption of extremely strict logging restrictions to protect forests after mandatory identification by the government, and the government must also provide compensation to implement these policies. In 2001, the State Forestry Administration formulated the "Definition of National Ecological Non-Commercial Forest Area," which notes that the basic ecological non-commercial forest principles are based on the ecological functions of the forests themselves. Local governments at all levels determine what constitutes an ecological non-commercial forest based on the local ecology, such as river sources, wetland nature reserves, and soil and water conservation areas. After the forest is certified, the landowner's felling activities are strictly restricted. Thus, in 2004, to provide compensation to the landowners, the Ministry of Finance established an ecological forest compensation fund with an annual budget of CNY 2 billion. When this fund opened in 2004, ecological non-commercial forests totaled 26.8 million hectares, accounting for 13.86% of the national forested area [6]. By 2017, this percentage had reached 44.46% [2]. As China transforms production forests into ecological forests, the ecological non-commercial forested area will continue to expand [7–10].



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Since the implementation of the ENCFC policy in 2004, the compensation amount has only been determined by the area of the ecological non-commercial forest, rather than its production value, which means that the compensation amount is standard and inflexible [11–14]. Thus, compensation generally does not reflect the quality and efficiency of the forest, which limits ENCFC's incentive function and sustainability [2]. China is in a critical period for the construction of ecological advancement and the realization of common prosperity, and it is particularly important to ensure that ENCFC provides sustainable ecological and economic benefits. However, Chinese officials have not yet determined how to continue to develop ENCFC in the future, and the topic is the subject of ongoing debates. Thus, to contribute to this discussion, this study summarizes the development of ENCFC and analyzes its challenges and improvements by conducting a literature review. It should be noted that current research on ENCFC is mainly concentrated in Chinese journals, and the ENCFC-related research that can be retrieved using the Web of Science is limited. Therefore, this study can aid international scholars in understanding China's ENCFC policy and is especially pertinent for those whose countries are preparing to implement similar ENCFC programs.

## 2. Theoretical Basis for Implementing ENCFC

The implementation of ENCFC in China originated from the concept of classified forest management. Since the establishment of the sustainable forest use theory in the 17th century, other theories such as the multifunctional forest theory, forestry division of labor theory, near-natural forestry theory, ecological forestry theory, and sustainable forest management have been developed. There have been many studies and discussions on forestry management theory in China and globally. To develop a functional forestry development model [15], a theory should be applicable to both sustainable forest management and forest resource management, and should include aspects such as cutting intensity, production capacity, and long-term ecological, social, and economic functions [16].

However, although there is a general consensus that forests have multiple functional benefits that are ecological, economic, and social in nature, there is usually a contradiction between harvesting forests to obtain wood and allowing forests to continuously provide ecological benefits; it is not realistic to maximize multiple benefits in the same woodland at the same time. To address this contradiction, there are several traditional solutions: choose ecological benefits at the expense of economic functions; choose economic benefits at the expense of ecological functions; or choose a low level of coordination between economic and ecological functions [17–19]. The third model seems to be most feasible, provided that the total supply of forest products is greater than the sum of economic and ecological demands; otherwise, the problems caused by uncoordinated economic and ecological benefits would be repeated [20]. If a part of the forestland is allowed to produce commercial forest products, the main goal would be to obtain economic benefits; however, if, at the same time, another part of the forest provides ecological forest products, with ecological benefits being the main goal, the specificity of the overall forest management function could be weakened, thereby reducing both the economic benefits and ecological benefits.

According to the theory of forest management classification, forests should be divided into public welfare forests and commercial forests to provide ecological forest products and economic forest products, respectively. The sustainability of classified forest management can be achieved by optimizing the allocation of various factors related to forest management and maximizing the overall benefits of forest management [21]. To this end, the Chinese government has implemented ENCFC. On the technical level, after an ecological non-commercial forest is certified according to the forest's function, one must ensure that the ecological non-commercial forest can perform its ecological function efficiently and sustainably [22,23].

To do this, operators need to carry out forest management activities such as construction, cultivation, management, and protection [24]. However, the ecological benefits that

are generated by these activities are shared by other unspecified social/public bodies and cannot be controlled and monopolized [25,26]. Therefore, the supply of public welfare forests' ecological benefits has positive externalities [27–30]. The basic idea involved in solving an external problem is to internalize it; in other words, social benefits or costs generated by certain behaviors can be transformed into private benefits or payments for actors through institutional arrangements [31,32]. For example, the ecological beneficiaries of ecological non-commercial forests compensate suppliers in various ways, which is an institutional arrangement and an internalization of the positive external characteristics of the ecological benefit supply [33]. However, due to the indeterminate nature of the ecological beneficiaries, the cost of compensation between suppliers and each beneficiary is often too high, or else the negotiation of compensation proves to be impossible, resulting in market failure [34]. Therefore, government intervention is urgently needed.

In most countries, the government is typically the main body that facilitates ecological benefit compensation; that is, the government obtains compensation funds through taxation or fees and then provides compensation to others through fiscal expenditures [35]. Therefore, it is justifiable and necessary for the government, as the centralized representative of public interests, to carry out ecological benefit compensation on behalf of the unspecified public [36]. After a forest is certified as an ecological non-commercial forest, logging will be prohibited or significantly restricted. Thus, ENCFC can be seen as a government restriction on the property rights of forest managers and landowners based on the needs of public interests [37,38]. Therefore, ENCFC implementation in China is also accompanied by a compensation plan.

