

Article

Socio-Ecological Adaptation of Agricultural Heritage Systems in Modern China: Three Cases in Qingtian County, Zhejiang Province

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Abstract: This paper, on rural restructuring in China, focuses on the ability of agricultural heritage systems to adapt to modernizing conditions in the rural economy. Since 2002, when FAO initiated the protection of Globally Important Agricultural Heritage Systems (GIAHS), the value of agricultural heritage has been widely acknowledged, as has the importance and urgency to protect the systems in which they are embedded. However, such complex systems have not been fully assessed for their contribution to food security, ecosystem services and cultural preservation, as well as their ability to adapt to the demands of modernization. In fact, they have not been effectively evaluated as whole systems, largely because we have not yet devised satisfactory ways of studying complex systems, nor have we been able to assess them fully for their multi-faceted contributions to sustainability. This paper accepts the premise that such systems are sustainable in that they have survived as agro-ecosystems for many hundreds of years, having endured the predations of droughts, famines, plagues, floods and wars. This ability to sustain a rich diversity of biological and human systems is considered, in the theory of Complex Adaptive Systems (CAS), to be a form of resilience, meaning that these systems have either formed a new normal or returned to the old normal after a period of environmental or social stress. In effect, ancient agricultural heritage systems can be seen to represent what has been traditional and normal in China, but which today are faced with the overwhelming forces of modernization. Taking three examples from Qingtian County in Southern China, where physical and political conditions are consistent, the paper shows how similar rice-fish systems adapt differently and sustain themselves in the face of modernization, and particularly to the loss of youth and labor to urbanisation. One system self-adjusts by using remittances from abroad to sustain the system: an example of self-organization. In another township, the pursuit of tourism is the main form of adaptation to large losses of working population and marginal incomes. To maintain the landscape as a key attraction for tourists, this community has re-assembled abandoned rice terraces and is farming them as a collective enterprise under the auspices of a co-operative: an example of land and labor restructuring that has become common as the dominant form of agrarian change in China. In a third example, the local rice-fish system is being strengthened by modern farming technology and scientific techniques: an example of technological adaptation. The discussion explores the three responses as evidence of sustainable practice involving local restructuring, continued ingenuity, and the creative support of local governments in the face of the homogenizing demands of modernization.

Keywords: modernization and agrarian restructuring; Globally Important Agricultural Heritage Systems (GIAHS); Complex Adaptive Systems theory (CAS); rice-fish farming; labor loss; land abandonment; Qingtian County; China

1. Introduction

Rice-fish systems in China, created in ancient times to make mountainous areas more habitable, symbolize the adaptive relations between humans and nature [1]. Many variations of rice-fish terrace agriculture have survived and are still important food security systems which include appropriate technology and a local knowledge culture. However, with modernity bringing technological change, new social values and transformative economic development, China's rice-fish systems have been increasingly challenged [2]. So have many other traditional agricultural systems in different parts of the world [3]. Recognizing the vulnerability of these agricultural systems, FAO started an initiative for the conservation and sustainable management of Globally Important Agricultural Heritage Systems (GIAHS) in 2002. Rice-fish culture in Qingtian County was designated as one of the first five GIAHS pilot sites in the world in 2005 [4,5], which was the first designated GIAHS in China and was followed by another 10 GIAHS designations in the country in the next ten years. In this sense, agricultural heritage systems represent key forms of complex systems survival in the current wave of agrarian change.

Agricultural heritage systems are precious treasures left by the ancestors. They are living systems that are dynamic and adaptive, exhibiting the strategic values of multi-functionality and sustainability [6]. They also have exceptional ecological, social, cultural, scientific and demonstration values [7]. Nevertheless, it has become a general concern whether these unique agricultural production systems, having survived for many hundreds of years and having endured the predations of droughts, famines, plagues, floods and wars, will cope with the predations brought about by China's national policy of urbanization. If and in what way will rice-fish terrace systems remain sustainable.

The spectacular development of the Chinese economy since Opening Up (1980s) is comparatively well known. There are abundant data-laden references to population dynamics [8–11], increased economic activity [12–15], rapid urbanization [16–18], and impressive poverty reduction gains [19–21]. The main evidence of the economic transformation that made China 'the World's factory' derives from economic analysis of the periods of state-led industrialization, from heavy to light manufacturing and ultimately to mass-urbanization, always achieved with an emphasis on infrastructural development [10,22,23]. The focus of this change was in the cities and ports of eastern China, leaving the west and its vast mountainous areas as the rural hinterland and the main sources of migrant labor [18,24,25].

For this paper, two critical components of the transformative era have been selected to provide some specific details of the agrarian reaction to this massive on-going change as represented by the traditional rice-fish systems in South China: they are labor migration and land transfer. The feature of labor migration drives the modernization process and is of particular importance for the context of this paper. The loss of adult labor, both men and women, is widely seen in almost all the villages of China. The chronic demographic condition of some villages has reached the point that some scholars refer to them as 'hollowed out' communities [26,27]. The loss of adult labor is having profound effects on rural and agricultural development [28,29], social relations in the household and among villagers who are mostly 'left-behind' people [30], and the disposition of land [13,31,32]. With a large amount of rural labor migrating into the secondary and tertiary sectors [16,33,34], land abandonment has spread nationwide. Incomplete statistics show that more than 20 provinces (about 2/3 of the total) have reported domestic land abandonment since the 1990s [35], which has already negatively affected the stability of agricultural production. In such a situation, land transfer has become an effective pathway for migrant farmers to arrange the disposition of their contracted land when they no longer want to retain it for farming or for security purposes [36–38].

