

Article

Is Land Expropriation to Keep Agricultural Use an Effective Strategy for the Conservation of an Urban Agricultural Heritage System? Evidence from China

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Abstract: Urbanization is one of the major threats to the dynamic inheritance of the agricultural heritage system (AHS). The ability to achieve sustainable development in intra-urban areas is an essential proposition related to the innovation of AHS conservation principles. The Haizhu high bed-low ditch agroecosystem (HHBLDA), a China-Nationally Important Agricultural Heritage System site located at the center of Guangzhou City, is taken as an example in this study. The effect of implementing the Land Acquisition to Keep Agricultural Use (LAKAU) on intra-urban AHS conservation is assessed through literature collection and review, field survey, and in-depth interviews. The results show that the LAKAU was implemented because of a three-decades-long struggle between ecological conservation and urban sprawl. Because of the important functions of ecosystem services, the AHS can coexist with urban land use in the course of rapid urbanization. The LAKAU mode can ensure that the nature of farmland remains unchanged, which is an effective strategy for the conservation of an urban AHS. The resulting problems, such as high operating costs, insufficient agricultural outputs, and insufficient local farmers in the AHS site because of off-farm opportunities, should be addressed by establishing an effective self-sustaining mechanism. Realizing the compatibility of management concepts between the AHS and nature reserves, adapting to the changing role of farmers, and strengthening the acceptance of the AHS by urban managers should attract the attention of decision-makers.

Keywords: urban agricultural heritage system; high bed-low ditch agroecosystem; farmland; land acquisition; wetland; nature reserve



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1. Introduction

Since 2002, the Globally Important Agricultural Heritage Systems (GIAHS) program of the Food and Agriculture Organization (FAO) of the United Nations and nationally Important Agricultural Heritage Systems (IAHS) in China, South Korea, Japan, Italy, Brazil, and other countries have been developed to safeguard traditional agricultural systems of global or national importance [1,2]. Given that the AHS cannot be separated from the participation of farmers, the main distinction between it and the World Cultural and Natural Heritage (World Heritage Convention) is its dynamic situation [3]. The AHS is a way of living in harmony with nature and emphasizes the comprehensive conservation of agricultural biodiversity, traditional agricultural knowledge, technology, and landscape.

Accordingly, the closed-off management mode, which is the common method of conserving historical sites and natural resources, is undesirable for the AHS. Previous studies have confirmed that agro-products, sustainable tourism, industrial integration, ecomuseums, and ecological compensation are ideal approaches for the dynamic conservation of the AHS [4–9]. The AHS and its conservation research conform to the logical framework of “driving force–pressure–state–impact–response” in which every segment is a scientific problem worth studying. However, the existing studies on some segments have only begun, and neither the research methods nor the theoretical depth are sufficient to date. For a long time in the future, sustainable mechanism, dynamic conservation, and adaptive management will still be the core research contents of AHS conservation [8].

1.1. Dilemmas Faced by the Urban IAHS

Urbanization is one of the major threats to the dynamic inheritance of the AHS because city development may result in the loss of farmland, changes in farmers’ careers, changes in agricultural landscape patterns, and increase environmental pollution, which have serious effects on AHS sustainability and expression of its value [10–12]. The threat of urbanization to AHS sustainability is a global problem. The chinampas system in Mexico, which is an urban farming mode, was designated as a GIAHS site in 2018 [13]. Urban expansion and pollution have resulted in displacement of farmland for urban uses and substantial deterioration of the environment of the chinampas system in recent decades. To address decreasing farmland and yield loss, farmers have adapted through developing new production strategies, which have contributed to the disappearance of the traditional system and changes in chinampa’s structure [14,15]. Although the “chinampa-refuge model” (CRM) conducted by research groups has strengthened traditional agroecological practices and ecological restoration, some of the main challenges clearly out of reach of farmers’ actions and the CRM need be addressed by urgent and participatory government action [16]. China’s urbanization process has been in a rapid development stage since the 1980s. Land resources in peri-urban and suburban areas are increasingly scarce. This is an extremely challenging scenario for AHS conservation. The Xuanhua Grape Garden and the Jingxi Rice Cultivation System (Jingxi Rice Reserve located in Haidian District, Beijing) are two AHS sites located in intra-urban areas. The traditional vineyard area in Xuanhua City has been reduced to less than a quarter of its peak area due to rapid urbanization. Even after being designated as a GIAHS site in 2013, the increased government support and public awareness have not alleviated the conflict between conservation and development. Many vineyards have been expropriated to construct high-speed railways and buildings, which is supported by most farmers who are more inclined to obtain land acquisition compensation than plant grapes [17–20]. Jingxi rice refers to rice planted around the imperial gardens of the Qing Dynasty in the western suburb of Beijing City, with a planting area of 67 km² in the 1970s. Since the 1990s, the planting area in Haidian District has rapidly shrunk for regional gardening and greening and is now less than 0.67 km², of which only 0.53 km² is assigned within a permanent basic farmland zone (a type of farmland area that cannot be used for non-agricultural purposes under any circumstances) delineated by the government [21,22].

Based on the above-mentioned cases, the government, as a regulatory organ of market failure, can play a decisive role in AHS conservation under the demands of accountability and political interest incentives [23]. Only when the local government strongly intervenes in intra-urban AHS conservation can irreversible, huge heritage losses be prevented. AHS conservation must be incorporated into the urban planning strategy [24]. Notably, the issues confronting the urban AHS in different areas are not identical. A case study of GIAHS in Japan has shown that sustainable development may be easier to attain if AHS sites in urban areas do not involve farmland issues. In Ayu of the Nagara River System, people reap the river’s bounty and, in turn, strive to preserve it for future generations. Despite flowing through urban and residential areas, the pristine Nagara River that runs through the site’s center boasts an abundance of clear, high-quality water. Although farmers account for only 1% of the total population, the total revenue from Ayu (*Plecoglossus altivelis*)

across the entire prefecture is 18.3 million USD per year [25]. At present, the majority of IAHS sites worldwide are in rural areas. Although China is one of the countries with great achievements in AHS conservation in the world, only three of the 138 IAHS sites are within urban areas. Accordingly, the attention of researchers has not yet been drawn to the conservation of the intra-urban AHS. Previous studies are insufficient to guide the practices of urban AHS conservation, and further research is needed [26].

