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Research and Development Review on Marketization ofForest Environmental Resources

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Abstract: Based on a large amount of document materials, the concepts and measures that realizing marketization of forest environmental resource have been studied in this paper. Detailed content included evaluation value and clearly established ownership of forest environmental resource, the main issues that affected forestry marketization, such as principal-agent analysis, capital investment, the laws and government regulations and carbon sequestration market. Finally summarized the valuation and prospect of problems mentioned above. The purpose is going to provide basic messages and rational orientations for forest environmental resource development and research.

1. Introduction

Scholars have generally come to an agreement on the subdivision of forest resources into woodland resources, forest tree and environmental resources. A large number of research results have fully confirmed that forest environmental resources are the main body of forest resources, and its economic value is often several times that of forest land resources and forest resources. However, forest environmental resources are typical public goods, which are non-competitive and non-excludable, resulting in considerable external benefits for forest cultivation. But forest environment and deforestation consumers need not burden external costs. The result is that people have no desire to cultivate forest resources, on the other hand the consumptions are stimulated greatly. This is the root cause of the dramatic decline in global forest resources and environmental degradation in recent decades. The problems how to use the scientific and rational design of market mechanisms, to internalize the externalities of forest resource development, utilization, and consumption behaviors, to enable forest environmental resources to monetize the economic benefits brought by society, and to enter the market for equivalent exchange to realize its value, etc. The above topics have become hot issues and problems for academic research and exploration in recent years.

2. Basic concept of forest environmental resources

2.1 Definition of forest environmental resources

The decisive role of forest resources in improving the ecological environment and maintaining ecological balance has aroused wide public concern in today's society. With people's concern for sustainable development of environment, the term "forest resource" is broadly defined as "woody

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perennials dominated, playing an important role, which includes forestland, animals, plants, microbes and ecological services , has its biological structure and site type, forms the unique ecological environment." Subsequently, scholars have been analyzing forest resources as a whole system, and the forest environmental resources are considered to be an indispensable part of forest resources, attracted great attention. Many scholars have also defined them from different angles, the most representative of which is the definition of Kong Fanwen.

Chinese scholars, Kong Fanwen and Dai Guangcui who published research in well-known journals *Forestry Economy* in 1994, defined forest environmental resources in the "*Research on Forest Environmental Resource Accounting and Compensation Policies*". Authors suggested that forest is the center of forest environmental resources, the conditions determine its survival and development. The environment includes natural factors, technological measures and policies, laws and economic means, but mainly refers to the multi-functions of forests, including the material products, non-material products and Environmental restoration provided by forests for human and social development. the classification of forest environmental resources is shown in the following table:

Tab1. Classification of Forest Environmental Resources

	Classification	**Content**	**Market Model**	**Market Participants**	**Exchange Model**	**Accomplis-h ing model**
Classification of Forest Environment-al Resources	1.Forest landscape 2.tourism industry	1.Wildwood 2. Plantation	Market economy	1. Supplier 2. Consumer	Equivalent Exchange	Charge method
	Ecosystem service	1.Soil and water conservation 2.Cleaning air 3.Reducing poll-ution 4.Noise control	Transition to Market economy (Semi-market economy)	1.Supplier 2.water resources and hydropower 3. Agriculture 4.Chemical fertilizer 5.metallurgy	Fair trade	Market transactions
	1.Biodiversity 2.Gene Conversation		non-market economy	1.Supplier 2.national authorities.	Government Support	budgetary allocations

2.2 Economic value system of forest environmental resources

The economic value system of forest environment resource is composed of Utilization value and non-utilization value. The value of non-utilization includes the selection value, existence value and heritage value. Therefore, the total economic value of forest environmental resources can be expressed as follows:

Total economic value = utilization value+ selection value+ existence value +heritage value.

Among them, forest hunting, fishing, camping, picnics, strolling and sightseeing and other recreational opportunities, as well as water sources conservation of forest, protection of soil, increase of fertility and of microclimate improvement efficiency, production of oxygen and absorption of carbon dioxide, biodiversity, etc, are of forest environmental utilization values which are the scope of the current measurement of environmental value. Selection value refers to the value of forest resources available for future use. Existence value means that there is no need to define the future use of the forest, and its inherent is value. Heritage value is the cost that the present generation voluntarily pays to save the forest environmental resources and the public welfare which they provide to future generations. Selection value, existence value and heritage value have not been included in the current measurement system because of complexity and difficulty

3. Research and development issues in marketization of forest environmental resources

3.1 Value evaluation of forest environmental resources

The public benefit provided by the protection benefits, scenic benefits and other benefits of the forest environmental resources is the typical externality and has no market value. In the value evaluation, we should consider not only the existence value, but also the utility value, that is the indirect value of

environmental resources providing to nature and society. With the promoting of environment awareness, the implementation of sustainable development strategy, the establishment of compensation system for forest ecological benefits, forest environmental resources evaluation will get more and more attention in the future. In the assessment methods used for forest environmental resources, measurement technology and method of environment benefit are of the most important, should be scientific and reasonable, easy to operate. The resource assessment must be reasonable, fair and objective, in accord with local economical development, be usually highly authoritative and theoretical.