Undoubtedly, labor loss and the rapid increase of abandoned land are inimical to the protection and continuance of agricultural heritage systems that are dependent on human labor, local knowledge and the ingenuity of peasants. If few able bodied persons are left in the village to farm the land, the sustainability of many areas where agricultural heritage has long been practiced will inevitably be affected. The essential questions are: what responses to modernization are such ancient heritage systems taking in this era of spectacular restructuring in contemporary China, and does the GIAHS designation, a very prestigious international label, contribute to enabling the farming system to continue despite the pressure for change, or does the system adapt in some way to accommodate the clear need for improved incomes, the continuing call for geographical mobility of labor and the inevitable quest for modernization in farming?

Bearing these questions in mind, this paper examines the responses to modernization in the Qingtian rice-fish system using the conceptual framework of Complex Adaptive Systems (CAS) as a reference guide. Whether the responses to modernization are the same or differentiated in different locations is the initial question in a political environment where standardization of responses is generally expected and often encouraged. To what extent the processes of agrarian change produce sustainable outcomes is a key question. Offering some plausible explanations of the responses observed forms the conclusion of the paper.

2. Study Area

2.1. Qingtian County and Rice-Fish Culture

Qingtian County in Zhejiang Province is a mountainous area traversed by the river Ou, only 60 miles from the East China Sea. It is renowned as the hometown of overseas Chinese people, of stone carvings and of field-fish (The 'field-fish' is a local term for the red carp raised in the rice terraces by villagers. The field-fish is a local heritage variety of carp, consisting of seven colors in which red is the most common one.) cultivation. The county has a total area of 2493 km², of which 90% is covered by mountains, 5% by water bodies and only 5% by farmland, and has a registered population of 529,000. With such a small proportion of land suitable for agriculture, it is not surprising to find that, in the past, large numbers of people have left the area. For those who stayed behind, maintaining the terraced rice-fish upland farming system was one of the livelihood choices available.

In Qingtian County, the pressure of livelihood maintenance has long been apparent. Since the onset of the Qing Dynasty, the rural people of the county have opted for domestic and overseas migration as one way to relieve the pressures and constraints of poverty such that three large-scale emigration waves occurred between 1842 and 1937 [39]. Being near the sea, many communities availed themselves of easy access to trading to make a livelihood. Traditions of relations with overseas countries grew up with the trade in stone carvings. These pre-conditions meant that by the time of industrial modernization, there were already established several migration circuits and many perceived benefits of out-migration. Thanks to Opening Up, the scale of overseas migration has increased rapidly since 1985 and the modern period (1990s to the present) has witnessed many others taking this well-trodden road to material betterment. It is officially estimated that there were 279,600 overseas Chinese people from Qingtian County living in 121 countries and regions abroad by the end of 2014 (These data were collected from Qingtian Statistical Yearbook 2014.)

The topography and moist climate conditions in Qingtian County have long rendered this area suitable for wet rice production in the small man-made terraces on the upland valley sides. Water is conserved in the soils under the forest cover at the top of the mountain slopes and provides a constant supply of fresh water for rice cultivation and village needs (Figure 1). A traditional economy of rice and fish has been developed in the terraces over many hundreds of years and is ingeniously supported by a gravity-flow irrigation system which has a history of at least 1300 years [40]. The Qingtian rice-fish culture, recognized as a GIAHS by FAO in June 2005, is a world-class agricultural heritage system and represents many thousands of square kilometers of similar landscape in South China.

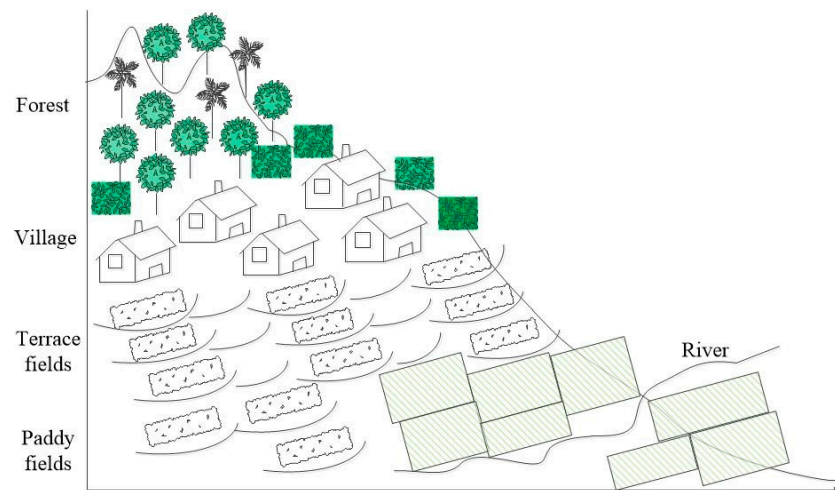


Figure 1. Depiction of rice-fish terrace landscape in Qingtian, South China.

