Conference Title

Research Advances and Trends in Ecosystem Services and Evaluation in China

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Abstract

Ecosystem services and value evaluation have become research focus of ecology, ecological economics, environmental economics and other frontier fields; moreover, it is a national economic accounting and an important basis for market operations. At present, studies of ecosystem services falls far from what the nation needs. This paper summarizes progress of Chinese ecosystem services and valuation research during the past decade. We discussed some key issues and future directions in ecosystem services function. An aim of our paper is to provide ideas for the development of ecosystem services and evaluation research in China, and support a more detailed reference for government.

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1. Introduction

The concept of ecosystem services first appeared in 1960s. Ecologists have tried to analyze the different ecosystem services and their value since 1980s[1,2,3], Peters et al. [4] analyzed the Brazilian Amazon rain forest ecosystem services and provided some propositions for using tropical rain forests in the region. Pearce et al. [5] discussed the meaning and method of the economic valuation of biological resources, and enumerated a number of tropical rain forests, wetlands, plateau and marine ecosystem services and their value. Pimentel et al. [6] collected research results of relevant international natural capital and ecosystem service evaluation, and compared the economic value of biodiversity of the United States with the world's biological diversity. In a very real sense, study on ecosystem services and evaluation began in 1997 when Costanza [7] published an article in the Nature. He estimated value of ecosystem services about the global biosphere for the first time. Once his result was published, it drew widespread international attentions and caused an upsurge of research of ecosystem services and evaluation.

The article is on the research progress of ecosystem services' function and evaluation in China, it will discuss trends of research through temporal series, proposal blind area of research through spatial span, analyze index system and methods of evaluation on ecosystem services' function by all published articles up to now in order to establish a fairly standard index system and methods for following researches, and promote healthy development of research on the ecosystem services function.

1 Chinese Ecosystem Research services

People have little awareness of ecosystem services and their importance, have damaged ecosystem obviously by excessive production and obtainment, then threat to the environment for survival. Study on ecosystem service, which is a fresh field of ecology in recent years and only more than ten years in China. But it has become hot frontier in world currently [12].

Daily [13] defined ecosystem services as the ecological processes for maintenance of natural environment conditions and functions for survival of human. Chinese scholars, Ouyang & Wang [14] analyzed connotation of ecosystem services function, and believed it not only provide mankind with food, medicine and other living materials, but also maintain global ecological support systems, and format the necessary environment conditions for survival of human. The meanings of ecosystem services consist of production of organic matter, generation and maintenance of biological diversity, regulation of climate, storage and recycling of nutrient, renewal and maintenance of soil fertility, purification of environment and the degradation of toxic substances, propagation of plant pollen and the spread of seeds, control of pest, mitigation of natural disasters and so on.

![Figure 1 Amount of papers about different ecosystem styles service and value evaluations](image)

To a certain extent, the generally accepted concept of ecosystem services and the proposal of their connotation guided development of this field in China. Based on the theory, lots of researches were started by scholars after this. There is no denying that a large part of papers about the ecosystem services assessment, as shown in Figure 1. We can see many researches of the forest, wetland, grassland, farmland and marine ecosystem services, while the papers about valuation of ecosystem services are the greater proportion of all, and the order of ratio is other ecosystem, forest ecosystem, wetland ecosystem, steppe
ecosystem, agriculture ecosystem and marine ecosystem. Moreover, other ecosystem studies are the same circumstance as Figure 1, we can see from Figure 2, a total of 23 species of other ecosystem types, and only eight ecosystem types have no papers about evaluation of ecosystem services. The number of researches other ecosystem services are also low, and ignoring the importance of intrinsic mechanism of ecosystem services.

![Figure 2 Amount of papers about different ecosystem styles service and value evaluations (Other ecosystem styles)](image)

According to the study regions in Figure 3 showed that, we found that study regions mainly are concentrated in eastern and southern of China, and very few studies in other regions.

![Figure 3 Distributions of survey region of different ecosystem styles service and value evaluations](image)

2 Research trends in future

2.1 To strengthen mechanistic study on ecosystem

Researches on ecosystem cannot be concentrated in static analysis of forests services value on certain areas or types. In fact, an ecosystem of the same type included different space-time elements, large
differences are generated in ecosystem services of different types. Therefore, ecological systems need to be dynamically analyzed, compared and evaluated spatially and temporally, which is also a difficult and important research of ecosystem services.

