



GIAHS

Globally Important Agricultural Heritage Systems

Proposal of Globally important Agricultural Heritage System



浙江湖州桑基鱼塘系统

Zhejiang Huzhou Mulberry(Morus sp.)-dyke & Fish-pond System

中国湖州市南浔区人民政府

The People's Government of Nanxun District, Huzhou City, P.R.China

November, 2017



The partial image of Zhejiang Huzhou Mulberry-dyke & Fish-pond System



Digang Fish Village in the Zhejiang Huzhou Mulberry-dyke & Fish-pond System





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I . SUMMARY INFORMATION

Name of/Title the Heritage System : Zhejiang Huzhou Mulberry(*Morus* sp.)-dyke & Fish-pond System

Requesting Agency/Organization: The People’s Government of Nanxun District, Huzhou Municipality, Zhejiang Province, P. R. China

Responsible Ministry (for the Government): Ministry of Agriculture, P. R. China

Location of the Site: The Zhejiang Huzhou Mulberry-dyke & Fish-pond System (37°12’18” N and 120°17’40” E) is located in the plain of the South Bank of the Taihu Lake, which is the center of the Yangtze River Delta- largest Economic Zone in China, and also known as the hinterland of the three big cities: Shanghai, Hangzhou, and Nanjing. The site is connected to the third largest freshwater lake of China – Taihu Lake on the north; 40km away from Hangzhou on the south; 100 kilometers away from Shanghai on the east; continued to the Mogan Mountain and Tianmu Mountain range on the west. It is mainly distributed in the administrative areas of Linghu Town and Hefu Town, Nanxun District, Huzhou City, Zhejiang Province (Figure.1.) .



Figure 1. Location of Zhejiang Huzhou Mulberry-dyke & Fish-pond System

Accessibility of the Site to Capital City or Major Cities: The site of the Huzhou Mulberry-dyke & Fish-pond System has a convenient transportation network. It adjoins the Shanghai–Jiaxing–Huzhou–Hangzhou Expressway (S13) to the east, Hangzhou–Ningbo Expressway to the west (G25), and Shanghai–Jiaxing–Huzhou–Hangzhou Expressway (S12) to the north. It is within a one hour drive from Shanghai, Suzhou, Hangzhou, and other major cities around (Figure.2).



Figure 2. Traffic conditions of the Huzhou Mulberry-dyke & Fish-pond System

Area of Coverage: 6900 hectares

Agro-Ecological Zones (for Agriculture, Forestry and Fisheries): the lowland wetland ecosystem of South Taihu Lake in China , which is a typical feature in south of Yangtze River .

Topographic Features: floodplain

Climate Type: The climate is subtropical monsoon

Approximate Population (Beneficiary): 129,219

Ethnicity/Indigenous population:100% the Han nationality

Main Source of Livelihoods: sericulture, fish culture and off-farm jobs

Executive Summary:

The Zhejiang Huzhou Mulberry-dyke & Fish-pond System originated in the low-lying plain on the south bank of the Taihu Lake during the Spring and Autumn Periods more than 2500 years ago. In ancient times, flood related disasters were common during the rainy season when massive water was poured into the low-lying region through the East Tiao River and the West Tiao River which originated from the Tianmu Mountains on the west. Over millennia, local people have designed and built the effective water conservancy works to store and drain excessive water through a network of “Zongpu” (narrow rivers in the longitudinal direction),

and “Hengtang” (wide rivers in the latitudinal direction). At same time, they dug and converted the perennially flooded area into fish ponds, and piled the sludge around the ponds as dykes. They gradually developed the ecological mode of the mulberry-dyke & fish-pond system in which the mulberry trees were planted on the dykes, the mulberry leaves were harvested to feed silkworm (*Bombyx mori*), silkworm excrement was used to feed fish, the fish excrement enriched the pond muds, which were in turn dredged as fertilizers for the mulberry trees. Thus, the system has effectively controlled floods, but also resulted in the beautiful “chessboard” like landscapes of interconnected mulberry dykes and fish ponds, dotted with ancient water villages, and colorful traditional silk and fish cultures associated with complementary relationships between mulberry-planting, silkworm-rearing and fish-raising (Figure 3). Currently, the system still covers nearly 4000 hectares of mulberry tree dykes and nearly 10000 hectares of fish ponds.

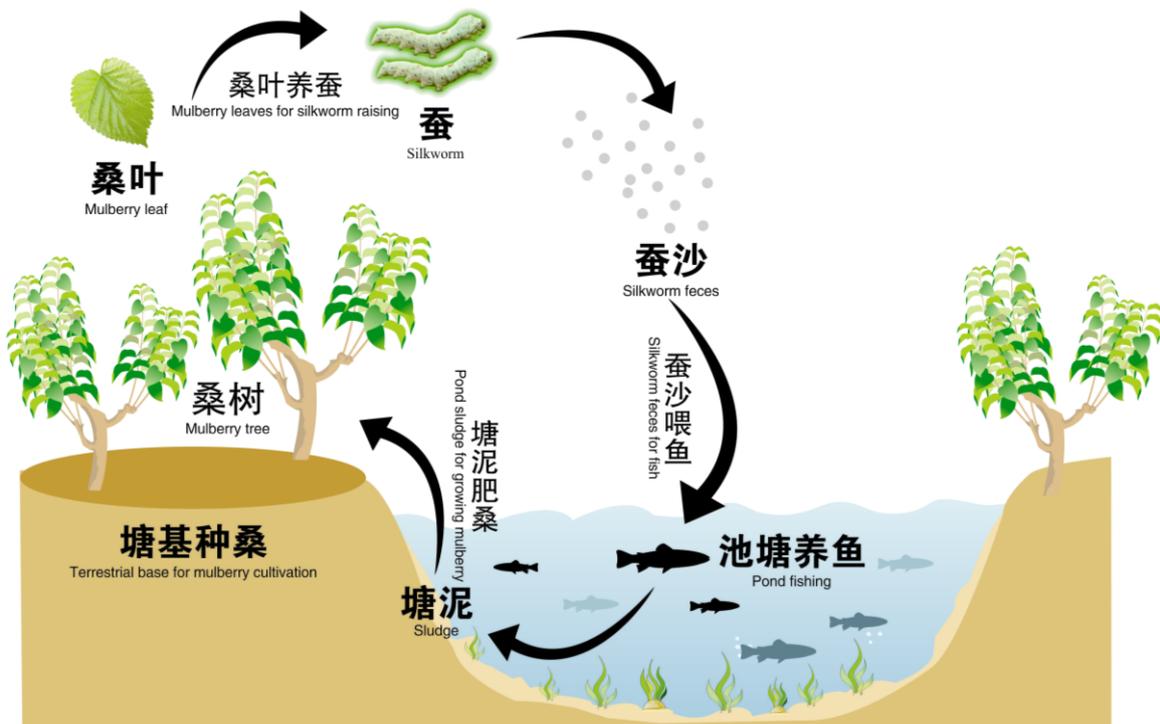


Figure 3. An Agro-ecological cycling model of the typical Huzhou Mulberry-dyke & Fish-pond System

The system demonstrates a perfect ecological cycle of nutrients: recycling of wastes through mulberry cultivation, mulberry leaves harvested for silkworm, silkworm feces used to feed fishes, and pond sludge dredged to fertilize mulberry trees. The circular system of agriculture generates no pollution and protect the natural environment, promotes sustainable development of the Taihu Lake shore economy over many generations. As an artificial wetland, the system embraces rich agrobiodiversity of mulberry, silkworm and fish of global significance, and associated biodiversity, but also functions as an enormous reservoir for water storage and flood regulation and drought mitigation. The four types of fish: black carp,

grass carp, silver carp, and bighead carp are ingeniously selected, integrated and cultured to make full use of different ecological niches of water body vertically in the fish ponds. Thus, the system is a remarkable land use system in low-lying areas and supports a circular agricultural economy. In 1992, the Mulberry-dyke & Fish-pond was praised by UNESCO (the United Nations Educational, Scientific and Cultural Organization) as “the rare scenic spots in the world and a virtuous circular model” .

The system exemplifies the traditional Chinese philosophy “unity of man and nature” in ingenious adaptation to the nature of low-lying areas. The system illustrates well the traditional rural life in China “men-farming and women-weaving” and embodies rich sericulture and fishery cultures. There are a major annual regional festival- “silkworm flower festival,” and numerous silkworm rearing related customs such as: worshipping and thanking the Silkworm Goddess, etc. All kinds of taboos are associated with silkworm rearing. Other customs connect silkworm rearing and marriage ceremony such as: sending, welcoming, and strewing silkworm flowers, etc. Fish cultures are also rich, such as the performance “Fishman’s Family Happiness”. Silkworm and fish cultures have been closely linked due to the complementary processes of mulberry planting, silkworm rearing, fish farming, and traditional festivals, and daily life. Traditional cultures are deeply penetrated into all aspects of daily life with its unique cultural heritage. The China Silk Weaving Skills, the Silkworm Flower Festival, and the tradition of Closing the Front Door to Keep Silkworm Flowers Inside the Room are listed in the UNESCO Representative Works of Human Intangible Cultural Heritage (Figure 4) .



Figure 4. The plaque of traditional sericulture silk craftsmanship listed in the UNESCO Representative Works of Human Intangible Cultural Heritage

Currently, Shezhong village in Linghu Town is referred as the Mulberry Dyke Fish-Pond system Teaching Base of FAO (Food and Agriculture Organization of the United Nations) Comprehensive Training Center for Fish Farming in the Asia-Pacific Region (Figure 5) . The Unique technology from Zhejiang Huzhou Mulberry-dyke & Fish-pond System is not only spread all over the country, but also diffused to the world through the training center: such as Russia, Japan, Korea, Vietnam, Romania, Albania, Afghanistan, Libya, Africa and playing a positive role for the sustainable development of global agricultural economy.



Figure 5. The Mulberry-dyke & Fish-pond system Teaching Base of FAO Comprehensive Training Center for Fish Farming in the Asia-Pacific Region

II .DESCRIPTION OF THE AGRICULTURAL HERITAGE SYSTEM

2.1 Significance of the Proposed GIAHS Site

2.1.1 Ingenious knowledge and technology for sustainable development of low-lying areas

The Zhejiang Huzhou mulberry-dyke & fish-pond system is ingeniously adapted to natural conditions in the low-lying areas vulnerable to floods. Instead of filling depressions, local farmers have dredged those perennially flooded depressions and converted them into fish ponds, piled the dug-out earth around the ponds as dykes over generations. The ecological mode of mulberry-dyke & fish-pond system has been gradually created. Mulberry trees are planted on the dykes, the mulberry leaves harvested for feeding silkworm (*Bombyx mori*), silkworm excrement used to feed fish, the fish excrement enriched the pond muds, and muds in turn dredged and piled on the dykes to fertilize the mulberry trees. Nutrients are fully recycled in the proposed system. The four types of fish: black carp, grass carp, silver carp, and bighead carp are ingeniously combined and cultured to utilize different ecological niches vertically in the fish ponds. The silver carp lives in the upper water, and eats phytoplankton; the bighead carp lives in the middle of the water, and eats zooplankton; the grass carp lives in the middle and lower areas of the water, and eats water plants; the black carp lives in the bottom of the water, and eats snail, clam and mussel and other mollusks. The excrement from black carp is a good food source for plankton, and leftovers can also be used to feed common carp, blunt snout bream, and crucian carp. The grass carp eats supplemental vegetation. Raising grass carp in ponds controls the growth of aquatic plants on the pond surface and ensures sufficient sunlight for the growth of planktonic algae. The silver carp feeds on phytoplankton in the water column, the bighead carp consumes zooplankton. The substantial phytoplankton population enhances the growth of zooplankton, which in turn provides a substantial food supply for bighead carp, completing the food chain and maintaining the biological balance of the ponds. According to the records of “*Shen's Book on Agriculture*” (AD 1658):The ecological integration of four types of fish forms the three dimensional ecological model in fish pond that “keeps seventy percent of black carp and grass carp, twenty percent of silver carp and ten percent of crucian carp and bream in the same pond, and all fishes will grow very well.” At the same time, the proposed system is very rich in globally important agro-biodiversity of silkworms, freshwater fish, mulberry and many other associated crops/animals. The system has produced not only a large quantity of silk products, but also a wealth of freshwater fish and other high quality protein products, generating a huge economic benefit. As a result, the system plays an important role in the sustainable development of the region and improving living standards of farmers. It demonstrates a remarkable example in the sustainable development of lowland in the world.

2.1.2 Remarkable practice for prevention of flood disasters in lowland

The northern part of the Zhejiang Huzhou Mulberry-dyke & Fish-pond System is next to the Taihu Lake. Floods and disasters were common in the past during the rainy season and caused by the massive water into the area through the East and West Tiao rivers which originated from Tianmu Mountain range on the west. In the process of coping with floods, our ancestors wisely designed and built the water conservancy system integrating “Zongpu” (Lou or Gang in local language) which are narrow rivers in the longitudinal direction from south to north, and “Hengtang”, which are wide rivers in the latitudinal direction from west to east in history (Figure 6). The distance between two Zongpu rivers is about 2.5 to 3.5 kilometers, between two Hengtang rivers 3.5~5 kilometers according to local conditions. The conservancy system adopts the principle of “storing water before draining it”. First, several Hengtang rivers were dug along the East Tiaoxi and West Tiaoxi rivers, so as to store water and allow gradual sedimentation. The over flow water was then drained into the Taihu Lake through the Zongpu rivers to protect crops and villages from flooding. Meanwhile, muds in the Hengtang rivers and fish ponds are yearly dredged and piled on the dykes to raise gradually the dyke height and increase the water storage capacity of fish ponds(Figure 7). As a result, the resilience to floods in the region is significantly enhanced. In addition, this water conservancy system harvests sediments of the East Tiaoxi and West Tiaoxi rivers in the Hengtang rivers, avoids them directly into the Taihu Lake to raise the bottom of the Taihu Lake, and reduce risk of the flooding from the Taihu Lake into the low-lying shore plain. Therefore, the water conservancy practice along with the Zhejiang Huzhou Mulberry-dyke & Fish-pond System demonstrate a remarkable solution to control flooding in low-lying areas in the world.

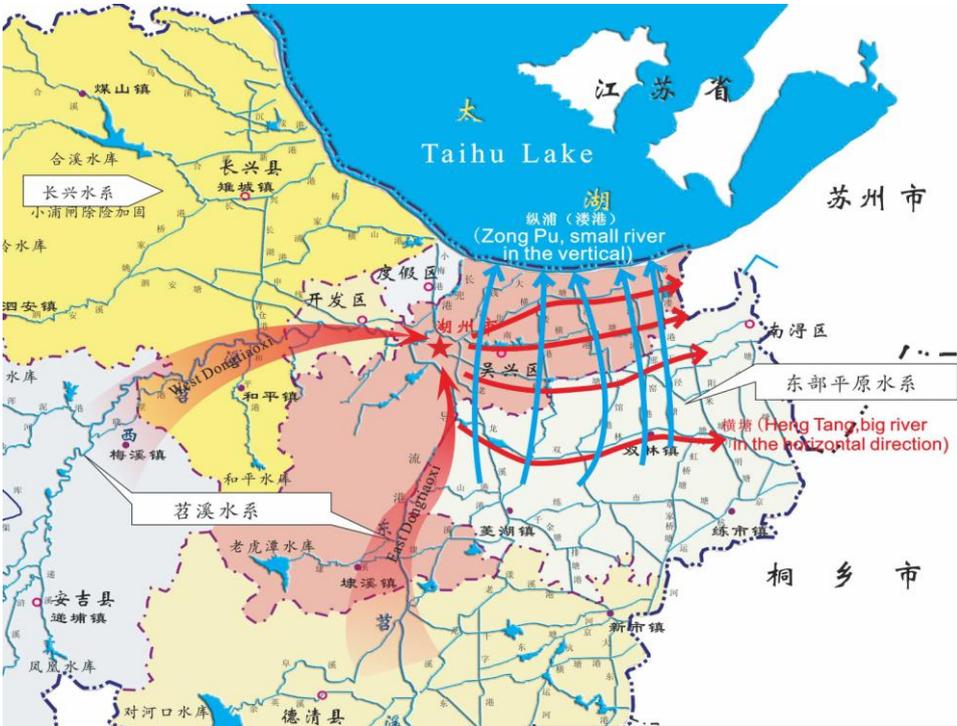


Figure 6. The ancient irrigation and drainage project called “Zong Pu Heng Tang”(vertical small rivers crossed with horizontal big rivers) in the Huzhou Mulberry-dyke & Fish-pond System



Figure 7. Huzhou Mulberry-dyke & Fish-pond System is a huge reservoir

2.1.3 Best practices for a chain of safe and zero-emission productions

The Zhejiang Huzhou Mulberry-dyke & Fish-pond System is an integrated agro-ecosystem that combines a chain of productions among mulberry cultivation, mulberry leaves for silkworm rearing, silkworm feces and excess silkworm pupa in the sericulture to feed fishes, and the pond sludge dredged to fertilize mulberry tree on the dykes. The system fully recycles all kinds of waste material from one production to another, achieve zero-emission, and converts energy effectively. The excess nutrient in the soil of mulberry dykes may be washed back by rain to the fish pond. The chain of productions in the system does not depend on external inputs and achieves near-zero emission to the environment (Figure 8). Therefore, the whole process of planting mulberry trees, rearing silkworms and culturing fish is recycling, zero-emission, safe and environmental friendly. The system demonstrates a recycling chain of safe productions with global significance. Because of a closed circular process, the system generates no pollution to the environment, plays in protecting water environment in the region, and demonstrates a practical example of global significance in protecting water environment and promoting the sustainable development. In 1992, the mulberry-dyke & fish-pond was praised by UNESCO as “the rare scenic spots in the world and a virtuous circular model”.



