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Review of Research Progress on Value Realization Mechanism of Forest Ecological Products

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Abstract

In recent years, with the continuous development of China's economy and society, the theories about ecological environmental protection have received more and more attention. In particular, the discussion on the realisation of ecological product value has become a hot topic in the academic world nowadays. In this paper, we use the method of literature combing to sort out and analyse the domestic and foreign studies on the mechanism of ecological product value realisation from the three levels of ecological product connotation, ecological product value realisation and forest ecological product value accounting. The following conclusions are obtained: (1) scholars have a unified view on the connotation of forest ecological products, and all of them pay attention to their utilisation value; (2) there are two schools of thought, the market-led school and the government-led school of thought on the mechanism of realising the value of forest ecological products; and (3) it is necessary to improve the accounting framework by combining with the specific characteristics of the forest resources when accounting for the value of forest ecological products.

Keywords

Ecological Products; Value Realisation; Mechanism Studies; Literature Review.

1. Introduction

After years of development since the reform and opening up,China's material products and cultural products have achieved a relatively abundant state on the whole, but in December 2010, The State Council issued the "National Main function area Plan" for the first time put forward the concept of "ecological products", which is listed as necessary for human life and consumable products. With the deepening of China's ecological civilization construction, the realization of the value of ecological products has become an issue that the central government pays more and more attention to. In September 2015, the State Council issued the "Overall Plan for the Reform of Ecological Civilization System", pointing out that natural ecology is valuable and economic means should be used to solve the external environmental diseconomy. In April 2018, General Secretary Xi delivered an important speech at a symposium on in-depth promotion of the development of the Yangtze River Economic Belt, calling for "exploring the path of realising the value of ecological products that is government-led, with the participation of enterprises and all sectors of the community, market-based operation and sustainable", making it clear that the establishment of a market mechanism is the direction of development for the realisation of the value of ecological products, and that the realisation of the value of ecological products needs to fully mobilise the participation of all sectors of society and other interested parties.In 2022, The 20th National Congress of the Communist Party of China, based

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on the strategic overall situation of comprehensively promoting the great rejuvenation of the Chinese nation by means of Chinese-style modernisation, made a deployment to "promote green development and harmonious coexistence between human beings and nature", and put forward the "establishment of a mechanism for realising the value of ecological products, and the improvement of the ecological protection compensation system", indicating that the construction of the ecological products of human beings and the natural environment should be carried out. General Secretary Xi put forward the ecological development concept of "Clear waters and green mountains are as good as mountains of gold and silver", emphasising that natural ecosystems can not only provide ecological products and services for human beings, but also have huge ecological benefits, and that their value can generate huge economic benefits through rational use. After more than ten years of development of "Two Mountains Theory", human beings are more and more aware of the existence of huge economic value in the ecosystem. However, due to its complexity and particularity, there is a lack of cognition, specific accounting framework and methods for realizing the value of ecological products, which makes the transformation from "Clear waters and green mountains" to "mountains of gold and silver" there are certain obstacles. Therefore, in the process of ecological civilization construction, to carry out the accounting of the realization of the value of ecological products is an important means to transform the intrinsic value contained in ecological products into economic benefits, which also makes it become a hot spot and an important direction of current research.

