Design of an Ecological Immigrant Compensation Program for China’s Nature Reserves

Xiao-yan WEI
Institute of Panchen Lama
Qinghai Normal University
Xining, China
e-mail: weixiaoyan4477@163.com

Feng-gui LIU
Key Laboratory of Qinghai-Tibetan Plateau Resources and Environment
Qinghai Normal University
Xining, China
e-mail: liufenggui@igsnrr.ac.cn

Xu-feng MAO*
Key Laboratory of Qinghai-Tibetan Plateau Resources and Environment
Qinghai Normal University, Xining, China
e-mail: maoxufeng@yeah.net

Abstract—Reasonable ecological compensation is about efficiency, equity and sustainable development of nature reserves in China. A large quantity of cases on ecological migrant’s compensation in various nature reserves of China was utilized to summarize the main program, contents and methods of ecological compensation of nature reserves in China. Some issues in different compensation stages were discussed to get a more scientific design. The current study may provide new ideas for ecological compensation for the ecological compensation with nature reserves in China.

Keywords—Nature reserves; Ecological compensation; Program design

I. INTRODUCTION

Nature reserves of different types provide a guarantee for ecological and environmental safety[1]. However, ecological immigrant compensation for the construction of nature reserves in China has been crippled by a lack of theoretical and practical guidance and ecological compensation is a troublesome issue at present[2].

Ecological immigrant compensation of the nature reserves has its unique features as compared with other immigration policies[3]: (1) Difficulty in clearly defining the participants receiving compensation; (2) Greatly diverse and unquantifiable loss and hence the compensation for the immigrants; (3) Long cycle of compensation; (4) great impact from local culture, custom and religious belief. Thus to devise an ecological immigrant compensation system reasonably and to ensure the sustainable development of the nature reserves, it is important to learn from the experiences of other compensation and make innovations.

In the absence of an established set of standards and procedures, ecological compensation contains high arbitrariness. Based on a summary of the ecological compensation cases of China’s nature reserves, we come up with the differences and similarities as compared with other types of ecological compensation. We tentatively proposed a design of ecological immigrant compensation system of the nature reserves so as to provide inspirations for the ecological compensation practice.

II. OVERALL DESIGN OF AN ECOLOGICAL IMMIGRANT COMPENSATION SYSTEM OF THE NATURE RESERVES

Nature reserves may differ greatly in the ecosystem, which includes forest, desert and wetland. Given to large disparities in the natural and social environment, there is rarely a unified set of standards and procedures of ecological compensation[4]. Whatever the ecosystem, ecological compensation for the immigrants should consider the following aspects: firstly, contributions made by the immigrants, and secondly, immigrants’ loss. Immigrants’ relocation is of high ecosystem service value and facilitates the ecosystem restoration. Loss, on the part of the immigrants, mainly refers to the loss of fixed assets, opportunity cost and social capital. However, the actual standards and procedures of compensation depend on the local economic development level combined with considerations of natural and social factors. Several methods are now in use for determining the standards and procedures of compensation, such as willingness investigation, market value investigation and opportunity cost estimation [5-7].

By analyzing the commonality across ecological compensation cases, we proposed a general design of ecological immigrant compensation system, which consists of four stages: the first is the preparation stage, during which large amount of data are collected; the second is the planning stage, during which the participants receiving the compensation and compensation standards and procedures are determined; the third is the implementation stage, during which the compensation is implemented in accordance with the standards; the fourth is the assessment stage, which is intended for assessing the compensation effect, identifying defects and formulating the countermeasures.

III. RESEARCH CONTENTS AND METHOD FOR EACH STAGE OF ECOLOGICAL COMPENSATION

A. The preparation stage

The preparation stage mainly involves the collection of data related to ecological compensation, which is divided
Advantages and disadvantages of each data collection method are taken into account and applied with discretion for different situations. Investigation of historical data has low cost, but lacks in timeliness. Naturalistic observation is more objective and intuitive, but labor- and time-consuming. Field survey can acquire the latest and objective data, but is also labor- and time-consuming. Experimental research provides accurate and scientific data, but it may be restrained by lack of equipments and skills. Expert consultation is easy and direct, but contains considerable subjectivity. 3S technology can acquire large-scale data very quickly, but further verification and analysis will be needed on a smaller scale.