1.2. Research Objectives

Only 28% of the European population lives in the countryside, and a projected 60% of the world's population is expected to reside in urban areas by 2030 [27,28]. The AHS is gaining increasing importance as a repository of lessons to be learned for more sustainable agriculture in the future [29]. Although only a few cases are discussed at present, scientific solutions to future common problems should be explored in the context of rapid urbanization to study how to scientifically and rationally conserve the intra-urban AHS. In this study, the authors developed an analytical framework to assess the sustainability of the urban AHS. The Haizhu high bed-low ditch agroecosystem (HHBLDA) is in the center of Guangzhou City, Guangdong Province, China. The government adopted the Land Acquisition to Keep Agricultural Use (LAKAU) in 2012 to permanently conserve the majority of farmlands in this region. An article in *Farmers Daily*, the state media of the Ministry of Agriculture and Rural Affairs of China, evaluated this method as a valuable mode for peri-urban AHS conservation [30]. Whether the AHS can achieve sustainable development in intra-urban areas is an important proposition related to the innovation of AHS conservation concepts. This study took the HHBLDA as a case study to achieve the following key goals: (1) to explore the dilemmas faced by AHS sites in the process of rapid urbanization; (2) to summarize the government's attention shift and policy change under the strategy of ecological priority; (3) to evaluate the effectiveness of the LAKAU mode for conserving the urban AHS; (4) to explore ways to deal with problems due to LAKAU implementation; and (5) to discuss the universality of the LAKAU mode in other urban AHS sites.

The marginal contributions of this study include the following three aspects. First, in terms of research direction, this study focuses on a rare case of the coexistence of a traditional agricultural system and urban land use in a metropolitan area, where the food and livelihood of farmers relied on land in the past, which is regarded as the first remarkable characteristics of GIAHS by the FAO, but has switched to other opportunities at present. It provides both a new theoretical theme and new practical field for future urban AHS research. Second, in terms of research method, this research provides a framework for assessing both natural and societal sustainability through multidisciplinary methods. Third, in terms of research results, it provides possible ways to achieve the survival and sustainable development of AHS sites in intra- or peri-urban areas by combining vertical (from government to farmer) and horizontal (food chain stakeholders) methods.

2. Study Area and Methodology

2.1. Study Area

The high bed-low ditch agroecosystem, also called the raised and sunken bed system, is widely distributed in southern China, northern and eastern India, Indonesia, Bangladesh, Thailand's Chao Phraya Delta, and other lowland areas with dense water networks in the tropics and subtropics [31–33]. The scale of the high bed-low ditch agroecosystem reached its historical peak in the early 1990s in the Pearl River Delta in southern China, with an area of more than 5000 hm², accounting for approximately 7.5% of the farmland area of the Pearl River Delta [34,35].

The HHBLDA was successfully selected into the sixth list of the China-NIAHS in November 2021. Haizhu District, located at 23°3'–23°16' N, 113°14'–113°23' E, is the only island district among the 11 municipal districts of Guangzhou City. The entire Haizhu district, with a total area of 90.40 km², is situated at Haizhu, Guanzhou, and Yajisha islands

and they are all surrounded by the Pearl River. Haizhu means “sea pearl” in Chinese. According to statistics, the permanent population of Haizhu District was 1.82 million and the urbanization rate was 100% in 2020. The spatial scope of the AHS site includes Areas Nos. 1 to 8 of the Haizhu Wetland (HW), which are managed by the Wetland Conservation and Management Office (WCMO), and four villages, including Luntou, Tuhua, Xiaozhou, and Longtan. The HHBLDA covers a total area of approximately 1100 hm², of which 30% is delineated as a permanent basic farmland zone (Figure 1). As the ecological conservation or ecological restoration areas, Areas Nos. 1-5 are not open to the public, but the orchards are managed by local farmers employed by the WCMO. The population within the HHBLDA site was 137,000 in 2020, among whom 109,000 were recent migrants.

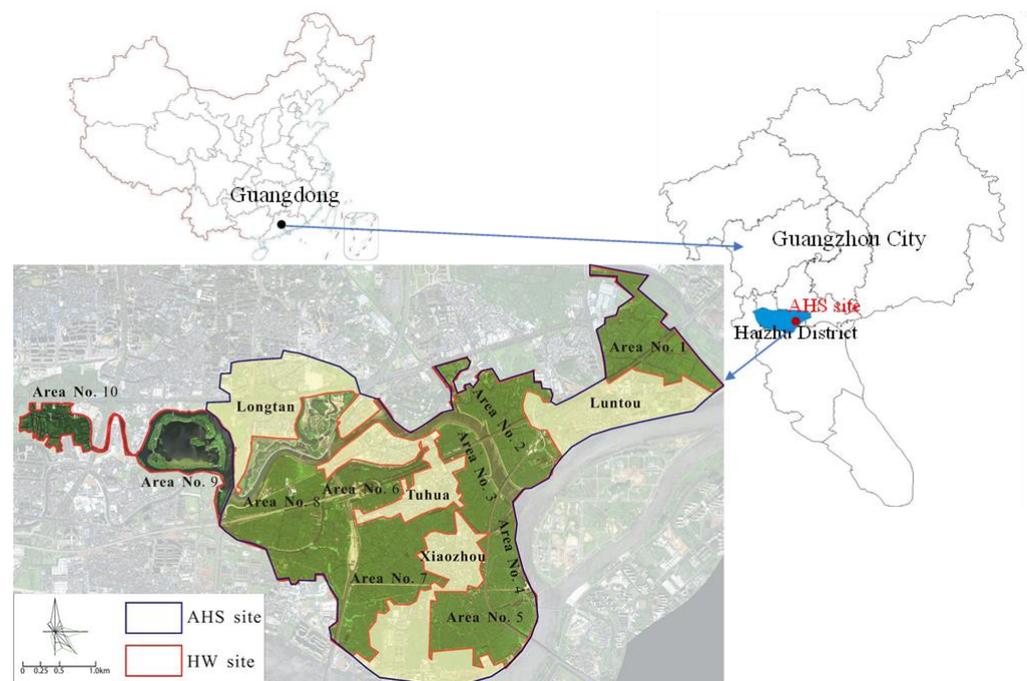


Figure 1. Location of the study area.