As an indispensable part of ecological products, forest is an important reservoir, money bank, grain bank and carbon bank, which contains huge ecological service value. On the one hand, forests can provide physical resources for human beings, such as forest trees, which can bring huge economic benefits to human beings through efficient market trading; On the other hand, forests can also provide irreplaceable ecological values for human beings, such as recreation, water conservation, climate regulation, air purification and other functions. However, due to the lack of recognition of the overall function of forests, the ecological value of forests is often ignored, and some phenomena of forest resource destruction and neglect of management occur, resulting in the resource loss of forest ecological products. With the increasing emphasis on ecological products and the continuous deployment of ecological civilization strategy, China has begun to realize the importance of forests. However, compared with the realization of the value of tangible assets, the ecological value of forests is difficult to realize due to its publicity and unmateriality, which is also one of the reasons why its value is easily ignored. Therefore, it is necessary to evaluate the value of forest ecological products by effective means, improve people's awareness of the tangible value and intangible value of forests, and provide government departments with decisions on the management and use of forest ecological products and compensation for forest ecological protection. To realize the value of forest ecological products and engender the value connotation of forest ecosystem is an important means to solve the environmental economic externalities and realize the balanced regional development, which is conducive to building a bridge between "clean waters and green mountains" and "mountains of gold and silver". In China, forest resources are very rich and contain huge ecological value, so it is necessary to realize the value of regional forest ecological products into economic value, in order to achieve the harmonious development of local economic civilization and ecological civilization, and to take effective ways to play the advantage of this resource is a problem to be studied. This paper intends to use the multi-dimensional pillar framework model to explore the driving mechanism of the realization of the value of forest ecological products, and conduct a comprehensive and effective assessment of the realization level of the value of forest ecological products, in order to tap the huge economic and ecological value of forest ecological products, so as to promote the realization of the "double carbon" strategic goal, comprehensively promote the rural revitalization strategy, and accelerate the realization of common prosperity.

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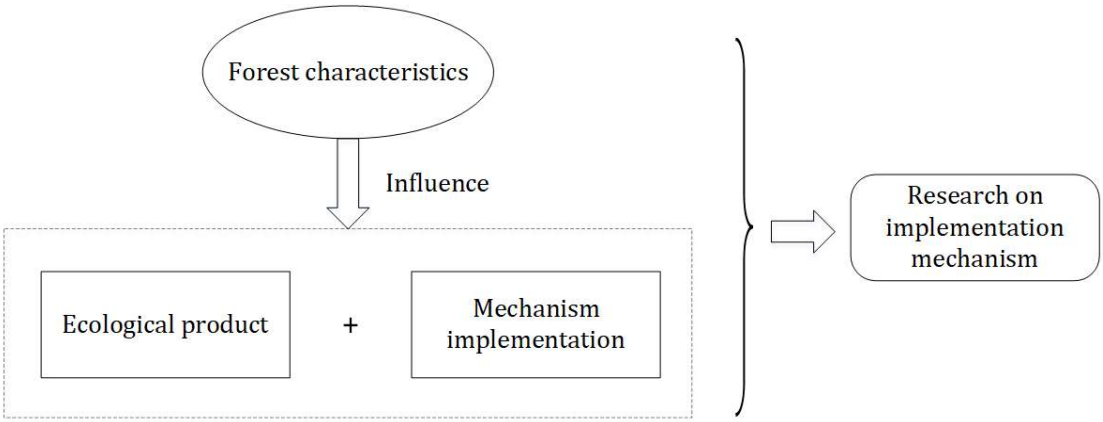

Fig. 1 Schematic research ideas

2. Research Significance

2.1. Theoretical Significance

According to the existing literature, the value of ecological products is the current research hotspot, and the existing literature has studied the accounting framework of ecological products value, the path of realizing ecological products value, and the compensation capacity of ecological products from various angles. This paper intends to draw lessons from sustainable development theory, public goods theory, property rights theory and other relevant disciplines to deeply analyze the concept and basic attributes of forest ecological products, and analyze the realization mechanism of forest ecological products value. At present, relevant researchers hold different views on the concept of "ecological products", and have not yet established a unified standard definition of the concept. In the world, there is still a lack of appropriate and universal value accounting framework. Based on the perspectives of ecological economics and environmental accounting, this paper intends to conduct an in-depth literature review on the accounting system of the value of forest ecological products, so as to provide necessary theoretical support for subsequent studies in related fields.

