Returning Farmland to Lakes in the Middle-Lower Yangtze Area: Practices, Challenges and Recommendations

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ABSTRACT
Lake degradation with shrunken water body and reduced water connectivity is currently serious in China. It is very significant to return farmland to lakes to improve lake related ecosystems and ecological service functions, from which the national ecological security could be enhanced. This article first streamlines how the work of Returning Farmland to Lakes could be implemented in China. Practical experience with the results gained from pilot projects carried out in the middle and lower reaches of the Yangtze River are summarized. Recommendations in response to problems and lessons learned from these projects are then made to facilitate better implementation in the future.

Keywords- *Middle-Lower Yangtze Area; Returning Farmland to Lakes; Lake Degradation; Ecological Security*

1. INTRODUCTION

Lake, as an important component of the watershed drainage, plays an important role in mitigating flood disasters, maintaining water supply, providing ecological services, improving regional climate, etc. China has a large number of lakes, characterized by many different types. These lakes are distributed in a wide range of China's territory and have been experiencing a long history of development. According to the first national census for water [1], there are 2865 lakes with individual perennial water surface area greater than 1 km^2, covering a total area of 78000 km^2. Among these lakes, over 20% are scattered in the Middle-Lower Yangtze Area. In recent decades, affected by regional climate change and irrational human activities, lake ecosystems in the Middle-Lower Yangtze Area are endangered by multiple threats and lake degradation has become a very significant problem [2]. The degradation usually relates to lake water reduction, eutrophication, water quality deterioration, habitat destruction, among others [3].

The campaign of Returning Farmland to Lakes is considered to be helpful to improve the integrity, stability and ecological service functions of aquatic ecosystems [4]. This work has been strengthened in the east part of China since the 1998 Flood of Yangtze River [5]. This paper introduces key policies of this work and summarizes the achievements and lessons obtained. Through analyzing the problems, suggestions and recommendations are made. This article serves as a scientific reference to improve the ecosystem services of lakes and promote the campaign of Returning Farmland to Lakes.

2. BACKGROUND OF RETURNING FARMLAND TO LAKES IN CHINA

2.1. Ecological Civilization Construction

The concept of Ecological Civilization Construction (ECC for short) was first proposed in the 17th Communist Party of China (CPC for short) National Congress. Moreover, the concept of 'enlarging forests, lakes and wetlands', one of the key elements of the ECC,

has been proposed in the 18th CPC National Congress. In accordance with the *Overall Plan of Ecological Civilization System Reform*, the request of establishing a Rehabilitation System of Rivers and Lakes has been set up in 2015. As a result, pilot projects for returning farmland to lakes or wetlands were carried out. The projects were generally successful. Therefore, the approach of Returning Farmland to Lakes associated with other efforts, such as returning human occupied ecological space to rivers and lakes, have been proposed in the *Rehabilitation Plan of Farmland, Grassland, Rivers and Lakes*, published in 2016.

2.2. Lake Chief System

The Lake Chief System is a major institutional innovation of lake administration and protection practice. The *Guidelines on Implementing Lake Chief System*, issued in 2016, has been put forward main tasks to accelerate the progress of Returning Farmland to Lakes, and gradually restore natural connections of rivers and lakes. Currently, the lake chief system has been fully established, including four levels of lake chiefs, i.e., province, city, county, and township levels, with a total number of over 24000. Besides, there are extra 33000 lake chiefs on village level. The Lake Chief System covers 90% lakes, except those located in the Qiangtang Plateau. Furthermore, the 'One Policy for One Lake' approach has been applied to implement customized management for each lake.

2.3. Pilot Programmes

The *Pilot Scheme of Returning Farmland to Lakes*, issued in 2016, aimed to explore a new model of Returning Farmland to Lakes in accord with current development requirements and to improve the ecological conditions of the lake. Then four lakes were selected for pilot objects, which were the Gucheng Lake and the Desheng Lake in Jiangsu Province and the Caojia-Dangwang Lake and Dazhou Lake in Hubei Province. Currently, detailed implementing scheme of Returning Farmland to Lakes of those pilot lakes has been approved and implemented step by step.