3.1.1 Review of foreign studies

The research on forest environmental resource evaluation is attracting more and more people's attention. Over the years, remarkable progress has been made in this field. Some countries such as the United States, Canada, Russia, Germany, Japan and so on have paid great attention to the value of forest environmental resources. A special discussion was made on how to conduct quantitative research on biodiversity in a conference organized by the International Scientific Joint Environmental Committee in 1991. The book “Nature Service: Societal Dependence on Natural Ecosystem” edited by Daily in 1997 introduced the concept of ecosystem services, a brief history of research, service value assessment, service functions of different biological systems, and regional ecosystem service functions. Costanza and other 12 American scientists estimated the value of natural capital and service function of global ecosystem. Odium provided a new theoretical perspective in quality resources and value measurement of environmental resources. Then, it is the basis of the evaluation today.

3.1.2 Review of domestic studies

The accounting of forest environmental resources in China began in the late 1980s. The series of articles translated and written by Li Jinchang and others have aroused people's attention to resource accounting and promoted the study of resource accounting. At the same time, many scholars had studied the environmental value of forest resources from the perspective of economic losses caused by environmental damage. In this field, Guo Xiaomin and Xu Songling studied the economic loss caused by environmental destruction, which included the the value of forest environmental resources. In 1993, Kong Fanwen systematically studied forest resource accounting including environmental value for the first time, and formed the overall framework of China's forest resource accounting research. Hou Yuanzhao and others also conducted a second comprehensive assessment of China's forest resources in 1994, which included ecological service values of three types: water conservation, wind protection and sand fixation, air purification. Li Jinchang published "Ecological Value Theory" in 1998, summarizing the theories and methods for measuring the invisible ecological value of forests, which indicated that China's forest resource accounting had gradually shifted from accounting of physical assets to intangible ecological value accounting, and accounting method from simple estimation to scientific method

3.1.3 Studies in evaluation methods

As the result of the diversity of forest environmental resources, the evaluation method system is different. The evaluation principle of forest environmental value is not alike in different national conditions. Countries should determine reasonable evaluation methods according to their own conditions. Generally speaking, there are two kinds of evaluation methods: substitute market and simulated market method. Substitute market method uses "shadow price" and "consumer surplus" to assess the economic value of environment. Specific methods include: cost expenditure method, market value method, opportunity cost method, travel expense method, etc. Simulated market method evaluates economic value of environment by means of willingness to pay (WTP) and net willingness to pay (NWTP).The primary method is contingent value method (CVM), that is from the perspective of consumers, under a series of assumptions, suppose that there are some kind of "public goods" and exists market exchange, we can get consumers' willingness to pay (WTP) or net willingness to pay for

the "public goods" through investigation, inquiry, questionnaire, bidding and other ways. Integrating all the net consumer willingness to pay and willingness to pay, commodity value of environment can be assessed.

3.2 Property right of forest environment resources and assets

3.2.1 Clarity of property right——Premise of effective market allocation of forest environmental resources

Microeconomics has proved that the equilibrium price formed by equal competition under the market system can accomplish the optimal allocation of resources. The clarity of property rights is a necessary prerequisite for effective allocation of resource markets. It is believed that goods exchange in the markets is actually the property rights exchange in property economics. Right is often attached to a kind of tangible goods or services, because what is exchanged in the market is the property right of resources, if the property right of resources is not defined clearly, it will inevitably affect the market price of resources. The ambiguity, non-specificity, and non-excludability of forest environmental resource property rights have led to a serious deviation between market prices and relative prices, which result in the deviation from cost and income, the rights and obligations, the behavior and the results in the production and consumption of forest environmental resources, and it is the cause of environmental deterioration. Clearly property rights and property rights trading are the important ways to correct the deviation of the price of the forest environmental resource market from the relative price, thereby internalizing the external costs.