2.2. Practical Significance

The "Two Mountains theory" is an important part of the construction of ecological civilization, and the realization of the value of ecological products is a key path for the transformation from "clear waters and green mountains" to "mountains of gold and silver". In this process, the accounting of the realization of the value of ecological products is one of the keys, so that the huge economic benefits in ecological products can be presented. Only by sorting out the value accounting ideas and standardizing the value accounting plan can the scientific, complete and timeliness of the value accounting work be guaranteed. By combing relevant literature, collating and analyzing large -scale remote sensing data, this paper intends to summarize the main research conclusions and progress in the field of ecological asset value accounting, and sort out the connotation and theoretical basis of ecological product value realization and accounting, discussion of forest ecological asset accounting methods, forest ecological asset management and value realization path from three aspects. Based on this, some thoughts and suggestions on the value accounting and management of ecological products in China were put forward.

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3. Literature Review on the Connotation of Ecological Products

According to the literature reviewed, foreign scholars mainly focus on ecosystem services or environmental services in the field of ecological products. Daily (1997) defined ecosystem services as "the natural environmental elements formed by ecosystems and ecological processes to maintain human survival and their utility". This concept includes the meanings of subject, process and service. Costanza et al. (1998) collectively refer to the products and services provided by ecosystem as ecosystem services.

The concept of ecological product has Chinese characteristics, and many Chinese scholars have given different definitions of its connotation. Chinese scholars Ren and Yuan (1992) first proposed the concept of ecological product, starting from the concept of ecological design. They hold that "ecological products refer to safe, reliable and pollution -free high-grade products produced by ecological industry (agriculture) art without ecological exhaustion". In this definition, resource -saving and environment-friendly agricultural products and industrial products belong to ecological products. With the improvement of productivity and the progress of science and technology, the value of ecosystem service functions has been widely recognized by the society. The adjustment functions provided by key ecological functional zones such as water conservation, carbon fixation and oxygen release, climate regulation, water purification and soil and water conservation are defined as ecological products in the National Plan for Main Functional Zones, which are different from service products, agricultural products and industrial products. Dai et al. (2013) put forward the concept of forest ecological products. The so -called forest ecological products are the general term for intangible products that can improve the ecological condition by making forests play their ecological functions through labor. Huang (2015) reflected the concept of ecological products with a continuum model, and proposed that according to different research topics and properties, the scope of ecological products is different, but they all have the characteristics of multi-dimensional value and externality products related to human well-being. Dou et al. (2022) analyzed and analyzed the concept of ecological products at home and abroad, and argued that some scholars' definition of the concept of ecological products is wrong, and ecological products should not be equated with ecological service system. Ouyang (2022) ecosystem regulation services refer to ecological products in a narrow sense, while ecological products in a broad sense refer to ecosystem services with positive externalities, including ecological organic products, regulatory services, cultural services, etc. The concept of ecological products in the broad sense is consistent with the multiple value attributes of ecological products, and at the same time meets the requirements of promoting the construction of ecological civilization in an all-round way and correctly handling the relationship between man and nature. It will help the design, production, trading and brand building of ecosystem services, and promote the supply of high-quality ecological products.

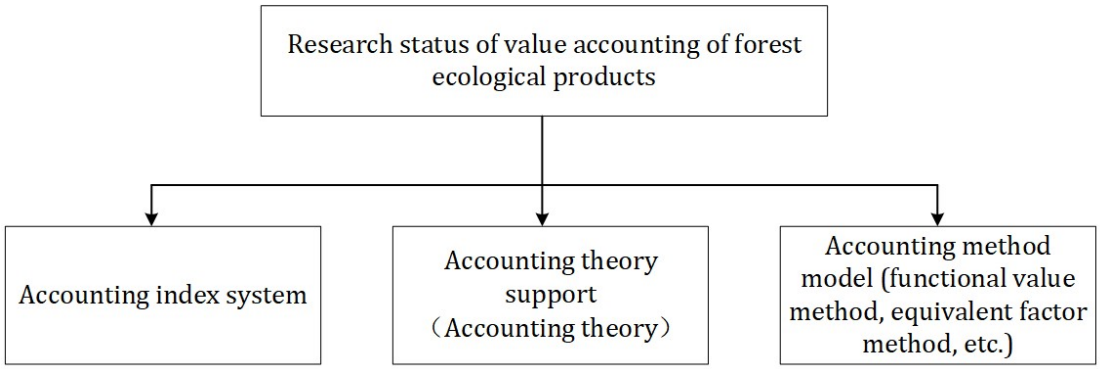

Fig. 2 Logical diagram of literature review

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4. Literature Review on Value Realization of Ecological Product