Figure 8. Nearly zero pollution of Huzhou Mulberry-dyke & Fish-pond System on the environment

2.1.4 Outstanding skills in the silk reeling and weaving

The system integrates production as well as processing of silk. The “Jili Hu Silk” produced from the system has the quality of fine, round, uniform, hard, white, clean, soft, tenacity features. It won the gold prize in the first World Expo in London in 1851, and silk fabrics made from “Jili Hu Silk” had been an article of tribute to the ancient imperial families in China. The other unique silk weaving skills “Shuanglin Silk Crepe Damask” in the system are well known as the “Oriental silk craft flower”. The Shuanglin damask silk is “thin as gossamer, light like mist” which is admired by the world textile industry. The traditional silk reeling technology and silk weaving skills in the system are inspiring the global silk fabric industry.

2.2 Characteristics of the Proposed GIAHS Site

2.2.1 Food Safety and Livelihood Security

2.2.1.1 Providing Abundant Ecological, Safe, and High-quality Agricultural Products and Food

The Zhejiang Huzhou Mulberry-dyke & Fish-pond System provides abundant high-quality agricultural products and food for people including freshwater fish and meal protein, food made from mulberry leaves, silkworm and silk (Figure 9).

(1) Aquatic Products. The ponds are rich in freshwater fish resources including black carp *Mylopharyngodon piceus*; grass carp, *Ctenopharyngodon idella*; silver carp, *Hypophthalmichthys molitrix*; bighead carp, *Aristichthys nobilis*; and crucian carp, *Carassius auratus*. All fish species in the pond provide people with an abundance of high-quality and safe protein.

(2) Mulberry Tea. Mulberry leaves in the system have been made into mulberry tea, and it contains 18 different amino acids required by humans. In addition, mulberry leaves contain the alkaloid 1-deoxynojirimycin(DNJ) at levels of as high as 0.7911% in the mulberry leaves of some wild species. DNJ is the inhibitor to α -glucosidase, therefore effectively inhibits the increase of blood sugar content after meal for diabetics. Mulberry leaves also contain gamma-aminobutyric acid and phytol by 3~4 times higher than those in green tea. Therefore, drinking mulberry tea has many benefits such as weight loss, beauty, and lowering blood lipid and sugar levels.

(3) Mulberry Leaf Powder and Its Products. Mulberry leaves in the system are also used to make mulberry leaf powder, which can be used to make cakes, yogurt, biscuits, noodles, desserts, and animal feed.

(4) Mulberry fruit Products. The fruit of the mulberry tree is rich in active proteins, vitamins, essential amino acids (EAAs), carotene, minerals, resveratrol, and oligomeric proanthocyanidins. Eating mulberry fruit may enhance defense responses, prevent atherosclerosis, reduce the signs of aging, benefit the kidneys, cleanse the intestinal canal, darken hair, and brighten eyes. Apart from eating fresh mulberry fruits, they can also be made into other products such as mulberry juice, jerry and jams, wine, ice cream, cakes, breads, and sauces.

(5) Silkworm Pupae, Silk Protein Products and Processed Products. Silkworm pupae are highly nutritive food, and very safe compare with other animal meat. Silk is the natural protein spun by mature silkworm. Silk is mainly used for silk industry, but it also can be used as food. Particularly, under the effect of actionozyme, silk protein can be broken down into oligopeptides and EAA powder, which can be used as a food additive for cakes, biscuits, noodles, jellies, ice creams, drinks, and candies. These are all organic foods and very attractive to consumers.

(6) Mutton. Branches and leaves of mulberry trees in the system are used as one of the most important foods for Huzhou sheep in the Taihu Lake area. Mutton is one of the main meats for consumption by local people and is richer in protein and lower in fat than pork. Mutton also has a higher calorific value than beef, making it an important food resource during the cold winter months. It is also taken as a supplement.

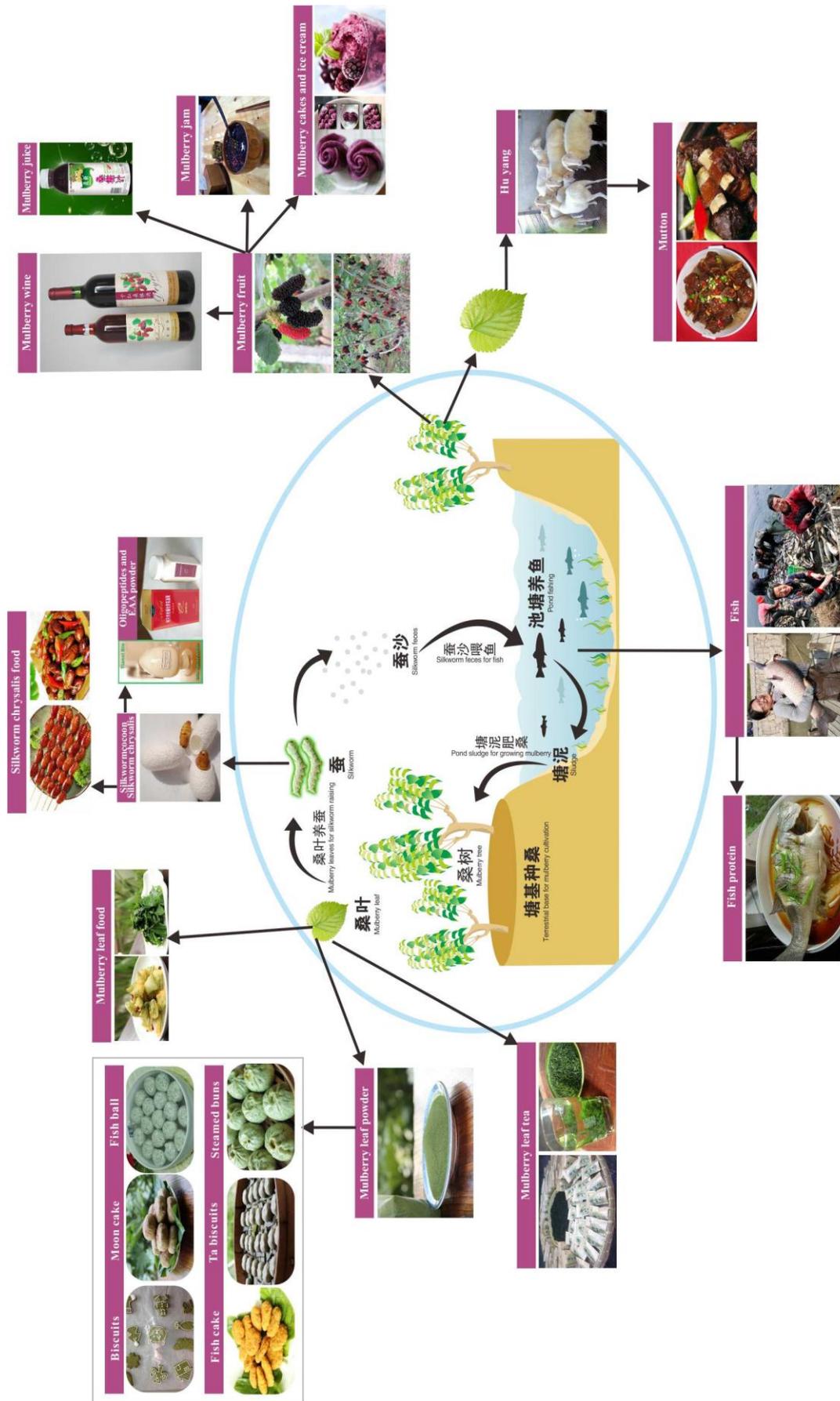


Figure 9. Zhejiang Huzhou Mulberry-dyke & Fish-pond Ecosystem provide related food

2.2.1.2 Livelihood Security

(1) The system provides the main source of income of farmers in the region. Farmers in the heritage site have 0.046 hectares of mulberry field and fish pond per capita. Generally, one hectare of mulberry field can feed silkworm from 60 boxes of eggs (30,000 eggs per box), will produce 2,700kg of fresh cocoons in average. Every 3.5 kg of fresh cocoon can produce 1kg silk quilt, and the market price of silk quilts is 300 CNY/kg. Therefore, cash income of farmers from one hectare of mulberry field is around $2,700/3.5 \times 300 = 231,429$ CNY. Per hectare of fish pond can harvest 15,000kg of fish, the fish market sales price is 16 CNY /kg in average, then cash income from fish culture is around 240,000 CNY per hectare ponds. At present, the proportion of mulberry field and fish pond is 3:7 in this system at present, that is per capita income of farmers from mulberry field is $0.046 \times 0.3 \times 231,429 = 3,194$ CNY; from fish pond is $0.046 \times 0.7 \times 240,000 = 7,728$ CNY. In addition, every 0.046 hectares of Mulberry fish ponds can raise 1 sheep, average price around 2,000 CNY; interplanting vegetables, soybeans and other crops, extra income of 1000 CNY. In total, income per capita from productive activity in the system is 13,926 CNY, which is accounting for 52.75% of the per capita disposable income 26,398 CNY of rural residents in 2016 in the heritage area. Therefore, farming production is the main source of rural household income in the heritage region.

(2) Development of the System Offers Rural Families with a lot of Jobs. Statistical studies indicated that mulberry fields in the system need seasonally up to 600 workers per ha and the fish ponds need 1200 man hours per ha annually. More work opportunities would be available for silk reeling, textiles, and other related industries including mechanical manufacturing, chemicals, technical training, transportation, and trade. Furthermore, different types of work demand different educational levels and different labor intensities. Thus, all people in this district can work all year round, effectively solving the problem that rural women cannot independently support themselves. The Zhejiang Huzhou Mulberry-dyke & Fish-Pond System also brings much larger social benefits including basic sustenance, community service, social connections, workforce structure, and status for women, and social harmony.

2.2.2 Agro-Biodiversity

2.2.2.1 Agricultural Biodiversity

According to the survey, there are 18 varieties of mulberry trees, 3 types of cereal plants, two types of tuber plants, 10 types of leguminous plants, 6 types of Oil-bearing plants, 17 types of fruit plants, 67 types of vegetables are cultivated in the area, and there are 16 varieties of silkworm hybrids, 20 species of fishes, 7 species of shrimps and crabs, 3 species of turtles and 14 species of domesticated animals are raised by farmers in the system. In

addition, there are 15 types of biennial flowering plant , 6 types of perennial flowering plants, 10 types of flowering bulbs, 5 types of foliage plants, 4 types of aquatic flowering plants, 12 conifer Species, 58 broad-leaf species and 11 bamboo species are artificially planted or wildy distributed in the system area. Details refer to Table 1.

Table 1. The agricultural biodiversity in the Huzhou Mulberry-dyke & Fish-pond System

| Category | Species/ strains/varieties |
|-------------------|--|
| Mulberry | Pi Sang, Zaoqing Sang, Bai Sang, Dazhong Sang, Heye Sang, Heyebai, Tuantou Heyebai, Tongxiangqing, Husang 197, NongSang 8, NongSang 10, Nong Sang 12, Nong Sang 14, Fengtian 2, Dazhonghua, Shengdong 1, Yu 71-1, Fruit mulberry. |
| Silkworm | Su14×Su16, Huahe×Donfei, Hang8×Hang7, Zhelei×Chunxiao, Qingsong×Haoyue, Dong34×603, Zhenong 1×Su12, Xinhang× Keming, Lantian×Baiyun, Huafeng × Xuesong, Chunlei×Zhenzhu, Qiufeng×Baiyu, Hangxin×Baiyun, Feng 1×Furi, Huaqiu×Songbai, Qiuhua×Ping 30, and the Reciprocals. |
| Fish | black carp, grass carp, silver carp, bighead carp, crucian carp, common carp, blunt snout bream, mandarin fish, top-mouth culter, snakehead, mud carp, yellow catfish, Japanese eel, rice field eel, loach, freshwater mussel and <i>Odontobutis obscurus, et al.</i> |
| Shrimp and Crab | river crab, oriental river prawn and red swamp crayfish, <i>et al.</i> |
| Turtle | grass tortoise, snapping turtle, soft-shelled turtle, <i>pelodiscus sinensis, et al.</i> |
| Cereal Plant | rice, wheat, corn. |
| Tuber Plant | sweet potato, potato. |
| Leguminous Plant | soybean, broad bean, pea, mung bean, red bean, kidney bean, haricot, hyacinth bean, Fresh soybean, sword bean. |
| Oil-bearing plant | rape, peanut, gingili, soybean, sunflower, castor. |
| Fruit Plant | Citrus, red bayberry, loquat, grape, pear, peach, prune, plum, apricot, cherry, chestnut, kiwifruit, fig, strawberry, jujube, pomegranate, ginkgo. |
| Vegetable Plant | radish, mustard, carrot, Chinese cabbage, cabbage, cauliflower, broccoli, tomato, hot pepper, Sweet pepper, cucumber, muskmelon, pumpkin, squash, winter melon vine, watermelon, balsam pear, chayote, loofah, onion, green Chinese onion, leek, shallot bulb, garlic, lettuce, celery, spinach, water spinach, three-colored amaranth, <i>chrysanthemum coronarium</i> , coriander, cluster mallow, Basella rubra L., <i>begonia fimbriatipula</i> , shepherd's purse, alfalfa, Mint, <i>Perilla frutescent crisp</i> a, lotus root, water chestnut, water bamboo, Chinese water chestnut, arrowhead, cress, gorgon fruit, <i>typha latifolia</i> L., water shield, calla, lobster, Bamboo shoots, Chinese mahogany, day lily, lily, asparagus, |

| | |
|---------------------------|--|
| | artichoke, rhubarb, purple chrysanthemum, fern, Chinese yam, taro, ginger, the Chinese bud lily, oyster mushroom, needle mushroom, lentinus edodes, lichens. |
| Animal | lake sheep, pig, cow, dog, rabbit, chicken, duck, goose, pigeon, quail, wild goose, parrot, bees, cormorant. |
| Biennial Flowering Plant | scarlet sage, cockscomb, marigold, petunia, zinnia, dianthus, <i>Calendula officinalis</i> , daisy, kale, pansy, corn poppy, <i>Begonia semperflorens</i> , snapdragon, violet, <i>Ageratum centaury</i> . |
| Perennial Flowering Plant | chrysanthemum, Chinese herbaceous peony, iris class, Chinese daisies, begonia, geranium. |
| Flowering Bulb | lily, tulips, hyacinth, gladiolus, bulbous iris, amaryllis, daffodil, canna generalis, cyclamen, calla Lily. |
| Foliage Plant | Cycas, bracket plant, adiantum, Chinese fan palm, asparagus fern. |
| Aquatic Flowering Plant | lotus flower, water lilies, gorgon fruit, calamus. |
| Conifer Species | mason pine, podocarpus, cedar, white pine, golden larch, metasequoia, Chinese cypress, <i>Juniperus chinensis</i> , dragons cypress, cypress, stone pine, <i>Platycladus orientalis</i> . |
| Broad-leaf species | Chinese pagoda tree, locust, elm, chinaberry, ailanthus, Chinese tallow tree, holly, Chinese photinia, <i>pinus sylvestris</i> , willow, poplar, big catkin willow, white poplar, Chinese willow, Palm, Bodhi, Chinese wolfberry, privet, <i>cryptomeria fortune</i> , thorn cedar, <i>metasequoia</i> , <i>dalbergia hupeana</i> , dahlias, oleander, camellia, medicinal cornel, southern magnolia, magnolia lily flora, <i>albizzia julibrissin</i> , maple, <i>zelkova schneideriana</i> , Chinese honey locust, Lacquer tree, Sago cycas, liriodendron, magnolia Chinese deer, plane tree, Chinese sweet gum, crepe myrtle, peony, winter sweet, Chinese rose, bauhinia, hibiscus, creeper, wisteria, camphor, privet, sweet-scented osmanthus, cuckoo, <i>pittosporum tobira</i> , boxwood, Gardenia, coral tree, rosebay, Chinese ivy, Honeysuckle, wisteria, rose wild rose. |
| Bamboo | <i>phyllostachys</i> , water bamboo, <i>phyllostachys arcana</i> , early bamboo, <i>phyllostachys dulcis</i> , thin bamboo, black bamboo, all seasons bamboo, yellow bamboo, <i>phyllostachys praecox</i> , feather bamboo. |

2.2.2.2 Genetic Diversity

The long history of sericulture and healthy ecosystem in this region had greatly enriched the genetic diversity of mulberry and silkworm, and supported rich biodiversity of heritage resources.