### 3. Evolution of ENCFC in China

#### 3.1. Germination Stage

This stage is characterized by forestry that focuses on providing wood to meet social and economic development needs, but with a corresponding classification in the form of classified forestry management. In 1956, China began to build nature reserves and protect the trees within them, and the idea of classified forest management was first proposed. Subsequently, the Regulations of the People's Republic of China for State Forest Managers, issued in 1958, proposed that forest resources should be divided into five forest species according to their role in the national economy: (1) timber forests, used for the supply of wood and bamboo for production and living; (2) special economic forests, used to collect tree fruits and seeds and develop other products needed for economic development; (3) shelterbelt forests, including soil and water conservation forests, windbreak and sand fixation forests, field protection forests, road protection forests, and green forests; (4) fuelwood forests, used for firewood and charcoal burning; and (5) forests with other special functions, including ancient and famous trees, scientific research forests, and national defense forests. Thus, a preliminary version of forest classification management was developed; however, due to the rigid demand of timber harvesting for national construction, wood development and utilization were the main forest resources during this time. The government did not conduct formal certification and classified management of forests during this stage [39].

#### 3.2. Formation Stage

In this stage, the forestry classification management system was gradually established. In 1984, the Forest Law of the People's Republic of China was passed by the Standing Committee of the Sixth National People's Congress, officially dividing China's forests into the five aforementioned types and restricting felling in some shelterbelts and special-use forests [40]. This marked the initial formation of China's forestry classification management system.

Due to excessive timber harvesting, China's ecological and environmental problems have become increasingly serious. Scholars have actively been exploring the development of China's forestry. Yong [41] put forward the division of labor in forestry. Yong [41]

emphasized that “dominant utilization of multiple forest functions” divided forestry into commercial forests, compatibility forests, and ecological non-commercial forests. This played an extremely important and positive role in promoting the classified management of China’s forestry.

In 1995, the former Commission for Restructuring and the Ministry of Forestry issued the General Outline for the Reform of Forestry Economic System, which suggested that forests should be divided into ecological non-commercial forests and commercial forests. Economic forests, timber forests, and fuel forests were classified as commercial forests, while special-use forests and shelterbelt forests were classified as ecological non-commercial forests. Subsequently, the Notice on Carrying out the Pilot Work of the Reform of Classified Forestry Management required the implementation of pilot work for defining the forest classification division of ecological non-commercial and commercial forests, which were concretely implemented into hilltop plots. However, there is no clear document on the construction management method and investment compensation policy of ecological non-commercial forests that matches classified forestry management.

After the significant floods in 1998, it became urgent for China to improve its ecological environment. The Chinese government successively launched various major forest ecological protection construction projects. When the Forest Law was amended in 1998, it further stipulated that commercial forests and ecological non-commercial forests should adopt different cutting and circulation systems and proposed that the central government should set up a compensation fund for the management and protection of ecological non-commercial forests. Clearly, however, the ecological non-commercial forest demarcation is the basis for the implementation of forestry classified management. Therefore, the implementation of the national forest classification regionalization work notice highlights the classifying forest demarcation. In addition, the National Bureau of Forestry and Grassland legally affirmed the use of forestry classified management practices for forestry classification management and mature space.

### 3.3. Pilot Stage

In this stage, the Chinese government formulated relatively detailed certification measures for ecological non-commercial forests. The Regulations on the Implementation of the Forest Law (2000) stipulate that the landowners of ecological non-commercial forests have the right to receive compensation for ecological benefits. To address the forestry department and Ministry of Finance’s compensation fund sources, repeated consultations were held, and finances were extracted from government-managed funds, charge reservoir beneficiaries, forest parks, and other ecological non-commercial forest compensation mechanisms, and arranged according to the budget compensation scheme [12].

In March 2001, in order to strengthen the protection and management of ENCFC, the former State Forestry Administration formulated the National Measures for the Recognition of Ecological Non-commercial Forest according to the Forest Law and the Regulations for the Implementation of the Forest Law to strengthen the protection. The demarcation scope of state ecological non-commercial forests includes the headwaters and trunk streams of rivers, important lakes and large reservoirs, national railways and highways, cultural heritage sites, national nature reserves and their surrounding areas, and the surrounding woodland of the natural forest protection project area. Simultaneously, to set China’s forestry classified management on a scientific path and guide the construction of ecological non-commercial forests and other ecological projects to improve their quality and efficiency, the State Bureau of Technical Supervision formulated the Construction of Ecological Non-commercial Forests standard. Subsequently, the Ministry of Finance issued the Measures for the Management of Forest Ecological Benefit Subsidy Funds, established a forest ecological benefit subsidy for the protection and management of ecological non-commercial forests in accordance with the Forest Law, the Regulations on the Implementation of the Forest Law, and other relevant regulations, and incorporated forest ecological compensation into the annual government budget.