The rice-fish system has survived many perturbations over time, such as disease, famine, floods and drought, as well as frequent local and regional conflicts. It is a robust and resilient system combining human agency and many natural advantages including the landscape and the micro-climate [2,41]. The landscape today is the product of many generations of trial and error in wet rice and fish cultivation [42]. Preserving and developing these environmentally friendly heritage systems is clearly advantageous for society, but requires local people with the skill and knowledge to maintain and operate them. These systems are labor intensive, physically demanding and vulnerable to the usual panoply of threats and risks experienced by upland farmers such as plant disease, unreliable weather and fluctuating market conditions. The overriding concern and one that has not been faced hitherto, is that of out-migration of the farm population and the loss of their labor and knowledge. According to official statistical data, out-migrants in Qingtian County reached 131,900 in 2014, which accounted for 30% of the local farm population (These data were collected from Qingtian Statistical Yearbook 2014.).

2.2. Location of Case Villages

What then are the responses of farm communities in the Qingtian county area to modernization in general, to continued out-migration and adjustments in landholding, and to the GIAHS designation in particular? In order to explore these questions, three village sites were selected: Longxian, Xiaozhoushan, and Renzhuang in the Southeast of the county (Figure 2).

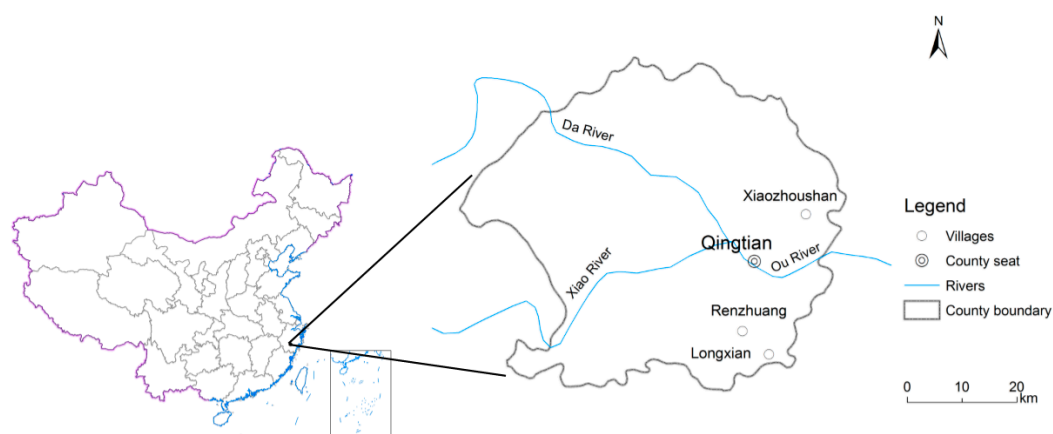


Figure 2. Location of the three villages under study in Qingtian County.

Longxian is located in a southeast valley of Qingtian County, only 40 min by bus from the county center. Covering 4.6 km², it has a registered population of 869 and more than 800 people living in over 20 countries and regions abroad. After the GIAHS designation, Longxian became the favored tourist destination for visitors to the rice-fish system.

Being more than 1 h from the county town, Xiaozhoushan is a remote mountain village with large scale rice-fish terraces on steep hillsides.

Renzhuang, situated in a wide valley, is 40 min by regular bus from the county center. With terraces and large flat rice paddies, Renzhuang village has a diversified range of crops, which makes it the scientific base for improving and maintaining the rice-fish system in the county.

3. Material and Methods

3.1. The Framework of Complex Adaptive Systems (CAS)

Agricultural heritage systems are Complex Adaptive Systems that are multi-scaled and multi-functional [42]. Their complexity is threefold. First, any important agricultural heritage consists of social, ecological and historical parts, among which, both the social and ecological components have deep historical dimensions. As difficult as it is to measure the legacy of history, it is vital to take into account the past for an understanding of agricultural heritage systems today. Secondly, the core systems are social and ecological systems that include many sub-systems. Almost all the sub-systems are inter-dependent in various ways and affect each other to some degree. For instance, the social system involves water management at the village level which, as a form of human intervention in the water cycle, clearly affects other parts of the ecological system. Thirdly, both the core systems and their sub-systems are influenced by external forces. Local policies, trade with other communities, national development strategies are potentially significant external forces that have important effects on the structures, functions and prospects of agricultural heritage systems. The extent to which sub-systems affect each other depends on the scale of the pressures brought by external forces [43]. The ability to survive is considered a form of resilience, meaning that these systems have either formed a new normal or returned to the old normal after a period of stress. In this paper, when a system reaches a new normal, the process is called adaptation.

The three villages in Qingtian County provide three cases of differential adaptation in maintaining and supporting a rice-fish system when faced with challenges brought about by modernization, especially labor loss and land abandonment. Homogenizing or differentiating responses to change are in themselves multi-scaled and complex. In response, this paper invites the use of a framework of 'Complex Adaptive Systems' to organize and keep track of the many variables and possible explanations involved [44–47]. The social system that maintains the Qingtian rice-fish system consists of governments, cooperatives, farmers and tourism agents as social actors. Land transfer, tourism, external capital are dynamic economic conditions in the socio-economic system, while the ecological system, on the other hand, includes ecological services (e.g., erosion control), terraces, local crop and fish varieties (Qingtian field-fish), biodiversity, water resources, etc. (Figure 3).

