

Research on Ecological Compensation Standards for the Xijiang

River Basin in Guangxi Based on Scenario Analysis

Preliminary Plan

1. Background

In May 2016, the General Office of the State Council issued the *Opinions on Improving the Compensation Mechanism for Ecological Protection*, clarifying that by 2020, the diversified compensation mechanism shall be initially established, and an ecological protection compensation system befitting China's national conditions shall be basically established. In December 2016, the Ministry of Finance joined by three other departments jointly issued the *Guiding Opinions on Accelerating the Establishment of a Compensation Mechanism for Horizontal Ecological Protection of the Upstream and Downstream Basins (Opinions)*. The *Opinions* proposes that by 2020, a horizontal ecological protection compensation mechanism will be initially established in cross-provincial river basins that have important drinking water functions and ecological service values, with clear beneficiaries and a strong upstream and downstream compensation wish. For this end, a number of pilot projects will be built to explore the feasibility. The report of the 19th National Congress expressly stated to “perfect the recuperation system of cultivated land, prairies, forests, rivers and lakes and establish a market-oriented and diversified ecological compensation mechanism.”

Xijiang River is located in the upper reaches of the Pearl River Basin and is also the main stream of the Pearl River. It originates from the Maxiong Mountain of the Wumeng Mountain Range, Qujing City, Yunnan Province. Flowing through Guizhou and Guangxi, the 2074.8 kilometers long river meets with Beijiang River in Sanshui District, Foshan City, Guangdong Province. It has a drainage area of 355,000 square kilometers, of which 204,900 square kilometers is in Guangxi Zhuang Autonomous Region, accounting for 57.7% of the entire Xijiang River Basin. To protect the downstream water quality and quantity, the upstream region has made tremendous contributions and sacrifices. Take Guangxi as an example, Guangxi has invested large amounts of manpower, material and financial resources to protect and repair the ecological environment, including investment in water conservation, soil erosion and industrial pollution control, giving up part of its rights to develop economically and socially.

In order to advance work on ecological compensation in the Xijiang River Basin in Guangxi, improve the ecological environment and ensure a coordinated economic and

social development of the upper reaches of the basin (Guangxi) and downstream (Guangdong), it is necessary to provide decision support for the basin eco-environment protection based on scenario analysis-oriented research on the ecological compensation standards of the Xijiang River Basin in Guangxi.

2. Purpose

The Pearl River system that belongs to the Xijiang River Basin is the third largest water system in China. It enjoys a unique ecological environment and unparalleled ecological value, positioning high in China's ecological security. Affected by the values of natural resources, the traditional national economic accounting system does not consider natural resources as cost input and consumption nor does it consider the cost that has to be paid when the environment is damaged. The ecosystem's contribution to economic activities has not been included in the national economic accounting system. This research explores the impact of land use change on the value of ecosystem services under different scenarios by setting changes in land use patterns under different policy environments. From the perspective of ecological building costs and ecological benefits, the paper proposed an ecological compensation standard for the Guangxi Xijiang River Basin in combination with natural geography and socio-economic factors. It provides a scientific basis for the formulation of scientific and rational ecological benefit compensation policies for Guangxi and even the whole country. It also lays a foundation for innovative ecological protection mechanisms.

3. Contents

Changes in land use/coverage must result in changes in the functionality of their original ecosystem services. Based on the accounting of the value of ecosystem services under the current land use/coverage status and combined with different economic and social development scenarios and scenarios of ecological compensation policy selection, the research analyzes and forecasts the eco-system services effect and values caused by changes in land use/coverage under different policy scenarios. With this as basis, establish the ecological compensation framework and standard for the Guangxi Xijiang River Basin.

The research focuses on the following:

(1) Basic research on the current status of land use and research on existing ecological environmental policy

a) Based on data of the status quo of land use in the Xijiang River Basin, combined with data collected from the region by various departments on environmental monitoring, remote sensing, resource survey, long-term meteorological observation as well as on important species, soil, vegetation, land use and socio-economic indicators, the research establishes six major ecosystem databases - freshwater, farmland, forest, ocean, grassland and city.

b) Investigate and collect land use-oriented policies related to eco-environmental,

agricultural, forestry and economic and social development in the Xijiang River Basin. The paper also does supplementary collection of data on soil, climate, hydrology, population, agricultural statistics and socio-economic statistics of the region, serving as a basis for comparison of the current effects of different land use policies.

c) Model the land use change of the Xijiang River Basin from 1995 to 2015, analyzing the temporal and spatial pattern change traits of the Xijiang River Basin, clarifying the relationship between land use types and driving factors.