(1)Genetic diversity of Hu mulberry variety. Hu mulberry, a well-known mulberry

variety for its best leaf quality for silkworm. It originated in Huzhou and once was the most dominant mulberry variety in China, Hu mulberry has the same leaf shape, but has different bark color with high genetic diversity developed in the system, such as green, yellow, and purple. And purple bark is also known as red skin and the best for silkworm rearing, their leaves are large and thick, the leaf yield is high, and the nutrition for silkworm is high. At present, there is the mulberry germplasm resource garden established in the system area to maintain the traditional developed mulberry genetic resources.

(2)Genetic diversity of silkworm. The system is very rich in silkworm breeds. The diversity of silkworm is reflected in shape, form, color and marking characteristics of eggs, larva, cocoon, moth, and silk gland. (Figure 10), skin markers(Figure 11), cocoons(Figure 12), moth color and eye color are displayed in figure 13 .

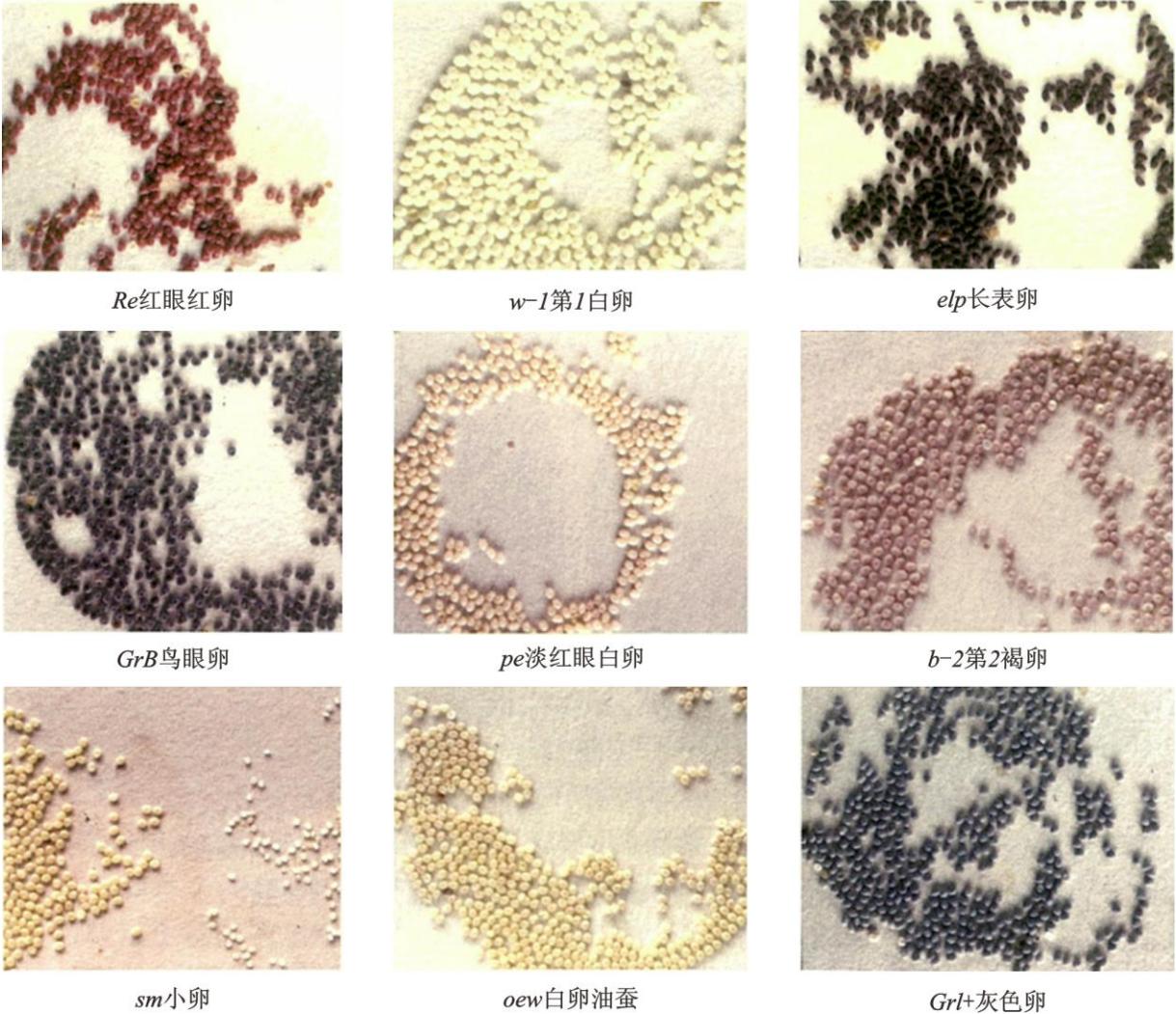


Figure 10. Genetic diversity of silkworm eggs



- Note: U: Bear colored silkworm
 SpC: Small speckled silkworm
 So: Coal colored silkworm
 q: Quail speckled silkworm
 pB: Black silkworm
 mi: White mold silkworm
 Lc: Diand brown round speckled silkworm
 Dus: Double star silkwormms: Multi-star silkworm
 bd: Light ink silkworm

Figure 11. Genetic diversity of silkworm larvae



Figure 12. Genetic diversity of silkworm cocoon traits



Figure 13. Genetic diversity of silkworm moth

(3) **Genetic Diversity of Taihu Ice Fish.** Taihu Ice Fish is special species in this region and very popular for the consumers. There are many strains distributed in this area, and the most popular for commercial production are four species: *Neosalanx Taihuensis*, *Neosalanx Oligodontis*, *Protosalanx Hyalocranius* and *Reganisalanx Brachyrostralis*, and the yield of *Protosalanx Hyalocranius* and *Neosalanx Taihuensis* are the highest (Figure 14).



Figure 14. Genetic diversity of Taihu Salangid

2.2.2.3 Associated biodiversity

Besides agro-biodiversity, the system supports rich diversity of wild animals and plants. The plant diversity contains 41 families and 119 species of vascular plants, among which there are 30 families and 52 species of aquatic vascular plants. Among animal category, there

are 12 orders, 27 families and 110 species of birds, 11 orders, 25 families and 121 species of fishes, 19 orders, 120 families and 1496 species of insects, 10 species of Mammalia, 30 species of *Reptilia*, 20 species of *Amphibia*, 10 species of crustacea, 10, 11 species of *Arachnida*, 12 species of *Myriapoda*, and 57 species of plankton, 68 species of phytoplankton, 100 species of *Zoobenthos*.

2.2.2.4 Ecological value

The unique pruning and harvesting style of mulberry trees in the system maximizes the growth and leaf production and also has made the mulberry trees the strong power for carbon sequestration. Recent study shows that mulberry tree has the capacity 9.47t /1hm² for carbon sequestration annually, which is the highest among all the agricultural plants, and greatly help to purify the air. Table 2 shows the average value of particulate matter, SO₂ and NO₂ in the mulberry field compare to the air quality in the forest. Research on the ecosystem services assessment on mulberry field also showed that its contribution to the carbon sequestration and oxygen release was much greater than the raw material production as shown in figure 15.

Table 2. Air purification function of mulberry trees

| | Particulate matter(mg/m ³) | SO ₂ (mg/m ³) | NO ₂ (mg/m ³) |
|----------------|--|--------------------------------------|--------------------------------------|
| Mulberry field | 0.1127 | 0.02685 | 0.03617 |
| Forest | 0.1343 | 0.01958 | 0.02383 |

Data source: Environmental Testing Station of Jiaxin City (May, 2007)

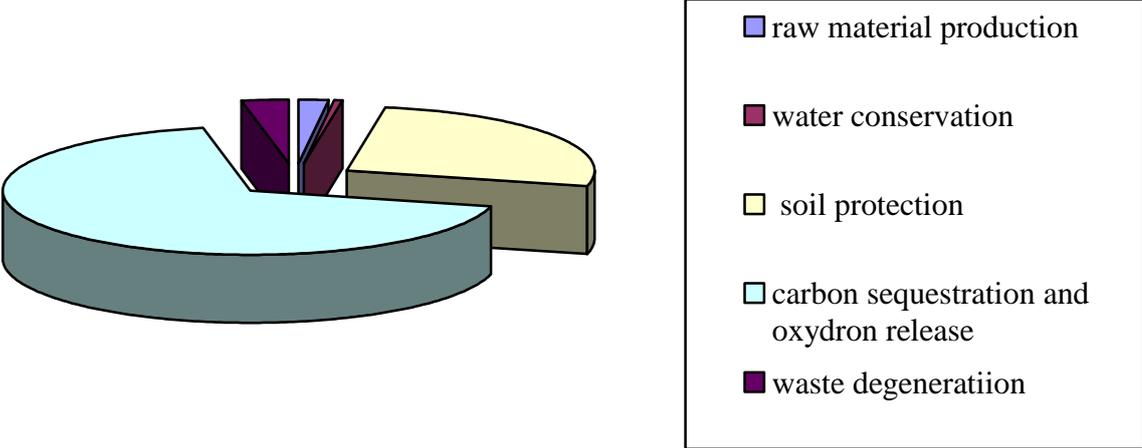


Figure 15. Value of ecosystem service assessment on mulberry field

2.2.3 Local and Traditional Knowledge System

In the aspect of sericulture, it is the complete chain of agriculture, industry and trading from mulberry cultivation, silkworm rearing, cocoon processing, silk reeling and silk weave

as show in figure 16.

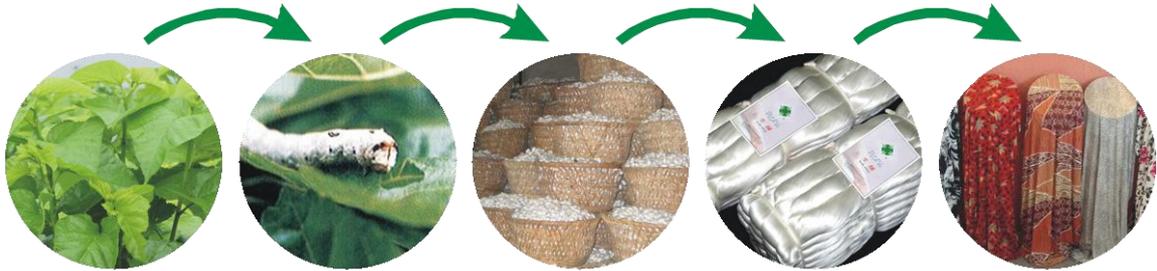


Figure 16. The chain of sericulture from mulberry cultivation to silk weaving

2.2.3.1 Mulberry breeding technology

Huzhou is the hometown of Hu mulberry, and the mulberry germplasm resources are rich. Based on the local varieties such as black skin mulberry, early green mulberry, white bar mulberry, big seed mulberry, and lotus leaf mulberry etc., and through artificial selection and sexual hybridization technique, mulberry varieties such as Heyebai, Tuantou Heyebai, Tongxiangqing, Husang 197, and Nongsang series, etc. are cultivated, the yield of mulberry leaves and the contents of sugar and protein in leaves are improved.

2.2.3.1 Mulberry propagation technique

As early as in Southern Song Dynasty (AD 1127 ~1247), farmers in the region had generally mastered the replacement of varieties and the “Embrace mother method” grafting technology of the reproduction of mulberry saplings. Then after, new grafting and cutting technologies such as green branch cutting, hard branch cutting, and bag-grafting method were developed (Figure 17).



Figure 17. Grafting technology and nursery of mulberry in Huzhou

① Mulberry sapling grafting; ② Growing of grafted saplings; ③ Nursery

2.2.3.3 Mulberry cultivating management technology

In Ming Dynasty (AD 1368~1644), farmers in the region had accumulated a complete set of mature experience in transplanting mulberry trees. According to the description of “*Shen’s Book on Agriculture*”: When transplanting mulberry saplings, it is not necessary to keep many roots, need to brush off the hair roots, range the line roots steadily at all sides and then gradually fill in mud to compact. Frequently water and manure for newly transplanted mulberry trees so as to induce new roots growth. Special techniques was also developed for mulberry pruning, generally the “short fist-shaped mulberry tree” pruning method was adopted. (Figure 18). The techniques of mulberry planting changed from the “:” form to the “.:” form, which favors air flow. In terms of mulberry garden management, farmers “twist fire clay” every summer and autumn, and in the winter, they clean and dredge the ponds after fishing and transport the resultant mud to the pond base as field organic manure. (Figure 19.).

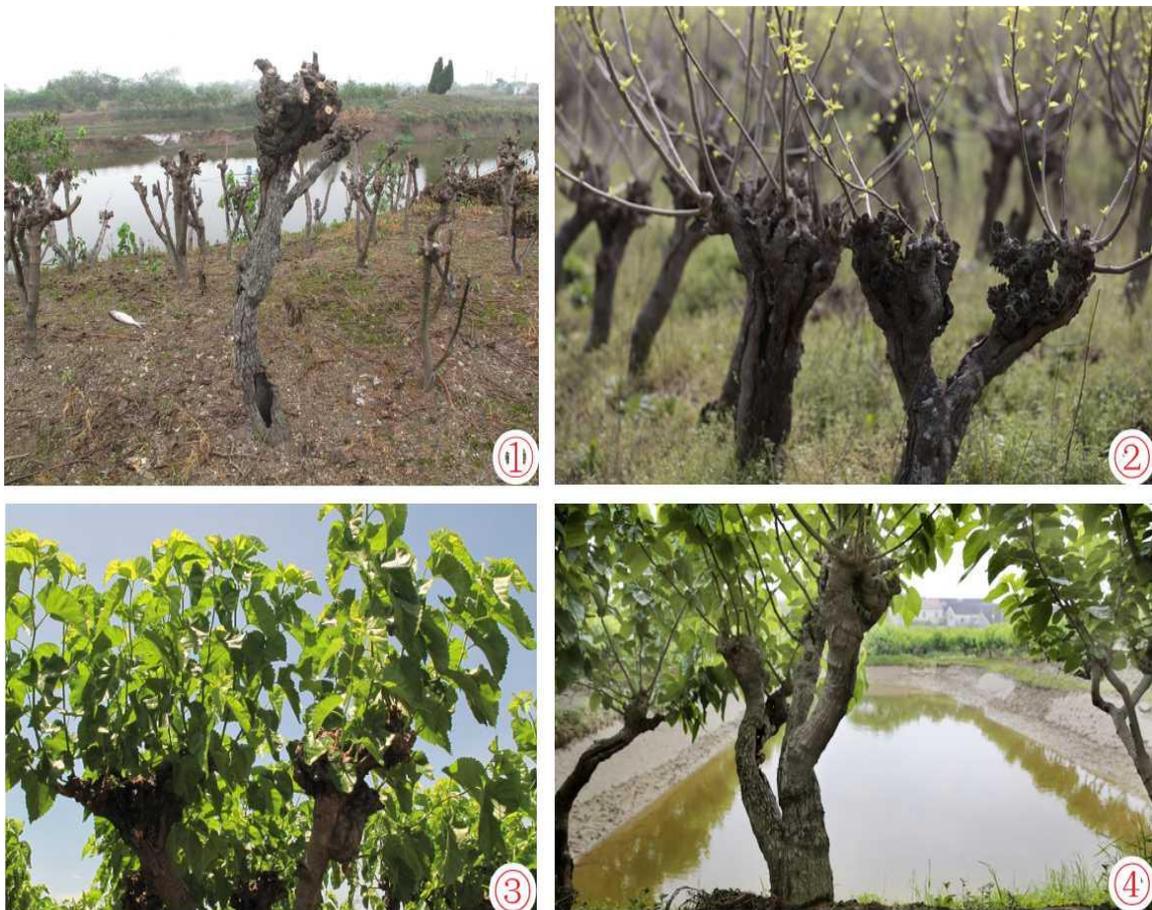


Figure 18. Pruning method of “short fist-shaped mulberry tree”for Hu mulberry

- ① Pruning method of “one fist-shaped mulberry tree”;
- ② Pruning method of “multi-fist-shaped mulberry tree”;
- ③, ④ Growth status after pruning



Figure 19. Mud dig up from fish pond bottom as mulberry manure.