In November 2001, China kickstarted its ENCFC subsidy funds and began pilot work. (The pilot provinces which implemented the forest ecological benefit subsidy fund area in 2001 are as follows: Zhejiang Province had 0.633 million hectares, Hunan 2 million hectares, Fujian 0.86 million hectares, Hebei 1.267 million hectares, Xinjiang 1 million hectares, Shandong 0.533 million hectares, Anhui 0.8 million hectares, Heilongjiang 1.914 million hectares, Jiangxi 1.267 million hectares, Guangxi 2.333 million hectares, and Liaoning 1.4 million hectares) The central government invested CNY 1 billion in Zhejiang, Fujian, Shandong, Heilongjiang, and 11 other provinces—an area of some 13 million hectares—in order to promote ecological benefits; the subsidy standard was CNY 75 per ha. The launch of the pilot ENCFC subsidy fund marked a new stage of the paid use of forest resources in China and ended the free use of ecological non-commercial forest resources [12].

### 3.4. Advanced Stage

After three years of pilot work, the System of Forest Ecological Benefit Compensation Fund was formally established and fully implemented in 2004 alongside the Measures for Defining the Regionalization of Key Ecological Non-commercial Forests and the Measures for the Management of Central Forest Ecological Benefit Compensation Fund. Of 267 million hectares of national forest land, 104 million hectares were designated as key ecological non-commercial forests and 27 million hectares were selected for ecological benefit compensation [42]. The average subsidy per mu was CNY 5, and the total scale of the central financial compensation fund reached CNY 2 billion. In 2005, the compensation standard for ecological non-commercial forests increased from CNY 5 to CNY 10 per mu per year, and the provinces also provided supplementary demarcations of ecological non-commercial forests according to the Measures for Demarcation of National Ecological Non-commercial Forests.

In 2009, the newly revised Measures on the Management of Forest Ecological Benefit Compensation Funds from the Measures on the Definition of Regionalization of Ecological Non-commercial Forests were implemented successively, which delimited the compensation area to 70 million hectares and strengthened the subsidies for those directly responsible for the management and conservation of these forests. By 2012, 124 million hectares of ecological non-commercial forest land had been zoned, of which 71 million hectares were owned by the state and 53 million hectares were owned by collectives and individuals. In 2013, the state increased the amount of compensation for ecological non-commercial forests given to collectives and individuals, raising the standard to CNY 15 per mu per year [43,44].

When the Forest Law was revised in 2019, it stipulated regulations for ecological non-commercial forests, for “establishing forest ecological benefit compensation system to increase support ecological non-commercial forest protection.” These regulations provided the basic system for clarity about “general” cases. The Forest Law also established strict protections for ecological non-commercial forests governed by the National Bureau of Forestry and Grassland.

According to the Forest Law, “the state will, according to the needs of ecological protection, identify forest land with important ecological locations or fragile ecological conditions, and the main purpose of exerting ecological benefits and forests on forest land as ecological non-commercial forest.” Ecological non-commercial forests are designated and announced by the State Council and the governments of provinces, autonomous regions, and municipalities operating directly under the Central Government.

## 4. ENCFC Challenges

### 4.1. Property Rights and Performance Evaluations

Although the Chinese government has announced ENCFC rules, there is a lack of consensus at the national level regarding how many large-scale ecological non-commercial forests China needs. By the end of 2018, China’s non-commercial forest area had grown to account for 52.43% of the total forest area in China. As the Chinese government has



been emphasizing ecological advancement in recent years, the scale of China's ecological non-commercial forests will continue to increase. In general, due to their environmental externalities, forests performing ecological functions should be provided and managed by the government [25]. However, after the collective forest tenure reform, China has delegated the management rights of some forests to village collectives or farmers. According to statistics, collectives and farmers now maintain 47.38% of the total area of public welfare forests. Chinese law stipulates that farmers only have the right to manage forests, and that the ownership of the forests belongs to the village collective or the state [45]. This results in difficulties during ENCFC. Even if the forest is artificial (i.e., built by farmers on the land), the farmer will lose the right to harvest this land after it has been certified, and the ENCFC subsidies are not enough to fully account for the economic deficit caused by this restriction. Thus, it is difficult to stimulate farmers' interest in the management of ecological non-commercial forests [16,46,47].

In addition, the lack of ENCFC evaluation mechanisms is also problematic. There are no evaluation mechanisms, quantitative or otherwise, that are used either before or after compensation [48]. The absence of a pre-ENCFC evaluation mechanism shows that the government lacks a clear understanding of what is actually required by China's ENCFC compensation payments, despite the fact that they set the compensation payment amount. Although evaluation and daily inspection have been conducted in the middle and late stages of the ENCFC project, standardized monitoring and evaluation work has not yet been carried out. To this end, the Chinese government should establish a forest ecosystem quality monitoring mechanism that includes indicators such as area and stock volume. This will enable timely and dynamic forest quality assessments and provide references for evaluating compensation effects [46,49]. It is also necessary to create an evaluation mechanism for compensation that enables accurate evaluation and adjustment of compensation objects, standards, and effects over a specified period of time, as well as continuous optimization of the compensation effects [50].

