

**Globally Important Agricultural Heritage Systems
Proposal**

**Kuancheng Traditional Chestnut
Eco-Planting System
in Hebei Province**

Administrative Region:

Kuancheng Manchu Autonomous County, Hebei, China



The People's Government of Kuancheng Manchu Autonomous County,
Hebei Province, China

October 2023

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I. SUMMARY INFORMATION

Name/Title of the Agricultural Heritage System:	Kuancheng Traditional Chestnut Eco-Planting System in Hebei Province
Requesting Agency/Organization	The People's Government of Kuancheng Manchu Autonomous County, Hebei, China
Responsible ministry (for the Government):	Bureau of Agriculture and Rural Affairs of Kuancheng Manchu Autonomous County, Hebei
Location of the site: (Please annex land use maps and geographical coordinates of the site)	<p>Location: Kuancheng Manchu Autonomous County, Chengde City, Hebei Province, China.</p> <p>Brief Description: Kuancheng County located in the eastern section of the Yanshan Mountains, northeastern Hebei and southeastern Chengde, is bounded by the following coordinates, from latitude 40°17' N to 40°45'N and from longitude 118°10'E to 119°10'E. The Kuancheng Traditional Chestnut Eco-Planting System covers 6 towns in the west of Kuancheng, including Nianziyu Town, Songling Town, Huajian Town, Boluotai Town, Kuancheng Town, and Tashan Town. The agricultural heritage system is divided geographically into the two sub-areas, performing the same productive, ecological, social, and cultural functions. The blank area between the two sub-areas of the agricultural heritage system is dominated by three land-use types, one of which is the Panjiakou Reservoir, the second is the ecological public welfare forests along the reservoir, and the third is two nature reserves (Qianheshan Reserve and Dushan Reserve).</p>