2.2.3.4 Silkworm egg reproduction technology

The ancient agricultural book “Nong-Sang Jiyao” (in AD 1273) describes the silkworm breeding and seed selection technology in detail: “When open the seed cocoon frame, select the cocoons facing the light side and on the upper part of frame should be selected for seed for these cocoons are healthy and better quality individuals.” “The silkworm moths emerged on the first day are called early eclosion moths, and the moths on the last day are called last eclosion moths, both of them cannot be used for seed egg production, take the moths emerged from the second day, put the female moths on the straw sheet, let the males mating with the females, separate the male from females before dark, gently place the female moths on the egg paper sheet to lay eggs evenly. The piling up eggs are not good, cannot be used for seed eggs. Through the breeding and selection of long history, standard silkworm seed egg production techniques are well-established. Silkworm was one of the earliest species of which hybrids was used for commercial production. Today, all silkworm varieties are greatly improved in healthiness, productivity and quality through the long term effort of silkworm breeders, standard protocols for seed egg production and disease control were adopted in the silkworm egg farms.

2.2.3.5 Silkworm rearing technique

The silkworm is the complete metamorphosis insects, characterized with four distinguished developmental stages, i.e., egg (silkworm seed), larva (silkworm), pupa, and adult (moth). It takes generally about 27 days from the day hatching to spinning cocoons, and the larva will molt for four times and can be divided into five developmental stages (also called 5 instars). Through thousands of years of domesticate rearing, people got well known with the living habits of the silkworm. Meanwhile, the silkworm rearing technology has improved continuously. One silkworm can eat 20~25 grams of mulberry leaves during the whole life. At the end of fifth instars, the matured silkworm stops eating and becomes transparent; it will look for a suitable place for cocooning (also called mounting). In rural areas, people usually use rice straw to make folding cocooning frame, or bamboo shoots or rape stems to make silkworm cocooning frame (Figure 20).

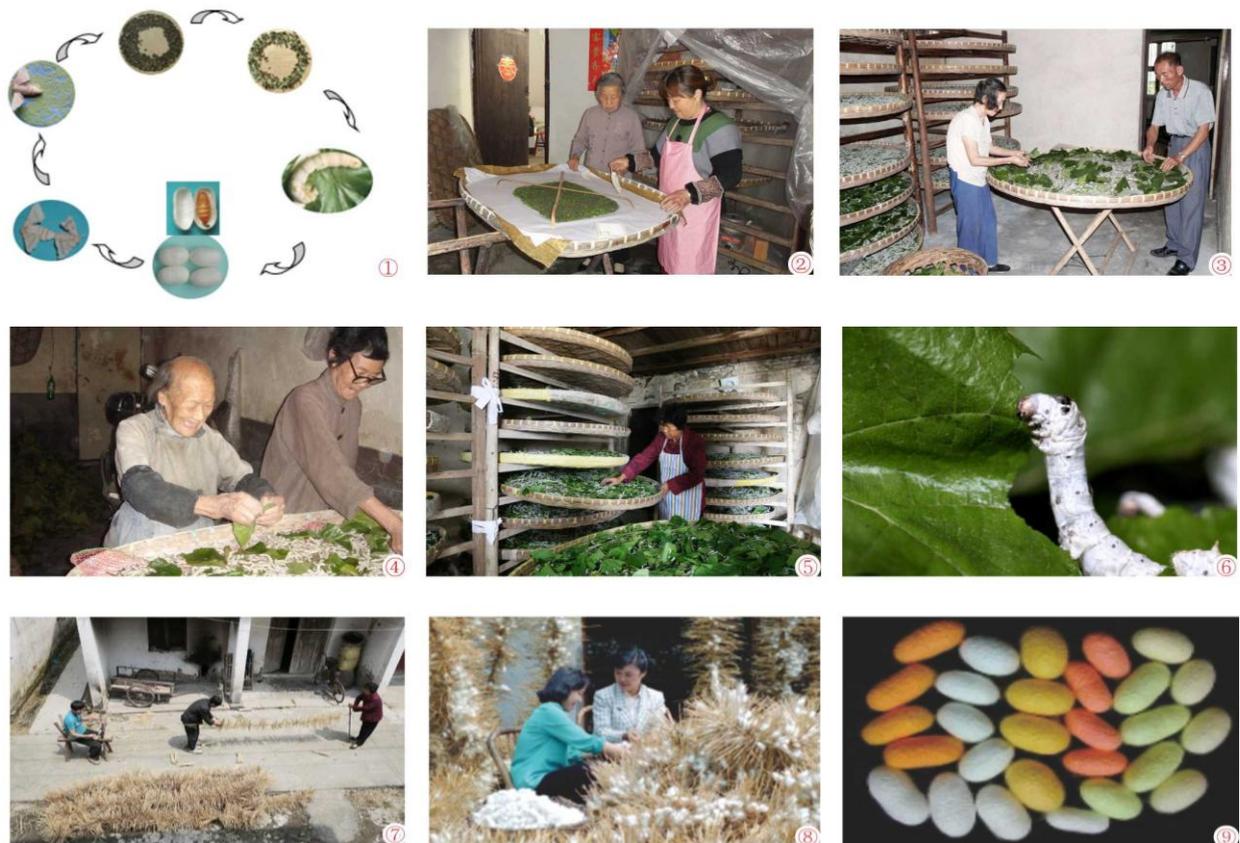


Figure 20. Developing stage and rearing technique of silkworm

- ①Development process of silkworm; ② Rearing of silkworm; ③,④ 102-year-old grandmother is enthusiastic in silkworm things; ⑤ Indoor stereo sericulture mode; ⑥ Silkworms eat mulberry leaves; ⑦ Farmers making straw cocooning frames; ⑧ harvesting silkworm cocoons in cocooning frames; ⑨Natural color cocoons

2.2.3.6 Traditional silk reeling and textile technology

The process reeling out silk from cocoon is called silk reeling. The traditional reeling method is to immerse the cocoons into hot water, reel off raw silk with hands, and wind on the silk basket. According to the intra-region Qianshanyang site excavation: People in the region had mastered the silk reeling and weaving technology 4700 years ago (Figure 21).



Figure 21. Traditional silk reeling and textile technology

2.2.3.7 Fish fry cultivation technique

In addition to mulberry cultivation and silkworm rearing, pond fish farming is also the main source of income for farmers, and fry quality is the key to a good harvest of fish pond system. As early as in the Wu Master Sun Quan period in Three Kingdoms (AD 222~252 years), people in the region invented the method of feeding fry with soybean milk to promote the fish growth, and it is still used even today (Figure 22).



Figure 22. Fry culture in the Huzhou Mulberry-dyke & Fish-pond System

The pond for cultivating fry requires 1.3 to 1.8 meters in depth, the bottom of the pond is flat and should not leak water, and the irrigation and drainage are convenient. 20 days before stocking, the pond water is drained and the sludge is dug out. The weeds are completely removed, and let the sun burn the bottom. Then 60kg lime/Mu is used for sterilization in a sunny day. 7 days before putting fry into the pond, clean water is filled in about to 70 cm. Stocked 150 thousand fries per Mu, fed with soybean milk, 20~25 days later, fry has grown into 3 cm or so, called summerlings, then fished out of the pool and put into the regular fish pond to culture.

2.2.3.8 Three dimensional ecological culture technology of fish pond

There are four main cultivated fishes (black carp, grass carp, silver carp, and bighead carp) with different biological characteristics in the system. The silver carp lives in the upper water, and eats phytoplankton; the bighead carp lives in the middle of the water, and eats zooplankton; the grass carp lives in the middle and lower areas of the water, and eats water plants; the black carp lives in the bottom of the water, and eats snail, clam and mussel and other mollusks. According to the life habit of the “four main cultivated fishes”, people in the region had mastered quite developed three dimensional ecological culture technology of fish pond in the late Ming Dynasty. According to the records of “*Shen's Book on Agriculture*” (AD 1658): “Put seventy percent of black carp and grass carp, twenty percent of silver carp and bighead carp and ten percent of crucian carp and blunt snout bream together in the same pond, and all fishes will grow very well.” In the event of bad weather, in order to prevent the death of fish hypoxia, the traditional method is to pump water from nearby river into the fish ponds or people boating in the middle of ponds by paddling at the same direction stop stroke to promote water flow and improve pond oxygen in water. Today, aeration equipment is adopted to replace the artificial aeration configuration in the fish pond.

2.2.4 Culture, Value System, and Social Organization

2.2.4.1 System of Cultural Value

Through the evolution of Huzhou Mulberry-dyke & Fish-pond System in thousands of years, there is also the accumulation of rich silk culture and fish culture.

(1) Sericulture and Silk Culture

① **Qianshanyang Site.** It is the relics about 4700 years ago, belongs to Huzhou Mulberry-dyke & Fish-pond System area. It is located in the Bainian Mu Village which is 7 kilometers south of Huzhou City. A large number of silk hemp fabrics, such as silk pieces, silk threads, silk ribbons, silk ropes and etc., were unearthed in Qianshanyang site. The silk fiber was identified to be the silk spun by domesticated silkworm rather than tussah silk, or wild silk yarn. It was observed under microscope that the section of a pair of monofilament forms a triangle, which is typical silkworm silk structure, and this is the earliest silkworm silk fabrics discovered in China till today (Figure 23). These shows that, in the Neolithic Liangzhu culture

period, Huzhou mulberry sericulture had been developed considerably and the textile technology had reached a very high level. At present, Qianshanyang site is known as the “origin of silk in the world.”



Figure 23. Qianshanyang site and silk thread pieces excavated in Zhejiang Huzhou Mulberry -dyke & Fish-pond System

- ①,② Qianshanyang Site; ③Silk ribbons unearthed in Qianshanyang site;
④ Silk hemp fabrics unearthed in Qianshanyang site; ⑤ Silk thread unearthed in Qianshanyang site; ⑥ Silk pieces unearthed in Qianshanyang site

②Sericulture and silk weaving technique. Sericulture and silk weaving technique is the original invention of China. It refers to the whole process of production technology such as mulberry cultivation, silkworm rearing, silk reeling, silk dyeing and silk weaving. At the same time, it includes the related folk activities and a variety of ingenious subtlety tools and looms derived in this process, and colorful silk products such as damask silk, leno and brocade and so on (Figure 24). The spread of sericulture industry also gave birth to the world famous Silk Road. The Silk Road is the ancient commercial road through the Asia and Europe, and it is also a bridge between the eastern and western culture. The Silk Road not only spreads the Chinese civilization, but also promotes the eastern and western economic and cultural exchanges. Over the past five thousand years, it has made a great contribution to China, and has a profound impact on the human civilization and has been playing a very important role in the promotion of China's economic and social development and business dealings with the world. On September 30, 2009, the “Sericulture and Silk Weaving Technique of China” was included in the UNESCO World Heritage list of human intangible cultural heritage.



Figure 24. Sericulture and silk weaving technique

- ①, ② Planting mulberry and raising silkworm;
- ③, ④ Sericulture;
- ⑤ Indigenous silk reeling;
- ⑥ Silk fabrics;
- ⑦, ⑧ Silk and clothing

③ **Sericulture convention (Hanshan Silkworm Flower Rolling and Sweeping).** In the long-term practice, silkworm rearing farmers developed a series of sericulture convention to pray for cocoon harvest with certain scientific sense, such as silkworm flower worship, silkworm flower invitation, silkworm flower ignition, warming silkworm flower, closing silkworm flower, removing silkworm worship, burning field silkworm, hearing silkworm news, thanks silkworm flower, eating silkworm flower meal and other sericulture practices in the process of sericulture. On Tomb-sweeping Day every year, the silkworm flower temple fair and silkworm flower rolling activities will be held once a year in Hanshan in the region of heritage, worship the Silkworm God to pray for a good silkworm cocoon harvest (Figure 25). In addition, during the Spring Festival, Lantern Festival, and Tomb-sweeping Day every year, “Silkworm flower sweeping” singing and dancing activities are held to pray for the harvest of sericulture production. These sericulture conventions were listed in the national intangible cultural heritage in China in 2008.



Figure 25. Hanshan Silkworm Flower Rolling Festival

④ **Shuanglin damask silk weaving skills.** The original place of damask silk is the Shuanglin Town in the system area, beginning from Eastern Jin Dynasty and had been exported to overseas since Southern Song Dynasty. Damask silk is the name implying damask and silk, “Those flaring are damasks, and those plain are silks”, both made of pure silk. The process of Shuanglin damask silk is exquisite, including soaking, silk turning, netting, needling, weaving, dyeing, finishing, calendaring, inspection of finished products and other production processes. There are various types of Shuanglin damask silk, named as Geng silk, alum silk, ghatpot flower, plain silk and many other varieties of silk. Shuanglin damask silk has a soft texture and bright color, it is “as thin as a cicada's wings, and as light as the morning mist”, which reflects strong regionalism and skill, known as the “flower of silk weaving process” (Figure 26). It was included in the national intangible cultural heritage list in China in 2008.



Figure 26. Shuanglin damask silk weaving skills in Zhejiang Huzhou Mulberry-dyke & Fish-pond System ① Shuanglin damask silk weaving skills have been included in the national intangible cultural heritage list; ②, ③ Inheritor Zhou Kangming; ④, ⑤, ⑥ Damask silk products

⑤ **Traditional producing technique of Jili silk.** Once considered the best silk in the world, Jili silk was produced in Jili Village, Nanxun Town, Huzhou City within the system area. The silkworm eggs to produce Jili silk were selected from the self-cultivated “lotus eggs”, which was an excellent variety at earlier time. The reeling process of Jili silk is complex, including silk stove building, water heating up, cocoon cooking, silk head drawing (end groping), silk nest wrapping (end feeding), silk axis winding, and charcoal baking (drying). Jili silk focuses on “fine” and “uniform” in reeling process, the silk is well known as high-stretch ability, soft and white. (Figure 27). It was included into the national intangible cultural heritage in China in 2011.

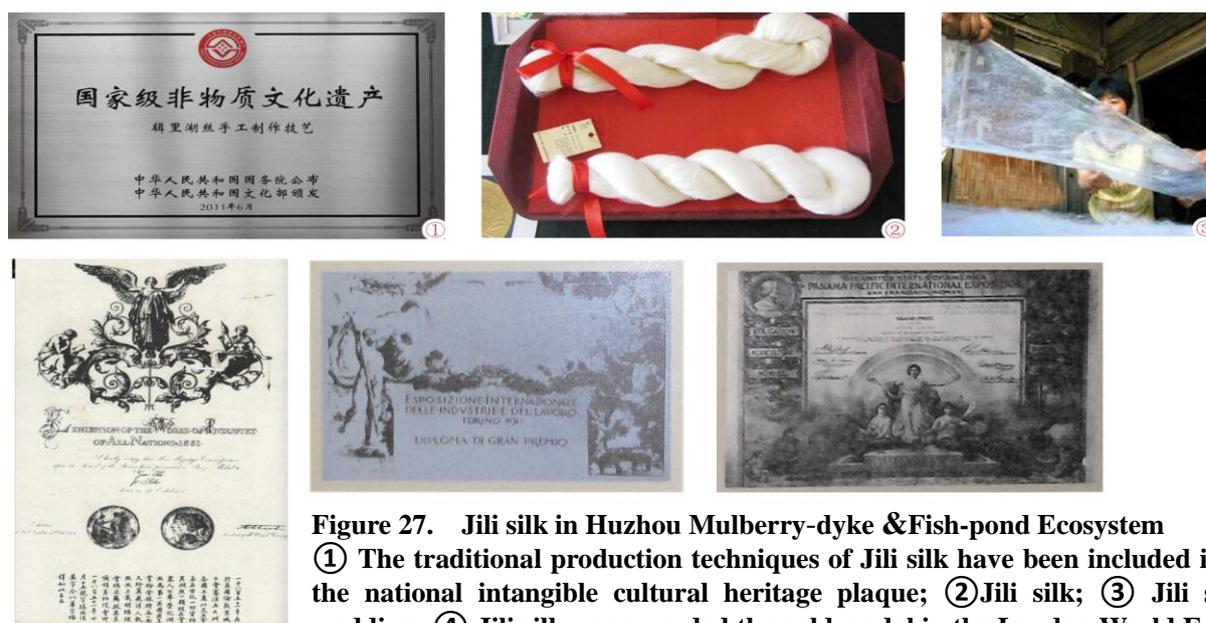


Figure 27. Jili silk in Huzhou Mulberry-dyke & Fish-pond Ecosystem ① The traditional production techniques of Jili silk have been included into the national intangible cultural heritage plaque; ② Jili silk; ③ Jili silk wadding; ④ Jili silk was awarded the gold medal in the London World Expo in 1851; ⑤ Jili silk won the first prize in the Italian Turin industrial exhibition in 1911; ⑥ Jili silk won a prize in the Panama World Expo in 1915

(2) Fish Culture

① “**Fisherman's Family Happiness**”. Fishermen take wooden apparatus for fish food, small wooden bucket storing snails and harpoon as treble instruments, take big water bucket and small wooden bucket storing water as alto instruments, and take small wooden barrel and water-chestnuts bucket as bass instruments to form a band to perform percussion Fisherman's Family Happiness. Fisherman's Family Happiness shows the whole process of production and harvest of Jiangnan fishermen from spring fry nursing, breeding and feeding, and fishing harvest at the end of the year, which expresses the hardships and the joy of the harvest of fish men's hard work. The villagers pray for good weather, bumper harvest of fishery by playing Fisherman's Family Happiness (Figure 28).