(2) Scenario-based research on estimation of ecosystem service functions

Scenario analysis is an effective tool to explore risks in existing policy selection. Scenario analysis considers a variety of influencing factors and provides decision-making departments with a more comprehensive and meaningful scientific reference basis from different ways. Since land use change/coverage is highly correlated with the performance of ecosystem services, this research plans to compare and analyze three land use change scenarios. Based on the scenario of 2015, the spatial dynamics of land use change in Guangxi in 2015-2035 is simulated according to the three policy scenarios - as usual, planning and policy optimization. Following this, ecosystem model is used to calculate ecosystem services beneficial to the lower reaches of the Xijiang River Basin (Guangdong), such as changes of water/soil/biodiversity conservation, flood control and carbon sequestration, then prepare ecosystem service accounts for the Xijiang River Basin under different land use change scenarios.

a) As usual scenario: Based on the scenario of 2015, the trend under the basic scenario will continue into the future. When forecasting the baseline scenario, assume that the trend of land use change over the past 20 years (1995-2015) has continued and explore changes in the value of ecosystem services over the next 20 years (2015-2035). With the scenario set, it is possible to provide a benchmark for comparison for the future effects of land use policies.

b) Planning scenario: Planning scenario consider existing development and environmental management plans for all management departments, including major ecosystem planning and land use planning, such as forestry development planning and overall land use planning. Similarly, the economic growth planning of various sectors, some potential ecological protection and the balance of interests of economic growth are also considered.

c) Policy optimization scenario: The development goals of the ecological management and protection sectors such as environmental protection, agriculture, and forestry are realized, and at the same time, the expansion needs of economic and social development are considered, accomplishing the goal to optimize ecosystem service supply. The basis of this scenario is to ensure the sustainable acquisition of ecosystem services under existing management strategies.

(3) Research on calculation of ecological compensation standards

In view of the above scenarios, the calculation of the management cost of the ecosystem in the upstream area mainly includes pollution control costs (in life pollution/aquaculture pollution/plantation pollution), ecological protection projects (water/water source conservation/integrated treatment of rivers, water/soil restoration cost, environmental supervision capacity building). Combined with the results of ecosystem accounts, an ecological compensation framework system is prepared to calculate the ecological compensation standards between the upper and lower reaches of the Xijiang River Basin, which provides decision-making support for the ecological environment protection for the Xijiang River Basin.

4. Methodologies and Technical Process

(1) Based on the social survey method, statistical analysis, GIS and remote sensing combined research methods, Xijiang River Basin's social economic, ecological environment and basin spatial databases are constructed.

(2) Using the model simulation method (such as CLUE model) to analyze the spatial pattern of land use in the Xijiang River Basin under different scenarios, and simulate its future dynamics under the set scenario.

(3) Using the account-preparing method to evaluate the ecosystem services of the Xijiang River Basin.

(4) Using the scenario analysis method to construct different compensation scenarios to measure the ecological compensation standards between the upstream and downstream regions of the Xijiang River Basin.

The research technical process is as follows:

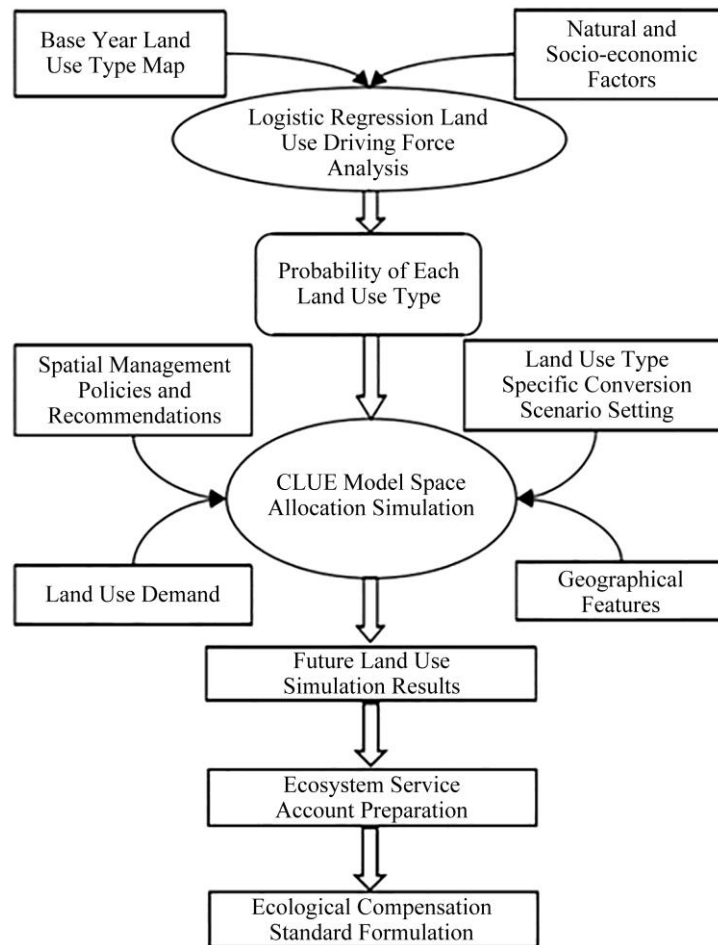


Figure 1 Technology Process

5. Schedule

Complete the research and draft of report by the end of October 2019.

