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Advances in Forest Ecological Value Assessment Research

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Abstract

Forest resources have three major benefits: economic, ecological and social. In the ecological aspect, forests are the main body of land security and improvement of the environment, specific irreplaceable role, ecological benefits in the basic position. Without forest ecological benefits, there is no forest economic and social benefits. Forest ecosystem service function refers to the natural environmental conditions and utility of forest ecosystems and ecological processes formed and maintained by human survival. Water is one of the essential material conditions for human life and industrial and agricultural production, it is the lifeblood of agriculture, industry, national economy and social development. As the global demand for water resources is increasing and the water environment is deteriorating rapidly, water scarcity has become a global problem of common concern. The water content function of forest ecosystems in arid and semi-arid regions has become a hot spot for research on ecological service functions.

Keywords

Forests; Ecological Benefits; Biodiversity; Service Values.

1. Introduction

Ecological service functions are the basis of human survival and modern civilization, and science and technology can influence but not replace ecological service functions [1]. As the main body of terrestrial ecosystem, forest is an important part of the earth's biosphere and has various functions such as water conservation, soil conservation, carbon sequestration and oxygen production, nutrient accumulation in forest, purification of atmospheric environment, protection of biodiversity, forest recreation and ecological culture [2].

Since the management of ecosystems needs to deal with a series of intricate influences that lead to changes in the ecological environment, this requires that policies, systems and investments at the local, regional and global levels must be correct and effective [3]. For this reason, an objective and scientific assessment of the water-conserving function of regional forests is a major theoretical source and technical issue for conducting forestry regional planning, formulating ecological compensation policies and carrying out forestry ecological engineering construction, which will have positive and important practical significance for the formulation of management decisions such as the rational distribution or not of forest resources and the optimal use of resources[4].

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2. Foreign Research Progress

After A.G. Tasley proposed the concept of ecosystem in 1935, the focus of ecological research began to shift from the study of system structure to the study of system function; Aldo Leopold proposed the irreplaceability of ecological service functions in 1949 [5]. By the 1960s, as global environmental pollution intensified and ecosystem damage became severe, people began to recognize the importance of estimating the value of ecosystem services and began to estimate the direct value of forest ecosystems. in 1972, the Japanese Forestry Agency used the substitution method to estimate the indirect value of seven forest types nationwide for the first time. peters et al. in 1989 estimated the value of non-timber forest products in the Amazon rainforest Gordon Irene in 1992 discussed some of nature's services to humans, and Constanza was the first in the world to estimate the value of ecosystem services in the global biosphere by synthesizing the results of internationally published studies on the valuation of ecosystem services using different methods. However, Opschoor et al. found the results of this assessment unconvincing. Nevertheless, Constanza provided a reference method for the valuation of ecosystem service functions in large regions. 1995, Adger et al. estimated the forest service functions in Mexico in terms of direct, indirect, existential, and selective values of forest ecological service functions, and estimated a total value of US$4 billion. 1997, Daily published the book "Nature's Services: Society depends on Natural Ecosystems", which systematically described the concept, content and valuation methods of ecosystem service functions and assessed the service functions of various ecosystems in different regions [6]. The publication of this book brought the assessment of ecosystem service functions to the forefront. In the same year, Costanza et al. carried out an accounting of the value of global forest ecosystem services from an economic perspective by integrating various previous international methods for assessing the value of ecosystem services and selecting 17 ecosystem service function indicators, which resulted in a total value of $16 trillion to $54 trillion for global forest ecosystem services In 2000, the Forestry Agency of Japan again used the proxy method to evaluate the value of six major public benefit functions of forests, such as water conservation and soil conservation , and each service function was refined in detail and the assessment method was greatly improved. In the same year, the World Millennium Ecosystem Assessment System was launched and a systematic assessment of the state of global forest ecosystems was carried out, and the FAO Global Forest Resources Assessment and international organizations such as the United Nations Framework Convention on Climate Change and the Convention on Biological Diversity have regularly monitored and evaluated the ecological state of forests to grasp the changing trends of the ecological function benefits of the world's forests. 2001 Kreuter and Konarska assessed the ecological service function assessment of three major watersheds near Texas, USA, using satellite remote sensing technology and borrowing Constanza's estimation method. The application of airborne remote sensing technology greatly reduced the workload and the assessment results were more accurate, which provided an effective reference for the wide application of service function value assessment in the future [7].

