

System of Accounting for Gross Ecosystem Product and Model for Realizing the Value of Ecological Product

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Abstract. The ecological economy has become a research hot spot of today's economic development, while the gross ecosystem value, is an important standard for quantifying ecological products, The accounting system and method of manufacturing ecological goods are critical to the ecological economy's progress. This article discusses the current state of research on the ecosystem gross product accounting system and the ecological product value realization mode using relevant research literature. In the field of ecosystem accounting, there has been abundant research on its accounting methods and a mature system has been formed, but there are not many research results in practical application. There are some constructive theoretical results in the research of ecological product realization mode, but the current research results are not rich, and most of the research results are at the theoretical level, and there are limitations in the practical application. By reviewing and analyzing the limitations and issues of the current study, this paper indicates that future research should pay attention to the extension of international research literature, the interaction between ecosystem gross product accounting and ecological product market as well as the practical landing measures of ecological product realization model.

Keywords: Ecosystems; gross ecosystem product; eco-product.

1. Introduction

Peak carbon and carbon neutrality are the twin carbon objectives that the Chinese government established in 2020, all sectors of society and academia have been paying more and more attention to important initiatives to implement sustainable development and green economy, and two important models related to them: the gross ecosystem product (GEP) accounting system and the eco-product value realization model, which are now the center of attention.

Currently, accounting for GEP has attracted widespread attention and discussion. First, to realize sustainable development, there is an urgent need to beyond traditional economic measures such as gross domestic product (GDP). GEP, however, summarizes the measure of the nature contribution value to economic activities, quantifies the distribution and contribution of ecosystems in different regions, and contributes to the resources' rational allocation and the realization of regional synergistic development. Second, the growth and development of the market for ecological products are facilitated by the enhancement of the GEP accounting system, and the steady advancement of the green economy is facilitated by the rise in the market share of ecological products. Finally, the eco-product market is an important part of the green economy, and its eco-product value realization model can effectively encourage and promote enterprises to realize green transformation, which is conducive to the development and improvement of the eco-product market.

This paper will summarize and compare the "Specification for the Assessment of Forest Ecosystem Services", "Ecosystem Assessment: Technical Specification for the Accounting of Gross Ecosystem Product ", and the ecological product accounting method recommended by the United Nations "SEEA-EEA", to better the GEP accounting system that is beneficial to the ecosystems of different regions. It will improve the GEP accounting system in favor of local ecosystems, explore the mode of realizing ecological products of ecosystems, and provide necessary references and inspiration for enterprises to complete the green transformation and the development of the national green economy.

2. Total Eco-system Value of Ecological Product

2.1. Definition

Gross ecosystem production refers to the overall worth of all the commodities and services that ecosystems offer to human society. One of the main concerns in the development of an ecological civilization system is how ecosystems contribute to human well-being, which is measured in practice by GEP [1].

2.2. Study Description

In 2012, Zhu Chunquan first proposed the concept of gross ecosystem production as a way to assess the ecological status [2]. Since the 70s of the 20th centuries, international research on different levels and perspectives of the Environmental Accounting System (SEEA) has been carried out one after another. Subsequently, various regions in China have developed GEP more rapidly. In 2015, when the country implemented the GDP 2.0 accounting system (green GDP) system, Wu Nan et al. added ecosystem services under human activities and the value of their products on the basis of "subtraction" of natural resource costs [3]. In 2018, Wang et al. proposed the concept of GEP (Green GDP Accounting 3.0) [4]. In June 2021, Ouyang Zhiyun et al. discussed the profile market value of terrestrial ecosystems in China, which has been extensively studied [5]. In 2022, He Xiangliang et al. put forward new perspectives on GEP accounting: 1. direct market method, 2. market substitution method, and 3. simulated market evaluation method, which played a more favorable role in the next research progress [6]. In 2023, three new methods will intervene, Zhang Yali et al. proposed the urban ecological management method of the city [7].

In the simulated market evaluation method, Zou et al. evaluated the GEP (Gross Ecosystem Product) of China's "Changzhutan" megacity and concluded that GEP can reflect the contribution of an area's ecosystem to human happiness and economic development. Even when rapid urbanization is spatially constrained by the protection and restoration of natural systems, the medium-term trend of GEP can reflect both changes in the area quality of ecosystems in a region [8].

In adopting the GEP accounting indicator accounting method, it has accounted for its ecosystem supply services (EPSs), ecosystem tourism services (ETs), and ecosystem regulation services (ERSs). In order to precisely determine the value of ecological goods and services, Wang Luying et al. optimized the GEP accounting system in accordance with the regional peculiarities of Guangxi [9]. This approach can offer China's "Two Mountains" transformation policy an index reference for the future as well as a uniform standard for assessing the transformation efficiency of the current "Two Mountains" in Guangxi.