The According to the literature reviewed, the mechanism of value transformation of ecological products has become a hot spot for scholars to study. Some scholars believe that the value of ecological products can be realized through market-led mechanisms. Daniel Perrot-Maitre (2001) studied the service market transaction of forest water temperature. Gouyon emphasized the importance of introducing market factors in his study. Zeng et al. (2014) put forward three approaches to realize the value of market-based ecological products, namely, economic transaction in the direct market, industrial management of ecological capital, and ecological purchase. Among them, the economic transaction in the direct market refers to the change of ownership of ecological products through public trading, so as to realize the value in the market trading. The means are carbon emission right, emission right and energy use right trading. The industrial management of ecological capital refers to the products with market value obtained through the development of ecological products in a certain scale, and such products generally have high economic benefits and social value. Ecological purchase refers to the realization of the value of ecological products in the process of government purchase. Liu (2022) believes that the value of forest carbon sink can be realized by joining the carbon sink trading market, and it is necessary to promote the integration of forestry carbon sink into the national carbon emission trading system to a greater extent, accelerate the establishment of ecological asset markets such as carbon sink trading and emission trading, accurately evaluate the growth potential of forestry carbon sink and corresponding policies, and improve the forestry carbon sink trading mechanism. Peng (2022) believes that the value of forestry carbon sink products can be realized through the forestry carbon sink financial path and the forestry carbon sink industrialization path. The forestry carbon sink financial path connects financial capital with forestry carbon sink economic entities, and activates carbon market trading and realizes the optimal allocation of forestry carbon sink products through the power of carbon finance capital. Besides, idle funds will be transferred to forest-increasing activities such as afforestation, forest management and reduction of deforestation.

"Ecological bank" is also a bold attempt to realize the path of marketization of the value of ecological products. Cui et al. (2019) elaborated on the "ecological bank" model, set the design ideas, overall structure, transaction process and operation mode, and took the "Forest Ecological Bank" in Nanping, Fujian Province as an example, combined theory and practice, and summarized the new path of "resource -asset-capital" conversion. Zhang (2020) investigated the operation mode of Fujian Forest Ecological Bank and adopted the mode of "decentralized number of employees and centralized output" to improve the value realization mechanism of forest ecological products, collect, store, integrate and optimize fragmented and decentralized forestry resources, open the channel of resources transforming into assets and assets transforming into capital, and transform ecological advantages into economic advantages.

Some other scholars believe that ecological products belong to public ecological products, and the government should play a leading role in the transformation mechanism of their value realization. Zhao et al. (2022) proposed that horizontal inter -governmental transfer payment (ecological compensation), resource and environment tax policy and government purchase are effective means to realize the value of public ecological products. Zhou (2022) believes that the participation of the government can effectively realize the value of ecological products, starting from two aspects: first, increase the input of the central government to speed up the realization of the economic value of the ecological environment, so as to take into account the protection of ecological products and the two -way sense of gain of the beneficiaries, so as to realize the value realization mechanism of ecological products. The second is to improve the horizontal compensation of the eastern region to the western region, the natural resource consumption area to the natural resource production area, the downstream area of the whole basin to the

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upstream area and the ecological benefit area to the ecological protection area. Xia and Wu (2020) clarified the path of realizing the value of ecological products dominated by government administrative channels, namely, transfer payment and government purchase, and government compensation for forest farm owners through acquisition, leading exchange, etc., so as to transform commercial forests prohibited from logging in key ecological zones into ecological public forests and realize the value of forest ecological products in the conversion process. Zhou (2022) studied the realization of the value of ecological products based on a typical case in Gansu Province, which is conducive to establishing and improving the realization mechanism of the value of ecological products and promoting the construction of ecological civilization in China. This paper discusses the process of realizing the value of ecological products in Gansu from three aspects: specific practice, case revelation and policy suggestions, and puts forward relevant policy suggestions on establishing and improving the mechanism of realizing the value of ecological products.