#### 4.2. Single-Source Funding

In contrast to other nations, which typically use a dual-source funding model consisting of the government and the market, China's ENCFC payments are only provided by the government [35]. This is because the compensation funds used to pay ENCFC in China are primarily derived from the vertical financial support of the central government policy. The central government arranges a sizable amount of funds for ecological forest compensation payments every year from sources such as the central investment account, and contributes up to 90% of the cost. The ENCFC payment system is based on the limited ecological forest compensation funding channel that has been in place since 2004. Cai and Li [51] used Fujian Province as an example and noted that the compensation fund only relied on financial input from the central and provincial governments and lacked other funding channels. Similarly, when looking at Zhejiang Province, Ying et al. [52] concluded that the existing forest compensation funds are borne by the central, provincial, and local governments, with the provincial government having the largest proportion of investment in the proportional allocation. Examining the situation in Guangxi, Ju and Nong [53] noted that the ecological benefit compensation funds for non-commercial forests come from the state and the autonomous region's finances, and there is only one channel.

According to the relevant research, there are two views on ecological forest payments: the first advocates for government support and compensation [2,54–57], and the second emphasizes the role of market mechanisms [57–62]. From the perspective of rights and obligations, Wang and Zhang [35] argued that the government is the representative of public interests and, thus, should provide compensation to ecological non-commercial forest managers. However, some scholars believe that the government's obligations are overemphasized, and the punishment for ecological destruction is not enough [63]. Although the central government has high credit and can guarantee the payment of compensation, the amount provided by the central financial compensation fund is typically not able to fully

account for the cost of local ecological protection. In addition, the financial resources of local governments are very different. Many provinces have matching compensation funds for non-commercial forests, but these cannot be released in time [64,65]. In this regard, some scholars believe that establishing a market-oriented and diversified ENCFC compensation payment mechanism is inevitable because it is an effective way to guide the participation of stakeholders, leverage social capital investment, and is a long-term solution [66–68].

#### 4.3. Payment Standards

Ecological non-commercial forest compensation is a key issue concerning ENCFC participants [12,69,70]. Some scholars believe that the compensation standard should cover the full value of positive forest externalities and give forest managers the maximum compensation [11,25,71–74]. Other scholars believe that afforestation costs should be used for compensation, [59,75–77]. In terms of feasibility, they noted that the formulation of ecological forest compensation standards should be based on the cost–benefit method. This means that the compensation standard should conform to the average social cost of non-commercial forest production input, and the ecological value should be comprehensively determined by the forest’s environmental benefits, sustainable forest management costs, and social and economic carrying capacity [46,49,78].

China’s ENCFC payments adhere to a unified standard and do not reflect regional differences in socio-economic conditions and forest productivity levels. Although the compensation standards have been increasing annually since 2004, they still do not consider forest location, ecological value, or costs pertaining to forest establishment, cultivation, and management. The compensation standard is mainly derived from the level of appropriation from the central and local finances, ignoring the differences in forest quality and efficiency, and fundamentally violating principles of fairness and justice [64,65]. For example, in southern China, a large number of planted forests have been certified as ecological non-commercial forests, and the value of their timber has greatly exceeded the ENCFC compensation [12,14,43]. Dai et al. [1] criticized the current ENCFC compensation standard, arguing that it is difficult to establish a single subsidy level in a large country that covers such a wide range of climatic and socioeconomic conditions. Many scholars believe that the government should set a floating range of compensation standards that pertain to local forest productivity, so as to formulate realistic compensation standards [63].

#### 4.4. Livelihood Transitions

At present, a large number of forest lands managed by farmers have been certified. If farmers are mostly economically dependent on forest resources and cannot harvest in these forests, their income will be significantly affected. Xu et al. [79] analyzed the impact of ENCFC on farmers’ income using household survey data from southern collective forest areas. They found that ENCFC compensation cannot make up for the cost of local ecological afforestation or the opportunity costs lost by farmers due to the construction of ecological forests, thereby significantly reducing the income of farmers whose livelihood is reliant on forestry production. If there is no reasonable ENCFC policy to support farmers’ livelihood transitions, ENCFC will negatively impact farmers’ economic outlooks and increase the possibility of illegal logging, which is not conducive to the sustainable development of the economic and social environment [11,24,26–30,80].

In a recent study, Xu et al. [4] found that ENCFC did not promote forest growth in China, and even reduced it in some collective forest areas in southern China. They suggested that this may be caused by ENCFC reducing farmers’ enthusiasm for forest management. On this basis, Xu et al. [81] investigated the impact of ENCFC on farmers’ forest investment in southern collective forest areas and found that it significantly reduced farmers’ input in ecological non-commercial forests because these forests lacked harvesting benefits. Similarly, ENCFC also has a negative spillover effect, because it leads to the fragmentation of commercial forests and reduces the enthusiasm of farmers to manage commercial forests. The current ENCFC single payment standard and funding channel lack

consideration of how to encourage farmers to participate in the cultivation and management of ecological non-commercial forests, which is not conducive to the long-term development of ENCFC [9–11].

## 5. Conclusions

ENCFC is the largest government-led forest certification program in China. This study examines ENCFC's evolution process and summarizes related research. Over time, ENCFC has evolved through the stages of formulation, formation, pilot compensation, and comprehensive promotion. Through the implementation of ENCFC, China's forest resources have been protected, forests' ecological functions have been strengthened, and the free use of the forests' ecological benefits has come to an end. However, although ENCFC has been in place for 18 years, it still faces several challenges, such as single compensation sources, low compensation standards, and the lack of a comprehensive ENCFC evaluation and supervision system.

