

**Format for Proposals of Candidate Systems
For The Globally-important Ingenious Agricultural Heritage Systems (GIAHS)
Programme
(PDF-B phase)**

a.	Country and location China: Qintian county in Zhejiang province; Congjiang county in Guizhou province.
b.	Project title / name of the system Development and protection of rice-fish culture in China: policy options
c.	Funding requested US\$ 85,000
d.	Requesting agency Center for Chinese Agricultural Policy (CCAP), Chinese Academy of Sciences (CAS)
e.	Governmental counterparts and other partners <ul style="list-style-type: none"> • Local communities • Local governments in provinces of Zhejiang and Guizhou • Ministry of Agriculture • National Agro-Technical Extension and Service Centre, Ministry of Agriculture • United Nations University
f.	Project duration (starting and end date) July 2004 – July 2006
g.	Summary of objectives and activities (max. 200 words) <p>The project objective is to recognize and promote multiple values of the rice-fish system for livelihoods, ecological and cultural preservation by evaluating policies, institutions and technological developments that impact on farmers' practices of rice-fish system, and developing a network of demonstration sites and partners in provinces of Zhejiang and Guizhou, China. The specific activities are:</p> <ul style="list-style-type: none"> • Document changing patterns of the traditional rice-fish system; • Evaluate impact of policies, institutions and technologies on farmers' practices of the rice-fish systems and identify those policies, institutions and technologies that encourage specialization of rice or fish production. • Set up representative demonstration sites/villages through partnership between local communities, government, CSOs and other partners; • Identify and demonstrate successful adaptations to social-economic changes, and explore the multiple values of the rice-fish system in the food safety, eco-agriculture, eco-tourism and ecological conservation. • Develop networking on conservation of the rice-fish system among communities, local governments, CSOs and other partners.

DESCRIPTION OF GIAHS

Rice is one of principal food crops of the world. It provides 20 % of total calorie supply of the world population. Ninety percentages of rice fields are distributed in the Asia. Ninety percentage of them are wet fields, which are irrigated, rainfed or deepwater. Upland rice accounts for only a small percent of the rice areas and production.

Over a long history, fish is farmed in some wet rice fields, either concurrently or rotationally with rice in Asia. The canon for fish culture written by Fan Li about 400 BC states:

... dig six mu of land into a pond ... put 2000 fry into the pond ...sell the rest in the market."

In a good year with ample rainfall and moderate weather, 2000 carp fry could produce numerous eggs. Some wise farmers may have placed excess fry in their rice fields. The fish in the rice fields may have grown better than those in the ponds, and the practice of raising fish in rice fields was born. There are no records of when the practice started, but this seems to be a logical explanation of how rice-fish farming began in China.

The rice-fish farming system is described not only as one of production style, but also as one of the culture. Tombs of the mid-Eastern Han Dynasty (25-220 AD) were excavated in 1964 in Hanzhong county, Shanxi Province¹. Two clay models were unearthed: a model of a pond and a model of a rice field. The pond model contained 15 miniature pieces (6 common carp, 1 soft-shell turtle, 3 frogs, and 5 water chestnuts). A stone carving of a pond and rice field model was discovered in the brick tomb of the Eastern Han Dynasty in 1977 in Emei County, Sichuan Province. Half the stone was carved into a pond with frogs, fish, and ducks. The other half was carved into a rice field with an inlet and outlet, two farmers toiling on one side, and two heaps of manure on the other. Four mid-Han Dynasty tombs with 200 relics were excavated in 1978 in Mian County, Shanxi Province. One of the intact relics was a rice field model containing 18 pottery miniatures of aquatic plants and animals. There were sculptured frogs, eels, spiral shells, crucian carp, grass carp, common carp, and turtles in this model. Another of a winter rice field showed farmland with a reservoir that also contained these fish. These relics not only proved that rice-fish farming system was one of farmer's production practices 1700 years ago. It also proved that the early rice-fish farming system is a very diverse system.

The more detail written record of rice-fish farming is from *Recipes for Four Seasons* which was written by Cao Cao² in Sanguo Dynasty (200-265 AD):

A small fish with yellow scales and a red tail, grown in the ricefields of Pi County northeast of Chendu, Sichuan Province can be used for making sauce.

After that, in Tang Dynasty, in Ming Dynasty, and in Qing Dynasty, there were also numerous written records about rice-fish farming system or culture. For example, Liu

¹ Liang, Jiamian. *History of China's Agricultural Sciences and Technology*. Chinese Agricultural Press. Beijing. 1986. pp. 155-158.

² Cao Cao is the emperor of Wei in The Three Countries Dynasty.

