

Literature review on the Chinese ecosystem management research

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If we recapitulate ecosystem management and biodiversity researches carried out since 2003 in China, it can be seen that they are mainly concentrated in the following areas, namely, integrated ecosystem management, ecological compensation mechanism, ecosystem services, ecological security and ecological economy.

I. Integrated ecosystem management

Integrated ecosystem management is a set of new management ideas and methods. Currently, both governmental bodies and academic circles have different understanding of the term. Academics have also examined, from various angles, its theories and empirical applications, hence bestowing plentiful new interpretations on the content and application of this notion.

In recent years, integrated ecosystem management has developed both in theory and practice. Wang Rusong (2003) thinks that management issues are, theoretically speaking, at the crux of China's environmental pollution and ecological damage. These issues include standstill to, or depletion of resource metabolism in terms of time and space, disjunction and conjunction of system-coupling in terms of structural and functional relations, conflicts and disorder in social behaviour vis-à-vis economic-ecological management. To resolve these problems, the author puts forward, from a theoretical angle, a complex ecosystem management that combines regional resources, environment and economy. He then brings forward the notion of industrial eco-management, which means turning environmental input into ecological output, thus enhancing equilibrium and coordinated development between ecological and economic assets, ecological and industrial infrastructure, as well as ecosystem and social service functions.

Cai Shouqiu (2006) tackles from the project background of integrated ecosystem management and investigates its concept, content, characteristics and roles from the perspective of environmental protection law. He points out that the integrated ecosystem management is not only a fresh concept and a new principle, but also a new type of management strategy, means and method. It carries considerable theoretical and empirical significance for the entire environmental resource management, construction of a related legal framework and development of environmental protection laws. It also carries long-term theoretical significance and important utilities in terms of directing, enhancing and reinforcing the work made on environmental resource management and its related legal framework construction, in particular, the planning, management and legal framework building in guidance and promotion of combating land degradation in six western provinces (or regions) in China.

Meanwhile, a group of researchers have also looked into the concrete application of integrated ecosystem management in different ecosystems. Wang Wenjie (2007) proposes the basic notion of adapted regional ecosystem management and outlines its theoretical framework. To support this theory, he has used the example of Xiaojian river basin in the Three Gorges reservoir area and carried out a detailed analysis on features of its ecological landscape and threats on the regional ecology. On this basis, he suggests to prioritise the aquatic ecosystem safety and make it the main objective, and within this framework, to identify various ecosystem resilience in the basin, as well as to study the adapted cycles in the ecosystem. Drawing on the features of each system resilience,

the author then proposes concrete adapted management methods and models.

Lin Qun et al (2007) apply the concept of ecosystem management on forest management, put forward and discuss the notion and significance of such a management. They delineate the main research directions and content of current forest ecosystem management from three distinct angles, namely, that from ecology, economics and sociology. They point out that forest ecosystem management is in fact the management of its resources, whose domain of application should extend from natural sciences to culture and society. As a result, more research should be done on forest ecosystem management mode that is adapted to China's current socio-economic development, according to the specific situations of the country and its forests.

Chinese scholars also apply the ecosystem approach to the management of concrete ecosystem elements and raise constructive viewpoints. Dong Ningping (2006) applies this approach to wetland management, and proposes twelve principles and five guiding steps in wetland resource management. Li Zhou and Bao Xiaobin (2003) also use this integrated ecosystem management concept to analyse water use and management in the Tarim basin. Jiang Zehui (2006) studies the integrated ecosystem management of land degradation in western China during the Western Development Process.

II. Ecological compensation mechanism

In the 90's, many Chinese researchers have started exploring and testing the ecological compensation system. To date, they have obtained certain progress in its theory and application. Some ecological compensation project areas start to see ecological effectiveness. On the whole, however, there are many problems between theory and practice, and China's ecological compensation sees difficulty mainly in mechanism implementation such as defining stakeholders' share, compensation implementation, encouragement and supervision. To sum up, these are mechanism issues in ecological compensation. In recent years, many researchers have studied, from various angles, the design and measures of application of such a mechanism.

Wang Jinnan (2006) makes a general summary on several important links in China's ecological compensation mechanism: the government and the market, the central and local government, integrated and unitary platforms, payments for environmental services (PES) and environmental damage compensation (EDC), new and old environmental 'debts', ecological compensation and poverty alleviation, exogenous "blood transfusion" and endogenous "blood generation", upstream and downstream responsibilities, compensation criteria and agreement, and lastly, the link between governmental and social capital. The author suggests that five categories of ecological compensation mechanism should be established in China: first, to establish a financial transfer payment system that favours environmental protection; second, to build a tax system that is 'eco-friendly', to set up ecological compensation policy in major functional regions, to implement an environmental and ecological cost internalisation system, and finally, to establish an ecological compensation mechanism in river basins.

Zhao Jingzhu et al (2006) have carried out studies on ways to improve China's ecological compensation mechanism. He thinks that ecological compensation should be calculated on the basis of ecological services, and compensation standards should be set up and determined according to their material and value flow.

The study of Fan Xiaoshan et al (2007) have made a step further, elaborating on the ecological compensation mechanism in basic ecological services by carrying out quantitative analysis using set models. A mathematical model is set up to calculate ecological compensation costs based NSE ecosystem service function.

Besides, some researchers have also studied ecological compensation of specific ecosystems, such as the major forest ecosystem ecological compensation framework set up by Li Wenhua et al (2007).