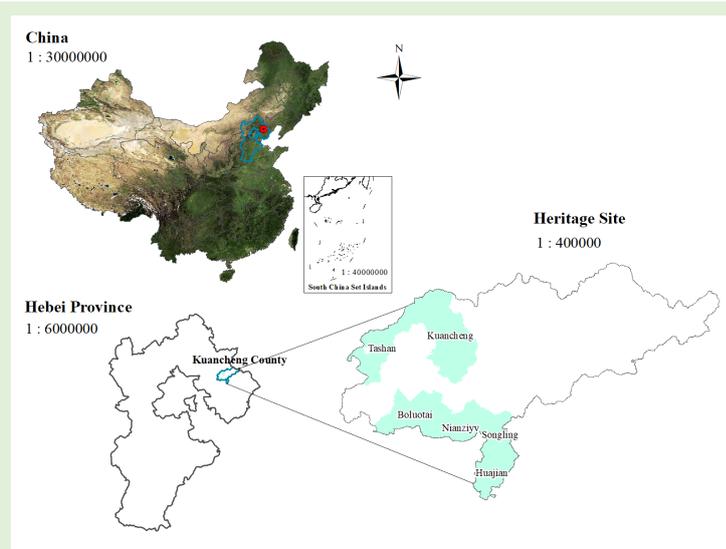


Figure 1-a The location of Kuancheng Traditional Chestnut Eco-Planting System

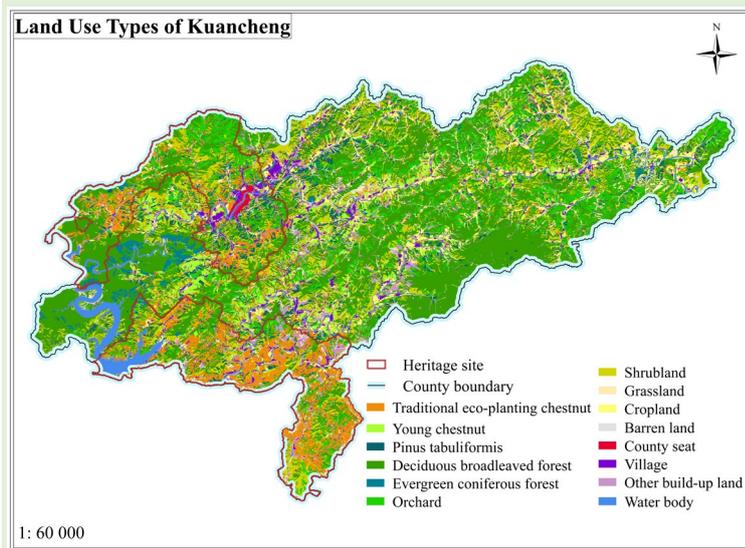


Figure 1-b The land-use map of Kuancheng Traditional Chestnut Eco-Planting System

Accessibility of the site to capital city or major cities:

Kuancheng Manchu Autonomous County, located in the hinterland around the Bohai Sea and the Beijing-Tianjin Economy Zone, has significant geographical advantages. It is 80 km away from Chengde Railway Station, 160 km away from Tangshan High-speed Railway Station, and 250 km and 290 km respectively away from Beijing Capital International Airport and Beijing Daxing International Airport.

	<p>The Chengqin Expressway spans the entire county, and the national highway Chicao Line, the provincial highway Chengqin Sea Road, Pingqingle Line, Beiling Line, Jingjian Line, and Bangkuan Line intersect in this area.</p>
<p>Area of coverage</p>	<p>Kuancheng has a total land area of 195,200 ha. The area for the Kuancheng Traditional Chestnut Eco-Planting System is 53,581 ha, 12,231 ha of which is used for cultivating the traditional eco-planting chestnut.</p>
<p>Agro-ecological zones¹ (For agriculture, forestry, and fisheries)</p>	<p>Yanshan Agroforestry Ecological Zone</p>
<p>Topographic features:</p>	<p>Kuancheng is located in the southeastern section of the Yanshan Mountains. With a vast mountainous area, it is high in northern-southern and central parts and low in the east and west. The heritage site has an altitude between 114 and 1248m and a maximum slope up to 60.48°, featuring the mountain landforms such as medium-height mountains, hills, and river valleys (Figure 2).</p> <div data-bbox="587 1339 1316 1608" style="text-align: center;"> </div> <p style="text-align: center;">Figure 2 Topography and slope</p>
<p>Climate type:</p>	<p>Located in the warm-temperate zone, Kuancheng has a semi-arid and semi-humid monsoon climate, with hot and rainy summers and cold</p>

¹ The agro-ecological zones are defined by FAO as homogenous and contiguous areas with similar soil, land and climate characteristics.

	<p>and dry winters, and people here will see rains and hot weather coming in the same season. The annual average temperature is 9.4°C, the climatological mean of accumulated values over a year when the temperature is higher or equal to 10°C is 3600°C, and the average annual rainfall is 618 mm.</p>
<p>Approximate population (beneficiary):</p>	<p>The registered population of 6 towns involved in the Kuancheng Traditional Chestnut Eco-Planting System is 108,346, including 15,519 people as agricultural labor force and 13,455 people as labor force who are directly engaged in the agricultural activities closely related to the agricultural heritage system.</p>
<p>Ethnicity/Indigenous population:</p>	<p>In Kuancheng Manchu Autonomous County, the Manchu is the dominant ethnic group accounting for 66.5%, the Han accounts for 26.5%, 13 other ethnic minorities such as the Hui, the Zhuang, the Miao, the Yao, the Mongol, and the Korean account for 7.0% of the total population.</p>
<p>Main source of livelihoods:</p>	<p>The sources of income for farm households in the area where the heritage is located fell into three categories: agricultural production, working outside, and tourism services. The income constituted 52.3% from agriculture production (farmers' income from chestnut planting and related services accounted for 44.7% of the agriculture production income), 45.9% from working outside, and 1.8% from commercial operations, tourism services, and other fields. Farmers' income from chestnut planting and related services accounted for 44.7% of the agricultural income.</p>

