

Exploring the Improved Methodology for Mangrove Conservation and Restoration in Southern China

中国南部におけるマングローブの保全と再生のための改良法の探求

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Abstract

Mangrove ecosystems in China have been facing the challenges of degradation since 1990s. Seawall construction, aquacultural activities and biological interference were considered as the major threatening factors. Despite the significant progress made in the recovery of mangrove vegetation, several challenges persist in conservation and restoration initiatives. These include the absence of a holistic strategy for implementing conservation and restoration projects, along with insufficient engagement of the local communities. In order to improve the current methodology, to further understand the underlying mechanisms and remaining problems, investigations were conducted by specific restoration projects, fieldwork, questionnaire survey, interviews and literature review. The research encompasses two cities situated along the southern coast of mainland China, specifically Beihai in Guangxi and Zhanjiang in Guangdong. Together, these locales represent 38% of the national mangrove coverage and 68% of the total mangrove species in China, under the administration of three national-level mangrove nature reserves.

Chapter 2 followed a project related to the comprehensive treatments of invasive cordgrass species *Spartina alterniflora* with physical clearance and biological substitution. After the artificial plantation with native mangrove species *Rhizophora stylosa* in the area of 2 hectares, results of periodic monitoring in eight months including growth conditions of newly planted seedlings, biodiversity of bird and macrobenthic organisms indicated that the study area possessed the potential ecological values according to the high percentage of critical bird species. However, in the early stage, the improvements remained less significant and biodiversity level is still relatively low. The overall methodology could be replicated in other mangrove restoration projects especially targeted at *S. alterniflora* while with further improvements in preliminary investigations of environmental conditions and long-term monitoring.

Chapter 3 investigated the livelihoods and environmental awareness, as well as the possible breakthrough points and feasibility for future projects in two villages (Beijia Village and Hebei Village) in Fucheng County by questionnaire survey supplemented with interview, fieldwork and literature review. Results illustrated that the livelihoods of these coastal communities were still traditionally based on natural resources. Large amounts of villagers still held misunderstandings of mangrove wetlands and their perspectives tended to be centered on personal interests. Attitudes towards mangrove conservation varied significantly among ages, major income resources and villages. Interviewees with greater ages, working on aquacultural activities and living in Beijia Village had less supportive attitudes, which might be the target group for environmental education programs. Additionally, according to field survey and

interview, the introduced mangrove species *Sonneratia apetala* has blocked the main drainage system and caused waterlogging problems in the villages, which could be one of the reasons why some villages held negative attitudes towards mangroves. Future projects can start from this complicated issue by reinforcing the relationship with the village committee, developing alternative livelihoods, and establishing a collaborative system among all stakeholders.

Chapter 4 investigated the development of ecotourism as well as different perspectives from various stakeholders including villagers, village committee, nature reserve officials, local NGOs and tourists in Xia Village, Beihai by interview survey, field observation and literature review. Ecotourism within the study region emerged independently through the initiative of local residents. Starting from 2017 with only a few households participating, the venture expanded significantly by 2022-2023, with over 40 households engaging in activities such as operating restaurants, guesthouses, shops, and offering guided tours. Results indicated that most interviewed villagers have formed sound understanding and rational behavior, but tourists still held superficial understanding of benthos and mangroves, which needs to be improved by related environmental education programs and publication. In addition, conflicts remained between nature reserve and local communities because of the harsh management measures. Third parties should get involved and act positively to promote smooth communication and project conduction.

Based on the studies of Chapter 2-4, Chapter 5 generalized and formulated a practical methodology which includes preliminary investigations, project implementation and following monitoring. Also, improvements in technical restoration approaches, diversified livelihoods of local communities including ecological aquaculture techniques, and the mechanisms of multi-party cooperation should be further explored in the future.