### TABLE I. TYPES, CONTENTS AND COLLECTION METHOD OF DATA

<table>
<thead>
<tr>
<th>Type</th>
<th>Content</th>
<th>Collection method</th>
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<tbody>
<tr>
<td>Basic data of the nature reserves</td>
<td>1. Natural resources: ecosystem type, resource type, amount and exploitation status, mineral resources, types, amount, growth status and distribution of wild animals and wild plants</td>
<td>Investigation of historical data, questionnaire survey, expert consultation, 3S technology</td>
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<td></td>
<td>2. Geological environment: physical and chemical properties of rocks and soils, soil fertility, land use types and distributions including farmland, pasture, forest land and barren resources</td>
<td>Field survey, experimental research, questionnaire survey, expert consultation, 3S technology</td>
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<td>3. Geographic environment: geographic conditions, location on the administrative region map, terrain &amp; topography, altitude</td>
<td>Field survey, experimental research, questionnaire survey, expert consultation, 3S technology</td>
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<td>4. Weather and climate: averages of temperature, sunshine hours, frost-free period, wind force, meteorological disasters</td>
<td>Field survey, experimental research, questionnaire survey, expert consultation, 3S technology</td>
</tr>
<tr>
<td>Social, economic and cultural background of the nature reserves</td>
<td>1. Means of production and livelihood for local residents, dependence on natural resources, development of tourism, material support</td>
<td>Investigation of historical data, questionnaire survey, expert consultation, field survey</td>
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<td></td>
<td>2. Information of the beneficiaries (e.g., government and enterprises), such as fiscal income, industrial structure, economic development level, ability and willingness to pay</td>
<td>Investigation of historical data, questionnaire survey, expert consultation, field survey</td>
</tr>
<tr>
<td></td>
<td>3. Information of the third parties (e.g., NGO and research institutes)</td>
<td>Expert consultation, investigation of historical data, questionnaire survey</td>
</tr>
<tr>
<td>Information of the stakeholders</td>
<td>1. Basic information of the victims, such as willingness to accept compensation and willingness to relocate</td>
<td>Investigation of historical data, questionnaire survey, expert consultation, field survey</td>
</tr>
<tr>
<td></td>
<td>2. Information of the beneficiaries (e.g., government and enterprises), such as fiscal income, industrial structure, economic development level, ability and willingness to pay</td>
<td>Investigation of historical data, questionnaire survey, expert consultation, field survey</td>
</tr>
<tr>
<td></td>
<td>3. Attitude and other information of the third parties (e.g., NGO and research institutes)</td>
<td>Expert consultation, investigation of historical data, questionnaire survey</td>
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</table>

### TABLE II. METHODS FOR ACCOUNTING OF COMPENSATION STANDARDS AND THE ADVANTAGES OF EACH METHOD

<table>
<thead>
<tr>
<th>Method</th>
<th>Advantages</th>
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<tbody>
<tr>
<td>1. Income method</td>
<td>Determination of the compensation standards based on the market value associated with ecosystem service</td>
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<tr>
<td>2. Accounting of immigrants' physical and social capital loss method</td>
<td>Determine the compensation standards based on the immigrants' physical and social capital loss</td>
</tr>
<tr>
<td>3. Estimating the contribution of immigrants' ecological footprint to the efficiency of ecological footprint</td>
<td>Determine the compensation standards based on the changes of ecological footprint before and after relocation and the accounting of the values associated with it</td>
</tr>
<tr>
<td>4. Survey on the willingness to pay and the willingness to accept the compensation</td>
<td>Determine the compensation standards based on the willingness of the responsibility subjects to pay and willingness of the immigrants to accept the compensation</td>
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</table>

### IV. THE IMPLEMENTATION STAGE

The implementation stage is the stage of enforcing the compensation standards through laws, regulations and policies under coordination between different government departments.

Building the information disclosure mechanism and holding public hearings on the compensation standards and procedures are effective measures to win public acceptance and support. Information such as the destinations of the compensation capitals and supplies can be disclosed via this mechanism regularly so as to mobilize the general public to get involved in the construction and perfection of the compensation system.

Moreover, sufficient communication and coordination between the immigrants, managerial personnel of the nature reserves, local residents and the general public via unobstructed channels are indispensable for ensuring the
equity and transparency of compensation implementation. That is, ensuring that the compensation capitals and supplies are received by the “right people”.

A multi-channel supervisory mechanism is another important aspect of implementation. An auditing mechanism can be built and operated in parallel with inquiries and exchange visits among the people receiving the compensation and working staff of the responsible authorities.

A market-based mechanism for ecological compensation will be the new orientation. Compensation funds, subsidies, guarantee payment (refunded after meeting the ecological requirements) and donations can all be the concrete forms of the market-based operation [31]. Any valuable experiences and lessons should be summarized for institutionalization and standardization of ecological compensation, providing reference for ecological compensation in other districts.

V. THE ASSESSMENT STAGE

The assessment stage, which is the final stage, consists of the following contents: firstly, assessing the compensation effect; secondly, assessing the development of the immigrants after relocation; thirdly, doing cost-benefit analysis of the ecological compensation.

Technologies such as remote sensing, GIS and GPS will provide considerable benefits for assessing the compensation effect. Building ecological monitoring and GIS platform can greatly facilitate the assessment of ecological environment changes, ecosystem structure, ecological functions, ecological sensitivity, resources and environment carrying capacity and ecosystem restoration. This will further promote the implementation assessment of major ecological projects, creation of ecosystem service evaluation system and perform an evaluation system, improvable of database and information inquiry system and finally the sharing of information resources.

Suitability of immigrants’ production and livelihood after relocation should be also assessed [32-35], by focusing on the following contents: living standards, income level, changes of living environment, building of a new social relation network, reconstruction of traditional customs and cultural transitions. The effects of various support measures (eg., policies, projects, industries, and training) are also assessed to monitor the infrastructure construction of the resettlement area, ensure social harmony and stability and increase immigrants’ income.

The cost-benefit analysis of ecological compensation is based on an input-output comparison. The input terms mainly include the capital investment for the early and middle stage of relocation and for subsequent development of the resettlement area. Outputs included into the accounting are changes in ecosystem service values before and after immigration and social benefits of immigration.

VI. CONCLUSIONS

We analyzed the commonality and individuality of ecological compensation of nature reserves in China as compared with other types of ecological compensation based on existing achievements. Then general procedures of ecological compensation of nature reserves were proposed. The disparities of ecological compensation of nature reserves mainly consist in the stakeholders, contents and time length of compensation. By reviewing different cases, we put forward the issues deserving attention for each stage of ecological compensation. We hope that our findings from this general analysis will shed new light onto the ecological compensation work in China.

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REFERENCES