- **Executive summary:**

Chestnut, an important nut tree species in the world, falls into four categories by region: European chestnut, American chestnut, Japanese chestnut, and Chinese chestnut. Chinese chestnut is divided into northern chestnut and southern chestnut. As the “hometown of chestnut in China” and the “dominant area of characteristic agricultural products”, Kuancheng is not only one of the origins of the chestnut tree and one of the first areas in China to cultivate chestnut, but also one of the core areas for chestnut planting in the north of China. As far back as the Han Dynasty, chestnut became the most important economic fruit tree that was cultivated in Kuancheng, and a traditional chestnut eco-planting system with chestnut cultivation as the core and the rational distributions of such resources as crops, medicinal materials, and poultry industries was gradually established. The eco-planting contains three aspects. One is the ecologically friendly production methods residents adopt throughout the process, from seed selection to harvesting of chestnuts. The second is the complex agroforestry operation of chestnut and its understory, fully realizing efficient and circular agricultural production. Thirdly, the whole system is highly adapted to the local natural conditions, realizing sustainable management and utilizing soil and water resources.

In Kuancheng, grain crops planting in large areas is not suitable, the Kuancheng Traditional Chestnut Eco-Planting System has then provided diversified material products which are rich in nutrition and stable in yields for local residents in different historical periods, including chestnut known as “Food from Woody Plants” and “Sure Source of Income” and products processed with chestnut kernel and chestnut powder, as well as the *grifola frondosa*, *scutellaria baicalensis gorgi*, chicken and other products that can be cultivated in the chestnut forest, which can effectively guarantee the provision of basic livelihoods and food security for local residents. On this basis, the Kuancheng Traditional Chestnut Eco-Planting System has presented an outstanding economic value. On the one hand, as an important chestnut production and processing center in China and even East Asia, Kuancheng has an average annual output value of RMB 639,530,000 and an annual processing capacity of up to 20,000 tons of the chestnut; the sale of the chestnut products directly contributes to 22.4% of the income of farm households and it has become one of the most

important sources of income in 74.3% of farm households in local areas. On the other hand, with the chestnut as the core, Kuancheng has gradually established an agricultural economic model of integrated development incorporating the primary industry (chestnut planting), the secondary industry (chestnut product processing and sales), and the tertiary industry (sightseeing and fruit picking in the chestnut forest), providing farmers with a variety of job opportunities in fields such as agricultural production, agricultural product sales, and agri-tourism. In the area where the heritage is located, 13,455 people are engaged in the chestnut and related agricultural production activities, accounting for 86.7% of the total number of the local agriculture labor force, and most of them are young adults and women.

In the Kuancheng Traditional Chestnut Eco-Planting System, there are a large number of ancient chestnut trees as well as chestnut varieties making up more than 1/10 of the total number in China, including 6 native varieties of Kuancheng. Therefore, this system is outstanding in chestnut varieties and is an important part of the global chestnut variety resources bank. Based on ancient and diverse varieties of the chestnut, the system presents important ecological value in the protection of biodiversity, water and soil conservation, and water resources conservation in the mountainous area. In the protection of biodiversity, the agricultural biodiversity has been enriched in this system through crop planting and poultry breeding in the chestnut forest. In addition, benefiting from the ecological agriculture production mode, important wild animals and plants resources are protected in this system, including 4 National Second-class protected plant species, 6 National Third-class protected plant species, and 2 National First-class protected bird species, 15 National Second-class protected bird species and 53 National Third-class protected bird species. In terms of ecosystem services, a series of resources management measures suitable for the local natural environmental conditions were implemented in this system, which has effectively, in such aspects as waste and soil conservation, water resources conservation, and climate regulation, ensured the outstanding ecological functions of Kuancheng, a “Beijing-Tianjin-Hebei Water Conservation Functional Area and Ecological Environment Support Area”.