Figure 28. Fisherman's Family Happiness Performance

②**Eat fish soup meal.** According to system regional customs, every family will go fishing before and after the Spring Festival. In order to celebrate the fishing harvest of a year, people get together, and eat a fish-based “fish feast”, commonly known as “fish soup meal” Eating fish soup meal to celebrate the harvest is a common diet custom for all fishermen in Huzhou City (Figure 29). On every festival or banquet of Huzhou people, the last dish must be the whole fish, meaning “every year has surplus for next year”, because the world fish and surplus have exactly same pronunciation in Chinese.



Figure 29. Custom of eating fish soup meal

(3) Folk Art

① “Sweep the silkworm flowers”. It is a kind of sericulture custom characterized by singing and dancing and performing in the Zhejiang Huzhou Mulberry-dyke & Fish-pond System. It usually performed in singing and dancing at the annual Spring Festival, the Lantern Festival and Qingming period, especially before and after the Qingming period is the most concentrated show time(Figure 30). That is the time when silkworm rearing farmers sweep silkworm rearing room, dust and seal the windows, clean tools and get ready to begin a year of sericulture production activities. In order to pray for cocoon harvest, silkworm rearing farmers would invite the professional or amateur entertainer to their own home and held a ceremony of “Sweep Silkworm Flower” in silkworm rearing place so as to remove all disasters and bad luck, pray for good luck and harvest.



Figure 30. The “Sweep the silkworm flowers” Performance



Figure 32. The silkworm flower drama Performance

④**Prick Silkworm Flowers.** The silkworm flowers were used to express sericultural farmer's hope for cocoon harvest in Zhejiang Huzhou Mulberry-dyke & Fish-pond System. According to a legend, silkworm flower is the embodiment of the silkworm goddess, wearing the silkworm flower in silkworm rearing can achieve twenty-four points of good harvest. Therefore, silkworm flowers are arranged in the silkworm rearing rooms, rearing trays, and on the farmer's hairs. Selling, inserting, and wearing silkworm flowers formed the bright scenic in this area(Figure 33). The village of Shicong in the system region specialized in production of silkworm flower with history over 500 years. The silkworm flower makers are all genuine sericultural farmers. In old time, first crumpled flower paper dyed in different color, and then cut into flowers and leaf- like, use fine stick as the core to roll the green paper as the leaves, and tight up the flowers. Today, colorful nylon materials and wires are used to replace the crepe paper and wood sticks so as to make the flower not easy to be faded or broken.



Figure 33. The silkworm flowers in Zhejiang Huzhou Mulberry-dyke & Fish-pond System

⑤**Paper Cutting in Qianjin Village.** Paper cutting is originally a custom to frighten off evil spirits, drive away mouse and pray for a good cocoon harvest in this area. Farmers would have red paper cut into the “tiger”, “silkworm cat”, “cornucopia” logo posted in their windows on May and June every year. Later, the sericulture custom gradually formed into a system of paper-cut art, and farmers described various scenes of sericultural activities through the paper-cut(Figure 34). Then the villagers paper-cut the words such as “happiness”, “gold”, “carp” for new year blessing in every Chinese New Year; cut out fancy varieties of the Chinese word “happiness” for marriage celebration; cut out the “three levels rise”, “happy fish”, “the god of wealth” logo affixed to the windows and the rooms when any family had new house constructed. Today, paper cutting has become a symbol of blessing and best wishes. It is an important part of social production and villager’s life.



Figure 34. The paper-cutting artworks on sericulture by the students of Qianjin Primary School in Zhejiang Huzhou Mulberry-dyke & Fish-pond System

(4) Silkworm Proverbs, Fish Proverbs, Poems and Monographs

①**Silkworm proverbs and fish proverbs.** The farmers had summed up many proverbs with experience in the long history of farming production activities and widely circulated in various regions orally in Zhejiang Huzhou Mulberry-dyke & Fish-pond System. For example, proverbs for mulberry cultivation and silkworm rearing: “Would prefer silkworm mature before the leaves run out, rather than (mulberry) leaves run out before silkworm mature”, “Sheep manure went to the mulberry field, mulberry bark burst”; “Hard working three years, one will get mulberry forestry, lazy for three years, it turns into stumps”; “Plant more cedars to live in a high-rise building, plant more mulberry tree to wear silk”; “So long you have three Mu of mulberry field, not afraid of famine year”; “If you want to see mulberry tree grow well, do not let grasses grow”; “Food from rice farming, cash from silkworm rearing”; “Males cultivate mulberry field, females rear silkworm larvae, you can expect cash income in 45 days”; “Silkworm wastes should be cleaned every day, ground should be disinfectant each day” and so on. Fish proverbs: “One inch of water, one each of fish, deeper water for bigger fish”; “To culture a pond of healthy fish, you’d better well manage the pond of water first”; “Grass to raise three types of carps and three carps drives bighead”; “The water building is divided into three layers, silver carp and bighead carp live in the upper, grass bream squatting in the middle, the green carp and crucian at the bottom, three dimensional rearing is the trick”; “Red in the morning and green at night (refer to the pond water color), silver carp grows fast”; “Fish builds skin during April, May and Jun, grows meat during July, August and September”; “When barley yellow and bean flowers, disease prevention is the important time”; “If shower did not fall through in the hot weather, beware of hypoxia” ; “Clapping, fish does move, severe hypoxia; clapping, fish makes sound, light hypoxia”; “If fish makes big noise in water by down, it is hard to live to next morning”; “If white heads float near the end of Chushu, fish will die without ending”; “Northern wind blows at the early summer, nine out of ten ponds will be empty”; “When the pond is not clean, sick fish keeps coming” and etc..

②**Poetry painting and calligraphy.** There are not only the farmers directly involved in the production activities, but a great number of well-known scholars involved, par in various activities Zhejiang Huzhou Mulberry-dyke & Fish-pond System. They wrote poetry to praise sericultural activities, or directly summed up the whole process and point out the advantages and disadvantages of sericulture production, or wrote professional works, so that the original silkworm culture was rising to the height of rational and image, this is most distinctive cultural connotation in Zhejiang Huzhou Mulberry-dyke & Fish-pond System.

The most representative poems, paintings and calligraphy works in Zhejiang Huzhou Mulberry-dyke & Fish-pond System are: **(A) Cheng Qi's “Farming and Weaving Drawings”and poems.** Cheng Qi, the famous painter and bibliophile, settled in Huzhou following his great grandfather Cheng Dachang. “Farming and Weaving Drawing” with poetry reflected the major activities of Agriculture and Sericulture by artist. It was known as “the earliest complete record in painting of men-farming and women-weaving in China”, and also as “world's first picture album on agricultural science” (Figure 35). It is one of the most precious literatures for the interpretation of the history of agriculture, textile and art in China. The colored silk edition of “Farming and Weaving Drawing” by Cheng Qi includes two volumes: Farming Drawings and Weaving Drawings, each has 24 pieces of silk, including egg

bathing, egg processing, feeding silkworm, first molting, second molting, third molting, separation of grown up larvae, collection of mulberry leaves, newly exuviated larvae of fifth instar, picking up the mature silkworm, mounting silkworm, cocooning protection, cocoon collecting, cocoon storage, silk reeling, silkworm moth, worship and thanks, winding, warp, weft, knitting, weaving flowers, and cut silk, that is to depict the whole process of silkworm rearing, silk reeling and weaving, plus each matched up with a poem in pentasyllabic regulated verse. Cheng Qi' drawing book is vivid and easy to understand, very popular in Japan, Korea and Southeast Asia, even widely spread in Europe. It is a world-renowned treasure, so precious and valuable for the study on silk culture.

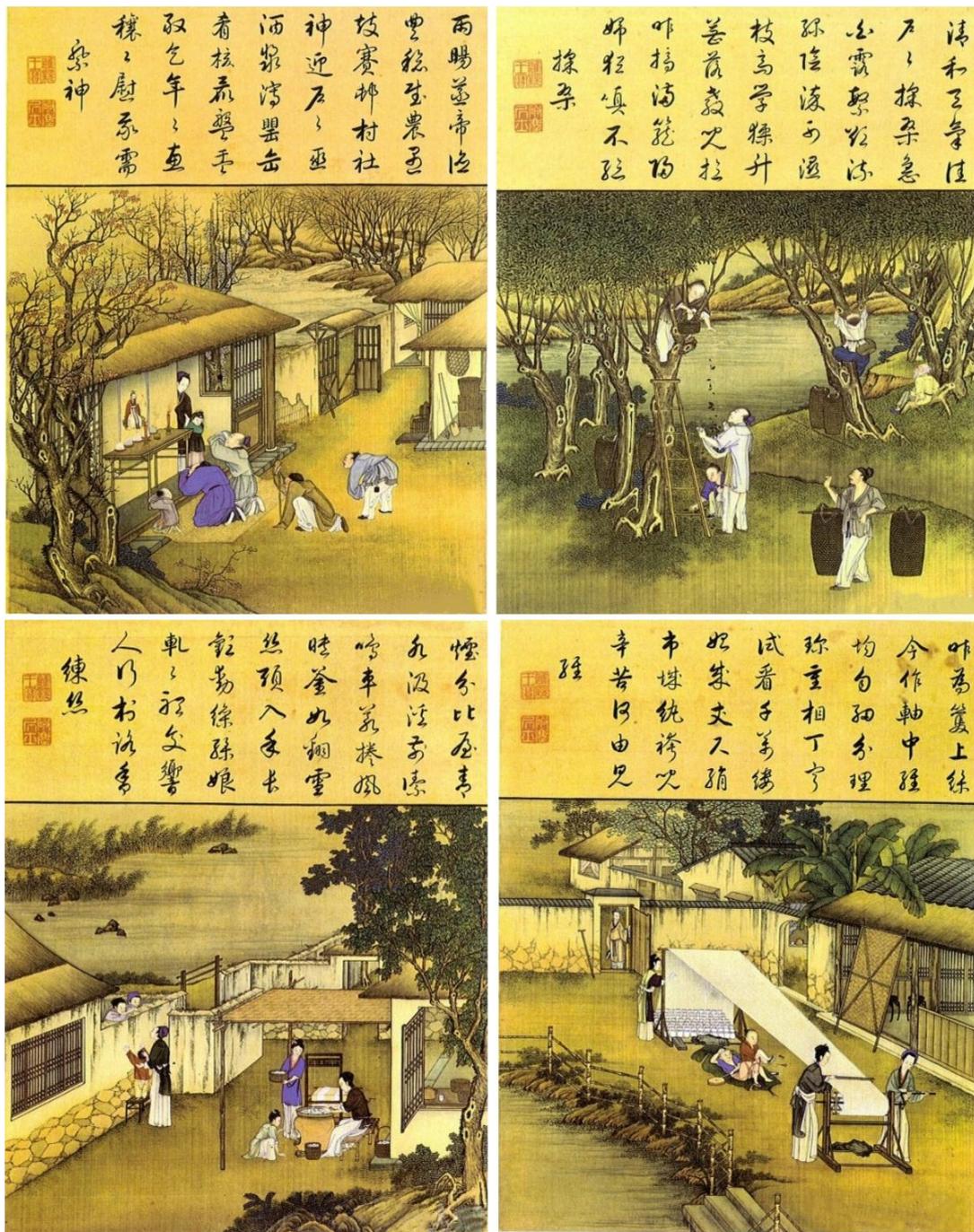


Figure 35. The “Farming and Weaving Drawing” with poetry reflected the major activities of Agriculture and Sericulture by copy in Qing Dynasty

(B) Shen Bingzhen's "Can Sang Yue Fu"(Collection of poems on sericulture). Shen Bingzhen (1679~1737) lived in Zhu Dun village, Gui Ann (now Huzhou City) in Zhejiang Huzhou Mulberry-dyke & Fish-pond System. "Can Sang Yue Fu" is a collection of long poems with the form of Yue Fu Songs to concisely and comprehensively describe 20 traditional methods for silk rearing or hardworking of sericulture farmers in Huzhou area such as egg incubation, newly hatched silkworm collection, mulberry leave collection, silkworm feeding, and molting control, first feeding after molting, floor arrangement, bound mounting frames, put up straw for cocooning, mounting mature larvae, warm the cocooning room, cocoon collection, cocoon selection, silk reeling, stripping pupa sponge, wadding, making silk quilt, puffy up of silk cotton, moth eclusion, egg laying, egg processing, worship and so on. These poems are lively and straightforward, the book is very popular.

③**Monographs.** The most influential books in the system are: **(A) "Nong Shu" (the Book of Agriculture):** Author Chen Fu, a hermit lived in Huzhou around late Northern Song Dynasty and early Southern Song Dynasty. This book was written in nineteen years of Song Shaoxing (year of 1149), with a total of 3 volumes. The third volume is specialized in sericulture, including mulberry cultivation, silkworm egg production, silkworm rearing method, cocoon harvest techniques and cocoon processing methods. In the part of mulberry cultivation, mulberry grafting method, manure application within the annular hole around mulberry tree, and intercropping of ramie were first recorded in words in this book. Mulberry sapling culture by direct seedling, mulberry nursery management and sapling transplantation technology were described in detail. In the section of silkworm rearing, it is the first book to record silkworm egg processing techniques by low temperature treatment: Put the silkworm eggs on the snow in December of Lunar Calendar, let the falling snow cover the eggs for a whole day. And also first time introduced the disinfecting technique of egg surface by warm water adjusted by cinnabar. There is also detailed description on the method to preserve silkworm eggs using salt, and first time mentioned about the cytoplasmic virus disease. Chen Fu's "Nong Shu" is the first agricultural book summarizing the experience of agricultural activities in Southern China. **(B) A supplement to Nong Shu (A supplement to the book of Agriculture):** Author Zhang Luxiang, a book written around Shunzhi fifteen years of Qing Dynasty(1658). Zhang Luxiang is highly appreciate of "Shen's Agricultural Book", and added on the second volume as a supplementary volume according to his own experience with the practice of agriculture. He carefully made the correction of the "Shen's Agricultural Book", and the two volumes were collectively referred to as the "Supplement to Agricultural Book". Chen Hengli, a Chinese agricultural historian highly appraised "Supplement to Agricultural Book" in his study on this book, said it had summarized the agricultural economy and technology of the late Ming and early Qing Dynasty, and it was one of the great works with most precious heritage in China. **(C) "Mulberry and Silkworm Series":** Author Shen Bingcheng, written in Tongzhi ten years of Qing Dynasty (1871). The book is divided into four parts: rules and regulations, fragmentary narrative, drawing illustration and Yue Fu. There is detailed description in narrative part on methods of mulberry cultivation and silkworm rearing, mulberry tree pruning and shape forming; and picture illustrations with word explanation for 36 related tools so as to make easy for imitation.

2.2.4.2 Social Organization

(1) Ancient Social Organization

① **Fish Industry Association.** Role of fish association: In the fish culture season, paying fixed deposit to fishermen, buying feed and fish fingerling for fishermen, supplying services for the fishermen in the process of fish production, helping fishman purchases and sell of aquatic products, therefore, fishermen would have no worries behind in the Huzhou Mulberry-dyke & Fish-pond System.

② **Fish Production Technique Improvement Association.** Its purpose is “to improve the production technology of fish culture with the spirit of equality and mutual assistance”. Main function: Collectively procure fish fingerling and fish feed, improve fish culture technology, collectively get loan from the State Bank for fish culture, cooperative fish culture in the large river mouth, cooperation in production and marketing The association gives fishermen great help in technology and capital, and it plays an active role in the sustainable development of fishery in Huzhou Mulberry-dyke & Fish-pond System.

③ **Silk Industry Association.** According to historical records, Silk Industry Association had operated for 447 years started from the Ming Dynasty Zhengde years (1506) until the date of May 15, 1952 when the Wuxing County People's Government of the new China canceled the local silk joint venture (Government office (1952) No. 2004 notice). Then after, the silk company was established, which plays an important role in the silk sales in the system region.

(2) Modern Social Organizations

① **Industry Alliances.** The Huzhou government and Zhejiang University have co-built the experimental demonstration area of a new social countryside in May 2006. The Huzhou Silkworm Industry Alliance Huzhou Specialty Aquatic Industry Alliance, Huzhou Animal Husbandry Industry Alliance, Huzhou Tourism Agriculture Industry Alliance, and Huzhou Grain and Oil Industry Alliance, were established under the joint effort of Zhejiang University, Department of Agriculture of Zhejiang Province, Zhejiang A & F University, Zhejiang Academy of Agricultural Sciences and Zhejiang Institute of Freshwater Fisheries. Specialists from sericulture, aquaculture, animal husbandry, grain and edible oil, and ecological agricultural tourism joined corresponding alliance to provide a strong technical support for the protection and development of the Zhejiang Huzhou Mulberry-dyke & Fish-pond System.