In the Basic Principles of Gross Ecosystem Production Accounting, Zhang et al. summarized GEP accounting's specific role and importance in the social economy by examining eight basic accounting principles: biological productivity, human benefit, production territoriality, current increment, actual effectiveness, physical metrology, data availability, and harmlessness [10].

Using the direct market method, the specific GEP change values of each county and district in Hainan Island were calculated and compared with the specific area per unit of GDP. This GEP accounting system is a useful reference for Hainan Island and can help relevant government departments establish matching development strategies. The calculation method of GEP is summarized in Table 1.

Table 1. Methods used in GEP accounting in time change

Method of Adoption	Author's Name	Year of Work
Equivalence Factor Method	Costanza	2015
Green GDP Accounting 3.0	Wang Jinnan et al.	2018
Classification of ecosystem services functions	Ouyang Zhiyun et al.	2021
Direct Market Approach		
Market substitution		
Simulated market valuation method	He Xiangliang, Du Yan, Ding Yuwei	2022
Short-term Target Method for GEP accounting	Linbo Zhang, Chaozhi Hao, Yang Song, Yiyao Wang, Wentao Zhang, Yuhua Huang,	2023
Urban Ecological Management Law	Yali Zhang, Baolong Han, Fangfang Sun	2023
Urban GEP Law	Chen Li, Sun Fangfang	2023

2.3. Summary

In summary, GEP can understand the ecological output efficiency and impact of a region, but the current accounting system and methods of GEP still lack the comparison of various regions, this paper will focus on the distribution of forest resources and forest ecosystems in the whole country, summarize and compare the current accounting system and assessment methods of forest ecosystem GEP, so as to compare the specific advantages of each GEP accounting index and summarize the GEP forest accounting system applicable to all parts of the country.

3. Ecological Product Value Realization Model

3.1. Concept Definition

Natural components that preserve the environment, ensure the operation of ecological regulations, and support life are referred to as ecological products. The three categories of products that enable modern humans to survive and thrive are material, cultural, and ecological products. Ecological product manufacturing is a specialized form of social production that acknowledges the intrinsic worth of both the inputs required to produce ecological goods and the ecological aspects themselves. They can be divided into two groups: community-based public ecological goods that are watershed, national, or regional in scope, and "private" ecological products. [11].

3.2. Synthesis

Firstly, the realization of the value of ecological products is particularly indicated by the complementary and mutually beneficial ecological, economic, and social benefits. Additionally, transformation and promotion can not only strengthen the effectiveness of ecological governance, but also encourage the distribution of ecological wealth and the sharing of resources in order to bring about organic unity and peaceful development among the three [12]. The ecological product value realization mode for systematic classification is approached from three angles—the value realization of the topic, carrier, and mechanism. Ecological compensation, trading of ecological rights, rights to resource circulation, management of resource quotas, premium of ecological carriers, and the diversity of methods for realizing the value of ecological products all represent the process of exchanging value for ecological products among various subjects [13]. Next, Liu Jiangyi examines the current state of affairs and obstacles facing China's recognition of the worth of eco-products

highlighting the significance of important avenues such as market transactions, eco-compensation, government purchases, transfer payments, and green finance [14].

In particular, he highlights the need to investigate more focused realization pathways and procedures in order to support the thorough and effective value of ecological products being realized, given the regional variations and category features of these items. This perspective not only demonstrates a thorough comprehension of the intricacy required to recognize the value of ecological items, but it also indicates the path that future studies should take. Concurrently, the innovative ecological product value realization mode is refined into three modes: the material product's ecological value realization, the cultural product's ecological value realization, and the regulatory service product's ecological value realization [15]. These modes are determined by differences in the properties of regional ecological products. Next, ecological products are divided into three groups: ecological private products, ecological public products, and ecological quasi-public products. For the features of each product type, particular and comprehensive value realization pathways are suggested [16].