Kuancheng is in a good position to allow natural growth of the chestnut in soil, climate, and other aspects. However, strong erosion caused by flowing water and relatively serious soil erosion and water loss due to the frequent rainfalls can be found in some areas of Kuancheng, which proposes obvious restrictions on chestnut cultivation and related agricultural production. Therefore, in the long history of chestnut cultivation, local residents have accumulated and passed on the rich knowledge and technical system through the inheritance of knowledge from generation to generation, demonstrating the mode of life and production incorporating the factors of effectively using the time and space resources, adapting to the local conditions to the extremely practical extent and satisfying the livelihood needs with sufficient supply. In terms of the cultivation of chestnut and its related crops, a technical system adaptable to local conditions has been established from such aspects as choosing the chestnut variety, planting & grafting, repairs & construction, fertilization, harvesting, and storage; on this basis, the ecological and economic benefits of the chestnut cultivation system can be synchronously improved through the cultivation of the *grifola frondosa*, *scutellaria baicalensis gorgi* and other crops and breeding of gallus domesticus brisson, laying hens and other poultry in the chestnut forest and the ecological measures to prevent and control pests in a physical and biological way. At larger spatial scales, measures such as reasonable allocation of forest resources, construction of terraces and contour trenches like digging ditches along a hillside, building fish-scale pits, ponds, dams, and valleys have been implemented, realizing the effective and efficient use of water and soil resources in the mountainous area and ensuring the harmonious symbiosis between the chestnut cultivation and the natural environment.

Rich cultural connotation is contained in the Kuancheng Traditional Chestnut Eco-Planting System, embodying the ecological view of respecting nature and the social organization form that promotes agricultural production. In terms of the ecological concept of showing respect for nature, a code of conduct for protecting the natural environment and promoting the harmonious coexistence between the human and nature has been gradually established by local residents in the evolution of history. In addition, the aspects such as clothing, dwellings, festivals, and ceremonies also show people's respect for and adaption to nature. In addition, the mode of the social organization formed under the

influence of Eight Banners (social organization forms of Manchu in Qing Dynasty of China), Zhuangtou culture, and families has played a positive role in promoting agriculture production. On this basis, the cultural symbol value of chestnut has been gradually formed in the local area, which is shown in the food culture of the chestnut: the chestnut can be taken not only as food but also fruit, with the functions of not only the food but also the medicine. It is also shown in the chestnut being taken as the spiritual symbol of auspiciousness and determination, the chestnut-related legends, stories, and literary works, as well as the ancient chestnut trees being taken as a historical and cultural symbol and other aspects.

The woodland/shrubs, chestnut forest, farmland, villages, and waters are the landscape elements in the Kuancheng Traditional Chestnut Eco-Planting System, constituting a typical mountainous agricultural landscape in northern China. From the perspective of the overall spatial structure in the mountain area, the “woodland/shrubs-chestnut forest-farmland-villages-waters” are distributed in order from the top of the mountain to the river valley. From the perspective of landscape elements and their distributions, each landscape element not only constitutes the spatial landscape of the heritage system, but also performs its own important production and ecological functions. The artificial *pinus tabuliformis* and the natural secondary forest located in the middle and upper parts of the mountain area have played an important role in the conservation of soil and water; the chestnut-dominated commercial forest is mainly distributed in the lower part with a deep soil layer and a gentle slope; the waters and farmland are located in the valleys of the mountain area. With such a spatial pattern, the stability of the Kuancheng Traditional Chestnut Eco-Planting System can be ensured, and the water and soil resources can be effectively utilized. From the perspective of the seasonal changes of the landscape, this area has a climate with four distinct seasons, and the landscape elements are differently characterized in different seasons, which makes the landscape in this system present high aesthetic values of landscapes in different seasons.