② **Industry Associations.** There are four fishery associations has established in Linghu, Hefu, Qianjing, and Shizong towns respectively, which are all located within Huzhou Mulberry-dyke & Fish-pond System under the administration of Nanxun District People’s Government of Huzhou City. The important role of the associations is to integrate fishery resources and promote cooperative management. Since the associations started active function, three major advantages have been appeared: First, brand advantages. The unified implement of standardized production and socialized services that strengthens the introduction and production of new varieties and quickly establishes organic food and geographic symbols.

Therefore, developing a superior fishery resource in the Linghu Lake has achieved brand advantage. Secondly, the industrial advantage. The unified supply of seeding and fishery medicines, technical standards, supervision in science and technology, brand sales, and service chain logistics are gradually taking shape. Thirdly, the technological advantage. Industry associations strengthen bonds between fishery farming and research institutes. Through the association, related experts can efficiently provide operating management services, technical training, and information consultation. Some breakthroughs in new technology was adopted right away, superior new varieties effectively spread, and new operating modes formed among fishery farmers in Huzhou Mulberry-dyke & Fish-pond System.

③ **Agricultural Cooperative.** There are now 23 farmer-specialized cooperatives of silkworms and fisheries in this area. Due to the special situation in this area: high density of population; very small limited land for each farmer but vast flat lowland; high percentages of farmers focusing on the same special field of agriculture, farm-specialized cooperative is a very effective way to organize small famers in a cooperative function. It is a mutual economic organization with voluntary association and a democratic management of production operators. These operators produce similar agricultural products and use similar management services but operating independently based on the management of a family contract in rural areas. Its main functions are providing assistance on purchase and sale, transportation and storage of agricultural products the, technical services and information service.

2.2.5 Landscape Features

2.2.5.1 An unique “chessboard” like land use mosaics of mulberry dykes and fish ponds

The proposed site covers nearly 4,000 ha mulberry dykes and 10,000 ha ponds, both of which are interconnected. Looking from a distance or from an aerial view, the land use mosaics of interconnected mulberry dykes and fish ponds appear as a huge blue–green chessboard, which has a unique charm in the water region of the Yangtze River Delta. The scenery is idyllic, simple, natural, and rustic. The landscape has a high aesthetic value. Green mulberry tree belts embrace bright fish ponds. The scenery alternates as you walk around, flowering in the spring and fruitful in the autumn. On the dykes, tall and short mulberry trees alternate, and mulberry leaves wave to and fro with the wind. In the ponds, various fish of different shapes and sizes swim and paddle in the water in schools, jumping out the water from time to time causing ripples, which are dizzying and bracing (Figure 30). The landscape of “silkworm rearing trays around each house, fishing nets sitting in the front yard of each family” demonstrates a beautiful scenery of flourishing mulberry growth, vigorous silkworm rearing and prosperous fish culture. The agricultural landscape of the Huzhou mulberry-dyke & fish-pond system was recognized as “the five-star site of National Tourism Resources”-the highest level in China.

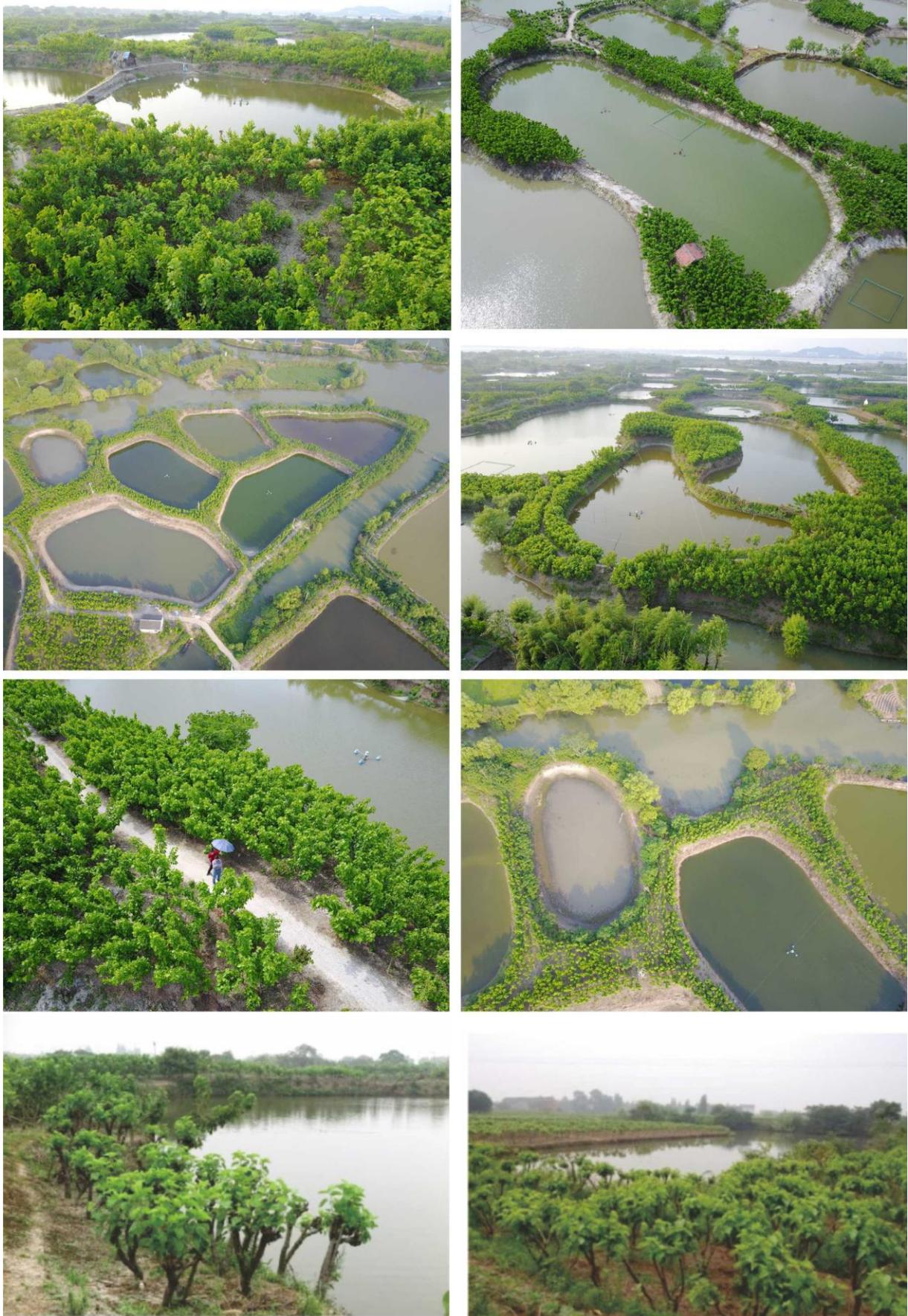


Figure 36. The landscape of the Zhejiang Huzhou Mulberry-dyke & Fish-pond System

2.2.5.1 The “chessboard” like landscapes are dotted with ancient villages

The proposed site of the Huzhou mulberry-dyke & fish-pond system is dotted with numerous ancient water villages which are more than 1000 years old. As one of these villages, Digang Village is located in the core area of the site. The village is nearby a big canal and crisscrossed with small rivers. Streets are along rivers. Houses are all built with white walls and black tiles. Stone bridges are over small rivers. The saloons, teahouses and silk shops are uniquely planned to compose a typical water town in the southern China. Particularly, the porch houses by the river, boats shuttle in the river and waves beat the shore, it is so beautiful to find more words to describe. The landscape of the proposed GIAHS site integrates perfectly ancient villages, agricultural landscape, sericulture and fishery culture. Therefore, Digang Village was inscribed to the list of Chinese Traditional Villages in 2013 by central government. The village was also awarded the title of "China Most Beautiful Leisure Village" by the Ministry of Agriculture in 2014, added to the list of "Zhejiang Province Material Cultural Heritage Tourist Attractions" by the Department of Culture of Zhejiang Province in 2015, and recognized as "National Characteristic Landscape Tourism Village" by Ministry of Housing and Urban-Rural Development and National Tourism Administration in 2015 (figure 37~40). Digang Village was awarded as one of the most beautiful “China Casual Countryside” and “China Famous Tourism Village”.



Figure 37. The landscape of an ancient village named Digang which is located in the Huzhou Mulberry-dyke & Fish-pond System)



Figure 38. Girls are so happy to send the harvested cocoons to the collection station



Figure 39. The cocoon collection station



Figure 40. International senior trainees of Agricultural heritage and FAO officers visited Digang Village and the Mulberry-Dyke & Fish-Pond System

III. ACTION PLAN FOR THE PROPOSED GIAHS SITE

3.1 Threats and Challenges

3.1.1 The price of cocoon and freshwater fish is unstable, and farmers lack confidence for the future in the industry .

In recent years, the prices of agricultural products both at home and abroad have fluctuated greatly, especially the price of cocoons has been up down every year and four major types of fish kept low, which has a great influence on enthusiasm of farmers in the field. Furthermore, young people now work in any factory to make at least 2000 yuan a month, which cause a lot of sericulturists feel safer to work in the factory rather than to maintain the farm. As a result, abandoned mulberry trees are increasing yearly. Therefore, it is a big challenge to encourage farmers to cultivate mulberry and protect the mulberry-dyke fish pond system. This might be done by expanding the system function and improving the efficiency so as to stabilize the labor force required in preservation of Zhejiang Huzhou Mulberry-dyke & Fish-pond System.

3.1.2 The reduction of the labor force of for sericulture has restricted the protection and development of the system.

Rapid development of rural industry and significant improvement of financial status of average people in China, many villagers, particularly the youths, are unwilling to rear

silkworms day and night but choose to work in factories or business department, which has resulted in a decrease in available skilled and strong silkworm farmers. Consequently, those who undertake silkworm rearing are mostly seniors; this in turn has caused abandonment and poor management of the mulberry-dyke fish-pond system and a decrease in the overall size of the system. Today, most silkworm farmers are >50–60 years old. With the passing away of “silkworm lady” and “fish men”, the traditional skills and customs practiced in the system will be disappearing soon or late. As we had mentioned before, the development of industrialization and urbanization, is still on going, the land in Zhejiang Huzhou Mulberry-dyke & Fish-pond System is continuously used for other constructions, such as plants, roads, and houses. The area of Zhejiang Huzhou Mulberry-dyke & Fish-pond System is decreasing year by year; currently the well conserve area of the system is only around 100 ha. It is our priority agenda that we should take further action to protect this treasure before it is too late.

3.2 Action Plans

3.2.1 Dynamic Conservation Concept of Huzhou Mulberry-dyke & Fish-pond System

To strengthen the establishment of geographical brands of agricultural products in the heritage area through setting up professional cooperatives and moderate scale family farms by making best utilization of the ecosystem advantages of traditional Huzhou Mulberry-dyke & Fish-pond System. The products from the system such as freshwater fish, silkworm cocoons, mulberry tea, mulberry fruits, beauty & health products made from silkworm cocoon, fruits, rice, soybean, sesame oil and other agricultural products will be known as the most reliable ecological security products by consumers. At the same time, to further enhance the added value of products from the heritage area through the deep processing of agricultural products and development of serial name brand products, so as to increase the income of farmers, to enhance farmers' enthusiasm for participation in the protection of Huzhou Mulberry-dyke & Fish-pond System, to ensure the dynamic conservation and sustainable development of the system.

3.2.2 Actions Taken

3.2.2.1 The leading groups are set up to work on the protection and development of the Zhejiang Huzhou Mulberry-dyke & Fish-pond System

So far, the leading groups are set in two levels, the district and city governments respectively, and they are attached to the agricultural (or agriculture and forestry) bureau, so as to strengthen the protection and utilization of Zhejiang Huzhou Mulberry-dyke & Fish-pond System. In Nanshan District People's Government, the Vice mayor Xu Guohua, who is in charge of Agriculture, is the group leader, and the associate group leaders including the chief of District Government Office, bureau of agriculture and forestry, and Hefu Town, and the principle members are from Propaganda Department of District Committee, Agriculture Office, National Development and Reform Commission and Commission of Economy and Information Technology, Finance Bureau, Water Conservancy Bureau, Sports Bureau, Tourism Bureau, Public Security Sub-Bureau, Environmental Protection Sub-Bureau, State

Land Bureau, and Planning Bureau. There is an administration office, and the director of the District Bureau of Agriculture and Forestry as the office director, who is responsible for organizing the implementation of the overall plan and scientific research for the protection and development of Zhejiang Huzhou Mulberry-dyke & Fish-pond System, timely handling the important issues if any related with the system protection.

3.2.2.2 Published the Measures for Protection of Huzhou Mulberry-dyke & Fish-pond System

The “*Measures for Protection of Huzhou Mulberry-dyke & Fish-pond System*” has a total of six chapters twenty-nine articles; it was approved in September 2013 through the discussion in the Huzhou Municipal People's Government executive meeting, and began to be implemented. The *Measure* stipulates that: The following activities are prohibited within the range of the protection zone of Zhejiang Huzhou Mulberry-dyke & Fish-pond System: reclaim, borrow earth and etc.; build chemical, pesticides, printing and dyeing plants around the ecosystem; release toxic and harmful substances, dump solid waste, set up garbage dumps; damage the protection facilities related with the system; any actions destroying the resources related to the system. If any specific areas are ready to be included as protection area, it shall report to the Department of Agriculture, Municipal People's Government for approval and record. The County People's Government Administrative Department in charge of agriculture shall designate in conjunction with the town (township), and village, and published after the approval of the County People's Government. The owners or users should be reasonably compensated for damages if any and their legitimate rights and interests should be protected.

3.2.2.3 Worked out the Protection and Development Plan of Zhejiang Huzhou Mulberry-dyke & Fish-pond System

In 2013, Zhejiang University was entrusted to develop the “*Protection and Development Plan of Zhejiang Huzhou Mulberry-dyke & Fish-pond System*”, and it was approved by the expert review committee. The system scope of the proposed GIAHS site mainly includes the Wang Jia Dun village, Qinglao village, Shen Jia Dai village , Nan shuang Lin village, Lu Jia Zhuang village, She Zhong village, Shan Xi village, Qian Feng village, Shan Tang village, Xu Lian village, Xin Miao Li village, Xia Ang village, Liu Bao Li village, Zhu Dun village, Chen Yi village in Ling Hu town of Nanxun district; the Digang village, Xin Di village, He Dong Village, Si Lian village, Chen Ta village, Qin Yi village in He Fu town of Nanxun district. Area of Coverage is 6900 hectares . Details refer to Annex 5.

3.2.2.4 Held the Forum

On September 21, 2015 Huzhou municipal government, joint with Zhejiang University, held the Forum for the Development of the Traditional Culture and Ecological Civilization of the Zhejiang Huzhou Mulberry-dyke & Fish-pond System at Digang Village, the system heritage site in Nanxun District, which further enhanced the social public's consciousness of protecting China's important agricultural heritage Mulberry-Dyke Fish-Pond System, and also

expanded the influence and popularity of the agricultural culture heritage of mulberry base ponds.

3.2.2.5 Enrich the content of Hanshan Silkworm Flower Rolling Festival

In order to further expand the influence of Hanshan Silkworm Flower Rolling Festival during the Tomb Sweeping Festival, on the basis of the original spontaneous folk cultural activities offering Silkworm God, Nanxun District People's Government integrates the promotion of scientific consultation on sericulture, large trade fairs, Miss silk flower pageant, carrying silkworm mother, shaking silkworm dragon, eating silkworm flower meal, wrapping rice dumplings contest, theatrical performances and other activities, and the silkworm culture activities have been further inherited and developed, and the annual tourists reach about 200,000 passengers.

3.2.3 Results Achieved

3.2.3.1 The protection and development of Zhejiang Huzhou Mulberry-dyke & Fish-pond System has been widely recognized by the people of Huzhou City

Since Huzhou municipal government formulated and published the “*Measures for Protection of Huzhou Mulberry-dyke & Fish-pond System*” in 2003, the legal guarantee was provided. City, district, Linghu Town, Hefu Town and related Shezhong Village, Digang Village at all levels carried out extensive publicity through a variety of ways, to raise farmer's awareness and the understanding of the significance to protect Huzhou Mulberry-dyke & Fish-pond System, so that to get support from villagers for heritage protection, and to create a good social environment and atmosphere for the protection and utilization of the ecosystem. At present, there are 8872 families who involved with silkworm rearing, and 5247 families who involved with fish cultureing.