To promote the healthy development of ENCFC in China, the optimizations suggested by existing research can be summarized into three specific policy recommendations. (1) When promoting ENCFC, the government should allow access to other funding sources for the payment of ENCFC compensation, improve market compensation channels, and ensure the stability of ENCFC compensation funds. (2) China should determine a reasonable ENCFC compensation standard, as well as supplementary standards that conform to the average social cost of public welfare forest investment; this process should involve consideration of forests' ecological and environmental benefits and the costs involved in sustainable forest management. (3) China should establish an ENCFC evaluation and monitoring system that includes indicators such as area and reserves. The government should also establish a supervision mechanism for the ENCFC compensation fund, promote the disclosure of information on the use of compensation funds, and further improve the ENCFC evaluation system.

Although scholars have conducted various studies on ENCFC, there are still some issues that need to be explored. First, there is a lack of relevant research that investigates how much ENCFC land China needs from a spatial and temporal perspective. To our knowledge, no government agency or research institution has determined the ecological non-commercial forest area that China needs to identify. Without a rigorous demonstration of the total amount of China's ecological non-commercial forest land, it is difficult to guarantee the scientific nature of the government's decision-making, as ENCFC currently appears to be based on the authoritative decision-making of the Chinese government. Second, there is a lack of research on ENCFC performance evaluation. The goal of ENCFC is to ensure the sustainable development of ecological forest benefits, but few studies have evaluated the ecological performance of ENCFC. In addition, ENCFC has certified a large number of forests managed by farmers, which may have an impact on their economy, especially for poorer farmers in the southern mountainous areas. From a longer-term perspective, the ecological performance produced by ENCFC may also have an impact on regional economic development. Finally, there is a lack of detailed research on how to improve the ENCFC program. Existing studies have discussed schemes and results of optimizing ENCFC, but few have conducted experiments or simulation studies on these possible schemes. These issues should be addressed in future studies.