Xun (about 889-904 AD), wrote in *Wonders in Southern China*:

In Xin, Long, and other prefectures, land on the hillside is wasted but the flat areas near the houses are hoed into fields. When spring rains come, water collects in the fields around the houses. Grass carp fingerlings are then released into the flooded fields. One or two years later, when the fish are grown, the grass roots in the plots are all eaten. This method not only fertilizes the fields, but produces fish as well. Then, rice can be planted without weeds. This is the best way to farm.

It indicated that before 1000 years ago, China's farmers had adopted the rotational rice-fish farming technology. Another record was found in chronicle³ of Shunde County, Guangdong Province in Ming Dynasty (1573 AD). It states that:

The periphery of a land was trenched as a plot, called the field base.... In the plot, a pond was dug to rear fish. During the dry season, rice seedlings were transplanted to the plot. The area might be several hectares. It indicated that rice-fish farming technology was further advanced 400 years ago.

Currently, many variations of rice–fish farming have been developed in China to fit in with local conditions⁴. In order to plant early, middle, and late rice continuously without interruption, fingerlings and summer fry are released directly into the flooded rice fields. The water level in the rice field needs to be adjusted or drained for rice cultivation. Ditches, furrows or ponds with appropriate level of water are built to host fish when conditions in the rice fields are not suitable to fish. Rice and fish can be combined with other beneficial plants. In the rice-azolla-fish system, rice is grown in the field, azolla on the surface of the water, and fish in the water. Fish feed on the azolla, and the field is fertilized by fish excrement. The azolla also fixes nitrogen for rice. The fish in the rice-fish system can be replaced by crab, shrimp, duck, frog etc. depending on local conditions and profitability. The intercropping of different rice varieties in the rice fields could reduce significantly the incidence of rice diseases and needs of pesticides⁵. This practice has helped to restore fish culture in the rice fields where the application of pesticides used to be a major threat to fish.

In addition to producing rice and fish for livelihoods, farmers also cultivate symbiosis between fish and rice in the wet fields. Fish eat many of the weeds and uproots the tender roots and stalks of the weeds by tilling and digging holes in rice fields⁶. Weeding by fish is timely and frequent and superior to chemical weeding. This was already recognized long time ago as well illustrated in above quotation by *Liu Xun* (about 889–904 AD).

Fish feed on insects and their eggs, such as rice borers, plant hopper, and leaf rollers. By adjusting water level, fish may jump to catch the insects on the rice plant. They also feed on and digest the nucleus of the bacteria that causes sheath and culm blight. The research shows that keeping fish in the rice field may reduce the possibility of rice diseases. Fish culture in rice fields also helps eliminate mosquito larvae and

³ Mackay, T. Kenneth (editor), *Rice-Fish Culture in China*. IDRC. 1995. pp.4

⁴ Ni Dashu and Wang Jianguo, *Different Methods of Rice–Fish Farming in Mackay, T. Kenneth (editor), Rice-Fish Culture in China*. IDRC. 1995.

⁵ Zhu, Y.Y., Wang, Y.Y., Chen, H.R., and Lu, B.R. 2003. Conserving traditional rice varieties through management for crop diversity. *Bioscience* 53 (2):158-162.

⁶ *Fish Culture in Rice fields: Rice–Fish Symbiosis*, in Mackay, T. Kenneth (editor), *Rice-Fish Culture in China*. IDRC. 1995.

reduce the incidence of malaria, which remains a threat to public health in tropical Asia.

The fish excrement is rich in nitrogen and phosphorus and therefore increases the fertility of the rice field. Fish activities also help spread nutrition in the rice fields. Nutrient analysis has reported that there are 1.2 times more phosphates and 1.3–6.1 times ammonia levels in rice–fish fields than in fields without fish.

The symbiosis between fish and rice is also reflected in the way that rice support fish in the wet fields. Rice growth releases oxygen to the air. The shallow water in rice fields brings much water in contact with the air. The disturbance by fish activities also helps maintain oxygen solution in the water for fish growth. The water in rice fields is replenished frequently. Rice plants absorb fertilizers and purify the water in the fields and, as a result, the water is continuously fresh and clear. The pathogenic bacteria are much less in rice fields than in pond water. The clear water may help reduce fish diseases. Some rare fish species have adapted to these special conditions of rice fields. For example, Longxian village, Qingtian county, Zhejiang province, is one of the traditional rice-fish farming villages. Because the special ecology and longer rice-fish farming history, an endemic fish landrace, named *China field carp*, is still cultured by the farmer.