3.2.3.2 The sericulture and silk culture has been introduced into the school

Cultural heritage needs a new generation's love and understanding, and traditional culture also needs continuous innovation and improvement for a long time spreading. Different programs of silkworm rearing as biological class and silk cultures were designed for different stages of kids from kindergarten to middle school. Volunteers of Grandma/grandpa went to school to telling stories, show them how to taking care the little baby silkworms, how to reel the silk out by traditional simple method. Of series of activities on communicating with silkworm were carried out, we invite kids to the silkworm egg production farms, mulberry gardens, silkworm rearing farms. In addition, taking Huzhou Phoenix Primary School as a pilot, a set of children's picture books based Huzhou Mulberry-Silkworm-Silk Culture were compiled, and integrated into the primary school art teaching since 2013. For example, children will understand the “silkworm flower temple fair” from the class of “*Design and Make Silkworm*” understand the silkworm God worship in local from the class of “*The Myths and Legends of Mother Ma*”, and understand the traditional production technology of silk from the class of “*Silk Reeling Process and Printing and Dyeing Cloth*”. Therefore, the sericulture and silk culture of Zhejiang Huzhou Mulberry-dyke & Fish-pond System has already introduced into educational programs. (Figure 41~44).



Figure 41. Huzhou Phoenix Primary School includes the sericulture culture into classroom teaching and practice



Figure 42. Some of the text books for art classes in Huzhou Phoenix Primary School.



Figure 43. Paintings to describe the forming process of Huzhou Mulberry-dyke & Fish-pond Ecosystem by the students of Huzhou Phoenix Primary School

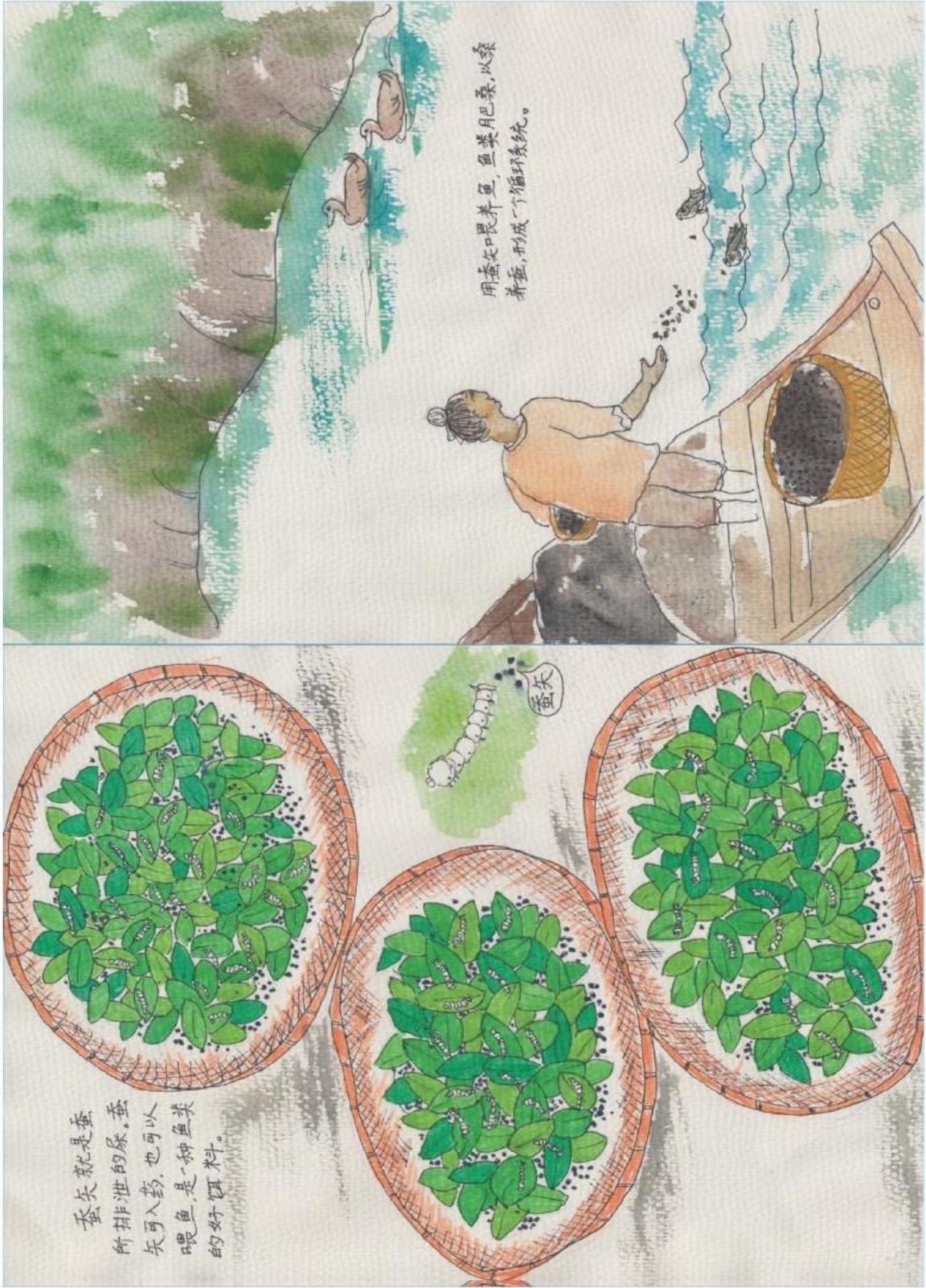


Figure 44. Paintings to describe the scenery of Huzhou Mulberry-dyke & Fish-pond Ecosystem by the students of Huzhou Phoenix Primary School

3.2.3.3 The related cultural projects and villages in Zhejiang Huzhou Mulberry-dyke & Fish-pond System have been included in the world, national and provincial intangible cultural heritage, and won the title of the Most Beautiful Leisure Village in China

In the last few years, the relevant non material cultural heritage has been declared positively. At present, the related cultural projects and villages in Zhejiang Huzhou Mulberry-dyke & Fish-pond System have been included in the world, national and provincial intangible cultural heritage, and won the title of the Most Beautiful Leisure Village in China (Table 3).

Table 3. Directory and title of awarded intangible cultural heritages in Zhejiang Huzhou Mulberry-dyke & Fish-pond System

| Name of Project | Heritage title | Awarded organization |
|--|--|--|
| Chinese Silk Weaving Skills (including Hang Leno, Damask silk, Silk wadding, Shu brocade, Song brocade and the customs of Rolling the Silkworm flower, Counting Silkworm Flowers | <i>Human</i> Intangible Cultural Heritage | United Nations Educational, Scientific and Cultural Organization |
| The Grand Canal (including Di Pond) | World Cultural <i>Heritage</i> | United Nations Educational, Scientific and Cultural Organization |
| Silkworm folk customs (Hanshan Rolling the Silkworm Flower, Counting Silkworm Flowers’) | National Intangible Cultural Heritage | The State Council of the people's Republic of China; Ministry of Culture of the People's Republic of China |
| Shuanglin Silk Crepe Damask Skills | National Intangible Cultural Heritage | The State Council of the People's Republic of China; Ministry of Culture of the People's Republic of China |
| Huzhou Writing Brush Craftsmanship | National Intangible Cultural Heritage | The State Council of the People's Republic of China; Ministry of Culture of the People's Republic of China |
| Hanshan Rolling the Silkworm Flower | Zhejiang Province Intangible Cultural Heritage | The People’s Government of Zhejiang Province; Zhejiang Provincial Department of Culture |
| Traditional Sericulture in Nanxun | Zhejiang Province Intangible Cultural Heritage | The People’s Government of Zhejiang Province; Zhejiang Provincial Department of Culture |
| Huzhou Folk Songs | Zhejiang Province Intangible Cultural Heritage | The People’s Government of Zhejiang Province; Zhejiang Provincial Department of Culture |
| Lianshi Ship Boxing | Zhejiang Province Intangible Cultural Heritage | The People’s Government of Zhejiang Province; Zhejiang Provincial Department of Culture |
| Sericulture and Silk Cultural Ecological Area | Ecological Protection Zone Pilot Project of Zhejiang Province Intangible Cultural Heritage | Zhejiang Provincial Department of Culture |

Table 3. Continure

| Name of Project | Heritage title | Awarded organization |
|-----------------|--|---|
| Digang Village | Tourism Destinations of Zhejiang Province Intangible Cultural Heritage | Zhejiang Provincial Department of Culture |
| Digang Village | China Most Beautiful Leisure Village | Ministry of Agriculture of the People's Republic of China |
| Digang Village | National Characteristic Landscape Tourism Village | Ministry of Housing and Urban-Rural Department of the People's Republic of China; China National Tourism Administration |
| Digang Village | Chinese Traditional Villages | Ministry of Housing and Urban-Rural Department et al., the People's Republic of China |
| Digang Village | National Civilized Village | Central Committee for the construction of spiritual civilization |

3.2.4 Intends to take a further action plan

There is the special government documents available named “Nanxun District People's Government of Huzhou City, Zhejiang Huzhou Mulberry-dyke & Fish-pond System Protection and Development Plan”(Xun Government Doc 2016 No. 92), which had issued to all related administrative departments of the city. The total area of the protected area of the system is 6900 hectares. The specific plan of action to be taken is as follows.

3.2.4.1 Agricultural landscape protection of Huzhou Mulberry-dyke & Fish-pond System

3.2.4.1.1 Protection Goal

Protect and utilize ancient villages through the establishment of multiple-level fund raising system: led by the government, participated by the society, and self-financed by benefited people. At the same time, effectively protect the culture and landscape in the protection zone by purifying and beautifying ecological corridors such as rivers, ports, ripples, ponds so that the beautiful ancient village landscape and natural ecological landscape have a greater attraction to tourists.

3.2.4.1.2 Protection Content

(1) Topography and geomorphology of traditional ratio mulberry-dyke to fish-pond.

It was considered to be equal importance between dyke-plantation and pond-fish culture, the outside input was minimized through the reasonable proportion of dyke-area and pond-surface in the traditional system. According to the long-term practice of the ancestors and investigation results from Zhang Jian (1993), when the pond ratio was 6:4, 5:5 or 4:6 of mulberry-dyke to fish-pond, a more harmonious relationship among the various departments of mulberry-fish ponds in the system could be established, and output of the system was relatively high, and the good ecological environment and biodiversity could be maintained. However, in recent years, due to the unstable price of silkworm cocoon and raw silk, farmers in this system had been pursuing the maximum cash income and laid more and more weight

on fish pond, resulted in larger ponds, narrower mulberry dyke. The ratio at present is about 3:7 in most area or 2:8 in some area. The unbalanced development of the system resulted in the unbalanced energy conversion, and finally the loss of mutually dependent recycling biological chain. That is because crops on the bank cannot meet the needs of aquaculture feed, exogenous input soared when the dyke is decreasing and pond is enlarged, and the pond sediment cannot be fully used by crops on the dyke, then the material and energy conversion efficiency is lowered, pond bottom elevated, pond water shallowed, pond bank collapsed, fish ponds becomes eutrophication, and finally the deterioration of ecological environment. Thus the ratio change has a serious impact on the ecological environment and sustainable development of system. Therefore, to protect the topography and topography of traditional system is very important to keep a healthy ecological environment in the region.

(2) **The irrigation system of “Zong Pu Heng Tang”.** To ensure the unblocked irrigation system is not only directly affecting the water quality and the ecological environment of the whole region, but also affecting the leisure landscape function. Therefore, to protect and further develop the original irrigation system of “Zong Pu Heng Tang” in the region is among priorities in the conservation and maintenance of Zhejiang Huzhou Mulberry-dyke & fish-pond System.

(3) **The beautiful natural ecological landscape corridor consist of rivers, ports, lakes, and ponds.**

(4) **The traditional mulberry-dyke and fish pond landscape with winding path leads to a secluded quiet place.**

(5) **The mulberry polder landscape.** Zhejiang Huzhou Mulberry-dyke & Fish-pond System is mainly developed from the mulberry polder landscape, and there are quite a few well conserved in the protection region.

(6) **The ancient villages, ancient buildings and bridges with long history.** Many ancient villages(Digang Village, Zhujiaba Village, Xiaang Town, Zhudun Village, Shezhong Village), buildings and bridges constructed in Tang, Song, Yuan, Ming or Qing Dynasty scattered within the area, the living and life style, farming culture, custom and tradition, as well as traditional folk arts and so on, constitute a colorful and vivid landscape of Huzhou Mulberry-dyke & Fish-pond System.

3.2.4.1.3 Protective Measures and Plans of Action

(1) **Establishment of high standard pond bank.** To reconstruct the fish pond in strict accordance with the Document of “Protection Plan of Mulberry-Dyke & Fish-pond System in Huzhou City” approved by Standing Committee of the People's Government of Huzhou City on August 30, 2013. There is the provision of the 4:6 ratio of mulberry-dyke to fish-pond in the document, so as to ensure the sustainable development of the system, to improve and play a positive role in promoting the regional ecological environment. Specific action plan:

2013~2015: According to the ratio of 4:6 to complete the restoration of traditional fish ponds in Digang Village and Shezhong Village in the core area of the system (Responsible unit: People's Government of Hefu Town, People's Government of Linghu Town).

2016~2020: There is no gutted fish pond left, the ratio of mulberry-dyke to fish-pond

will reach 6:4 in all other area inside the system. (Responsible unit: People's Government of Hefu Town, People's Government of Linghu Town).

2021~2025:To modify the fish ponds where the ratio is under 6:4 (Responsible unit: People's Government of Linghu Town).

(2) Set up the special fund for the protection of Huzhou Mulberry-dyke & Fish-pond System.

A special fund has set up for protection and development of Huzhou Mulberry-dyke & Fish-pond System in the reserve region. Fund resources are government funding, nongovernmental fund-raising and donations, and a multi participation protection network was formed. The main purpose of protection fund: restoration of mulberry dike and fish ponds in heritage site; subsidies and reward to the farmers who maintain the traditional ratio of mulberry dyke to fish pond; compensation for the reduced income of farmers who follow the traditional mode of ecological planting mode. By maximizing the integration of budgets from Department of Development and Reform, Water Conservancy, Forestry, Tourism and Culture, Environmental Protection, Land and Resources, give priority to the reconstruction of dilapidated fish ponds and mulberry tree replacement in the protection area. (responsible unit: Nanxun District People's Government Office).

(3) Planning and preparation of ancient village restoration, protection and utilization (2016~2020). On the basis of full survey, planning and restoration of old villages in the principle of “repairing the damage, keeping the original” based on the real condition of each village. Work along with the beautiful countryside project, to renovate dilapidated houses in rural areas, set up farmers drinking water system, establish rural cultural centers, and etc. (Responsible unit: Nanxun District Housing and Urban Construction Bureau of Nanxun District, Nanxun Tourism Bureau).

(4) The purification and beautification of ecological corridor with rivers, lakes and ponds. Selecting specific types of plants with both ornamental value and purification function of floating plants(such as lotus eyes), submerged plants such as Potamogeton and aquatic plants(lotus flower), to distribute in the water body in a proper ratio to establish the beautiful natural scenery and enhance the function of biological purification of water. Planting on high, medium and low height of plants, such as reeds and rushes, senior middle cattail and windmill grass and flowers to form layers of the landscape. At the same time, put in the proper stocking of mussels, snails and other aquatic animals, to effectively remove excess nutrients in the water. This is a very efficient way to establish the natural water purification net systems. Specified actionPlan:

2013~2015: To complete purification and landscaping of rivers, lakes and ponds in the core protected areas. (Responsible units: Agriculture and Forestry Development Bureau of Nanxun District, People's Government of Hefu Town, People's Government of Linghu Town).

2016~2020: To complete purification and landscaping of rivers, lakes and ponds in the expanding areas of the core protected site. (Responsible units: Agriculture and Forestry Development Bureau of Nanxun District, People's Government of Hefu Town, People's Government of Linghu Town).

2021~2025: To complete purification and landscaping of rivers, lakes and ponds in the

fruit-dyke & fish-pond system inside the protected area. (Responsible units: Agriculture and Forestry Development Bureau of Nanxun District, People's Government of Hefu Town, People's Government of Linghu Town).

3.2.4.2 Agricultural Culture Protection of Huzhou Mulberry-dyke & Fish-pond System

3.2.4.2.1 Protection Goal

In line with the concept of culture promoting protection, and through the excavation and publicity of the related sericulture silkworm culture in Zhejiang Huzhou Mulberry-dyke & Fish-pond System, let more people understand, appreciate, protect and inherit the sericulture silkworm culture, form a protection system of multi-level participation, make the sericulture silkworm culture an important part in people's lives, ecological tourism and leisure resort, make the sericulture silkworm culture an important content for the cultural development of Nanxun District as well as the cultural city creation of Huzhou City, and play an active role in enriching people's cultural life and building a harmonious society.

3.2.4.2.2 Protection Content

(1) **Panxing Pond Ruins.** Located in the Cha Jia Duan Village of Linghu Town in the protected region. Originated in the Three Kingdom Dynasty, once managed by Yang Juncheng in Wu Kingdom and one of the earliest and best preserved fish ponds with typical system characteristics.