3.2.2 Definition of property right of forest environmental resources

From the object of property right, the property right of forest resource should include the property right of forest environment resource besides the property right of forest land resource and forest resource. Based on the relationship analysis of property rights, it is usually difficult to define the property right of forest environmental resources, and it is hard to make profits, the result is that most of environmental resources are often use free in the actual economic life. If we fail to define the property right of forest environment timely, the interests of property owners will be damaged, and the forest environmental resources will be abused and destroyed. Many scholars have made beneficial attempts in this field, but have not yet achieved operable results

3.2.3 Property right compensation for forest environmental resources

Compensation for the property rights of forest environmental resources is a necessary link for the sustainability of social reproduction and natural reproduction, which can conduce to realize the value of forest environmental resources property rights, safeguard rights and interests of property owners. Some scholars have proposed four major compensation approaches: (1)Counterpart compensation, namely the beneficiaries of external economy and resource abusers pay compensation to those who are not beneficial from the resource protectors, or those whose interest was damaged by external diseconomy; (2) Government compensation, governments make overall compensation by using financial leverage, tax collection, transferring payment or financial budget to meet the need of value compensation; (3) Market alternative compensation. Governments should develop comprehensive accounting methods and assets appraisal system for resources, regulate appropriate resources depreciation rate and basic resources tax, the problems of resource pricing and compensation will be solved by market; (4) internalization of the external economy

3.3 Green GDP: the core index of government principal-agent performance to promote forest environmental resource cultivation

GDP is the core index appraising economic growth, governments pay great attention to it. Because

GDP is the key to performance appraisal for local development, governments try their best to pursuit local economic growth, and without measuring the cost of the environment and resources, resulting in serious environmental pollution and resource abuse. Theoretically, the performance appraisal should include employment rate, the minimum living guarantee rate, Gini coefficient reflecting the difference of income distribution, environmental and resource indicators. Now, "environmental responsibility of officials" has become a global trend, which can appraise government performance in the general. In the future, in order to unify economic growth with environmental protection, it is necessary to study and adopt the measure of green GDP, the environmental cost must be deducted from the value of growth, and form a more comprehensive standard to measure and select government officials.

In 1971, the Massachusetts institute of technology first proposed the "ecological requirements index" (ERI), which attempted to use the indicator to quantify the corresponding relationship between economic growth and resource environmental pressure. In 1972, American scholars, James Tobin and William Nordhaus proposed the net Economic welfare index, in which the social costs of economic behaviors such as pollution and traffic congestion were deducted from the GDP. In 1973, Japanese government put forward the "Net National Welfare" index to deduct the improvement cost of environmental pollution from the national income. In the past 30 years, some research institutions in China, such as the Development Research Center of the State Council, Chinese Academy of Sciences, Peking University and so on, have carried out research on the theory of green GDP accounting, and have got some achievements. However, on the issue of green GDP accounting, both foreign and domestic researchers have not reached agreement.

3.4 Financing and investment of forest environmental resources cultivation

Forest environment resources are social products and services to meet public needs, have non-competitive and non-exclusive characteristics. In addition, coupled with long cycle of forest environmental resource cultivation, affected by natural factors, uncertainty investing risk, dual attributes of commodity value and ecological value, the cultivation of forest resources must face a long period of capital occupation, slow capital movement, a long repayment period and a large amount of risk reserve. For creditors, especially in the unpredictable market economy, it is very difficult to foresee the economic benefits change after 10 years during the long period of forest resource management，the creditor has more uncertainty in the returns on investment and the prediction of market risk. Capital appreciation requires quickly capital movement and high profit, it is the main reasons why forest resources cultivation lack attraction to social capital and credit capital. In fact, the funds from the forest resource circulation often do not return to the forestry again, which to some extent proves the poor capacity of attracting capital in forest cultivation industry. In this field, many scholars have done a lot of relevant research and exploration work, such as using pawn method, setting up funds, financing in the bond and stock markets, however the problems have not been able to solve well yet. Western developed countries have attempted to use market mechanism to raising ecological fund, the market model include carbon trade, biodiversity trading and mutual repayment of environmental debt etc, which provide many ways to marketize forest environmental assets.

3.5 Policy system of the marketization of forest environmental resources

The property right of forest resources is the basic right of a country, its allocation has always been a issue attracting people, s attention. However, for a long time, China has failed to solve a series of major problems, such as unclear property of forest resources, random change of real right, inefficient market allocation and so on, which seriously restrict the sustainable development of the forest resources in China. The property right allocation of foreign forest resources is divided into state-owned and private forest. State-owned forests are managed by granting agencies or private. Private forests are operated by market rules

3.6 Forest carbon sequestration market.

3.6.1 The establishment of the framework of forest carbon sequestration market

In order to seek effective measures to mitigate the global warming process, in June 1992, the United Nations conference on environment and development was held in Rio de Janeiro, Brazil, which adopted the United Nations Framework Convention on climate change (UNFCCC). In December 1997, "Kyoto Protocol" was adopted, and “Joint Implement (JI)”, “Clean Development Mechanism (CDM)” and “Emission Trade (ET)” three model were put forward. Forestations, reforestation and other forestry activities have been incorporated into the CDM. All countries are encouraged to offset carbon dioxide emissions from industry by greening and reforestation. It means that developed countries can offset some of their greenhouse gas emission in the first commitment period, by implementing forestry carbon sequestration project in the developing countries. International negotiations on the Kyoto protocol have undoubtedly reduced the uncertainty of forest carbon transactions and promoted the trade and market development of forest carbon sequestration projects.