5. Literature Review on Accounting for the Forest Ecological Products

5.1. Research Progress of Accounting System

This According to the existing literature, it is found that exploring and improving the realization accounting system of the value of ecological products is an effective means to effectively evaluate the realization level of ecological products. At present, the accounting methods for the value of ecological products mainly involve two aspects: one is to use different evaluation frame price structure and index system, as well as different methods to estimate each index, and to calculate the tangible and intangible assets of forests; the other is to incorporate ecosystem services into the accounting system and build the accounting framework for the value of ecological products. These two methods complement each other, and are an important part of the accounting of the value of forest ecological products in our country. Huang (2015) believes that to evaluate the value of ecological products in a broad sense, one is to transform the current static model and build a dynamic model related to ecology and economy; Second, the emphasis should be shifted from the measurement of the value of ecological products to the impact of marginal changes in the quantity and quality of ecological products on human welfare, and the framework of single index, multi - dimensional pillar framework, and indirect driving force -- direct driving force -- ecological product-human welfare change framework (IDEHC) was introduced to evaluate the value of ecological products. Gao (2019) proposed eight accounting principles of ecosystem value, including biological productivity, human profitability, conservation effectiveness, actual occurrence, physical measurement, data availability, sustainable renewal, and non-harmfulness, with the goal of serving ecosystem management and related perfor mance assessment. An ecosystem value accounting index system consisting of 7 functional categories, 15 first-level subjects and 26 second-level subjects was selected and formed, and an accounting benchmark was set for the index that only a certain amount of material can form a service, and the application ability of the evaluation index was discussed by taking Xiamen City as an example. Guo (2021), taking forest resources in Jia County of northern Shaanxi as an example, built an asset stock value accounting model reflecting economic, ecological and social values based on asset pricing theory and conducted empirical research. By establishing GEP accounting index system at district and county level, Li (2021) took 8 towns/streets in Gaochun District, Nanjing City, Jiangsu Province, as the accounting unit, and calculated 18 indicators in 3 categories: material products, adjustment services and human settlement culture. Zou (2022) took Nanshan District of Shenzhen City as the research object, established its GEEP index and method system that was in line with the actual situation, and carried out the accounting in 2020.

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5.2. Research Progress Supported by Accounting Theory

In addition, the value accounting of forest ecological products needs the support of accounting theories and methods, and many scholars have made a lot of efforts and exploration in this research direction. For example, Wei (2014) established the framework of ecological value accounting by differentiating the concepts related to ecological value accounting, such as environmental accounting, ecological benefit externality accounting and ecological environment compensation accounting, including accounting assumptions, accounting recognition, accounting measurement and accounting report of ecological value accounting. Wei (2015) elaborated the framework of ecological value accounting from the aspects of accounting assumptions, accounting recognition and measurement, accounting subjects and accounting treatment, accounting reports, etc., and took Maduo County in the Sanjiangyuan Protection Zone as an example to elaborate the practical application of the framework. Zhang (2020) systematically elaborated on the objectives, preparation subjects, assumptions and principles, basic elements of statements, recognition and measurement of statement elements, account setting, presentation of statements, disclosure of notes and other contents of the value-based forest resource balance sheet financial report. At the same time, the measurement attribute of "benchmark value" was adopted to improve the operability of forest resource value measurement.