The HHBLDA has been used for more than 2000 years by local Haizhu people. Because Haizhu District is close to the old city of Guangzhou, in order to develop commercial agricultures dominated by dryland crop cultivation, ancestors fully utilized the local natural conditions of marine subtropical monsoon climate and dense water network to create and develop a high bed-low ditch agroecosystem with diverse forms of water and soil resource utilization. The typical traditional agricultural landscapes of HHBLDA include dike, artificial canal, water gate, high bed and low ditch, crop planting, livestock and poultry breeding, and aquaculture (Figure 2). More than a hundred years ago, Franklin H. King, an American agronomist, and George W. Groff, an American horticulturist, recorded the high bed-low ditch system of Haizhu District in pictures and text [36,37]. At present, the HHBLDA is the only IAHS site in China, which is located within a megalopolis as a whole.

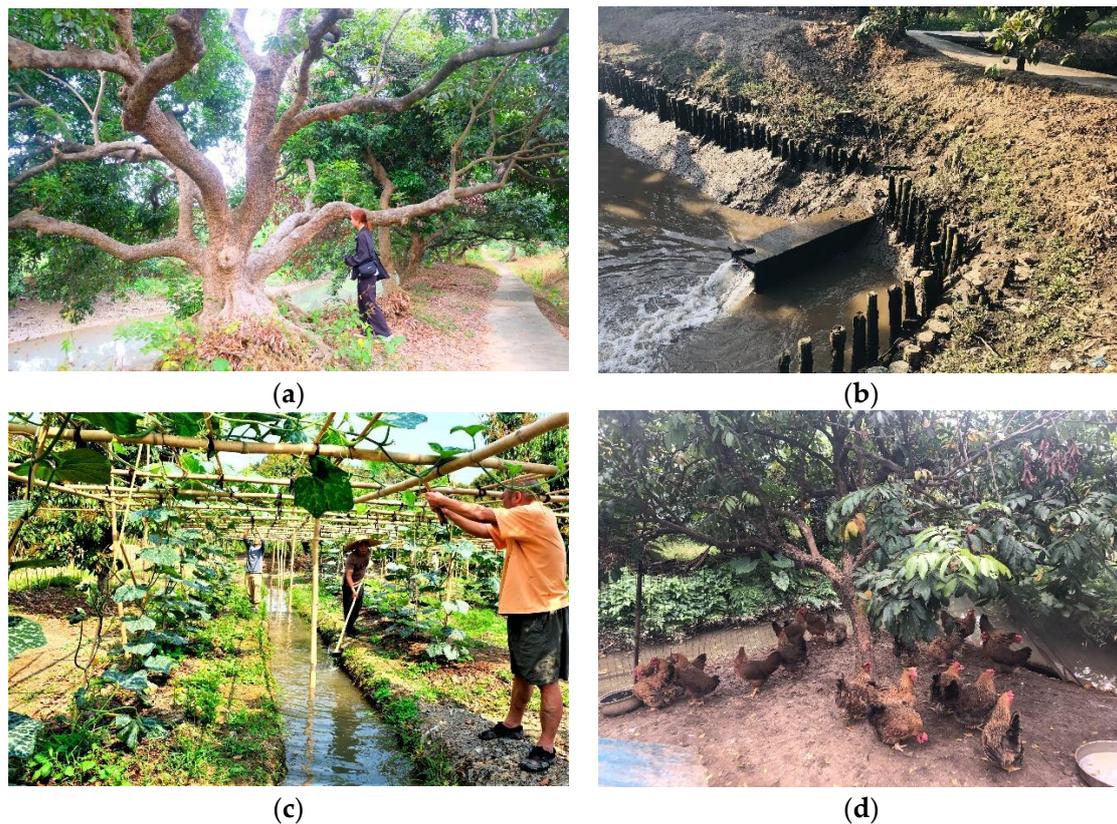


Figure 2. Photos of the HHBLDA: (a) Dike, ancient litchi trees, and artificial canal; (b) Wooden water gate; (c) High bed and low ditch; (d) Raising chickens under the fruit tree.

2.2. Study Methods and Analytical Framework

The authors were entrusted by the Haizhu District Government to undertake a comprehensive investigation and research on the AHS site in HW and nearby villages from September 2020 to October 2021 and completed the proposal and action plan for China-NIAHS. During this period, we travelled to the HHBLDA site to conduct this research and stayed for 42 days. Some of us repeatedly observed the traditional agricultural landscape, agricultural production, ancient trees, folk customs, historical buildings, and wetland park in the HHBLDA site. Meanwhile, various literature and materials related to the Haizhu District were collected and systematically collated, and semi-structured interviews were conducted with 28 villagers, eight government staffs, and three experts (Table 1). These interviews lasted between 30 min to 2 h. All interviews were recorded with respondents' permission and later transcribed. Through the above work, we had a comprehensive understanding of the conservation status of the HHBLDA and the management status of HW.

The effectiveness of a conservation strategy is decided by how well the strategy contributes to the AHS sustainability. This work established an analytical framework for assessing intra-urban AHS sustainability (Figure 3). The AHS has lasted for thousands of years because of its internal, stable, sustainable mechanism. Ecological and societal sustainability are the internal bases of the AHS, which ensure that the AHS has a sustainable agricultural production function [38,39]. Ecological sustainability includes natural and agricultural eco-environments. The premise for the existence of an urban agricultural system is its good maintenance of natural elements, such as water, soil, air, and biodiversity. Despite some vulnerabilities that occurred mainly due to socio-economic reasons, the intra-urban AHS still provides different ecosystem services to local communities, including food and byproduct supplies, soil erosion protection, prevention of hydrogeological risk and deforestation, agro-biodiversity and natural biodiversity conservation, cultural landscape

preservation, benefits for agro-tourism, and traditional knowledge inheritance [40]. Previous studies have shown that the guidelines for AHS conservation mainly involve societal sustainability, including dynamic conservation, adaptive management, and economic support [3,6]. A balance between conservation, adaptation, and socio-economic development is emphasized for the urban AHS’s dynamic conservation. The dynamic conservation and adaptive management of the AHS are inseparable. Different dynamic conservation approaches and dynamic management measures should be considered according to the local conditions. Generating income and adding economic value to goods and services of the AHS site in a sustainable fashion is one of the main objectives of AHS sustainable development [3,41]. The growing tourism interest in the AHS is witness to the importance of traditional livelihoods as heritage products [42,43]. Actions of ecological compensation and agri-food labeling system also prove that the use of economic support means can help to achieve the goal of AHS conservation [44–46].