China's legal system⁷ stipulates that most farmland is owned collectively by farmers. Launching in the end of 1970s, the rural household responsibility system (HRS) reform distributed the farmland (including cultivated land, water, and forest land etc.) to farmers. Farmers can decide by themselves what to grow in their land based on needs of home consumption and markets of agricultural products⁸. As one of the production technologies and activities, whether to adopt rice-fish farming is up to farmer's decision. Most farmers own both the water surface and the land in Qingtian county, Zhejiang province, and in Congjiang county, Guizhou province. They usually move the fish in the rice field to the water ponds when the rice is harvested. Some farmers raise fish fry and young fish in their rice fields and sell them to the fish folks, who will then continue to raise them in fish ponds. It is relatively easy to move fish between the rice fields and the fish ponds, and the production cycle of rice-fish culture is also relatively short. As a result, farmers' input to the rice-fish system is not so much affected by the security of the land tenure.

As rice fields in China are small, farmers' cooperation in the village is essential to managing this rice-fish culture. In some cases, rice growers and fish growers cooperate in using same rice fields for production.

Demonstrating an ingenious approach to generating economic and social benefits through encouraging essential ecological functions (food web, carbon and nutritional cycles, and pest regulation), rice–fish system can reduce pesticides and fertilizers application, which are threatening human health, other species and environment.

Besides those, the rice-fish system provides multiple goods and services, including:

⁷ The law system include the Land Management Law, Regulations for the Implementation of Land Management Law, Regulations for the Protection of Fundamental Farmland, Regulations for the Rehabilitation of Land, Provisional Regulations on Land Appreciation Tax, Measures for Management of the Construction-Used Land, etc..

⁸ It is not like most of the developed countries, China's farmers still feed themselves by their grain productions. Rice and fish they produced in rice-fish farming usually as their important food. They only sell the surplus in the markets.

food security (rice production); quality nutrition and income generation (consumption and sale of fish); prevention of malaria (reducing mosquito by fish); conservation of biodiversity (rice, fish and associated species due to reduction of pesticides); pest regulation; carbon and nutrient cycles. The rice-fish system also demonstrates an ingenious approach to inspiring how economic and social benefits can be achieved through encouraging essential ecological functions.

THREATS AND CHALLENGES

The rice-fish farming area in China had increased from 667 thousand hectares in 1959 to 985 thousand hectares in 1986 and 1532 thousand hectares in 2000⁹. However, it has decreased from 1532 thousand hectares in 2000 to 1528 thousand hectares in 2001 and 1480 thousand hectares in 2002. The rice-fish farming system is threatened by expansion of highly productive mono rice or fish systems, which include improved rice or fish varieties with excessive application of chemicals (especially pesticides for rice and antibiotic medicines for fish) in rice fields or fish ponds.

The food safety, ecological functions and environment conservation are seriously undervalued. With chemicals, rice growers do not need to depend on fish to regulate pests and recycle nutrition. The intensive fish culture produces much fish at a low cost to the market. During last 20 years, the total aquatic production in China has increased by 8.7 times, but the prices of aquatic products have increased by only 4.4 times. As a result, the benefits by raising fish in the rice fields over the mono rice production are diminishing.

The management of rice-fish farming needs more labor and village cooperation than the mono rice production. A survey in Jiangsu province showed that only half of farmers who adopted rice-fish farming technologies in 2002 would prefer planting single rice or other crops to rice-fish farming in 2003. Some farmers claimed that if they dig the same area of rice field as a fish pond, they would make more money than the rice-fish farming. Some farmers who used to practice rice-fish farming reported that they prefer buying fishery products in markets to raising fish in their rice fields. The additional labor for managing a rice-fish system is valued at nearly as same as the fish it would produce. For fish to reach the marketing size, farmers often need to continue to raise fish in the pond or rice field after rice is harvested. This competes for land and labor, which are increasingly scarce in rural China. The integrated rice-fish farming is further threatened by the monoculture of rice or fish with the decreasing costs of production. The cost reduction of the mono-culture is achieved through promotion of high-yield varieties and chemical inputs. The little gain from adopting the rice-fish culture undermines continuation of the rice-fish culture, especially in more developed areas.

However, the government is encouraging farmers to continue the rice-fish culture as one of environmentally friendly technologies. The local government's agricultural extension agents, particularly in the poor areas, are making great effort to extend the technology of the rice-fish farming. Sometimes, the government's objective in ecological environment is not consistent with farmers' interest in profits.

⁹ MOA. Unpublished fishery state.