5.3. Research Progress of Accounting Methods and Models

For the specific accounting methods of ecological products, due to the characteristics of morphological diversity and complexity, as well as the attributes of externality and regionality, there are certain difficulties in accounting. The accounting methods of ecological product value by scholars from various countries can be summarized as the following: First, the functional value method; Under the functional value method, there are market assessment method, alternative market assessment method and simulated market assessment method, followed by equivalent factor method, which is the secondary transfer of benefit transfer method. In addition, some scholars have analyzed the impact of community concept on ecosystem service payment from the perspective of payment willingness . AKP et al. (2015) believe that the direct market method can also be called the actual market method, and its applicable premise is that the market mechanism is relatively complete and the amount of ecological products to be accounted for is sufficient, and the accounting of specific products can be completed by relying on the shadow price of related commodities. The specific methods include transaction value method, labor cost method, protection cost method, recovery cost method and opportunity cost method, etc. Jose R (2016) believes that alternative market method is a method to calculate the value of public commodities by using alternative market and shadow price. The above method is often used to calculate the value of water conservation products, water purification products, carbon fixation and oxygen release products. Pan and Zhang (2017) believe that the willingness survey method is a value accounting based on the survey of the value that resource users are willing to pay, and the specific value is the capital that resource users are willing to pay to obtain different types of ecological products. The willingness survey method can also be called the virtual market method, and the method is mainly conditional value method. Li and Zhang (2017), aiming at the types of ecological products in the source area of Three Rivers, constructed a measurement method for the evaluation index of ecological products from the perspectives of material quality and value quantity, and used the direct market price method and the alternative market method to calculate the value of ecological products. Lin (2022) evaluated the value of forest resource assets in Anfu County by using annuity capitalization method, replacement cost method, harvest present value method and market price inversion algorithm. From the perspective of market-based non -public product supply and support services, Wang (2022) took the wetland Pine carbon sink forest project of Jiangxi Fenglin

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Investment and Development Co., Ltd. as an example, calculated the economic value of the project by using the cost-benefit method and the ecological value of the carbon sink by using the B -S option method. And conducted sensitivity analysis on the total value of the project with respect to the price of pine wood, turpentine and carbon sink.

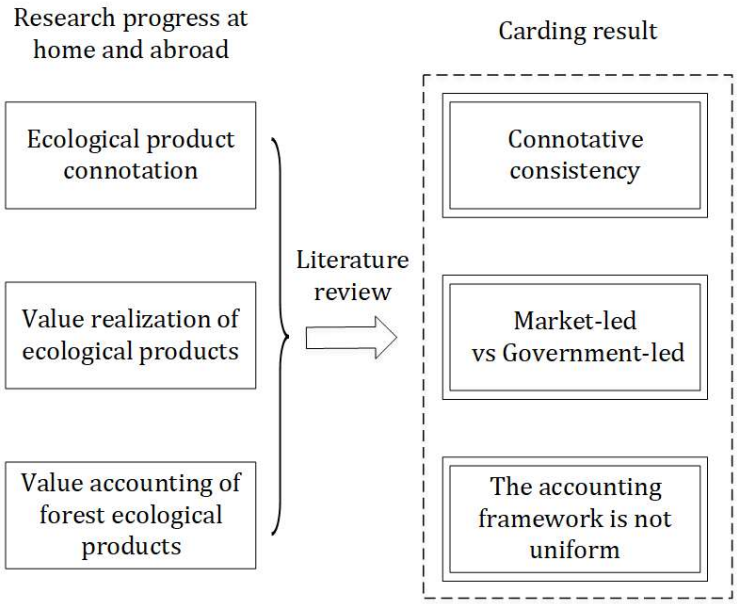

Fig. 3 Research progress in accounting for the value of forest ecological products

6. Conclusion and Discussion

It can be seen from the above literatures that there are abundant researches on the realization and accounting of forest ecological products by domestic and foreign scholars.

(1) First of all, combined with the existing research, it can be found that there is no obvious dispute between domestic and foreign scholars on the connotation of forest ecological products, the main difference is the subdivision and understanding of forest products. According to most studies, forest ecological products can be divided into the following four categories according to their manifestations: material supply products, regulatory service products, cultural service products and support service products. According to this study, material supply products belong to the tangible products in the forest according to whether they have material form or not, and their value is the direct use value of forest resources, while the other three products belong to the intangible products in the forest resources because they have no material form, and their value is the indirect use value. Therefore, the main connotations of current forest ecological products are summarized as follows: first, they are tangible ecological products with utilization value and scarcity; second, they are intangible ecological products with various intangible services provided for human beings.