3. PRACTICES OF RETURNING FARMLAND TO LAKES IN THE MIDDLE-LOWER YANGTZE AREA

Since 2000, lake ecological protection and restoration projects have been carried out in the Middle-Lower Yangtze Area. Lake ecological functions were significantly improved as the outcome of the projects. The projects involved approximately 16 lakes where Returning Farmland to Lakes was implemented, as illustrated in the Figure 1.

In Hubei Province, the Returning Farmland to Lakes was mainly executed in the Hong Lake, Chang Lake, Liangzi Lake, Futou Lake and Diaocha Lake, which planned to increase a lake area of 18600 ha in total. At present, the total increased area of the five lakes has reached 7253 ha. In addition, the pilot programme of the Caojia-Dangwang Lake and Dazhou Lake has started with an increased lake area of 4100 ha.

The comprehensive treatment of the Dongting Lake and Poyang Lake has been carried out since the 1998 Flood of Yangtze River. The flood storage area of the Dongting Lake has increased to 347000 ha by demolishing 333 embankments in Hunan Province. Similarly, the flood storage area of the Poyang Lake has increased from 390000 ha to 510000 ha with 418 embankments, 82 beaches and 1 pondage land being decommissioned in Jiangxi Province.

The ecological river and lake action plan has been proposed in Jiangsu Province. In this plan, Retreating Polders to Lakes Planning has been carried out aiming to increasing a lake area of 49300 ha totally, related to the Gaoyou Lake, Ge Lake, Baima Lake, Changdang Lake, and so on. Currently, the Retreating Polders to Lakes project of the East Taihu Lake, Baima Lake and Dazong Lake finished, and the total lake area has been increased by 10000 ha.

The comprehensive treatment of the Hejiachi Lake has started in recent years in Zhejiang Province, and the lake area has increased from 40 ha in 2014 to 180 ha in 2017.
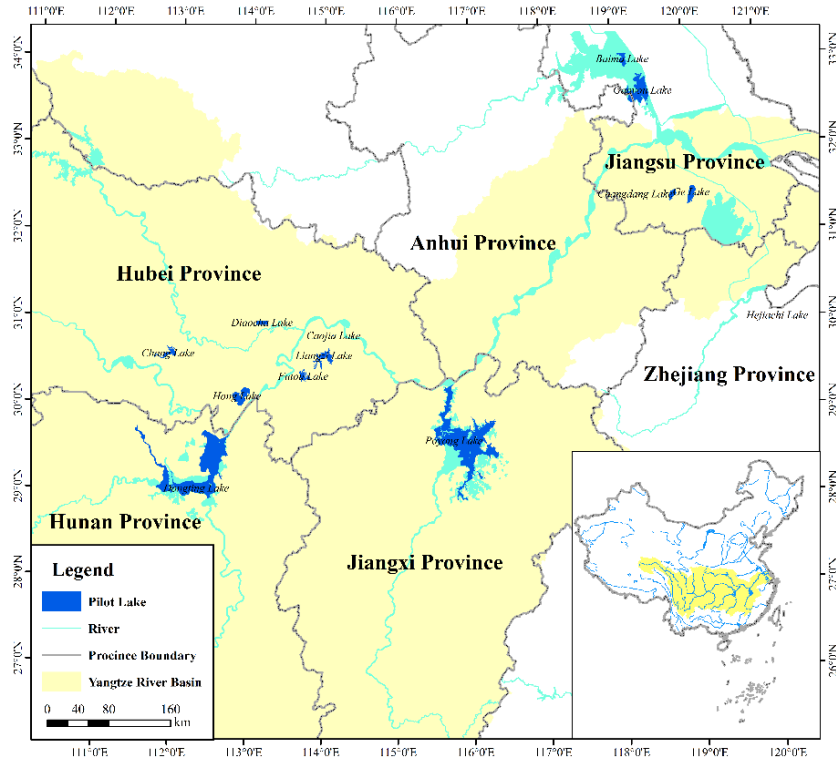
Fig.1 Distribution of the Returning Farmland to Lakes in the Middle-Lower Yangtze Area