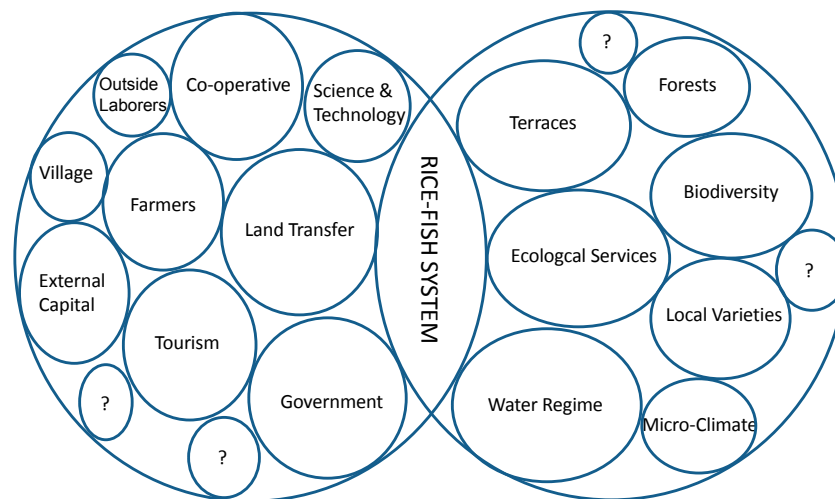


Figure 3. Conceptualized socio-ecological components of Qingtian rice-fish system (One way to enter the system in Figure 3 is to place the topic of major interest in the center. The subsystems that touch the central topic are those most likely to affect and be affected by adjustments at the center. Outside subsystems have indirect influence in that they closely interact with the subsystems near the center. This would represent the researchers' expectation of the connections in the system (size of subsystem represents importance), which can be verified by research in the field and which allows surprises to be noted (as indicated by symbol "?"). A three-dimensional diagram would make the complexity of these connections more explicit.) Note: ? = unspecified sub-system.

3.2. Data Collection and Processing

The data collection technique of this paper was that of observation and questioning in an inductive approach to enquiry. The overall framework of observation is adapted from complex systems thinking which suggests that almost all sub-systems are joined together in various ways and influence each other to certain degrees depending on the 'change' that is being brought about and studied [43]. The type and sequence of themes are informed by 'appreciative enquiry', a system for recognizing and valuing the various assets that each situation has according to the question being posed or the change being observed. The inductive nature of this approach ensures that no presumption of outcome is given at the outset and that through observation and discussion a picture of the situation will emerge that reflects the 'lived' reality as reported by locals, officials and experts. This may be referred to as the 'big' picture. It emerges free of templates, models and prescriptions. Once a big picture has emerged, quantitative techniques can be applied, for example in the form of field surveys, on those topics identified by the stakeholders as important and on the questions that have been posed and that have arisen in stage one. In this way, the inductive approach has at least two steps and combines both subjective and objective techniques (mixed methods). Only in the final analysis are the experiences and views of the researcher added to the interpretation of the emergent picture to give further meaning and significance to any discernable patterns.

In this approach, less time is spent on assessing the detailed accuracy of measurement and more on getting the general pattern of the story behind agrarian change. One is less concerned about gathering evidence to support one's theoretical hypotheses and more intent on recognizing 'surprise' and dealing with unfamiliar situations. What emerges are 'narratives' about agrarian change, provided by the 'actors' involved, that reflect complexity, incidences of contestation, and a degree of confusion and contradiction. The dynamic capacity of complex systems is such that one is never finished as in a 'final conclusion' or end game, but that one is part of a narrative that is continuously unfolding. Such research provides valuable glimpses of change, but not the whole picture (as one is never absolutely certain what the whole picture would look like). One needs to be incrementally satisfied with part-pictures, insights and clues as to what might reveal more in further research.

In terms of providing additional evidence for this paper, a field survey of Qingtian farmers and officials was undertaken. The authors conducted seven field surveys between October 2013 and December 2014 to build a ‘big picture’ of the system in each village and then to focus on key elements of the big picture in a direct enquiry. Each visit lasted from 3 to 7 days. Among 34 key informants interviewed for the focused survey, 18 were local directors (4 women) and 16 were farmers (6 women). The interview focused on local production and daily activities, including household information, agricultural production in general and in busy seasons specifically, non-agricultural occupations, perception of village changes, understanding of the GIAHS designation, and attitudes towards agriculture development in the future. These questions were informed by the Sustainable Livelihoods survey methodology. All contacts were approved through the Ministry of Agriculture and interviewer/translators were provided to ensure that local idioms, language and customs were duly observed and incorporated. Although the process was top down to begin with, it was supplemented by several ‘informal’ contacts who emerged from the process and who were interviewed in the evenings and weekends. In this way, several young people were included in the research and the average age bias at the outset (average age of formal contacts was 48; the average age of all contacts was 38 years of age) was reduced. As migrant youth are considered to be the main problem affecting the sustainability of the rice-fish system, it was considered essential to include some youth in the discussions and survey.

4. Results

4.1. Longxian Village

At first glance, there are two core features of Longxian village: the village settlement and the terraced fields maintained for rice-fish cultivation for many centuries by the villagers. The community is nestled into the surrounding mountains and is the last village on the valley road in Fangshan Township. In the past there was a high level of integration between village settlement and the rice terraces (all households had rice fields) with many paths and alleys connecting the two. Today, only 50 out of 249 registered families—less than one third of the present residents (Table 1)—farm the land and derive their basic livelihood from rice-fish cultivation.

Table 1. Farm land and labor in three case villages, Qingtian County, 2014.