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## References

- Dai, L.; Zhao, F.; Shao, G.; Zhou, L.; Tang, L. China's classification based forest management: Procedures, problems, and prospects. *Environ. Manag.* **2009**, *43*, 1162–1173. [\[CrossRef\]](#) [\[PubMed\]](#)
- Cao, C.W. Government compensation for ecological public forest: Current situation, problems and countermeasures. *J. Jiangnan Univ.* **2018**, *35*, 31–38, 126–127. (In Chinese)
- He, M.; Wu, Z.; Li, W.; Zeng, Y.R. Forest certification in collectively owned forest areas and sustainable forest management: A case of cooperative-based forest certification in China. *Small-Scale* **2015**, *14*, 245–254. [\[CrossRef\]](#)
- Xu, C.; Lin, F.; Zhu, C.; Li, C.; Cheng, B. Does classification-based forest management promote forest restoration? Evidence from China's ecological welfare forestland certification program. *Forests* **2022**, *13*, 573. [\[CrossRef\]](#)
- Bai, R.S.; Li, H.X. Research on impact assessment of CFCC on sustainable management of forest farm. *Ecol. Econ.* **2019**, *35*, 160–165. (In Chinese)
- Xi, H.Y.; Feng, Q.; Cheng, W.J.; Si, J.H.; Yu, T.F. Spatiotemporal variations of Alxa national public welfare forest net primary productivity in northwest China and the response to climate change. *Ecohydrology* **2022**, *15*, e2377. [\[CrossRef\]](#)
- Wu, W.G.; Shen, Y.Q.; Xu, Z.G. Forest farmers' livelihood, participation willingness and sustainability of public welfare forest construction: An empirical analysis based on the survey of forest farmers in Zhejiang Province. *China Rural Econ.* **2008**, *6*, 55–65. (In Chinese)
- Niu, X.; Wang, B.; Liu, S.R.; Liu, C.J.; Wei, W.J.; Kauppi, P.E. Economical assessment of forest ecosystem services in China: Characteristics and implications. *Ecol. Complex.* **2012**, *11*, 1–11. [\[CrossRef\]](#)
- Cheng, B.D.; Xu, C.; Qin, G.Y.; Xiong, L.C. The impact of ecological public welfare forest construction in collective forest area on labor migration—Taking Zhejiang Province as an example. *J. Agrotech. Econ.* **2021**, *2*, 40–49. (In Chinese)
- Chang, W.Y.; Li, Z.; Lu, K.F.; Chang, S.J. Optimal eco-compensation for forest-based carbon sequestration programs: A case study of larch carbon sink plantations in Gansu, northwest China. *Forests* **2022**, *13*, 268. [\[CrossRef\]](#)
- Yao, S.B. Study on forest ecological compensation. *Sci. Technol. Rev.* **2004**, *4*, 54–56. (In Chinese)
- Liang, B.J.; Shi, Y.; Yuan, W.G. Review and reflection on forest ecological benefit compensation policy in China. *J. Cent. South Univ. For. Technol.* **2014**, *8*, 1–5. (In Chinese)
- Liu, C. Research progress of forest eco-compensation and development of policy practice in China. *Environ. Prot.* **2018**, *46*, 12–17. (In Chinese)
- Jin, L.S.; Zhu, K.N. From compensation for ecological and environmental damage to ecological compensation and then to realize the value of ecological products. *Environ. Prot.* **2020**, *48*, 15–18. (In Chinese)
- Chen, L.Q. The historical evolution of theories on forest management. *J. China Univ. Geosci.* **2007**, *2*, 50–56. (In Chinese)
- Zhang, M.; Liu, W.P. Discussion on compensation standard of ecological public forest in China. *World For. Res.* **2010**, *23*, 69–72. (In Chinese)
- Li, R.L. Summary of forestry classification management in major forestry countries in the world. *For. Resour. Manag.* **1999**, *2*, 20–26.
- Klooster, D. Beyond deforestation: The social context of forest change in two indigenous communities in Highland Mexico. *Conf. Lat. Am. Geogr. Yearb.* **2000**, *26*, 47–59.
- Zhang, Y.Q. Re-understanding of classified forest management in New Zealand. *World For. Res.* **2003**, *3*, 52–57. (In Chinese)
- Xie, S.X. Research on classified regionalization method for regional forest resources. *For. Resour. Manag.* **2006**, *4*, 6–11. (In Chinese)
- Ficko, A.; Lidestav, G.; Dhubbain, A.N.; Karppinen, H.; Zivojinovic, I.; Westin, K. European private forest owner typologies: A review of methods and use. *Policy Econ.* **2019**, *99*, 21–31. [\[CrossRef\]](#)
- Xie, S.X. The concept and causes of forest classification management. *East China For. Manag.* **2005**, *19*, 1–7. (In Chinese)
- Hou, Y.Z. Economic basis of forestry division theory. *World For. Res.* **1998**, *11*, 1–8. (In Chinese)
- Wu, S.R.; Gu, Y.L. International forest ecological compensation practice and its effect evaluation. *World For. Res.* **2009**, *22*, 11–16. (In Chinese)
- Pattanayak, S.K.; Wunder, S.; Ferraro, P.J. Show me the money: Do payments supply environmental services in developing countries? *Rev. Environ. Econ. Policy* **2010**, *4*, 254–274. [\[CrossRef\]](#)
- Alix, G.J.; Wolff, H. Payment for ecosystem services from forests. *Annu. Rev. Resour. Econ.* **2014**, *6*, 361–380. [\[CrossRef\]](#)
- Li, H.; Yao, S.B.; Liu, C.; Wang, B.W. Empirical analysis of agricultural production technology efficiency of different commercial forest farmers in southern forest area under the background of a new round of forest tenure reform—Taking Fu-jian and Jiangxi as examples. *J. Agrotech. Econ.* **2015**, *3*, 108–120. (In Chinese)
- Li, Q.; Wen, W.J.; Wang, X.J. Key issues of constructing forest ecological compensation mechanism. *Acta Ecol. Sin.* **2016**, *36*, 1481–1490. (In Chinese)
- Shi, W.P.; Long, H.X.; Liu, J.L. Regional identification of national key ecological function zones under the negative list of industry access. *Econ. Geogr.* **2019**, *39*, 12–20. (In Chinese)
- Liao, W.M.; Tong, T.; Peng, T.Z.; Li, D.H. Ecological compensation policy and poverty reduction effect: Review and prospect. *For. Econ.* **2019**, *41*, 97–103. (In Chinese)
- Wunder, S. Payments for environmental services and the poor: Concepts and preliminary evidence. *Environ. Dev. Econ.* **2008**, *13*, 279–297. [\[CrossRef\]](#)