6. Expected Result

A Report on Ecological Compensation Standards for the Xijiang River Basin in Guangxi Based on Scenario Analysis

7. Other

Nanning Normal University has a provincial key laboratory of earth surface process and intelligent simulation, and a coordinated innovation center for ecological environment and integrated development of the Xijiang River Basin in Guangxi. These two facilities fit well with this work. The next step is to collaborate with Nanning Normal University on this work.

Appendix: Materials related to the ecological compensation research for the Xijiang River Basin in Guangxi

In August 2014, the People's Government of Guangxi Zhuang Autonomous Region and the People's Government of Guangdong Province co-signed the *Agreement on the Cooperation of Cross-border Water Environment Protection in the Jiuzhou River Basin*. In March 2015, the two parties jointly introduced the *Jiuzhou River Basin Water Environment Compensation Implementation Plan*. In September 2015, the Jiuzhou River Basin was listed as one of the three pilot projects of the national cross-regional ecological compensation in the *Overall Plan for the Reform of Ecological Civilization System* promulgated by the State Council. On March 21, 2016, under the guidance of the Ministry of Environmental Protection and the Ministry of Finance, Guangxi and Guangdong signed the *Agreement on Horizontal Ecological Compensation for the Upstream and Downstream of the Jiuzhou River Basin* (2015-2017, referred to as the *Agreement*). It marks the pace of horizontal ecological compensation between the two. The *Agreement* stipulates that Guangxi and Guangdong jointly set up the Jiuzhou River Basin Water Environment Compensation Fund, each contributing RMB 300 million. Central Finance will allocate RMB 300 million to Guangxi every year if it passes the annual assessment. The assessment target is the cross-border stone section in Jiuzhou River. The standard to reach is an annual average of Grade III water quality.

In June 2018, the Ecological Environment Department of Guangxi Zhuang Autonomous Region reached out to the Chinese Research Academy of Environmental Sciences, the Scientific Research Academy of Guangxi Environmental Protection and Renmin University of China for a study on the ecological compensation of the Jiuzhou River Basin. Based on accounting results from pollution control, ecological protection and economic development and opportunity cost, nine kinds of Jiuzhou River Basin ecological compensation scenarios (Table 1), ecological compensation plan and compensation mode are formulated.

Table 1 Scenario Design on the Jiuzhou River Basin Ecological Compensation

Solutions	Scenario Design
Solution 1	Recent pollution control projects, recent ecological protection projects, taking into account minimum living security and employment training.
Solution 2	Recent pollution control projects, recent ecological protection projects, opportunity costs for livestock and poultry farming, opportunity costs for comparing with Zhanjiang City in Guangdong, taking into account minimum living security and employment training.
Solution 3	Recent pollution control projects, recent ecological protection projects, opportunity costs for livestock and poultry farming, opportunity costs for comparing with the country, taking into account minimum living

	security and employment training.
Solution 4	Recent and long-term pollution control projects, recent ecological protection projects, taking into account minimum living security, employment training and industrial support.
Solution 5	Recent and long-term pollution control projects, recent ecological protection projects, opportunity costs for livestock and poultry farming, opportunity costs for comparing with Zhanjiang City in Guangdong, taking into account minimum living security, employment training and industrial support.
Solution 6	Recent and long-term pollution control projects, recent ecological protection projects, opportunity costs for livestock and poultry farming, opportunity costs for comparing with the country, taking into account minimum living security, employment training and industrial support.
Solution 7	Recent and long-term pollution control projects, recent and long-term ecological protection projects, taking into account minimum living security, employment training, industrial support and basic capacity building.
Solution 8	Recent and long-term pollution control projects, recent and long-term ecological protection projects, opportunity costs for livestock and poultry farming, opportunity costs for comparing with Zhanjiang City in Guangdong, taking into account minimum living security, employment training, industrial support and basic capacity building.
Solution 9	Recent and long-term pollution control projects, recent and long-term ecological protection projects, opportunity costs for livestock and poultry farming, opportunity costs for comparing with the country, taking into account minimum living security, employment training, industrial support and basic capacity building.