(2) Secondly, as for the value realization mechanism of forest ecological products, according to the research of current scholars, it can be mainly divided into the following two ways: one is to establish a market-led mechanism to realize the value of ecological products; the other is to take the government as the lead to realize the value of forest ecological products due to the characteristics of public distribution. However, there are few researches on the value realization mechanism of forest ecological products, and no unified and standard model has been reached.

(3) Finally, it can be found through the current research that there is no uniform accounting framework for the value of forest ecological products. As different scholars have different

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accounting frameworks for the value of forest ecological products due to different statistical calibers, the results of value accounting may not be uniform. In addition, the existing studies also ignored the discussion on the characteristics of forest resources in the study area when constructing the accounting framework, and accounting the value of forest ecological products according to the existing framework may also lead to accounting errors. Therefore, this paper believes that the accounting framework should be improved according to the specific characteristics of forest resources when accounting the value of forest ecological products.

Acknowledgments

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References

[1] H.W.Luo, Y.Q.Jiang: Measurement of ecological value of natural resource assets, theory and case, Friends of Accounting, Vol.622 (2019) No.22, p.104-110.

[2] C.F.Wei, J.L.Qin: Construction and application of ecological value accounting framework--A case study of Maduo County in Sanjiangyuan Reserve, Friends of Accounting,Vol.517 (2015) No.13, p.12-15.

[3] C.F.Wei, J.L.Qin: Construction of ecological value accounting framework, Friends of Accounting, Vol.501 (2014) No.33, p.25-29.

[4] R.C.Zhang: Research on the construction of conceptual framework of forest resource balance sheet financial report based on value volume, Accounting Research, Vol.395 (2020) No.9, p.16-28.

[5] Z.H.Zhou, Q.J.Yuan: Research on value realization of ecological products based on typical cases in Gansu, Friends of Accounting, Vol.678 (2022) No.6, p.151-154.

[6] H.G.Wang, Q.F.Li and H.Rao: Calculation of the whole life cycle value of forest ecological products under the background of carbon neutrality: A case study of Pinus prunus, Forestry Economics, Vol.44 (2022) No.7, p.79-96.

[7] Y.X.He: Review on value accounting of Marine ecological products, Friends of Accounting, Vol.659 (2021) No.11, p.99-105.

[8] B.Zhou, X.M.Chen: Research on the mechanism of realising the value of ecological products in China in the new era, Price Monthly, Vol.540 (2022) No.5, p.28-33.

[9] X.Li, Z.Yao and A.G.Chen: Mechanism of realising the value of natural resources ecological products, China Finance, Vol. (2021), p.78-79.

[10] W.M.Zhang: Improving the mechanism of realising the value of ecological products-A research based on the forest ecological bank in Fujian, Macroeconomic Management, Vol. (2020), p.73-79.

[11] F.Li, H.B.Yan, G.Lv: Prerequisite study on the mechanism of realising the value of ecological products--An example of accounting for gross ecosystem product (GEP) in Gaochun District, Nanjing, Environmental Protection, Vol.49 (2019) No: 12, p.51-58.

[12] F.Li, L.B.Zhang and J.M.Shu: Accounting for the value of ecological products in Sanjiangyuan DistrScience and Technology Herald, Science and Technology Review, Vol.35 (2017) No: 6, p.120-124.

[13] Z.M.Li, X.W.He, H.Ma and L.Y.Wang: Discussion on value realization mechanism of ecological products in Yangtze River Economic Belt, Enterprise Economics, Vol.41 (2022) No: 1, p.45-54.

[14] X.L.Gao, Y.Q.Lin, W.H.Xu and Z.Y.Ouyang: Progress of research on value realisation of ecological products, Journal of Ecology, Vol.40 (2019) No: 1, p.24-33.

ISSN: 2692-7608 DOI: 10.6981/FEM.202312_4(12).0027

[15] L.H.Hao, S.Chen,S.He: Accounting method and application of the value of ecological products in marine supply category--Taking Wenzhou City, Zhejiang Province as an example, Environmental Protection, Vol.49 (2021) No: 22, p.54-60.