Overall, the Returning Farmland to Lakes has a total increased lake area of 219390 ha, ranged from 140 ha to 120000ha, while the increased lake area percentage ranged from 1.41% ~ 31.56% of the five provinces in the Middle-Lower Yangtze Area, as showed in the Figure 2.
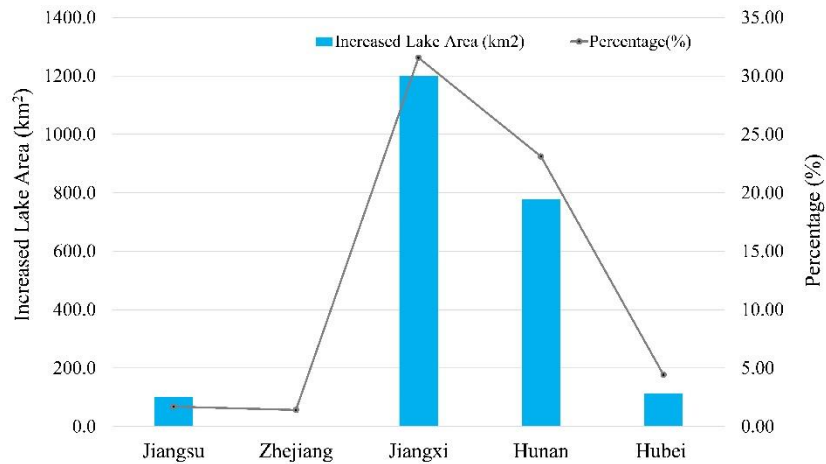
Fig.2 The provincial increased lake area and the area percentage according to the Returning Farmland to Lakes in the Middle-Lower Yangtze Area

4. CURRENT CHALLENGES OF RETURNING FARMLAND TO LAKES

4.1. Insufficient Knowledge of Watershed Integrity

Watersheds are a compound system of society, economy and nature, while lakes are key nodes in the system [6]. However, previous work mainly focused on issues of sand deposited in lakes and water space occupation, with no fully considering the relationship between Returning Farmland to Lakes and water conservation in the upper reaches of the Yangtze River, as well as water regulation in the lower reaches.

Besides, insight into the essence of Returning Farmland to Lakes is quite incomplete. Flood retention and water supply protection are main objectives of

implementing Returning Farmland to Lakes, while the values of comprehensive utilization of natural resources and the lake ecological service functions are poorly understood.

4.2. Imperfect Theoretical and Technical Support

At present, systematic theoretical system and mature technology have not been built yet to guide Returning Farmland to Lakes being applied practically in China. The basic theoretical research on lake ecological protection and restoration is still at an early stage. Thoughts and methods for implementing Returning Farmland to Lakes are generally limited to experience description, statistical analysis and preliminary simulation, which focus on specific cases and are difficult to be incorporated into a more generic framework being used to steer national-level implementation of Returning Farmland to Lakes in China.

Furthermore, a complete set of the technique systems should be forged for lake ecological restoration. This is because lakes could be distinct from each other in terms of their characteristics, functions, and associated issues, which could require various responses to figure them out. A simply universal technique for implementing Returning Farmland to Lakes could be ideal but unrealistic unfortunately. Specialized methods should be tested and assessed. Those functioning well could be subsequently identified and compiled together to form a 'toolbox' for further use.