Village	Registered Residents	Present Residents *	Percentage of People “out”	Arable Land in Village (mu **)	Arable Land Used (mu)	Percentage of Abandoned Land
Longxian	869	300	65%	450	300	33%
Xiaozhoushan	1160	160	86%	700	540	23%
Renzhuang	4686	2325	50%	420	300	29%

Note: * Present residents means villagers who lived in the village for over 6 months in 2014; ** 1 mu = 1/15 ha.

Longxian was almost a closed system in the past. Today it is open at multiple levels. Each of the levels represents an entry point into understanding the village system. Most of the households have access to a car and there are several motorcycles in the village. A bus runs from Longxian to Qingtian and back 10 times a day, at one-hour intervals seven days a week. Some people work in surrounding township villages, others work regularly or occasionally in the countytown, some are farmers and traders, some work in mining and construction and others in the tourism sector. However, more than 60% of the villagers work overseas and the loss of labor has led to one-third of the farmland in the village being abandoned (Table 1).

Because of the GIAHS designation, Longxian is presented as a picture-perfect rice-fish terrace system highly attractive for tourists today. On entering the village there is a small car park and the official stone fish symbol of the Qingtian heritage site (Figure 4). The terraces are up on the hillside on one flank of the village, and can be accessed by paths that traverse the terraces and turn into a boardwalk and viewing platform (built with GIAHS funds) in the middle of the rice-fish terrace landscape, ideal for observing the fish in the small contour-terraced fields and admiring the many

other plants grown as companion crops, such as taro, and dry paddy rotation crops such as sweet potatoes. Azolla, a fern that lives and multiplies rapidly on the surface of the water in the terrace, is good for creating shade and food for fish and provides an attractive water surface color which has been captured in thousands of photographs by tourists. From the viewing platform all paths lead into the village where there are three restaurants and a few small shops. Not many tourists actually visit the terraces and sit in the viewing area; most are interested in tasting the fresh red carp meals in the old style restaurants and taking home some of the dried fish.



Figure 4. Longxian Rice-Fish Terraces (provided by Qingtian Agriculture Bureau).

Due to the GIAHS designation, the Qingtian field-fish has become more famous than before, and the price of the fish has increased considerably. Over the past ten years, the price of the field-fish produced in Longxian increased from 30 yuan per kilogram to 120 yuan per kilogram, much higher than the average price in the whole county. Today, the price of dried fish is astonishingly high, reaching 400 yuan per kilogram in 2014. One family in the village, who were unable to go abroad in the past due to economic limitations, now can earn almost 1 million yuan in a year by selling the fish meals and the dried fish in the restaurant that they run by themselves. Fish are more valuable today than rice. Almost all households, even those who do not farm the land any more, still keep the fish tank next to their house or a 3 to 5 m section of a village stream for raising the red carp.

Taking into account the modest impact of tourism, the low engagement in traditional farming, and the high geographical mobility of village residents, a surprising contradiction appears in the assessment of the adaptation of village life. This is reflected in the village buildings. Most of the houses in Longxian are 3 to 6 storey buildings, constructed or renovated in the past 10 years and in a style reminiscent of Mediterranean Europe. They have flat roofs, pastel-colored stucco walls, marble floor tiles and wrought-iron decorative railings around the balconies and along the stairways. These tall buildings, separated by narrow alleys, form canyons in the village. Most buildings have iron grills on the windows and are locked and empty. This is a different kind of 'hollowed out' village.

A GIAHS designation has not reduced the general situation of labor loss and land abandonment in Longxian, although some overseas people have been attracted by the GIAHS brand to come back from abroad and invest in the village. Accounting for the adaptation mode of Longxian village, one is struck by the multiple streams of engagement with the outside world. Modernization is present in most forms of village life, but is muted by the GIAHS effect which is to keep the village landscape ancient and the village culture as traditional as possible. The present village leaders, all return migrants

and wealthy, wish to keep Longxian in traditional mode to enhance the historical assets as a way to sustain tourism, fulfill the GIAHS mandate and bring prestigious visibility to their community such that other overseas Chinese will return and invest in the betterment of their hometowns. One project is to build a road, at great cost, around and above the village to enable tourists to view and photograph the rice-fish terraces from vantage points above the fields. Another overseas-inspired project is to renovate a church which reflects the Roman Catholic traditions of Southern Europe and complements the many Mediterranean style buildings in the village. Most surprisingly, the present leader renovated the abandoned primary school and changed it into a GIAHS-theme restaurant using photos from different GIAHS sites in China to decorate the rooms. This enables tourists to learn about other GIAHS sites while tasting the fresh fish meals in the restaurant.

The loss of young farmers, as well as the increase in the price of labor, has made the rice-fish system operate in a simple way. The local farmers only hire laborers to sow and harvest. They barely use chemical fertilizers, pesticides and herbicides during the production period, which makes the rice-fish system a suitable production base for green food, highly favored by consumers. However, ironically, egrets move faster than the consumers. Several years ago, egrets began to settle down in the county, attracted by the non-chemical environment and the delicious field-fish. Now, egrets have become a disaster for the local farmers because they eat small fish and peck out the eyes of the adult fish, which has seriously damaged the fish yield and also the earnings of the farmers. (This information was collected in conversation with farmers during the field surveys.)