Qingtian county and Congjiang county are among the few counties where farmers still practice the traditional rice-fish farming technology as well as the new rice-fish farming technology they have adopted. The promotion of the rice-fish system has multiple benefits:

- 1) Contribute to conserve this traditional agricultural heritage with associated cultures and biodiversity;
- 2) Improve farmers' health with reduction of pesticide application;
- 3) Increase farmers' income in the marginal regions where labor opportunity cost is low;
- 4) Improve safety and nutrition of food products from the rice-fish system;
- 5) Develop potential approaches to managing this unique system, such as eco-tourism.

SITES SELECTION

We have selected two provinces as our demonstration sites: Zhejiang and Guizhou. Zhejiang is one of the richest provinces and located in the southeast of China. Guizhou is one of the poor provinces and located in the southwest of China. Two counties, Qingtian (Zhejiang) and Congjing (Guizhou) are selected to conduct the proposed project. Different from most of rice-fish farming counties in China, the Qingtian and Congjing counties have a long history of the rice-fish farming practices and the recorded history is more than 1000 years. Besides those, Congjiang is also one of the Dong nationality counties and fish is one of the principal foods, which the most Dong people do. The long history, diverse cultures and natural scenery make the two counties not only have important value of heritage protection for rice-fish farming, it also has important value for the landscape development.

Two villages are selected as focal sites in the two selected counties: Longxian village in Qingtian county of Zhejiang province and Zengchong village in Congjiang county of Guizhou provinces. Longxian is one of the famous villages inhabited by relatives of overseas Chinese. Although there are only 784 residents in the village there are 650 relatives living in 50 countries. Extensive overseas relatives supply the resident abundant market information and spread the village's products to the world. Every year hundreds of overseas relatives, tourists and merchants visit the village and the village's fishing product, tea, carved stone and other products are taken to their countries of residence.

The major agricultural products are rice, fish and tea in Longxian village. Although the per capita land in the village is only 0.44 hectares in the village, each farmer grow rice and raise fish in their rice fields. One of unique characteristic of the village is that where there is water, there is fish, and where there is house, there is fish. Every household in the village has ponds around their house, which make farmers can rotate the fish in rice field and pond. Besides agriculture, stone carving is the major non-agricultural industry in the village. Wu's family, one of the historical architecture heritages – Wu's house which was built in 1929, is one of the major cultural tourist treasures, and one of the initiating families of stone carving in Qingtian County. Fish lanterns are traditional in this village. The village is also a demonstration site of the provincial fishery and the quality of the rice field fish is certified as Green

Agricultural Product. The tourism agriculture combined with attractions of cultural heritages is becoming the major driver of the village development.

Zengchong is another village selected as the focal site. As one of the Dong villages, Zengchong is located on a low hill and two streams flowing through the village. With the good forest management 70% of the land is covered by forests. The most common species of trees is fir and pine. The tree seedling is planted when a boy is born. It is cut to build the house when the child reaches the age of 18 and marries (the tree are also called “18 years tree”). The rice fields are usually located beside the river and streams, and some scattered on the hills. Dry land is rare and scattered among the mountainous area.

Besides rice production, fishery is farmers’ another major income resource in the Zengchong Village of Dong ethnic minority. There are three ways of fishery in the village: *Pond fishery*, *rice field fishery* and *fish nest fishery*. Most households in the Zengchong Village have a fish pond near their houses or their rice fields. In such fish ponds, big fishes are raised and fish fry produced. Fish farming starts in the rice fields a few days after planting of rice seedling and applying fertilizer in the rice fields. First of all, fry larger than 3 cm are brought from fish ponds to the rice fields. As the rice is ready for harvest, fish grow up and is harvested after water is drained before rice harvest. Fish from rice fields are used for home consumption and sale, while the remaining is moved back to fish ponds for further grow-up. Fish nest fishery means fish farming in the nearby rivers near villages. The fish nest usually is located in the slow flowing and deep part of the river, for example, the inner side of river when it makes its turn and where the coffer-dam is located along the river banks. After the raining season and before the next raining season, farmers put tree branches and grass, even fish meal in these nest places for fish to reproduce and grow up. A few months later before the Spring Festival farmers usually fish the nesting places. Traditionally fish nest farming is managed by families or clans.

Water in Zengchong Village is well managed to sustain the traditional rice-fish culture. For generations, a coffer-dam diverts water from meeting point of two rivers to the fish ponds and rice fields through canals and ditches in the whole village. The water system combines forces of nature and human serves not only the rice-fish culture, but also fire control and drainage of the village. The fire control is important to protect the traditional wooden architecture of Drum Temple in the Dong culture.

POLICY AND DEVELOPMENT RELEVANCE

Public care for food safety and ecological conservation is now being addressed through policies on monitoring, eco-labelling (Green Food/Organic Food Programs) and eco-agriculture. In addition, ecotourism on agricultural landscape is also being promoted. There is good potential to integrate the traditional rice-fish culture into those new policy changes.