(2) **Silkworm Flower Festival.** A festival to worship Silkworm Flower Goddess held annually at Tomb-sweeping Day. Activities are including: To name silkworm flower girl, parade of silkworm mother sedan, talent competition of sericulture. It was included in the national intangible cultural heritage protection list in 2001.

(3) **Silkworm Rearing Custom.** Including: worship to Silkworm Flowers; inviting, keeping, sending and thanking Silkworm Flower, and other customs melt in the marriages ceremony.

(4) **Folk art.** Such as: wooden utensils with different sizes and shapes to store snails, fish food in Digang Village, small and large wooden barrels, music band consisted of a combination of fishing tools, performance to celebrate harvesting and etc.

3.2.4.2.3 Protective Measures and Plans of Action

(1) **Strengthen sericulture cultural propaganda.** 2013~2015, set up the website, micro-blog, WeChat, combining with newspaper and television network media to spread the silkworm and fish culture, strengthen the ecological function and cultural value of the system. Let the majority of the people of all fields to aware of responsibility and desire to protect the heritage of Zhejiang Huzhou Mulberry-Dyke & Fish-pond System (Responsible unit: Propaganda Department of Nanxun District Party Committee of the CPC).

(2) **Build Yang Juncheng Memorial Hall.** From 2016 to 2020, establishment of Memorial Hall to respect Yang Juncheng, the founder of four common fish culture. (Responsible unit: People's Government of Linghu Town).

(3) **Establish the Museum of Silkworm culture.** From 2016 to 2020, in Digang Village of Hefu Town, the core protected area. (Responsibility unit: People's Government of Hefu Town).

3.2.4.3 Agricultural Ecological Protection Huzhou Mulberry-dyke & Fish-pond System

3.2.4.3.1 Protection Goal

Through the improvement of rivers, ports and ripples and the water quality in the protection and development zone, to provide the maximum space for different species of living organisms, to create a harmony environment for the development of biodiversity, so as to further improve the ecological environment in the region. At the same time, through regular dredging and obstacles removing on the rivers, ports, ripples, ponds etc., to increase the capacity of water storage in the region, to enhance the capability to resist flood disaster, and promote the sustainable development of regional rural economy. Specific protection objectives at all stages are as following.

2013~2015: All pollution sources to the rivers, ports, ponds and lakes inside the protection area should be completely cut off; The remote water monitoring platform for day around will be established. Water monitoring system All-day long has been basically completed, and the ecological environment will be further significantly improved.

2016~2020: The ideal proportion of Mulberry dyke to the fish pond and the irrigation system of "Zong Pu Heng Tang" will be effectively restored, and energy conversion system is in the natural balance in the system.

2021~2025: The overall ecological environment of the reserve has changed qualitatively.

3.2.4.3.2 Protective Measures and Plans of Action

(1) **Improvement of Water Environment in the System.** To enhance and protect the regional agricultural ecological environment through the promotion of fishermen on land housing, strict restriction on the agricultural pollution caused by over-use of fertilizers and pesticides, shutting down the paper-making, printing and dyeing, leather and chemical factories, implementation of unblocked irrigation project and ect. Specific action plans are:

2013~2015: Complete fishermen on land housing project, promote the rural environment contiguous remediation work, using aerobic anaerobic biological treatment processing technique to treat rural domestic sewage, set up garbage collection facilities for rural garbage collection. The village sewage treatment rate reached more than 60%, garbage collection rate reached 100% (Responsible unit: People's Government of Hefu Town, People's Government of Linghu Town). The demolition of illegal pig farms, greenhouse turtles farms; eliminate direct discharge of waste from any pig farms and turtle greenhouses, all farming animal waste should be properly treated and ecologically recycling. Finish the work on removing river bank garbage, river obstructions, abandoned floating debris, sewage pits, drains and salvage work (responsible units: People's Government of Hefu Town, People's Government of Linghu Town).

2016~2020: Complete the plan of job relocation for some fishermen, promote project of beautiful countryside establishment of the villages Zhu Jia Ba, Wang Jia Dun, Qianlao, Qianjian, Shen Jia Dai, South Shang Lin, Lu Jia Zhuang of Linghu Town and villages of

Hedong, Silian, Yangdong, Chenta and Qianyi of Hefu Town. (Responsible unit: People's Government of Hefu Town, People's Government of Linghu Town).

2021~2025:To promote project of beautiful countryside establishment of the villages of Shanxi, Qianfeng, Shantang and Liubao of Linghu Town (Responsible unit: People's Government of Linghu Town).

(2) **Establishment of regional platform for water condition monitoring.** From 2016 to 2020, complete the establishment of automatic remote monitoring system for water quality in the area, to realize real-time monitoring of the whole process, to ensure the water quality in the area meet the qualification of class II and III standards year around, to create a suitable environment for biodiversity. Set up real-time acquisition of water sampling and video information in the places of Xi Hong Tang River in the west of Shezhong Village, Xiahe Pond of Qingshang Gate in west of Qingfeng Village, Ang Creek in east of Xia Ang Ji Town, Houzhuang River, Niupeng River, Long Brook in the west of Digang Village , Hefu Lake, Yijia River in north of Donghe Village, Linhu Pond in east of New Digang Village, Nanheng River in south of Wang Jia Dun Village, and Sanglin Lake in South Sanglin Village. All data and vedio on real-time water quality information will send to the platform for water condition monitoring located in the District Management Center by wireless transmission. The data includes: algae concentration, turbidity and PH, dissolved oxygen, water temperature, conductivity, the rate of total phosphorus, total nitrogen, potassium permanganate, so that water quality parameters of regional river can be automatic real-time monitored and get early warning in any unusual situation.(Responsible unit: Environmental Protection Bureau of Nanxun District).

3.2.4.4 Development of Eco-products in Huzhou Mulberry-dyke & Fish-pond System

3.2.4.4.1 Development Goal

As a wide spread concern in China, consumers are more aware of the quality of agricultural products. Aiming at the market hot spots, making full use of ecological advantages of the Zhejiang Huzhou Mulberry-dyke & Fish-pond System, to develop the customer-trusted agricultural products featured with organic and ecological security, including the freshwater fish, mulberry leaf tea, mulberry fruit, silkworm cocoon beauty care products, fruit, rice, bean, sesame oil and etc. by strengthening the supervision of agricultural product quality controlling and brand building, to gain the added value of the products, increase the income of farmers in the region, and ignite farmer's enthusiasm to protect Zhejiang Huzhou Mulberry-dyke & Fish-pond System.

3.2.4.4.2 Development Content

(1) **Agricultural products and food with ecological safety.** Such as: mulberry tea, mulberry fruits, wine, juice and jams made from mulberry fruits, ice cream, bread and cake made from mulberry leave powder. Add on higher economic value fishes varieties except the four common fishes, such as, crabs, whitebait, eel, turtle, snakehead fish, whitefish, yellow catfish, perch, and other high-quality aquatic products.

(2) **Green silk protein food.** The silk can be decomposed by actinozyme into oligopeptides and amino acid powder, which can be used as a food additive with high nutrition value and food safety.

(3) **Green silk protein medical and beauty products.** Silk is one of the best material to develop medical and beauty products due to the similar and excellent biocompatibility of silk protein to human keratinocytes and the collagen structure, plus silk protein is free from the concern of allergenic or carcinogenic characteristics. At present, there are facial mask, artificial blood vessels, bones, tooth enamel and skins made from silk with high potential of practical use.

3.2.4.4.3 Plans of Action

(1) **Establish stable base for the production and processing of ecological farm products.** Planning for 2013~2020: establish a 6900 for live herring and dry herring in Digang Village; 1500 Mu ecological processing base for live grass carp and dry grass carp in Chenta Village; 3000Mu ecological rice base for rice production in Xin Miao Li Village; 800 Mu ecological base for leave and fruit mulberry tree plantation in Siling Village and etc.(Responsible unit: Agriculture, Forestry and Development Bureau of Nanxun Town).

(2) **To establish the quality standards and technical regulations of the agricultural products in the system.** Planning for 2016~2020, set up series of quality standards and technical regulations of the agricultural products in the system based on the characteristics, safety and sustainable development of the system. (Responsible unit: Agriculture, Forestry and Development Bureau of Nanxun Town).

(3) **Promote investment in R & D of new sericulture technology and agricultural products.** Set up special funds for transformation of scientific and technological achievements, increase add-on-value of traditional agricultural products and stabilize farmer's income in the region. (Responsible unit: Science and Technology Bureau of Nanxun District).

3.2.4.5 Development of leisure agriculture in Huzhou Mulberry-dyke & Fish-pond System

3.2.4.5.1 Development Goal

In line with protecting the ecological model of traditional Huzhou Mulberry-dyke & Fish-pond System, combining the ecological landscape of the region, water village natural scenery, ancient village style, Confucianism culture and humanistic landscape and beautiful countryside construction, to create the protection zone as an ecological agricultural leisure tourism scenic spot including ecological tourism, life experience of water villages, culture influence, popular science education and health care through the improvement of land road facilities, water transport facilities and tourism infrastructure in the protection zone, the village remediation and the holding of Sericulture Culture Tourism Festival and Fish Culture Festival. The upgrade edition of traditional Huzhou Mulberry-dyke & Fish-pond System will become the most attractive tourist destination in Southern Taihu Lake, and the sustainable development of ecological agricultural system will be further strengthened.

3.2.4.5.2 Development Content

There is a particular design of spatial layout for development and restoration of the system called “one axis, two corridors and seven bodies”.

(1) **One axis.** Take Longxi port as the axis core, to form the protection and development axis of mulberry-dye- fish pond.

(2) **Two corridors.** Take Longxi port as the axis core, to establish the smooth boat transportation corridors in the east and west sides.

(3) **Seven bodies.** Establish 7 comprehensive cultural center based on the practical conditions of each ancient village of Digang, Chenyi , Zhu Jia Ba, Xiaang, Shezhong, Zhudun and Lu Jia Zhuang, so as to promote the inheritance of traditional culture and development of leisure agriculture.

3.2.4.5.3 Plans of Action

(1) **Setting up the administrative committee for the development of ecological leisure agriculture in the system.** (Responsible unit: Office of the people's Government of Nanxun District).

(2) **Elaborate detailed development plan of ecological leisure agriculture in the system.** Emphasizes on the protection of natural resources and biodiversity, maintain the sustainable use of resources, realize the sustainable development of the tourism industry. The income from ecological tourism will be used to protect the ecological environment, and exploitation of tourism industry will strictly limited according to the safe protection of the system. (Responsible unit: Tourism Bureau of Nanxun District).

3.2.4.6 Guarantee set up in the Management System

3.2.4.6.1 Institutional guarantee

In accordance with the executive meeting of the Huzhou Municipal People's Government on 30 August 2013, the measures for the protection of Zhejiang Huzhou Mulberry-dyke & Fish-pond System were discussed and adopted, and the relevant regulations and policies in the implementation of the measures were actively implemented.

3.2.4.6.2 Organizational guarantee

To strengthen the protection, inheritance and utilization particularly in the Nanxun region of Zhejiang Huzhou Mulberry-dyke & Fish-pond System, there is the plan to set up “Nanxun Management Committee for Protection of Huzhou Mulberry-dyke & Fish-pond System” which involved district government officers, stakeholders, and farmer’s representatives.

3.2.4.6.3 Technical guarantee

There is the strong technical consulting committee supported by the experts from “Huzhou sericulture industry alliance”, “Huzhou aquatic industry alliance”, “Huzhou fruit industry alliance”, “Huzhou city animal husbandry industry alliance” organized by the Huzhou Municipal People’s Government and Zhejiang University, Agriculture Department of Zhejiang Province, Zhejiang Agriculture and Forestry University, Huzhou Normal College, Zhejiang Academy of Agricultural Sciences, Zhejiang Institute of Freshwater Fisheries for a comprehensive technical support.

3.2.4.6.4 Publicity guarantee

Establish a multidimensional and ecological civilization education propaganda system, form a protection and development network by multiple level participation. The traditional Zhejiang Huzhou Mulberry-dyke & Fish-pond System model will be cooperated into test book for primary and secondary school students. Urban and rural interaction will be strengthened, volunteers from the city will become regular activity to let people realize you are live in a green city of agricultural heritage in Zhejiang Huzhou Mulberry-dyke & Fish-pond System. Furthermore, disseminate knowledge and awareness through the website, micro-blog, WeChat and other means of network to the public.

Annex 1: Commitment Letter

湖州市南浔区人民政府

承诺函

我们郑重承诺保护农业文化遗产浙江湖州南浔桑基鱼塘系统及其相关的生产方式、生物多样性、知识体系、文化多样性以及农业景观。我们将制定长期保护与发展规划，采用动态保护、适应性管理与可持续利用途径，保护此项重要农业文化遗产，并在此基础上提高遗产地人民的生活水平。

承诺人：湖州市南浔区人民政府区长



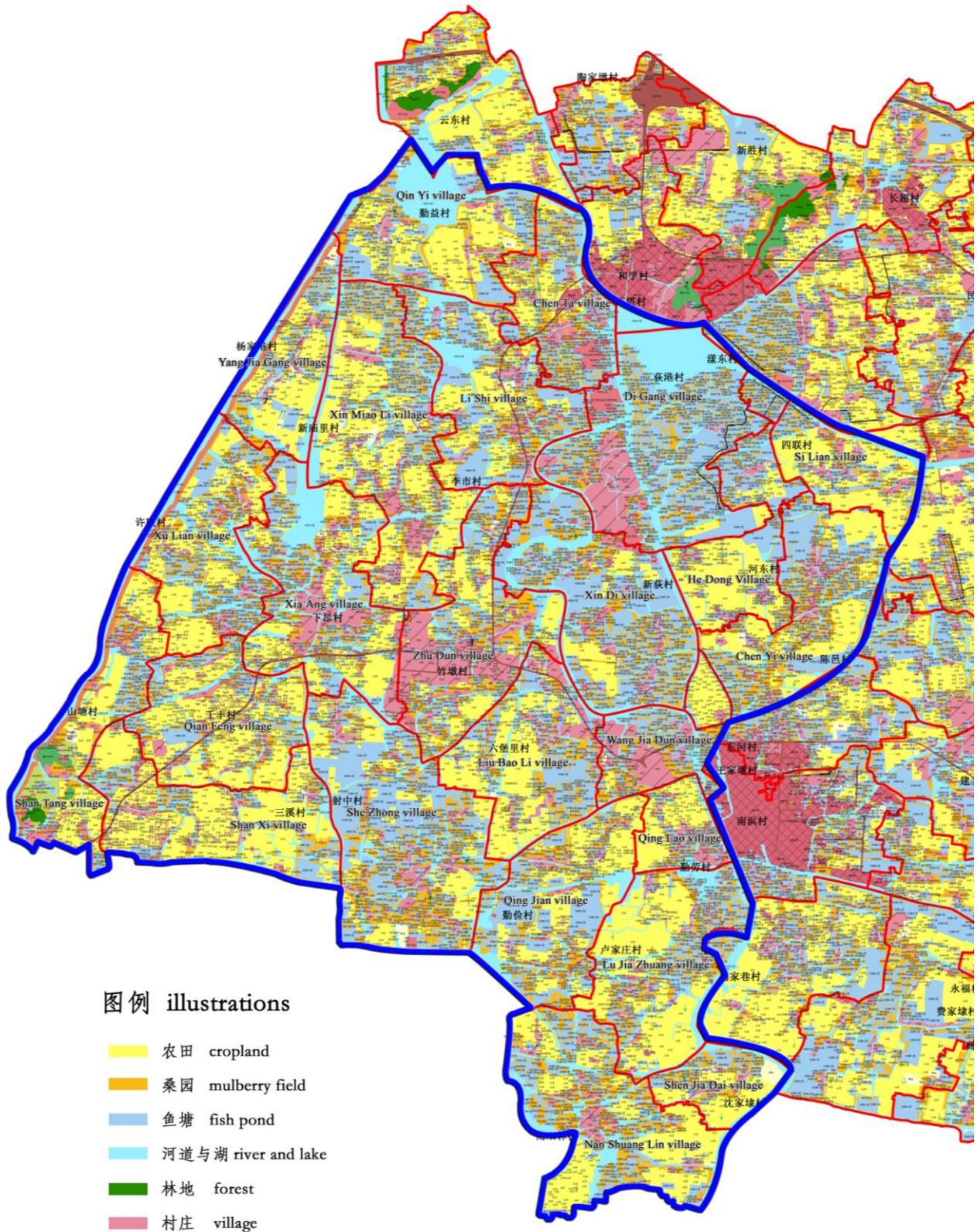
Annex 3: China important agricultural heritage- the plaque of Zhejiang Huzhou Mulberry-dyke & Fish-pond Ecosystem



Annex 4: Sign of Zhejiang Huzhou Mulberry-dyke & Fish-pond Ecosystem



Annex 5: The System Scope of the Proposed GIAHS Site and Land Use Status Map



Annex 6: Digang ancient villages in the Huzhou Mulberry-dyke & Fish-pond Ecosystem