In the village of Longxian, adaptations to the forces of modernization have taken economic and cultural forms with the traditional rice-fish system representing its 'face to the world' and supporting a manageable scale of tourism. The village of Longxian has re-organized itself within the framework of the traditional Chinese village administrative system and with the logo of GIAHS has proudly adopted an international seal of approval. In this sense, the village is 'self-organizing' in response to its former poverty and to the opportunities, as perceived, in modernization. In this example, government support for development is channeled through GIAHS administration (the Agriculture Bureau) and the Tourism Bureau which, together with village leadership, may, over time, move the village closer to a new reality; perhaps that of becoming a 'living museum'.

4.2. Xiaozhoushan Village

Located high in the mountains in another part of Qingtian County, Xiaozhoushan also has newly built and renovated houses in the Mediterranean style, but only a few. In this village, three quarters of the old stone farmhouses are in poor repair with collapsed roofs and open walls. Most of them are abandoned. As it is remote, Xiaozhoushan no longer has a school, but does have four restaurants and is the seat of the township government. More than 22 people work in the local government, but none of them live in the village.

Xiaozhoushan has a vast terraced landscape and once supported a large farming community. As many people have left the area for non-farm work in neighboring provinces, especially Guangdong, many farm fields (terraces) have been abandoned. Today some of these fields are being re-organized into a group enterprise under cooperative arrangement with village labor and workers from surrounding villages. A fundamental shift in land management is taking place.

Xiaozhoushan is re-inventing itself. It has chosen the tourism route to a re-structuring of village livelihoods. Village leaders tried the idea of sowing auspicious Chinese characters and symbols into the terraces with rapeseed plants near to the road to attract visitors in the Spring (Figure 5). As a result, on weekends in April and May, more than 1000 cars are parked along the tiny road to the village so that people can walk into the terraced fields along terrace-wall paths to see the patterns at first hand. Although highly seasonal, this is a remarkable achievement and has encouraged the village leaders to undertake the development of more attractions: summer symbols in the rice paddies, a hiking trail to see several waterfalls, and the provision of overnight home-stays and a village hotel.



Figure 5. Auspicious design in rapeseed landscape in Xiaozhoushan (provided by Qingtian Agriculture Bureau).

The essential feature of the tourism attraction, however, is the rice-fish terraces and their continued use. It is important to note that the land assembly co-op is central. A retired village leader who lives outside the community undertook, with government support, to assemble abandoned fields in the village at the end of 2011 and hired labor from the village to farm the fields in a traditional agro-ecological way to produce organic rice and fish. In 2012, a cooperative was formed to assist in the assembly of more land and to obtain some government financial support. By now the farming enterprise was large enough that labor from outside Xiaozhoushan was recruited from surrounding villages. Villagers now have the possibility of working their own traditional fields, working on the auspicious shapes for the township, and/or working for the co-op and the ex-village leader turned entrepreneur. Ironically, with all these choices for farm labor, there are only approximately 160 people resident in the village (Table 1), most of whom are over the age of 55. Clearly there is a serious farm labor shortage in Xiaozhoushan.

The GIAHS designation for Qingtian County has a different scale of benefit in Xiaozhoushan. The GIAHS logo is visible on the organic rice packets produced by the co-op and has become a prestigious label for marketing. Although some village signs for tourism make reference to the GIAHS, they are not prominent or well understood. Tourism here is a product of the village government and has little to do with GIAHS or the County Tourism Bureau. The high price of red carp here is the same as that in Longxian and is thought to be mostly due to the GIAHS designation on the labeling.

At this point (2014), capital and influence from 'outside' have not been a major factor in Xiaozhoushan. There are a few new and renovated houses and a refurbished hotel, but no central cultural influence other than the two churches in a village of 160 people. Perhaps this is because most of the migrants went to Guangdong Province in S.E China and not overseas.

Although there is a sense of 'too little-too late' in Xiaozhoushan, there is also growing evidence of an endogenous adaptation process taking place which also contains a strong 'self-organizing' element.

4.3. Renzhuang Village

Renzhuang is a progressive community with big rural settlements, large flat rice fields formed in squares, an agricultural experiment station, a fish hatchery and a regular bus to the county town. It differs notably from Longxian and Xiaozhoushan.

In response to the GIAHS designation, Renzhuang has taken on the 'technological development' role in rice-fish cultivation in the agricultural economy. There are many experimental fields in the area

where new ways to improve rice-fish cultivation techniques are being tested, often by local farmers (Figure 6). This effort is being spearheaded by the Agriculture Bureau and researchers from Zhejiang University who are looking at integrated pest management methods, new companion crops and edible animal species in the rice paddies, and improved rice seed selection. This represents a fusion of science and the traditional knowledge systems in rice-fish cultivation. In effect this approach most clearly embraces modernization.



Figure 6. Rice-fish experimental field in Renzhuang (provided by Qingtian Agriculture Bureau).

In one area, a variety of Japanese soft-back turtle has been introduced, with the co-operation of farmers, into large-scale experimental rice paddies. In another, a rice-seed drying plant has been established with government funds to help improve seed selection and rice plant propagation and ultimately to increase crop production.

The whole of the Renzhuang area is populated by new houses, many in the European style, and renovated homes for local people who no longer work in the agricultural sector. The area buzzes with everyday activity, most of which reflects modernization in China in its rural forms. There are clothing stores in Renzhuang as well as farm supply stores; there are hairdressers as well as restaurants and convenience stores for locals. Few of these retail services appear in Longxian or Xiaozhoushan. Renzhuang is not 'hollowed out' and has a vibrant population mix, although still dominated by older people.