● Pictures:









II. DESCRIPTION OF THE AGRICULTURAL HERITAGE SYSTEM

1. Significance of the Proposed GIAHS Site

1.1. Specific values and features

(1) Complex agricultural system and agricultural landscape

The Kuancheng Traditional Chestnut Eco-Planting System is a complex agricultural system by taking chestnut cultivation as the core with a reasonable multi-level distribution of crops, medicinal materials, and poultry to get full adaption to the ecological environment in the mountain area. From the perspective of a macro scale, a spatial landscape structure is formed, with “woodland/shrubs-chestnut forest-farmland-villages-waters” distributed in order from the top of the mountain to the river valley (Figure 3). The upper part of the hillside has a thin soil horizon and poor water conditions, so a *pinus tabuliformis* plantation shall be built or hillsides shall be closed to facilitate afforestation to form a natural secondary forest with live oak and *quercus mongolica* as the main group species, which will mainly play a role in soil and water conservation; the middle and lower parts of the hillside are fertile with deep soil horizons, and have good moisture conditions to plant chestnut trees; in the valleys at the foot of the hill, featured by flat terrain, deep soil horizon, and best conditions for water and fertilizers, it is appropriate to plant such grain crops as maize, soybean, and millet; in addition, the ponds in the valleys can collect the water flowing down from the slopes and regulate the water flow, providing water supply for the irrigation of the farmland. As a result, a stable landscape system with a reasonable allocation of ecological forests, commercial forests, farmland, and waters is formed, presenting conspicuous rationality in the ecology. It is a masterpiece for mankind to adapt to nature and transform nature, realizing harmony between man and nature.

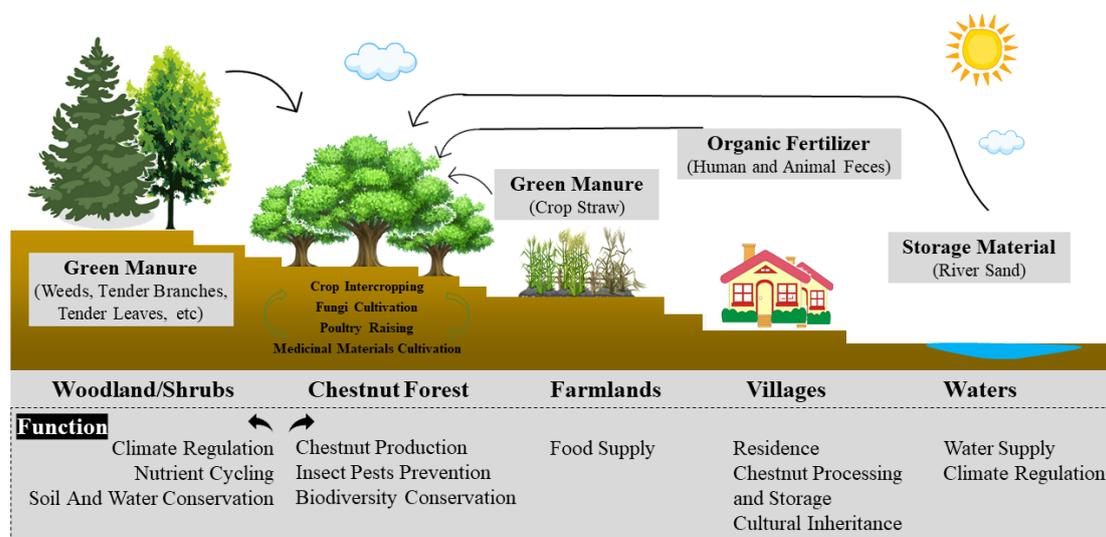


Figure 3 Functional diagram of the landscape elements of the heritage system

Viewed from the microscopic stand scale, the upper layer of the chestnut forest is composed of fruit trees such as chestnut trees and hawthorn trees, and the lower layer is medicinal materials or agricultural crops such as soybeans, millet, sweet potatoes, grifola frondosa and scutellaria baicalensis gorgi, or poultry is raised in the forest to form a complete ecosystem. Soybeans, millet, sweet potatoes and scutellaria baicalensis gorgi fill the ecological niche in the forest, realizing the full use of space resources and forest stand environment; grifola frondosa grows by making full use of the pruned branches of chestnut trees as the growth substrate. Such substrate, after it has been used up, will become organic fertilizer, increasing the soil fertility in the chestnut forest; poultry is fed on insects and dry branches and fallen leaves in the chestnut forest, and their manure can also be used as organic fertilizer to fertilize the soil. In this way, the materials and energy in the chestnut forest ecological system can be efficiently recycled and utilized through the rational allocation of chestnuts, agricultural crops, medicinal materials, and poultry (Figure 4).