32. Zilberman, D.; Lipper, L.; McCarthy, N. When could payments for environmental services benefit the poor. *Environ. Dev. Econ.* **2008**, *13*, 255–278. [\[CrossRef\]](#)
33. Zhang, Z.Y.; Guo, Z.F. On the determination of compensation standards for non-commercial forest. *J. Subtrop. Resour. Environ.* **2010**, *5*, 19–25. (In Chinese)
34. Sims, K.R.; Alixgarcia, J. Parks versus PES: Evaluating direct and incentive-based land conservation in Mexico. *J. Environ. Econ. Manag.* **2017**, *86*, 8–28. [\[CrossRef\]](#)
35. Wang, H.Y.; Zhang, H.X. Research on allocation of rights and obligations of compensation subjects in public welfare forest from the perspective of environmental equity. *For. Econ.* **2012**, *12*, 100–104. (In Chinese)
36. Hou, J.Y.; Yin, R.S.; Wu, W.G. Intensifying Forest Management in China: What does it mean, why, and how? *Policy Econ.* **2019**, *98*, 82–89. [\[CrossRef\]](#)
37. Yin, R.S. Combining forest-level analysis with options valuation approach—A new framework for assessing forestry investment. *For. Sci.* **2001**, *47*, 475–483.
38. Yin, R.S. Evaluating the socioeconomic and ecological impacts of China’s forest policies, program, and practices: Summary and outlook. *For. Policy Econ.* **2021**, *127*, 102439. [\[CrossRef\]](#)
39. Shang, W.B. The “thirteenth five-year plan annual forest cutting quota compilation plan” was released, the goal is to ensure that forest resources are harvested more and more. *China For.* **2014**, *11*, 1. (In Chinese)
40. Xu, Y.F. Study on the Legal System of Forest Resources Management in State-Owned Forest Areas. Master’s Thesis, Northeast Forestry University, Harbin, China, 2007. (In Chinese).
41. Yong, W.T. *Division of Labor in Forestry: Research on the Development Path of Forestry in China*; China Forestry Publishing House: Beijing, China, 1992. (In Chinese)
42. Zhang, L. Study on Reform of Forestry Classification Management in China. Master’s Thesis, Beijing Forestry University, Beijing, China, 2007. (In Chinese).
43. Liu, M.M.; Lu, Q.Q.; Yang, J.C. On the problems and improvement of China’s forest ecological benefit compensation system. *Issues For. Econ.* **2018**, *38*, 99. (In Chinese)
44. Qiu, X.L.; Chen, S.Z.; Zhao, R. Review on ecological compensation of public forest owned by collective and individual. *World Agric.* **2017**, *9*, 216–220, 231. (In Chinese)
45. Chinese Academy of Geological Sciences. Forest Law of the People’s Republic of China. *China For.* **2019**, *24*, 10.
46. Zinda, J.A.; Trac, C.J.; Zhai, D.; Harrell, S. Dual-function forests in the returning farmland to forest program and the flexibility of environmental policy in China. *Geoforum* **2017**, *78*, 119–132. [\[CrossRef\]](#)
47. Gao, S.P.; Li, M.H.; Su, W.P. Measurement of realistic compensation for forest ecological benefits: A case study of Jiulong County, Western Sichuan Province. *Sci. Silent. Sin.* **2006**, *4*, 88–92. (In Chinese)
48. Lin, X.Y.; Hong, Y.Z.; Yang, X.J.; Huang, G.X.; Chen, J.; Liu, Y.Y.; Chen, Z.J. Quantitative analysis of forest ecological compensation policy: Based on policy modeling consistency index model. *For. Econ.* **2022**, *44*, 5–23. (In Chinese)
49. Sheng, W.P.; Zhen, L.; Xiao, Y. Ecological compensation standard of differentiated ecological public forest: A case study of Beijing. *Acta Ecol. Sin.* **2019**, *39*, 45–52. (In Chinese)
50. Li, J.L.; Deng, X.Z.; Zhang, F.; Cai, C.N. Effects of ecological forest compensation on farmers’ income from the perspective of incentive compatibility theory: A case study of Sanming, Fujian Province. *J. Nat. Resour.* **2020**, *35*, 2942–2955. (In Chinese) [\[CrossRef\]](#)
51. Cai, J.F.; Li, D.Y. Defects and improvement strategies of ecological forest compensation system in Fujian. *J. Fujian Prov. Comm. Communist Party China* **2009**, *2*, 44–48. (In Chinese)
52. Ying, B.G.; Yuan, W.G.; Ruan, Y.F.; Xu, B.S. Effect and optimization strategy of compensation fund for public welfare forest in Zhejiang Province. *For. Econ.* **2011**, *2*, 64–70. (In Chinese)
53. Ju, W.Z.; Nong, S.Q. Consideration on compensation of ecological public forest in Guangxi. *For. Surv. Plan.* **2011**, *36*, 133–137. (In Chinese)
54. Ferraro, P.J. Asymmetric information and contract design for payments for environmental services. *Ecol. Econ.* **2008**, *65*, 810–821. [\[CrossRef\]](#)
55. Muradian, R.; Corbera, E.; Pascual, U.; Kosoy, N.; May, P.H. Reconciling theory and practice: An alternative conceptual framework for understanding payments for environmental services. *Ecol. Econ.* **2010**, *9*, 1202–1208. [\[CrossRef\]](#)
56. Wang, J.R.; Liu, M.C. Study on the influencing factors of compensation intention of Chinese chestnut agroforestry complex system in Qianxi, Hebei Province. *J. Resour. Ecol.* **2018**, *9*, 407–415.
57. Pei, S.; Zhang, C.; Liu, C.; Liu, X.N.; Xie, G.D. Forest ecological compensation standard based on spatial flowing of water services in the upper reaches of Miyun Reservoir, China. *Ecosyst. Serv.* **2019**, *39*, e100983. [\[CrossRef\]](#)
58. Engel, S.; Pagiola, S.; Wunder, S. Designing payments for environmental services in theory and practice: An overview of the issues. *Ecol. Econ.* **2008**, *65*, 663–674. [\[CrossRef\]](#)
59. Hannes, B. Accounting of forest carbon sinks and sources under a future climate protocol factoring out past disturbance and management effects on age-class structure. *Environ. Sci. Policy* **2008**, *11*, 669–686.
60. Sattler, C.; Matzdorf, B. PES in a nutshell: From definitions and origins to PES in practice—Approaches, design process and innovative aspects. *Ecosyst. Serv.* **2013**, *6*, 2–11. [\[CrossRef\]](#)