The form of adaptation here is that of developing and enhancing 'the product', the product being the rice-fish tradition of the agricultural economy. The GIAHS is not visibly a major feature in Renzhuang, although the commitment of the county government to the GIAHS idea is expressed in agricultural scientific development and concomitant investments in infrastructure for ecological experimentation. In general, it brings eco-agriculture to the forefront of official agricultural development in Qingtian County.

5. Discussion

It is clear that Qingtian County's being designated a GIAHS site has elicited, over time, different responses from the three settlements under review. The central purpose of the GIAHS designation is to sustain the rice-fish system of terrace farming to demonstrate the benefits of ecological agriculture in the hilly and mountainous environments of southern China. Promoted under the concept of 'adaptive management', the county has shown strong support for GIAHS, but in a typically scientific and agricultural development manner. A second strand of support has been through tourism development but, overall, this is much less prominent in terms of budget and effort. Importantly, the three villages

studied all show that rice-fish production is the central component of their farming system, and to this point have found both overlapping and different ways to accomplish this GIAHS goal. This illustrates the flexibility of adaptation in Chinese agrarian change.

In terms of the bigger picture, these diverse responses reflect village adaptation strategies to global restructuring. All three villages are connected in different ways to international markets: for labor, for goods, for capital and, in the case of GIAHS, for ideas about heritage conservation. There seems to be a relatively free flow of people, capital, innovations and cultural transfer between international markets and remote villages in mountainous regions of South China. These connections are not under the auspices of grand ‘development’ schemes, international agencies and multi-lateral programs and the like, but are self organized by families and communities at the local level on a seemingly ad hoc basis. These flows represent effective self-organizing responses to global economic restructuring.

The following diagrams (Figure 7), based on observations and key informant discussions, attempt to illustrate the centrality of rice-fish farming, but sustained by very different constellations of supports (represented by circles) with widely varying degrees of influence (size of circle) (The representation of the interdependence of sub-systems in Complex Adaptive Systems theory is that of subsystems, here depicted as circles. A visual representation of subsystems in the typical GIAHS system is shown in Fuller et al. [43]) in the three villages.

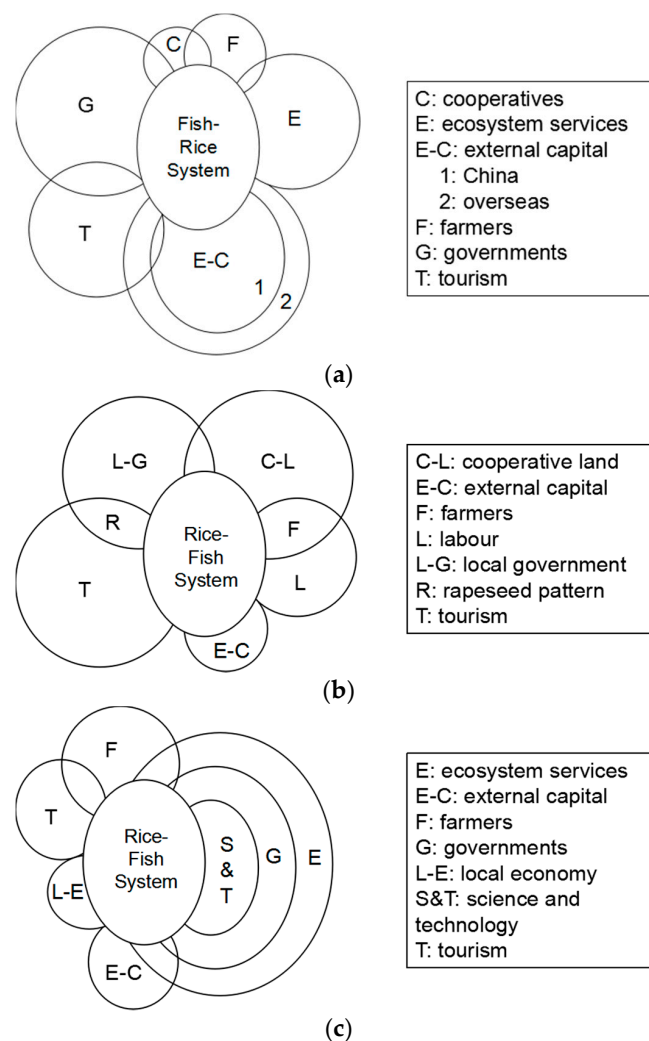


Figure 7. Diagrammatic representation of the rice-fish support systems in three villages of Qingtian County. (a) Longxian; (b) Xiaozhoushan; (c) Renzhuang.

In Longxian village, the factors affecting the rice-fish farming system are well balanced between government supports for GIAHS, channeled mainly through tourism infrastructure and agricultural advisory services, and a large amount of external (private) capital. The village system is dominated by this outside capital and related demographics. Farming itself is a small subsystem. Note that in Figure 7a, the farming system is termed fish-rice system to reflect the restructured relationship between rice and fish. The surprise here is the influence of outside capital and the many connections to overseas culture and ideas.

In Xiaozhoushan, the rice-fish system is sustained by an ongoing reorganization of land management under both cooperative and private enterprise efforts. The local government is the prime mover in ‘inventing’ a major tourism attraction (auspicious shapes in the rapeseed and rice fields) and is using modern techniques (GPS and laser designs as well as online promotions) to develop this comparative advantage further. The surprise here is the need for farm labor to come from outside the village, even from as far away as Guizhou Province.