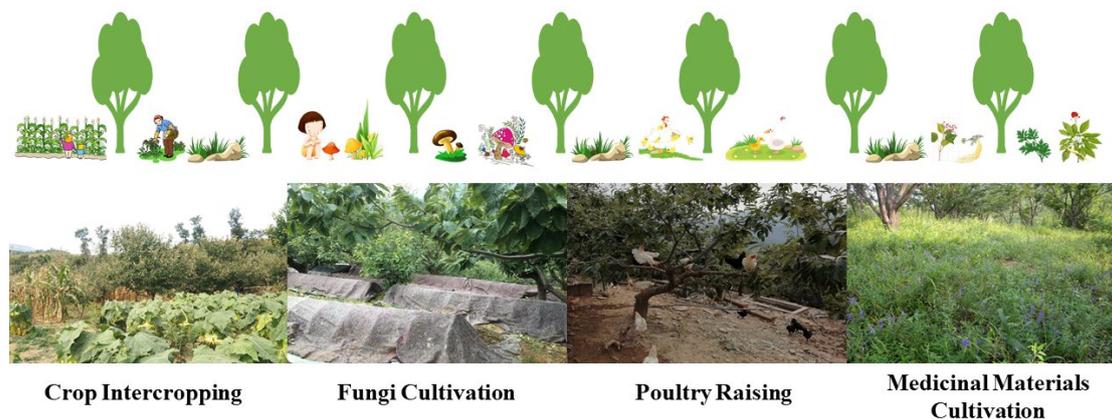


Figure 4 Complex planting structure in the chestnut forest

(2) Diverse agricultural production modes and products

As a typical complex agricultural system, in terms of production, the Kuancheng Traditional Chestnut Eco-Planting System presents the characteristics of combined production integrating the cultivation of chestnut and breeding in the chestnut forest; in terms of agricultural products, it presents the diversified characteristics with chestnut and its processed products as the core and the output from the crops and livestock in the chestnut forest as the supplementary. Therefore, at the industrial level, it shows the characteristics of industrial integrated development including primary production and traditional processing of agricultural products and sightseeing and fruit picking in the chestnut forest (Figure 5).