[16] F.Yu, W.S.Yang and G.X.Ma: Recent progress and outlook of ecological value accounting at home and abroad, Environmental Protection, Vol.48 (2020) No: 14, p.18-24.

[17] Y.F.Sun, C.Y.Xu: Ecosystem services:A bridge from physical volume to value in natural resource asset accounting, Finance and Accounting, Vol. (2016) , p.74-76.

[18] J.H.Xiao, X.T.Ding and Y.F.Chen: Comparative study of voluntary and mandatory payment instruments by conditional value assessment method--Taking the recreational value assessment of Yimeng Lake National Water Conservancy Scenic Area as an example, China Population-Resources and Environment, Vol.28 (2018) No:3, p.95-105.

[19] Q.J.Wang, X.Q.Wang and S.L.Lu: The theoretical foundation of policy science of ecological compensation and China's ecological compensation policy, Forestry Economics, Vol.326 (2019) No:9.

[20] Y.Liu, A.G.Wang: Theoretical and methodological overview of natural capital accounting research, Friends of Accounting, Vol. (2019) , p.26-31.

[21] José R.Soto,Damian C. Adams,Francisco J.scobedo.Landowner attitudes and willingness to accept compensation from forest carbon offsets: Application of best-worst choice modeling in Florida USA, Forest Policy & Economics, Vol.(2016).

[22] Daily G C.. Nature's Services: Societal Dependence on Natural Ecosystems,Washington, D C: Island Press, Vol.(1997), p.220-221.

[23] Costanza R, d'Arge R, De Groot R, et al. The Value of the World's Ecosystem Services and Natural Capital, Ecological Economics, Vol. 25 (1998) NO.1,p.3-15.

[24] AKP,BHB,DBBC,etal.Participatory assessment and mapping of ecosystem services in a data-poor region:Case study of community-managed forests in central Nepal, Ecosystem Services, Vol.13 (2015)No.2,p.81-92.

[25] PERRINGS C. BIOTIC DIVERSITY, SUSTAINABLE DEVELOPMENT, AND NATURAL, Investing in natural capital: the ecological economics approach to sustainability, Vol.92(1994).

[26] ENGELBRECHT H-J. Natural capital, subjective well-being, and the new welfare economics of sustainability: Some evidence from cross-country regressions,Ecological Economics, Vol.69(2009), No.2,p. 380-388.

[27] Ouyang Z , Zheng H , Xiao Y , et al. Improvements in ecosystem services from investments in natural capital, Science, Vol.352(2016) ,p.1455-1459.

[28] Robert Costanza, Herman E.Natural Capital and Sustainable Development, Conservation Biology, Vol.6(1992) No.1.

[29] DAILY G C, KAREIVA P M, POLASKY S. Mainstreaming natural capital into decisions, Natural capital: theory and practice of mapping ecosystem services, Vol.112(2011),p.3-14.

[30] Coombe R J.Preserving Cultural Diversity through the Preservation of Biological Diversity: Indigenous Peoples,Local Communities,and the Role of Digital Technologies, Social Science Electronic Publishing,Vol.(2014).

[31] Porter S D,Reay D S.Addressing food supply chain and consumption inefficiencies:potential for climate change mitigation, Regional Environmental Change, Vol.16(2016)No.8,p.2279-2290.

[32] Hamilton K.Measuring Sustainability in the UN System of Environmental-Economic Accounting, Environmental and Resource Economics,Vol.64(2016)No.1,p.25-36.

[33] Dewitt T J.Expanding the phenotypic plasticity paradigm to broader views of trait space and ecological function, Current Zoology, Vol.62(2016)No.5.

[34] Tolunay,Bassullu.Willingness to Pay for Carbon Sequestration and Co-Benefits of Forests in Turkey, SUSTAINABILITY-BASEL, Vol.(2015).

[35] COSTANZA R, D'ARGE R, DE GROOT R. The value of the world's ecosystem services and natural capital, Nature, Vol387(1997),p.253-260.