The Renzhuang set of system influences is heavily skewed towards scientific and technical support for improving the sustainability and the productivity of the rice-fish farming system. The remaining actors and activities in Renzhuang area are what one normally sees in a rural system adjacent to a city, indicated in the diagram as ‘normal’ functions of a relatively balanced rural life with population, employment and functional diversity. There are no surprises here other than the amount of scientific support for an ancient agro-ecological farming system.

6. Conclusions

It is evident that rural China is undergoing rapid and profound forms of change and that these are either self-induced as responses to external forces of change or are imposed as institutional forms of restructuring or planned change. Applying observation and interviews with a wide range of actors, not only does this study discover the socio-ecological adaptation features of Qingtian rice-fish system, it also produces many interesting questions for the debate on agrarian change in China.

From this research, the first observation is that heterogeneity of response is far more common than expected in a State in which centrally planned development has been the norm. It is evident that ‘centrally planned’ can mean state, province or county level planning, but in effect the administrative village is also effective in forming its own restructuring response within the county administrative framework. The three village representations in Figure 7 demonstrate, by their distinctive differences of shape, the variations in response to maintaining traditional rice-fish farming landscapes in Qingtian County. These diverse responses also include some common elements such as strong government support and the development of tourism. Secondly, in an era of modernization, welcomed by most rural Chinese, the mobility of labor is a striking factor and has diverse consequences for the reorganization of rural farming systems. Evidence from the three sites studied here shows that rural areas have moved from having “surplus labor” to having a “labor shortage” in two decades or in one generation. In all three villages there is a local labor problem and farmers from other regions are being recruited for work on the land in Qingtian County. In the chain process of labor movement and land transfer, self-employed farmers have become farm workers. The third observation, which in fact accompanies this trend, is that of land assembly. As upland terraces are difficult to cultivate and maintain, being far from the village, high in the mountain reaches, and hard to access for carrying farm implements and recovering the harvests, they have been abandoned by farm families that have long ago left for non-farm work elsewhere. At first these high terraced fields may be left for neighbors to cultivate or watch over in a form of usufruct, but eventually they are completely abandoned. Today, a remaining farmer has a wide choice of which village fields to cultivate, how many, and for what purpose.

Sustaining the fields farmed in an ecological way with economic returns to labor and/or capital has become an important goal of local and County level governments. Three villages in Qingtian County have adapted differently to the challenges brought by modernization in maintaining their traditional systems. Consequently, the rice-fish system remains and is the core component of tourism

attractions, for marketing local products, sustaining a range of eco-services including bio-diversity, and maintaining a local culture. These objectives and their outcomes are almost exactly those of the GIAHS program.

What, then, has the GIAHS achieved in Qingtian County? A 10-year evaluation will potentially answer this question more fully, but it is clear that a GIAHS designation does not imply a template or single model of what to do to achieve sustainability in a heritage system. There are many different ways to achieve decent livelihoods and to maintain landscapes with ecological integrity. These mechanisms allow for flexibility in the response to modernization, manifest as land and labor mobility, and as well provide a bulwark against the increasing loss of environmental quality. Even abandoning terraces may not be a bad outcome at this point in time, as high mountain terraced land can be left fallow to recover its natural fertility and/or be planted with low maintenance trees for greater erosion control and environmental sustainability. As with all complex systems, it depends on how one looks at it and from which entry point one makes the first steps of enquiry.

As this paper shows, looking at the GIAHS rice-fish areas from a whole systems viewpoint helps to elucidate more about complex systems in relation to ancient agricultural heritage sites faced with the predations and temptations of modernization and to formulate more pertinent questions for further research. By examining multiple views of the same situation, the complexity of agrarian systems can be taken seriously and surprises and confusions noted. These can become the starting points for further research on responses to capital-led farming change in China and elsewhere. The potential of land assembly will certainly lead to more dramatic changes in the agricultural systems of lowland China. What forms of restructuring will occur in the mountain areas, however, remains a more open question. While, as has been shown, rice-fish systems in terraced landscapes are clearly a sound ecological use of land, they are drastically threatened by a loss of labor and the indigenous knowledge that derives from on-site familiarity and practice.

The insights gained from an inductive approach to tracking and interpreting agrarian change and sustainability are manifold, as demonstrated by this simple use of complexity thinking and analysis. This paper has not been an exercise in measurement as in objective science, but an exploration of farming systems in a general sense designed as a way to get a bigger picture of resilience in a complex system and to be more sure that we are asking the right questions for future research. Of primary importance is the new found ability to add to the 'official' narrative, and to accept surprise as a technique in developing new insights and making improbable discoveries. Two new churches in a village of just over 100 people, in a country with no official religion, raises many interesting questions. New houses of alien styles and functions beg questions of cultural renewal and future directions of social change. To what extent will capital penetration into upland farming systems go before new forms of resilience and resistance occur? Employing elements of complex systems thinking and the language of resilience and adaptation in a social systems context opens more questions for future research. Such questions will also have implications for environmental impact. No subsystems operate independently. Importantly, these questions are not derived from linear thinking or path dependency, but from uncertainty and contradiction. If the persistence of rice-fish farming is normal, is the modernizing context in which the farming system is embedded a new normal? What we need now are more penetrating techniques to follow these questions and learn more about resilience and the sustaining of such systems into the future.

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