Recently, a completely new paradigm for the production of ecological goods has been constructed from the three dimensions of ecological resource association, ecological asset capitalization and ecological product asset securitization. The capitalization process of ecological assets can be effectively promoted through the direct trading of operational products and the flexible trading of ecological rights and interests. Additionally, the main body of the operation and development of ecological products can expand the financing channels and offer a wider range of over-the-counter financial support by securitizing ecological product assets [17]. Policies, markets, and technology all have an impact on the understanding of the importance of ecological products, which continues to confront obstacles including the difficulty of defining property rights and the complexity of resource evaluation [18]. Countermeasures, such as the establishment of the perfect institutional framework to guarantee the seamless operation of the market, are recommended to promote the implementation of complete measures that would enable the realization of ecological product value; accelerating the market trading system's development to accomplish the monetization of environmentally friendly products; enhancing the legal framework to encourage ecological transformation; and refining the guarantee framework to inspire investors and producers of ecological products. To guarantee that the sustainability and integrity of the natural ecosystem are not jeopardized while encouraging the recognition of the value of ecological products, these countermeasures should also center on the balanced growth of ecology and economy. By means of scientific and technical advancements, it is possible to enhance the effectiveness of assessment and commerce, optimize resource allocation through policy direction, create a strong foundation for the government, market, and social governance, and collaboratively advance the appreciation of the worth of ecological products in a direction that is higher quality and more sustainable. The realization methods of ecological product value are summarized in Table 2.

Table 2. Literature of ecological product value realization model

Realization Mode	Author's Name	Year of Work
Exchange of value, exchange carrier, exchange mechanism	Yu Huiyi, Zhang Linbo	2019
Transfer payment, government purchase, ecological compensation, market transaction, green finance	Liu Jiangyi	2020
Realization of the values of ecological material products, ecological cultural products, and ecological regulation service products.	Wang Jinnan	2020
Identifying and differentiating between ecological products that fall into three categories: quasi-public, public, and private.	Liao Maolin	2021
Assetization of Ecological Resources, Capitalization of Ecological Assets, Securitization of Ecological Product Assets	Sun Bowen	2023

4. Limitation and Outlook

4.1. Limitation

The gross ecosystem product accounting system benefits from the enhancement of the ecological product trade network, which in turn influences the accounting system itself. The ecological product value realization model is grounded in GEP accounting.

The establishment of an ecological product market requires a standardized GEP accounting system, but there are still problems of non-uniformity in GEP accounting indicators, such as an excessive number of versions of GEP accounting methods and evaluation systems. Part of the research on GEP accounting focuses on places with locally characterized ecosystems or ecological resources. Too many systems have been produced with multiple feasibilities; and the ecosystems of each place have different characteristics, so they cannot be applied to the whole country. The current research on eco-products focuses on classified eco-products, resulting in a certain distance from the establishment of eco-product markets to the implementation of the theory, and a lack of practicable solutions for eco-product marketing and eco-industry development.

At present, the channels for realizing ecological products are not clear enough as well as the development of ecosystems and the establishment of eco-industries are difficult, considering the population, resources, environment and other factors, the development of eco-industries is difficult to attract sufficient inflow of capital, labor workers.

4.2. Future Prospect

At present, there are obvious differences in the distribution of research in ecosystem production-related fields, and there is an imbalance between the natural economic conditions and research development among regions. Foreign research in the field of ecological products is relatively shallow, for example, natural resource-rich regions such as Europe, South America, and Africa do not have a clear understanding of the value of ecosystems, whereas, in China, there is already a relatively solid theoretical foundation and literature support for domestic GEP accounting and ecological product realization models. With the support of the literature, subsequent research can focus on unifying the GEP accounting of different ecosystems and ecological environments in China and other countries, and on how to establish concrete and practicable ecological product realization modes and channels in regions with different social conditions.

The amount of literature on eco-products and ecological study has increased since 2020, when the Chinese government set the double carbon target (carbon neutral and peak carbon), which shows that this area is rich in research significance. The limitations of the current research have led to uncertainty about the practical significance of ecosystem accounting systems and ecological product channels and marketing policies, suggesting that subsequent research focuses on a GEP accounting system that buttresses the realization of the value of ecological products that are universal and practicable across the country. The study investigates how the ecological product value realization system and the growth of ecological industries are impacted by legislative support, technological means, social conditions, and other aspects, focusing on the implementation of specific realization channels and the study of ecological product marketing strategies, and the substitutability of GEP for the role of GDP industrial guidance and the function of industrial structure guidance.

5. Conclusion

The research in this paper includes a literature review of the concept of GEP to the continuous improvement of its accounting system, as well as an in-depth discussion of the ecological product value realization model. These methods cover the introduction of urban ecological management, accounting short-term target method and accounting system method, which reflect the diversified path of ecological value assessment and realization. In the process of value realization, it is necessary to implement comprehensive policies from many aspects, including institutional system, market

transactions, legal mechanisms, guarantee mechanisms, scientific and technological innovation, and policy guidance. While encouraging the recognition of the value of ecological products, it is also vital to focus on the balanced growth of ecology and economy to guarantee that the sustainability and integrity of natural ecosystems are not jeopardized. Therefore, it is necessary to form a good pattern of co-governance between the government, the market and society, and together encourage the value of ecological products to be realized in a path that is higher quality and more sustainable.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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