Table 1. Basic information of interview samples.

Category	No.	Main Interview Contents	Remarks
Villagers	A 1–28	Traditional agricultural production knowledge Livelihood transition after farmland loss Evaluation on farmland status	Twenty-four villagers are regular or temporary farmers employed by WCMO
Officials of WCMO	B 1–4	Implementation process of LAKAU Farmland management system	One official is the leader, the remaining staff are responsible for wetland maintenance
Officials of the Bureau of Agriculture and Rural Affairs	C 1–4	AHS conservation actions already completed and planned	One official is the leader
AHS experts	D 1–3	Evaluation of AHS conservation status	All experts are members of China’s Advisory Committee on IAHS

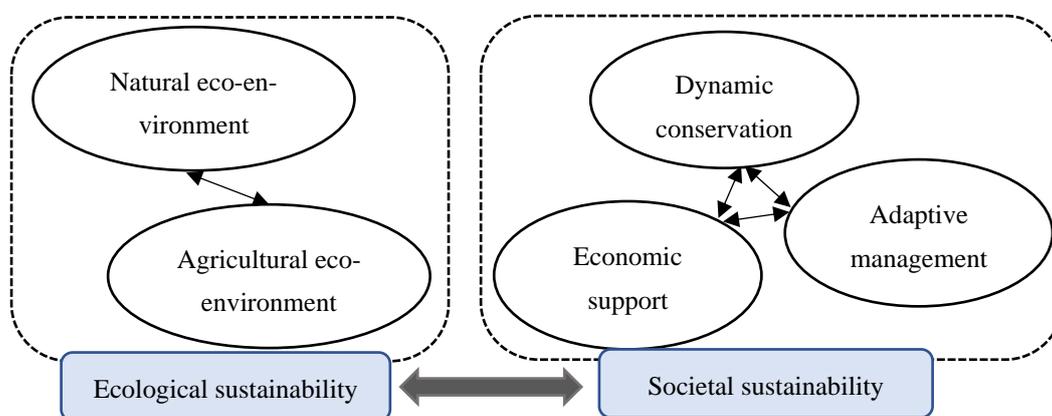


Figure 3. Framework for assessing intra-urban AHS sustainability.

3. Historical Background of the LAKAU Mode: Government’s Attention Shift and Policy Change

3.1. Peri-Urban Period

In ancient times, Henan Island (old name of Haizhu District) was separated from the Guangzhou urban area by the Pearl River. Henan Island has a history of peri-urban agriculture dating back more than 1000 years, making it one of the important fruit-, vegetable-, flower-, and tea-producing areas in Guangzhou. By the 1980s, the fruit cultivation was dominated at the AHS site. The area of farmland continued to diminish due to urban construction and industrial pollution. During the same period, the Guangzhou Municipal Government changed the functional orientation of the AHS site from an agricultural zone to an ecological zone, regarding it as the “southern lung” of Guangzhou for its important

role on CO₂ fixation, O₂ release, and air flow. In 1991, the *Haizhu District Zoning Plan (1990–2010)*, adopted by Guangzhou Municipal Government, stipulated that Haizhu District is a vegetable garden and orchard reserve and the farmlands in this area must not be arbitrarily encroached upon or used for other purposes [47]. However, farmers were willing to build houses rather than continue to plant traditional fruit trees in order to obtain more economic benefits. During the rapid urbanization and industrialization in the surrounding areas, the relative economic benefits of fruit trees continued to decline and villagers' livelihood no longer depended on them. "In Tuhua Village, the annual longan fruit yield was 800,000 kg in the 1980s, but by the middle and late 1990s, it was only 10,000 kg, with an average of only 3–4 kg per household" (B2). The villagers transformed part of the orchard into factory buildings, shops for rent or for self-operation, or developed animal husbandry to compensate for the economic losses caused by the deterioration of fruit growing conditions due to environment pollution. This resulted in the gradual reduction of the orchard area and increased soil pollution [48]. A 72-year-old man in Luntou (A27) noted that: "At that time, many farmers destroyed fruit trees and built illegal buildings to make a living. Village collective not only acquiesced, but even provided temporary loans to farmers who were short of money to build house". The *Guangzhou Urban Comprehensive Plan* proposed the establishment of the Haizhu District Orchard Reserve in 1996 to prevent the "southern lung" from becoming a "southern waste land" [47]. According to the *General Plan for the Orchard Reserve* completed in 1998, the household contract responsibility system with small scale farmers, an effective agricultural management mode used elsewhere at that time, had limitations for orchard conservation in this region. The correct way to preserve orchards was by changing the decentralized contract mode of fruit tree management to an intensive and large-scale operation [49].

3.2. Intra-Urban Period

With the rapid eastward and southward expansion of the Guangzhou urban area, especially affected by the construction of Xiaoguo Island University Town, the AHS site has been surrounded in the center of the city since 2004. According to statistics, the area of the orchard was 2700 hm² in 1986, 1300 hm² in 1998, and only 1100 hm² in 2005. From 1990 to 2005, the land for urban development approved by the government within the orchard reserve reached 51.816 hm², and another 134 hm² of land was illegally used for construction. Tourism was considered by the government to balance development and conservation. Some orchards in the reserve, leased by the government at 15,000 RMB per hectare, were built into the Yingzhou Ecological Park, Longtan Fruit Park, and Shangchong Fruit Park between 1998 and 2010. However, their role in improving the incomes of local villagers remained very limited. The problems of low economic benefits of fruit trees and reductions in orchard area have not been effectively solved [50].