On the other hand, much has to be done to identify and remove inappropriate policies, institutions, and technologies that encourage shifting rice-fish systems to intensive mono rice or fish systems.

The rice-fish system is widely practiced in many countries, especially in Asia. The extension of the system has potential to reducing use of POPs in agriculture. It

maintains ecological functions of carbon and nutritional cycles. The system also hosts a variety of rice, fish and other associated species.

MAJOR OUTPUTS

- Document changing patterns of the traditional rice-fish system;
- Evaluate impact of policies, institutions and technologies on farmers' practices of the rice-fish systems and identify those policies, institutions and technologies that encourage specialization of rice or fish production.
- Set up representative demonstration sites/villages through partnership between local communities, government and CSOs;
- Identify and demonstrate successful adaptations to social-economic changes, and explore the multiple values of the rice-fish system in the food safety, eco-agriculture, eco-tourism and ecological conservation.
- Develop networking on conservation of the rice-fish system among communities, local governments, and CSOs.

JUSTIFICATION OF SYSTEM ACCORDING TO THE CRITERIA FOR GIAHS SELECTION

With multiple livelihood and ecological values listed above, the traditional rice-fish system is a remarkable model of the biodiversity-enhancing agriculture. The rice-fish system is now being replaced by modern chemicals-based agriculture of intensive mono rice or fish production. The ecological functions of the rice-fish system are not widely recognised. Inappropriate policies have also led to expansion of the chemicals-based agriculture. There is potential to build on this heritage for balancing the shortcomings of the chemicals-based agriculture and developing ecosystem approaches to managing wetlands and flood plains. Support and collaboration from local communities, local governments and Ministry of Agriculture for demonstrating this system as GIAHS is confirmed.



Figure 1 Distribution of Rice-Fish Culture in China

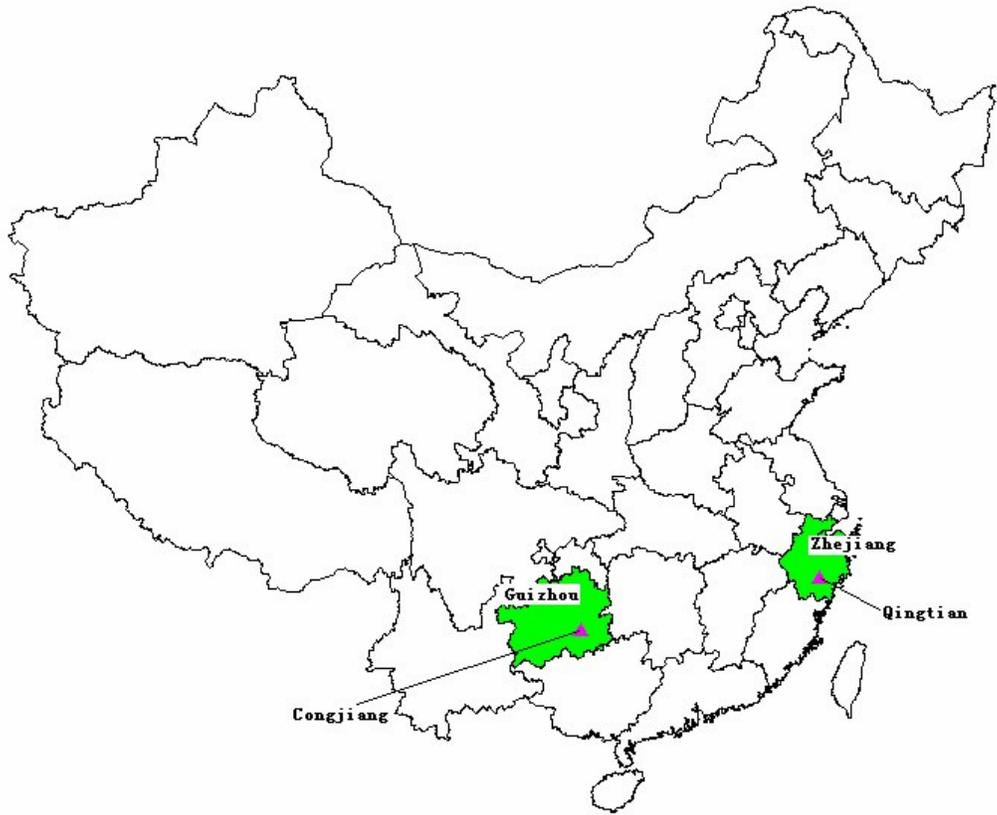


Figure 2 Location of Demonstration Site