61. Katharine, N.F. Intellectual mercantilism and franchise equity: A critical study of the ecological political economy of international payments for ecosystem services. *Environ. Sci. Policy* **2014**, *12*, 137–146.
62. Wang, Y.J.; Xie, B.G.; Li, X.Q.; Liao, H.Y.; Wang, J.Y. Ecological compensation standard and compensation method of public welfare forest reserve. *Chin. J. Appl. Ecol.* **2016**, *27*, 1893–1900. (In Chinese)
63. Lv, J.H.; Zhang, H.R.; Zhang, B. Economic analysis and standard study on value compensation of forest ecological products. *World For. Res.* **2015**, *28*, 6–11. (In Chinese)
64. Kong, F.B. On the policy theory, object and realization approach of forest ecological compensation system. *J. Northwest For. Univ.* **2003**, *02*, 101–104, 115. (In Chinese)
65. Mutandwa, E.; Grala, R.K.; Petrolia, D.R. Estimates of willingness to accept compensation to manage pine stands for ecosystem services. *Policy Econ.* **2019**, *102*, 75–85. [\[CrossRef\]](#)
66. Arriagada, R.A.; Sills, E.O.; Ferraro, P.J.; Pattanayak, S.K. Do payments pay off? Evidence from participation in Costa Rica's PES Program. *PLoS ONE* **2015**, *10*, e1021455.
67. Hatcher, J.E.; Straka, T.J.; Greene, J.L. The size of forest holding/parcelization problem in forestry: A literature review. *Resources* **2013**, *2*, 39–57. [\[CrossRef\]](#)
68. Zhang, Q.; Song, C.; Chen, X. Effects of China's payment for ecosystem services programs on cropland abandonment: A case study in Tian-tang-zhai Township, Anhui, China. *Land Use Policy* **2018**, *73*, 239–248. [\[CrossRef\]](#)
69. Li, G.Z. Research progress on forest ecological compensation. *For. Econ.* **2019**, *41*, 32–40. (In Chinese)
70. Peng, X.L.; Sun, S.S.; Yan, S.G. Review on the mechanism of forestry ecological compensation. *J. Cent. South Univ. For. Technol.* **2019**, *13*, 45–51. (In Chinese)
71. Mantymaa, E.; Juutinen, A.; Monkkonen, M.; Svento, R. Participation and compensation claims in voluntary forest conservation: A case of privately owned forests in Finland. *Policy Econ.* **2009**, *07*, 498–507. [\[CrossRef\]](#)
72. Deng, H.B.; Zheng, P.; Liu, T.; Liu, X. Forest ecosystem services and eco-compensation mechanisms in China. *Environ. Manag.* **2011**, *48*, 1079–1085. [\[CrossRef\]](#)
73. Yang, H.; Zeng, S.F.; Zeng, W.Z.; Yang, F. Ecological compensation of forest carbon sequestration based on Hicks-analysis method in China: A case study of land use change from "grazing land to carbon sequestration forest". *Sci. Technol. Manag. Res.* **2016**, *36*, 221–227. (In Chinese)
74. He, Q.; Zeng, C.; Xie, P.; Liu, Y.L.; Zhang, M.K. An assessment of forest biomass carbon storage and ecological compensation based on surface area: A case study of Hubei Province, China. *Ecol. Indic.* **2018**, *90*, 392–400. [\[CrossRef\]](#)
75. Macmillan, D.C.; Harley, D.; Morrison, R. Cost effectiveness analysis of woodland ecosystem restoration. *Ecol. Econ.* **1998**, *03*, 313–324. [\[CrossRef\]](#)
76. Kremen, C.; Niles, J.O.; Dalton, M.G.; Daily, G.C.; Ehrlich, P.R.; Fay, P.J.; Grewal, D.; Guiliery, R.P. Economic incentives for rain forest conservation across scales. *Science* **2000**, *5472*, 1828–1832. [\[CrossRef\]](#) [\[PubMed\]](#)
77. Chen, X.; Chen, Z.Q.; Bai, S.Q.; Pan, H. Analysis of influencing factors of ecological compensation standards for ecological public welfare forests in Fujian Province—Based on the survey data of Acceptance of Compensation Standards Based on Economic Loss. *For. Econ.* **2017**, *39*, 81–86. (In Chinese)
78. Zhang, Q.; Wang, Y.; Tao, S.; Bilsborrow, R.E.; Qiu, T.; Liu, C.; Sannigrahi, S.; Li, Q.; Song, C. Divergent socioeconomic-ecological outcomes of China's conversion of cropland to forest program in the subtropical mountainous area and the semi-arid Loess Plateau. *Ecosyst. Serv.* **2020**, *45*, 101167. [\[CrossRef\]](#) [\[PubMed\]](#)
79. Xu, C.; Lin, F.; Li, C.; Cheng, B. Effects of designating non-public forests for ecological purposes on farmer's forestland investment: A quasi-experiment in southern China. *Policy Econ.* **2022**, *143*, 102804. [\[CrossRef\]](#)
80. Pagiola, S.; Arcenas, A.; Platais, G. Can payments for environmental services help reduce poverty? An exploration of the issues and the evidence to date from Latin America. *World Dev.* **2005**, *33*, 237–253. [\[CrossRef\]](#)
81. Xu, C.; Cheng, B.; Zhang, M. Classification-based forest management program and farmers' income: Evidence from collective forest area in southern China. *China Agric. Econ. Rev.* **2022**, *14*, 646–659. [\[CrossRef\]](#)

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