The Guangzhou Tower, Haixinsha Park, Flower City Square, and other major municipal projects were completed one after another, then forming the Central Axis of Guangzhou New City before the opening of 2010 Guangzhou Asian Games. The AHS site is located at the southern end of the central axis, with a straight-line distance of only 3 km from Guangzhou Tower. With the substantial growth of land value, the contradiction between the "lung" (environment) of the city and the "stomach" (livelihood) of the villagers further intensified. Guangdong Provincial Government accelerated the protection and utilization of the orchard reserve in early 2011 to thoroughly solve the problem and improve the image of the city. On 16 March 2012, the Ministry of Land and Resources approved Guangzhou to use the LAKAU mode for overall farmland acquisition. This was the first case in China to use the LAKAU mode. Subsequently, land acquisition was conducted smoothly and completed on 23 April 2012. A total of 790 hm² of farmland was acquired, involving eight villages, 11,382 households, and 34,146 people. This land acquisition was the largest project in the history of Haizhu District. Government departments effectively protected the interests of village residents through measures such as a high compensation standard, which reached 4.9 million RMB per hectare, implementation of social security

for all villagers, deployment of land reserved for economic development according to 10% of the land acquisition area, and a priority to provide jobs for villagers [51]. In summary, the implementation of the LAKAU was a result of a three-decades-long struggle between ecological conservation and urban sprawl, which resolved the contradiction between the “lung” of the city and the “stomach” of the villagers to a certain extent.

4. Evaluation of the LAKAU Mode: An AHS Perspective

4.1. Ecological Sustainability

4.1.1. Natural Eco-environment

In 2012, the Haizhu District declared the core area of the orchard reserve as the pilot construction unit of the National Wetland Park. After a decade of construction, HW has become an important ecological space accessible to Guangzhou citizens and a regulator and stabilizer for the urban ecological environment. Continuous monitoring data in recent years show that the ecosystem of HW has been fully restored. The related monitoring indicators, such as water quality and air quality, have shown a stable and positive trend each year, and biodiversity has steadily improved. At present, the main water quality conditions in the wetland range from Class IV to Class III water standards, and the water quality in certain areas can reach Class I and II water standards. Villagers understand very well the improvement of the eco-environment. A resident of Xiaozhou (A22) noted that: “The most serious water pollution was during the period of 1990s. The water was smelly and dirty, and even those native fruit trees would easily die. Now the recovery is quite ideal. There are more fish, shrimp, and crabs now”. According to statistics in March 2022, the number of bird species in HW has increased from 72 to 183, that of vascular plants has raised from 294 to 835, the number of insect species has promoted from 66 to 536, and the number of fish species has grown from 36 to 60 since the establishment of the automatic monitoring station in 2015.

At present, HW is the only national key construction wetland in Guangdong Province. It occupies a pivotal position in the tourism industry of Haizhu District. It is the “ecotourism core” and “eco-cultural tourism zone” in the spatial layout of regional tourism development. With convenient transportation and abundant resources, the WCMO has established a nature school and an agricultural education base to conduct various forms of natural education, farming culture popularization, and popular science activities. In recent years, the WCMO has won some national level awards, such as the National Model Prize for Residential Environment, the National Wetland Protection Demonstration Award, the National Forest and Grass Science Popularization Base, the National Primary and Secondary School Environmental Education Social Practice Base, and the National Nature Education School Base.

4.1.2. Agricultural Eco-environment

Identifying and listing the core AHS elements are essential prerequisites for IAHS scientific conservation, which has been valued by the Ministry of Agriculture and Rural Affairs of China since 2020 [52]. The core elements of the HHBLDA mainly include the land use mode of the high bed-low ditch, the landscape of the dike paddy field biodiversity, traditional agricultural species, Pearl River culture, and traditional waterside villages. Government departments at all levels have continuously attached importance to and strictly protected the ecological function of the AHS site in the past 30 years. Specifically, after the construction of the wetland in 2012, most farmlands in this region have been permanently protected. This allows the traditional agricultural landscapes in HW to avoid the influence of urban sprawl and the area is “refrigerated”. This initiative has realized the good retention of preserving the traditional landscapes of the high bed-low ditch system and dike paddy field. In particular, the dikes, old trees, water gates, foot bridges, and other AHS elements are rare in the Pearl River Delta region today.

In addition to the farmers in the AHS site, the WCMO has played an important role in promoting local farming culture through multiple channels by setting up the Haizhu

Wetland Natural School and Agricultural Education Base and organizing tourism festivals, such as the Dragon Boat Festival and the Shixia (name of a longan cultivar) Longan Festival. The flat bed and straight ditch are typical landscape features of high bed-low ditch systems. However, the high bed-low ditch landscape and fruit trees in the open area of HW have been lost to varying degrees and replaced by park landscapes dominated by artificial lakes, ornamental trees, ornamental flower fields, and hardened roads due to the creation and implementation of a series of tourism landscapes and infrastructure projects (Figure 4a). In 2018, the WCMO commissioned a team of experts to select approximately 20 hm² of orchard in Area No. 5 to implement an ecological restoration project. This project aimed to optimize ecosystem services by widening the furrow and making it meander. Borders were piled high, the fruit forest was thinned, and tall trees were sparsely planted to form a vegetation layer of tree, shrub, and grass (Figure 4b) [53]. Transforming the high bed-low ditch landscape may have been beneficial from the perspective of biodiversity and landscape aesthetics, but this task was destructive from the perspective of AHS conservation because the structure and function of the traditional high bed-low ditch system were deformed or lost. For example, boats were often needed for transportation from one bed surface to another bed because of the widened ditches, which made it difficult to manage fruit trees daily. Some bed surfaces were uneven and stacked, which easily caused water and soil erosion. The flourishing of other plants inevitably resulted in the inhibition of fruit trees. Although the Bureau of Agriculture and Rural Affairs of the Haizhu District hoped that the fruit trees could be well managed, they couldn't do much because the farmlands were assigned to be managed by the WCMO. A staff member from this bureau (C2) noted that: "Although we can apply for some government funds, WCMO does not always have enough enthusiasm to cooperate with us. WCMO is a subordinate unit of the Forestry Bureau, it seems to be inevitable for them to take agriculture less important".