At the same time, it is necessary to strengthen basic research, such as the contribution of respiration of soil microorganism to C sources in micro-scale and leguminous rhizobia to azotification, application of RS and GIS technology to research ecological services dynamics and spatial heterogeneity in large-scale, multiple scale will be research a focus of future, which is also an inevitable way to science. At present, however, there are less basic research focuses on China's ecosystem services. Most of the reports assess value of ecosystem services directly (Figure 4).

Cross-application of remote sensing technology, geo-information technology, economics and management science provides better technical and theoretical support for obtaining quantitative, real-time or on-site information, the evaluating ecosystems services more accurately, which will be a better solution to the lack of dynamic and spatial heterogeneity in the field of ecosystem services, and will also be a good foundation for revealing deep-seated problems of ecosystem services, such as its formation mechanism.

As continuous development of studies on ecosystem services, it is imminent to strengthen studies on changes of various ecosystem services under the impact of human activities. The differences are mainly embodied in the manner and extent, including human disturbance (change of operation mode, planting patterns, etc.) and natural disturbance (fire or natural disasters, rainfall distribution, etc.) in manner. Therefore, comparative analysis on response mechanism of ecosystem services under the influence of interference will be expandable and in-depth research directions in future, and should be strengthened because it is one of research blind spots now.

2.2 To improve ecosystem services and evaluation system of value

So far, there are been no widely accepted evaluation systems and methods of ecosystem services yet. Thus it is a priority to establish a unified and mature index system of value of ecosystem service.

It is necessary to establish a logical framework of evaluation of grassland ecosystem services in line with our social and economic characteristics, in order to enhance credibility of evaluation, different index system of evaluation and methods of forest ecosystem services resulted in difficulties comparing and analyzing the differences of forest ecosystem services in the same area. The implementation of new norms will help to improve this phenomenon.

Classification of ecosystem services lacks of uniform standards, there is no research data of some ecosystem value services (such as farmland ecosystem, desert ecosystem, glacier ecosystems, etc.), and no relevant research results in partial functions and service value of some ecosystem. It is very difficult to
To quantify ecosystem structure, function, process, formation mechanism, and it is necessary to use methods of evaluation of service function according to different ecosystems, different regions and different developmental characteristics of social and economic.

From the progress of international ecosystem services and the requirements of ecosystem services by ecological construction and natural conservation in China, research of ecosystem services in China will base on long-term orientation research of ecosystem from now on in order to provide scientific basis for sustainable management of ecosystem services and the establishment of GDP accounting system (Green GDP) in China.

To improve evaluation theory and methods of ecosystem services value
Measurement of ecosystem services value could have an impact on economic activity and then play a greater role by better integration with economics to reveal the links between ecological and economic processes and their dynamic change. In the future, we should modify the current or clockwise static description models and build regional or global dynamic for links between ecology and economic in order to better understand the complex dynamics in physical and biological processes of ecosystem and effects of these processes on human welfare.

The research orientation will be shifted from stock measurement to marginal change in quantity and quality of value of ecosystem services and its impact on losses of human welfare. Quantitative methods of the unit price of ecosystem will be unified, data will be standardized (including specification of how to deal with double counting, scaling issues and assessment methods selection, Calibration of spatial heterogeneity and regional economic differences by selecting unified parameter, etc.), and economic and technical methodology of ecosystem services evaluation will be improved.

The results often can not accord with actual value because of complexly specific issues in practical work, such as invalid market, vacant price, etc. According to characteristics of wetland ecosystems, appropriate accounting methods will be taken and integrated conditions will be notably applied to calculation.

There are large differences among ecosystem services value of different regions because of socio-economic and natural region discrepancy. Calibration of regional differences, and certainty of evaluation methods of service function or economic value according to different region and developmental characteristics of social economic will become research focuses in future, which includes more precise access to natural, social, and economic data in specific areas, means of combination between experimental observation and system simulation or natural and social science, calibration of regional differences by physical and biological (topography, soil, vegetation)or socio-economic attribute data (traffic, economic level).

Meanwhile, the legislation of evaluation of ecosystem services will be developed or increased in order to ensure the legitimacy and effective result of evaluation.

Finally, since ecosystem services are not only a natural science but also a social science, for the researcher, the requirement is proposed that scholars of ecosystem services should be with multi-disciplinary background, such as ecology and economics, etc.

Method: The data of this article are derived from CNKI http://www.cnki.net, deadline 2010-9-19, and key word is ecosystem services, sub-keywords are nomenclatures of a variety of ecosystem types, 457 articles are searched.
References