4.3. Single Implementation Measures

Currently, Returning Farmland to Lakes is primarily carried out by local governments, while community participation is still very rare. Stakeholders including residents in polder areas are included in management committees. However, they are expected to have more significant impacts. Meanwhile, the current implementation of Returning Farmland to Lakes in China is still driven by short-term policies, while this work should be planned in a broader view and embedded in long-term economic and social development policies. In addition, Returning Farmland to Lakes has faced many difficulties when being implemented. For example, water quality is not considered as important as quantity. These issues should be fixed.

4.4. High Financial Pressure

Ecological space of lakes occupied by humans is mainly located in the developed part of eastern China. When farmland was returned to Lakes in this region, resistance was observed, because arable land became less, the house-building subsidy was not enough, and the investment in infrastructure construction was insufficient. The ecological compensation mechanism for returning farmland to lake has not been established. The majority of the investment is funded by the local governments, resulting in high financial pressure.

5. FUTURE RECOMMENDATIONS FOR RETURNING FARMLAND TO LAKES IN CHINA

5.1. Guidance of Systematic Thinking

Returning Farmland to Lakes is a complicated and systemic project, influencing ecological security, economic development and social stability. It is necessary to coordinate water and land exploitation and utilization with ecological protection and restoration of lakes, so that the integrity of lake watersheds is guaranteed [7]. Based on the principles of the integrity, diversity and sustainability of ecosystems, more attention should be paid to land use changes at watershed scale and industrial structure adjustment, rather than lake basins only. Under the framework of the Integrated River Basin Management, the objectives, tasks and technical standards of Returning Farmland to Lakes should be clarified.

5.2. Enhancing Science and Technology Support

To deal with the problems discussed above, further studies should be conducted, especially for the basic theory, methodologies and applications of Returning Farmland to Lakes. Some interesting topics could include lake dynamic evolution theory under coupling force of nature and human activities, mechanistic model development of lake hydrodynamics-sediment deposition, dynamic monitoring and regular surveying of lake ecology, dynamic demonstration of lake eco-hydrological processes, and so on. In addition, social, economic, and ecologic benefits of Returning Farmland to Lakes should be evaluated comprehensively after a multi-scale evaluation index system is created.

5.3. Improving the Policy System

Within the present law framework, it is necessary to find how well laws and regulations ensure the enforcement of Returning Farmland to Lakes, including the objectives to be achieved, the detailed procedures of the implementation, the management measures and the responsible bodies [8]. When necessary, an appropriate institutional system equipped with regulations should be formulated. Such regulation could be related to a compensation mechanism to reimburse people whose interests are negatively impacted, a resettlement system, a public participation mechanism and so on.

5.4. Effective Financial incentive Scheme

Returning Farmland to Lakes should be financially supported by an investment system combining funding from the government and social capital with the government as the dominant investor. The diversified investment and financing platform of Returning Farmland to Lakes should be constructed to widen the investment and financing channels. The ecological compensation mechanism of Returning Farmland to Lakes should be established based on local conditions. Meanwhile the differentiated taxation system and the transfer payment system should be improved to balance the benefits areas with the damaged areas. Allowances related to Returning Farmland to Lakes should be increased according to the local conditions.

6. CONCLUSIONS

Based on the above analysis and discussions, the conclusions could be drew as below:

(1) The Returning Farmland to Lakes is a key measure to promote the Ecological Civilization Construction and the river-lake chief systems in China, which could effectively improve the lake ecosystems and its ecological functions.

(2) The Returning Farmland to Lakes has been already carried out broadly in the Middle-Lower Yangtze Area since 2000 and has won some general achievements, with the total increased lake area of 219390 ha.

(3) The Returning Farmland to Lakes also confronts some challenges, which include the insufficient knowledge of watershed integrity, imperfect theoretical and technical support, single implementation measures and high financial pressure.

(4) The recommendations for returning farmland to lakes has been put forward for next step, which include the guidance of systematic thinking, enhancing science and technology support, improving the policy system and effective financial incentive scheme.

ACKNOWLEDGMENTS

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