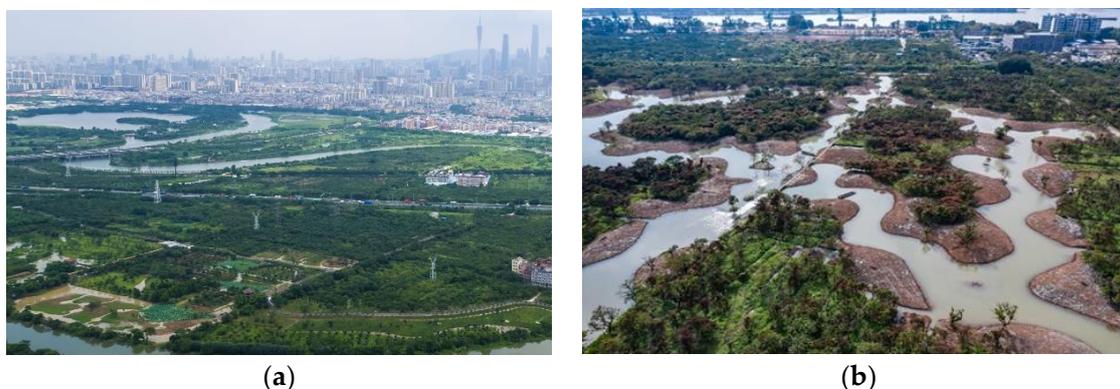


Figure 4. Loss of traditional agricultural landscape: (a) Haizhu Lake with an area of 53 hm² constructed in 2011 (Credit: Huiqiang Xie); (b) Landscape after implementing an ecological restoration project (Credit: Huiqiang Xie).

4.2. Societal Sustainability

4.2.1. Dynamic Conservation

In addition to government financial support, the main source of economic income in HW is tourism. The Haizhu Wetland Park (Areas Nos. 6 and 8) is now a tourist attraction with great influence. From 2013 to 2019, the number of tourists has exceeded 40 million. In 2013, more than 3.75 million people bought tickets to enter the park. In 2019, this value rose to 8.43 million, and the ticket revenue reached 5.02 million RMB. The living state of the HHBLDA in an intra-urban area is not as good as other IAHS sites in rural areas. The main duty of the WCMO is ecological conservation. This inevitably results in not paying enough attention to fruit tree production. The management and protection measures for fruit trees were mostly equivalent to those of ornamental trees in parks. Constrained by the financial system, the fruit produced by orchard trees cannot be sold on the market and are

only given to tourists, welfare institutions, and schools. This results in the lack of important economic benefits for heritage activation. “As a government department, WCMO has no power to sell agricultural products. All financial revenues and expenditures should be audited. So if these fruits are sold, this will be against the rules” (B3). Approximately 10–30 farmers are employed in each area of HW. A certain number of temporary workers are also hired during the busy season, and they are responsible for the management of thousands of fruit trees. Existing farmers have a difficult time completing the workload required for the normal production of fruit trees. Farmers must also be responsible for the removal of invasive plants, such as *Mikania micrantha*, and the dredging of rivers and ditches. A head farmer working in Area No. 3 (A15) noted that: “Although it saddens me to see some trees dead, the area of orchard is too large to manage. All we can do is just to keep all fruit trees to survive, we don’t care whether they bear fruit”. According to the existing staffing, carefully managing the fruit trees to reproduce the vibrant appearance of orchards before the 1980s is impossible. At present, Areas Nos. 2 to 5 of HW have a total of more than 300 hm² of orchards for ecological conservation, which have not yet been opened to the village residents and the public. The surrounding residents in Xiaozhou and Tuhua expressed their frustration. The three AHS experts interviewed did not agree with the current management mode of farmlands. One expert (D1) noted that: “Since HW is a constructed wetland evolved from agricultural production, its management mode cannot be equivalent to the natural wetland. At present, the natural eco-environment has been well restored. It is time to resume agricultural production and let the public participate in management”.

4.2.2. Adaptive Management

Different AHS sites exist in distinct environments, hence protection and management methods should also vary. Establishing a sustainable adaptive management mechanism and avoiding the misunderstanding of closed-off conservation are important for intra-urban AHS sites. After the enclosure management of the wetland, the WCMO paid attention to strengthening cooperation with the village community. A co-construction agreement with Longtan Village promised to give priority to hiring village residents for wetland management and to set up a team of local farmers in charge of orchard management. Most farmers who lost their farms did not have enough skills to get a job in the urban sector [11]. When the villagers saw that the land cultivated by their elder generations was protected, some were also inspired and actively participated in the ecological restoration, management, and maintenance of HW. A villager of Luntou (A4), the head of the Agricultural Education Base, noted: “I was also extremely opposed to land acquisition at the time because I was afraid that the government would use the precious farmland left by our ancestors to build high buildings. After the land acquisition, I felt that the government had not reneged on its promise, and I just came across the recruitment of the wetland, so I agreed to work here”. Statistics provided by the WCMO confirmed that 379 employed farmers were all from villages near HW (Figure 5). The view of a Tuhua farmer (A11) was representative: “I’m not old enough to retire. I do not like playing mahjong, nor do I have any other hobbies. Keeping fit is my goal. You know that the salary 2800 RMB per month, is only enough for breakfast and cigarettes. Our elder generations have been planting fruit trees, and I have a lot of affection for this. Working for WCMO is also quite decent”. The survey also found that interpersonal communication was one of the reasons for female interviewees who chose to work there. According to the survey, most farmers were between 50 and 60 years old, and their self-occupied housing area was approximately 2000 m². Thus, house rental was the main source of income for most families. The job was still unattractive to most migrant workers due to the low salary. A leader of the WCMO (B1) noted that: “These farmers are basically over 50 years old now. After a few years, once they retire, there will be no suitable residents. We do not know how to resolve this problem”. In view of the adaptive management of HHBLDA, an expert (D2) noted that: “A multi-stakeholder

system should be established involving communities, farmers, governments, scientists, and business enterprises as well as social organizations”.