United Nations conference on climate change held on Copenhagen in December 2009, further confirmed the importance of reducing carbon emissions from deforestation and forest degradation (REDD), the aim was to remove greenhouse gases by forests. The Paris Agreement further promoted the development of the carbon market and provided beneficial conditions for the carbon sequestration project trade.

In short, the UN Framework Convention on Climate Change and the Kyoto Protocol form the legal basis and theoretical framework of the international greenhouse gas emissions trading market.

3.6.2 The development of the forest carbon sequestration market

After more than 10 years development, Forest carbon sequestration trade has evolved from theoretical concept to market tool to mitigate global climate change, from initial spontaneous transactions to more complex market mechanism. However, current forest carbon sequestration market is still a loose, imperfect market, market functions have not operated well, and is a huge potential market. According the function of price signals and transaction cost, market price changes in carbon sequestration are mainly related to each different transaction, rather than determined by supply and demand. Thus, the investment of these projects makes the carbon credit lack liquidity, they are valuable only to investors themselves, but not to other organizations. The buyers of carbon credit provide whole project capital and participate in all process, so it is difficult to reflect the market price regulating function.

3.6.3 The study on forest carbon sequestration market

The research of forestry carbon sequestration in foreign countries is mainly focus on forest and its carbon sink, reduction cost of emission, measurement and monitoring methods. Because most of developed countries are the member under the Kyoto Protocol, they early studied global warming, energy saving and emission reduction, and the research on carbon sequestration market is relatively comprehensive.

Study on forestry carbon sequestration in China mainly concentrated in sequestration potential, technical standard system, forestry carbon sequestration market, trading legislation issues and project development, etc. The research achievements have been increasing in quantity, and provided important information, reference and methods. However, not all of forest sequestration can be traded, only the portion of carbon sinks generated by sequestration project can enter the market to get profits. In addition, because of the imperfect methodologies and the lack of detailed and accurate discussion on the trading mechanism of forestry carbon sequestration market in China, the research on the framework and operating mechanism of China's forestry carbon sequestration market has not made a breakthrough

4. Conclusion and Prospect

4.1 Evaluation of forest environmental resources marketization

Some international organizations such as the Organization for International Economic Cooperation and Development, the International Monetary Fund, the European Community, the Nordic Economic Commission and Canada, Sweden, France, Germany, Japan, Norway, the Netherlands, Italy, Spain and other countries are committed to research and exploration of the theoretical framework and implementation of the accounting of environmental resources. Experts in China have made many beneficial explorations, but most of them only focus on theoretical research and value evaluation of forest environmental resources. Research results have showed the following characteristics: focusing on the externality of public products, forest public welfare, the necessity and feasibility of compensation system, the complexity and principle of compensation and so on, but less research on the key compensation mechanism. Some experts have made a preliminary study on the market of natural resources, but there are few studies on the marketization of forest environmental resources, it is urgent to study the marketization of forest environmental resources.After years of research, people have been aware of the value of forest environmental resources, and have achieved certain research results, but the system is not perfect, far behind the needs of practice.

Experts at home and abroad have carried the research on value measurement of forest environmental resources and have achieved fruitful research results. However, the different researchers are based on different economics foundation, resulting in confusion in terms of concept definition, measurement method, application field and so on. Some metrological models are far-fetched and less persuasive, and their measurement results are often sensational

4.2 Prospect of forest environmental resources marketization

The dramatic decrease of forest resources and the continuous deterioration of the environment have become the common challenges facing mankind. The problem how to design and implement the market through a good market mechanism to realize the efficient allocation of the forest environmental resources will still be a major concern of governments, business circles, academia and even the public in the new century. There is no doubt that future research will focus on the marketization of forest environmental resources, emphasize the rationality and operability of the research results. Future research focuses will be as following: (1) Evaluation of forest environmental resource value; (2) The definition of forest environmental resources property rights; (3) The transaction and value realization of forest environmental resources property rights, including the domestic and foreign market mechanism. According to the trend of market-oriented development of forest environmental resources, with the improvement and ease operation of market related mechanisms, related industries such as forest environmental resources cultivation will develop widely and become a huge industrial chain, form a very active and huge market for forest environmental resources.

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