In 2002, Boumans developed the Global Biosphere Complex (GUMBO) model and calculated that the total value of global ecosystem services in 2000 was about 4.5 times the gross world product in that year. Since then, CITYgreen), InVEST, ARIES, SoIVES (Sher- The Millennium Ecosystem Assessment (MA) was completed in 2005, and 1360 leading scholars from 95 countries conducted a study on ecosystems and their contribution to human well-being. Leading scholars from 95 countries conducted a pioneering, multi-scale, integrated assessment of ecosystems and their impacts on human well-being, and provided detailed data for government decision-making. UK scientists spent two years completing assessments of 25

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ecosystem service functions, culminating in the first systematic UK-wide comprehensive assessment report in 2011[8].

3. Domestic Research Progress

The evaluation of forest ecosystem service functions in China originated from the research on forest resource accounting in the early 1980s, and in 1983, the Chinese Forestry Society conducted a study on the evaluation of comprehensive forest benefits. In 1988, the Development Research Center of the State Council received funding from the Ford Foundation of the United States to carry out the work of accounting for the value of resources including forests, and in 1995, Hou Yuanzhao and Wang Zuo estimated for the first time the value of forest ecosystem service functions in China from the functions of forest in purifying the atmosphere, connoting water and preventing wind and sand, which started the evaluation of forest ecological service functions in China. In 1999, Jiang Yanling and Zhou Guangsheng referred to the information on the global average value of forest ecosystem service function estimated by Costanza et al. and combined with the data of the 3rd national forest inventory, Ouyang Zhiyun and Wang Haoke et al. (1999) assessed the terrestrial ecosystem service function and analyzed the ecological and economic value in China; Li Jinchang and Kong Fanwen et al. assessed the ecosystem [9]. Due to the diversity of assessment calculation methods, the non-uniformity of selected indicators and parameters, and the dynamic change of data, the assessment results of ecological service function values in the same region also vary greatly. Therefore, the State Forestry Administration promulgated the forestry industry standard LY/T 1721-2008 "Forest Ecosystem Service Function Assessment Specification" in 2008, and the project team of "Forest Ecosystem Service Assessment in China" applied this specification and soon arrived at the total value of forest ecosystem service function in China for the 7th national forest inventory period (2004-2008) of 10.01 trillion yuan/year. The promulgation of the industry standard has greatly developed the assessment of forest ecosystem service functions. Yue, Y. J., Han, J. J., Li, Y. Z., Chen, J. J., and Li, G. T. assessed the physical quality and value quantity of two ecological service functions of the Daxinganling forest, water containment and soil conservation, during the period 1994-2008 [10].

In 2011, Zhang Qiu-Liang, Chun-Lan, Wu Tong et al. conducted a quantitative assessment calculation of the main forest ecological functions such as water conservation, soil conservation and carbon sequestration and oxygen release benefits of the main forest types in the Savannah Mountain Forest area of Inner Mongolia [11]. Guo Shengxiang, Wang Youkui et al. conducted a preliminary evaluation and analysis of the ecological benefits of 282,900 hm2 of new forests in the natural forest protection project area of Qilianshan National Nature Reserve in Gansu in 2012[12].In 2014, Xiao Qiang, Xiao Yang, Ouyang Zhiyun et al. classified the forest ecosystem service functions in Chongqing into four categories: product provisioning function, regulating function, supporting function and cultural service function , and quantitatively evaluated the economic value of forest ecosystem service functions in Chongqing using the market value method and production cost method, etc., using 2006 as the base year[13]. All these studies have laid a solid foundation for the assessment of the value of forest ecosystem service functions.

So far, not many studies have been conducted on the detailed assessment of water content value of single tree species, and this assessment was conducted for different age groups of Xing'an larch, without taking into account the spatial variability of precipitation, forest evapotranspiration and surface runoff in the study area, and the difficulty of accurate measurement of forest evapotranspiration and the dynamic changes caused by the regeneration of forest resources have affected the accuracy and timeliness of the assessment, so further improvement is needed in future studies.

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