Figure 5. Farmers employed by the WCMO: (a) Fruit tree cultivation (Credit: Huiqiang Xie); (b) Vegetable cultivation; (c) Dredging ditch mud (Credit: Huiqiang Xie); (d) Farming culture education (Credit: Huiqiang Xie).

4.2.3. Economic Support

In recent years, the ecological effect of HW has brought great economic benefits to the surrounding areas, and it has become a signature for attracting top enterprises and talents. According to a study in 2014, the space scope impact of HW on the appreciation of the surrounding real estate prices was expected to reach 1400 m, within which the real estate appreciation was 6.7% [54]. Nowadays, the Guangzhou Artificial Intelligence and Digital Economy Pilot Zone adjacent to the wetland have successfully attracted several leading companies. In contrast, in the four villages in the core area of the HHBLDA site, the WCMO cannot make overall use of the surrounding construction land due to multiple land ownership issues, resulting in difficulty of implementing key projects. However, the spillover effect of park ecology and tourism value is relatively limited, and no strong positive feedback relationship exists between wetland investment and land appreciation [55]. According to the survey, the current income sources of villagers mainly included rental income from factory buildings and houses, wage income, commercial operation, and dividends from the village collective economy. Longtan, which has many industrial lands but no farmland, gains a considerably higher annual income per capita than the other villages, which was 3.0, 5.3, and 13.5 times that of Tuhua, Luntou, and Xiaozhou villages, respectively in 2019. The construction and maintenance of the constructed wetland ecosystem require a large investment of capital and manpower, and the management and protection of more than 200,000 fruit trees. The security investment is also great due to the large and scattered area. According to a leader of the WCMO (B1), the operating cost is considerably higher in the intra-urban area than in a wetland park far from an urban area. It was estimated that

the operating cost of HW is 30 times higher than that of Nansha Wetland of Guangzhou, which is approximately 60% of the HW area. Commercial operation projects of the park are limited due to the needs of wetland conservation, and the lack of sufficient profit channels makes the operation of the park unable to support daily management. Moreover, the operation investment mainly depends on government financial support. In view of the limited economic benefits, an expert (D3) noted that: "The integration of tourism and AHS may never be sufficient to generate enough economic benefits comparable to the rise in land value caused by urbanization. It is inappropriate to overemphasize the economic benefit of intra-urban AHS". In 2019, the *Haizhu Wetland Quality Improvement Work Plan* issued by the Bureau of Forestry and Landscaping of Guangzhou Municipality proposed utilizing farmlands to develop a diversified economy and planned to explore social marketing and other channels to participate in wetland operation. In 2020, the Haizhu Wetland Ecological Development Co., Ltd., responsible for wetland revenue business, was established. The revenue capacity and social and economic benefits of HW are expected to soon be greatly improved and may be able to provide economic support for the sustainable development of the HHBLDA.

5. Discussion

5.1. Option on Land Acquisition or Not

The current reform of China's agricultural land system involves three modes: Land Acquisition to Keep Agricultural Use (LAKAU), No Land Acquisition to Keep Agricultural Use (NLAKAU), and No Land Acquisition to Transfer Agricultural Use (NLATAU). As far as the AHS is concerned, preserving farmland for agricultural use is a prerequisite. The NLAKAU mode is an option for intra-urban AHS conservation and is even the most acceptable method according to mainstream concepts. However, previous case studies of intra-urban AHS sites have shown that the NLAKAU mode cannot drastically solve the dilemmas caused by urbanization. Considering that the main source of income for households is no longer from agriculture, many farmers either actively give up agricultural production because the income from agriculture is relatively limited and bearing the high cost of living in urban areas is difficult, or they passively give up agricultural production because of water and air pollution. Government departments constructed scenic spots by leasing orchards. However, the tourist attraction effect and economic return were quite limited because the construction of supporting facilities had many restrictions. If an area is contracted by enterprises, obtaining sufficient economic benefits is difficult without changing land properties due to the high renting rate in an intra-urban area. In the Xuanhua Grape Garden site, the vineyards are in the courtyards of the residents. Only a small proportion of farmers in Xuanhua support grape planting, and many farmers welcome real estate developers to expropriate their land [19]. In urban areas where land resources are scarce, the current NLAKAU mode is eventually likely to evolve into expropriation in the interests of all parties. Practices of intra-urban IAHS in China have proven that regulating permanent basic farmland zones has an important impact on the choice of AHS conservation strategies. Permanent basic farmland, as the strictest manifestation of China's farmland protection system, is a decisive factor in safeguarding sustainable farmland utilization in urban areas, and its existence ensures that urban managers take measures to protect farmlands [56]. So for the urban AHS, the LAKAU mode is an effective measure to protect against its extinction risk and provides a choice for urban managers in China.

5.2. Challenges Brought by the LAKAU Mode

Although the LAKAU mode is one good option, its universally adoptability and whether the policy obstacle can be removed remain unclear.

First, can the incongruity of conservation principles between the AHS and nature reserves be solved? The coexistence of the IAHS and nature reserves is common in China, but the two protection systems are managed by different government departments which usually have different resource management concepts and focuses. For example, the AHS

requires the continuity of the agricultural production function, which is often ignored by nature reserves. The organic integration of conservation concepts and the integration and unification of management levels between the two can help in accurately and comprehensively understanding the scientific mechanism of the AHS, thereby improving the depth and breadth of AHS conservation and realizing rational heritage protection and utilization. The AHS advocates the development of agricultural production in an ecological manner, which should complement with ecological conservation projects. The positioning and management of IAHS sites in the natural reserve system are worthy of consideration by decision-making departments [57].

Second, can the dominant role of farmers in AHS sites be changed? IAHS conservation has always advocated for respecting the dominant role of farmers, which is fully applicable in rural areas. However, the livelihoods dominated by agricultural production are unsustainable in many peri- and intra-urban areas, and farmers have gradually engaged in non-agricultural occupations. Practices of GIAHS in Japan have shown that multi-stakeholders from rural and urban communities can equally provide important contributions toward sustaining food security and continuity of traditional agricultural systems [58,59]. Therefore, AHS managers should look at the new practices of multi-stakeholders according to local conditions, not stick to outdated regulations, and actively take flexible countermeasures that allow citizens to participate in production through farmland lease and maximize the enthusiasm of local farmers and public for AHS conservation [60].