III. Ecosystem services

Functions of the ecosystem have always been the main focus of ecology. It mainly reflects the natural attributes of ecosystems, while ecosystem services stress the usage of their functions by Man. With an increasing demand of the current application of economic instruments to adjust natural resources allocation, it is important to assess the value of ecosystem services in a correct and scientific way. This will then form the basis for an effective ecosystem management and a sound biodiversity protection policy implementation. In the past few years, researchers in China have carried out huge amount of work in ecosystem services and its value assessment, laying the foundation for ecosystem evaluation operation.

Li Wenhua (2006) once pointed out that studies on ecosystem services is the core of ecosystem evaluation. More studies should be done on China's ecosystem service assessment, whose execution is almost imperative.

Ouyang Zhiyun et al (2004) have carried out studies on aquatic ecosystem services and its indirect values, bringing forward a preliminary assessment of the merit of this approach to China's aquatic ecosystem in continental areas. This is also the first time for China's scholars to carry out ecosystem service value assessment in certain environmental medium.

In this domain, many Chinese scholars have carried out further researches. Liu Zigang (2006) has established a market mechanism of wetland ecosystem services, basing on studies on values of ecosystem services. Dong Jiahua et al (2006) have adopted indirect market evaluation methods such as the replacement cost method, cost control and shadow pricing, to assess the consumption and impact of an artificial ecosystem on ecosystem services. Drawing on the empirical example of Taicang city in Jiangsu province, researchers have looked into the annual varied trends of supply and consumption of local ecosystem services during 1996 and 2003. They have then analysed Taicang city's ecosystem service equilibrium situation.

IV. Ecological economy

Current studies on ecological economy in China mainly target at natural reserves. As these reserves are key protection areas and a hub of biodiversity, their management and development have become the focus of many a research. Secondly, peripheral regions of these reserves are generally less economically developed, it is therefore important to link ecosystem protection in natural reserves with the economical development in their periphery. In this area, western scholars have often applied, in their study, approaches such as Integrated Conservation and Development Project (ICDP) and 'participative management' in natural reserves. In recent years, more and more Chinese researchers have also adopted these approaches in their study on concrete issues related to protection areas.

Cheng Qin (2005) analyses the Yunnan Upland Ecosystems Project (YUEP), a demonstration project which investigates upland ecosystems and biodiversity conservation in Yunnan Province, China. Since its inception, this project has introduced and promoted the idea and method of participation, and has explored possibilities of resource sharing having communal villagers as mainstay, biodiversity protection and modes of monitoring by villagers. Communal management and organisation members are elected on a democratic basis, their role is to manage community

protection and development funds. This fund follows the example of the micro-credit system in Bengali rural banks, and loan money to rural households in the project areas to help boost farmers' income. The interests collected will finance activities such as communal management and organisation as well as villagers' monitor of biodiversity, which makes the project all the more sustainable.

Ouyang Zhiyuan (2004) looks into current studies on the ibis (*nipponia nippon*) protection zones and analysis of problems encountered related to their existence, and suggests the possibility of combining ecological protection and eco-tourism when developing protection zones. He also highlights certain noteworthy issues arisen during the development process and correlations that should be dealt with care.

V. Other issues

Apart from certain big research hotspots in this domain, many new research directions have also emerged, such as ecological security, eco-regions and rural ecological problems etc.

Wang Rusong (2007) is the first researcher to study the notion of 'eco-region', taken in account the current zest for building an harmonious society. The term 'eco-region' is a short term to designate an administrative unit that is planned, built and managed according to laws of ecology (including natural ecology, economic ecology and human ecology). It refers to the use of ecological economy principle and project method within the ecosystem carrying capacity, to change the production and consumption mode, strategies and management methods. It also refers to the exploitation of all usable, potential resources inside and outside the region, to establish a type of sustainable region that is economically efficient, socially harmonious and ecologically secure. The ecological bases for the building of an eco-region are: consider the environment as essence, economy as usage, ecology as programme, culture as norm. Ecological security, recycling economy and a harmonious society are the three pillars to sustain an eco-region.

In the research field of ecological security, Wang Rusong et Ouyang Zhiyun (2007) start with analysing the common significance, system framework, dynamics mechanism and control theory methods, then explore strategic management and construction methods of regional, rural-urban and population ecological security. They state that the essence of ecological security not only lies in survival stability but also in the support capacity of development. It concerns not only the security of environmental structures but also the soundness of ecological links. Ecological security should not only be assessed by negative aspects such as natural ecological risks and human ecological threats, but should also be assessed by positive aspects in terms of natural ecological services. Not only can ecological security be safeguarded by protection and reconstruction, it can also be reinforced by artificial building.

Lee Wenhua (2004) describes the characteristics of China's ecological agriculture development, its main achievement, existing problems as well as new challenges and opportunities it faces. He also puts forward development strategies for the new-age ecological agriculture.

VI. Summary

The above analyses show that current research on ecosystem management and biodiversity in China have the following characteristics:

1. Research contents are closely related to the current socio-economic development in China. They emphasize on a series of ecological issues brought on by the country's economic development and their possible solutions. For the construction of a harmonious society in China, these researches

carry emblematic and significant interpretation of the relationship between Man and Nature.

2. These researches are mostly concentrated on application and practice levels, and have played an active role in resolving different kinds of problems faced by ecosystems in China.

3. These researches mainly aim to resolve problems arisen during the administrative process related to ecological protection, but do not sufficiently explore the implementation of ecological service value and the process of its commercialisation.

4. Analyses of the coupling 'eco-economic-social system' not only help to efficiently resolve ecological and environmental issues within the regions, they also help resolve development problems between the regions (for instance, between eastern and western China, rural areas and cities), thus providing valuable lessons.

5. In the future, new research directions such as interpretation of ecosystem ownership, value assessment of ecosystem services, larger-scale ecosystem management coordination will be research hotspots for Chinese scholars.

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