Third, can urban managers better accept the AHS? The first LAKAU mode was approved and implemented in Haizhu District, which has its particularity in China. This policy was effective not only because of the urgent need to protect the urban ecological environment and solve the livelihood problems of villagers, but also because of the high attention and strong promotion of government departments at all levels. Farmlands are not a necessary landscape in intra-urban areas, and they will be difficult to preserve if they are not delineated as permanent basic farmland zones. Owing to their ecological functions, farmlands should coexist with urban land uses in the process of urbanization [61,62]. Agriculture can become an integral part of the urban ecological environment, and the innovative development of cities in the future should be able to better accept the AHS. The integration of animal raising and crop planting can realize the recycling of material and reduce the risk of crop diseases and pests in a non-chemical manner, which is a classic practice of traditional ecological agriculture. The basic prohibition of livestock, poultry, and aquaculture in current urban areas causes great challenges for the integrity and value of the AHS. Whether intra-urban AHS sites can be delimited as a restricted animal raising area is worthy of further discussion.

5.3. Suggestions for Improving Intra-Urban AHS Vitality

One of the most serious difficulties that the intra-urban AHS faces is the lack of vitality due to the separation of farmland from farmers caused by changes in farmers' livelihood or by land acquisition. From the perspective of HHBLDA conservation, the construction of a wetland park through the LAKAU mode was one of the best options available in 2012. This initiative preserved core AHS elements to the greatest extent and reserved the opportunity for future value exploration, protection, and utilization. At present, some difficulties and problems still remain, such as insufficient agricultural production function, separation of farmland and local community, shortage of local farmers, high operating cost of HW, and low public participation in some areas. To this end, the following strategies are recommended for adoption in the future: (1) straightening out the management mechanism of the coexistence of National Wetland Park and China-IAHS, maximizing the unity of management concepts, and improving the function of agricultural production without damaging the ecological environment; (2) selecting an area of HW to build a demonstration area for AHS protection and utilization, and exploring an AHS co-management system with multiple stakeholders; (3) establishing an eco-compensation mechanism to make up for villagers' contribution for ecological protection; (4) enlarging the open area of HW in

an orderly manner and expanding the tourism economic radiation effect on surrounding villages; and (5) increasing financial support and popular science propaganda, fostering so called “bellwethers”, including high bed-low ditch agricultural technology inheritors and local intangible cultural heritage successors, and letting them lead the growth of a group of “new farmers” in villages by opening training classes or recruiting apprentices.

Due to the implementation of the LAKAU, the relationship between community residents and farmlands has fundamentally changed, so it is particularly important to establish an adaptive co-management system for the HHBLDA’s sustainable development. This co-management system could be formed both vertically and horizontally. The vertical management system includes coordination among government authorities, implementation institutions (such as the agricultural bureau, natural protection bureau, financial bureau, and institutions for research and education), local community organizations (such as village organizations), and cooperation among individual farmers. The horizontal management system includes combined efforts from multi-stakeholders along the food chain from field to table, including people and enterprises for production, storage, marketing, processing, selling, and consumption. The financial support for the LAKAU and annual subsidy, the *Haizhu Wetland Quality Improvement Work Plan* (2019), and the formation of Haizhu Wetland Ecological Development Co., Ltd. (2020) are parts of the efforts for the formation of this co-management system.

6. Conclusions

The development and prosperity of the HHBLDA are the result of the unique natural conditions of the site as an island and the advancement of commercial agriculture in the suburbs of Guangzhou during the historical period. Because government departments at all levels have attached great importance to the ecological function of Guangzhou’s “south lung” for a long time, this AHS site was fortunately not swallowed up by urban construction when it entered the central part of the metropolis, finally realizing permanent protection through the implementation of the LAKAU. The following achievements are worthy of recognition in the field of AHS conservation through the construction of the National Wetland Park in the past decade. First, the ecological function of the AHS has been effectively protected and improved through continuous ecological conservation, making it one of the symbols of ecotourism in Guangzhou. Second, the traditional high bed-low ditch landscape, traditional fruit tree species, rivers, water gates, ancient trees, and other AHS elements have been preserved due to the overall conservation of farmlands. Third, traditional farming culture has been promoted through multiple channels by hosting activities of natural and agricultural education and agricultural festivals such as the Longan Festival and the Dragon Boat Festival. Fourth, optimization of the eco-environment has encouraged the surrounding villages and communities to change from “urban value depression” to “ecological value highland”, thus gradually and effectively alleviating the contradiction between the city’s “lung” (ecological effect) and the villagers’ “stomach” (economic effect). Lastly, hundreds of villagers have been employed in posts for agricultural technology, personnel management, commercial operation, cultural popularization, security, and others. They have taken new responsibilities in the conservation and inheritance of the AHS. In the process of rapid urban sprawl, time is the worst “enemy” for saving local traditional agroecosystems. This case study proves that permanent extinction of the urban AHS can be avoided and opportunities for subsequent dynamic development can be retained through the implementation of the LAKAU in a short time.

Different agricultural types have varying circumstances in the face of the urbanization process. As an essential cultural component of cities, the AHS should be more accepted by urban managers [11,26]. Facing the various dilemmas of urban AHS, the LAKAU is undoubtedly an effective conservation strategy. However, this mode can only resolve some specific problems faced by urban AHS sites, meanwhile, new challenges inevitably arise. So only by continuously improving management and operation mechanisms can AHS inheritance and protection be effectively guaranteed. In China, land resources are owned

by the state and the government plays a key role in decision-making and implementation, thus the government can effectively intervene in alleviating human-land conflicts during the urbanization process of AHS sites. However, types of land ownership are quite varied in different countries. Whether the LAKAU mode is applicable to urban AHS conservation in other countries should be explored through further case studies and related practices. As large areas of the countryside are being swallowed up by towns, the conservation of the urban AHS deserves more attention from researchers, governments, and the public.

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