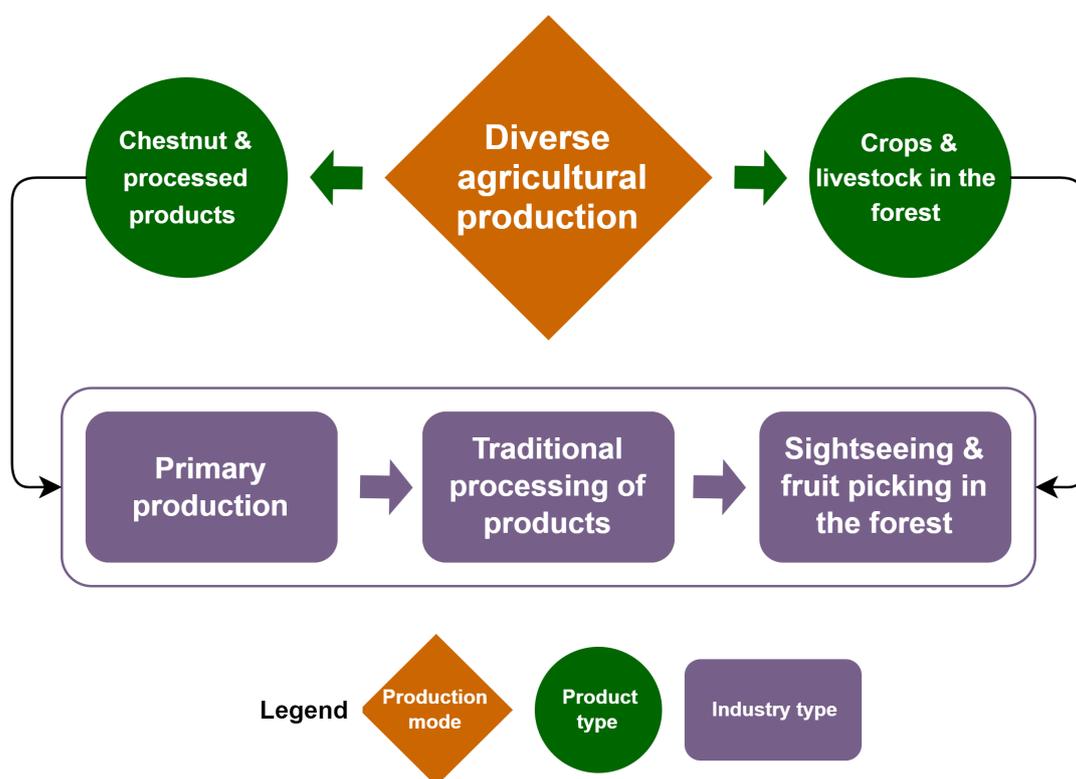


Figure 5 Diverse agricultural production structure of the heritage system

In terms of agricultural production, in addition to pure chestnut planting, *grifola frondosa* is also planted in the chestnut forest; chestnuts are intercropped with millet, maize, and other grain crops; with oiling crops such as sunflowers, soybeans, and peanuts; with vegetables such as onions, garlic, and Chinese cabbage. Diversified production modes such as chickens and rabbits raising are applied in the chestnut forest.

In terms of types of agricultural products and traditional processed foods, as the Kuancheng Traditional Chestnut Eco-Planting System is a complex agricultural system in mountain areas mainly based on planting of fruit trees, plentiful varieties of products can be produced from this system, including forest products such as chestnuts, hawthorns, and apples, grain crops such as millet and maize, oil crops such as sunflower seeds, soybeans, and peanuts, vegetables such as onions, garlic, and Chinese cabbage, edible fungi like *grifola frondosa*, and farm products like chicken and honey. In addition, there are a variety of traditional processed foods. The processed products which are

made by taking chestnut as the raw material include sugar roasted chestnuts, chestnut cakes, chestnut dumplings, glue pudding containing chestnut, soy milk with chestnut and steamed corn bread with chestnut. The processed products which are made by taking chestnut as an auxiliary material include braised chicken with chestnuts, braised sweet potato with chestnuts, stewed chicken with chestnut, rice porridge with jujube, eight-treasured rice porridge, fried Chinese cabbage with chestnut, and other cuisines.

In terms of industrial development, based on the protection of the traditional chestnut cultivation system, the local authorities use the landscape of the chestnut orchard during the flowering and harvest seasons as the resources, and integrate its cultural promotion and display with the development of leisure agriculture, which has effectively brought the increase of job opportunities and promoted the social and economic development. In addition, a leisure agriculture mode of “claiming a chestnut tree” has been developed in the local area. The tourist can select a chestnut tree and hang a sign carrying his/her wishes or blessings in it, remotely monitor the growth and fruiting conditions over a mobile phone and go to pick the fruit or entrust local farmers to pick the fruit when the fruit is ripe.

(3) Unique technology for resource utilization and culture of chestnut

Kuancheng, home to the Kuancheng Traditional Chestnut Eco-Planting System in Hebei, is featured by more rainfalls, strong erosion by flowing water and serious soil erosion and water loss, which restrict the agricultural production, but it shows good suitability for the natural growth of the chestnuts in terms of soil and climate. Therefore, in the long history of chestnut cultivation, an agricultural technical system to improve the resource utilization efficiency has been gradually generated, formed, and evolved, and the harmonious symbiosis of man and nature has been advocated through the knowledge inherited from generation to generation (Figure 6&7). Such precious technologies and culture, an important part of the Kuancheng Traditional Chestnut Eco-

Planting System, play an active role in maintaining the production, ecological, social, and cultural functions of this system.

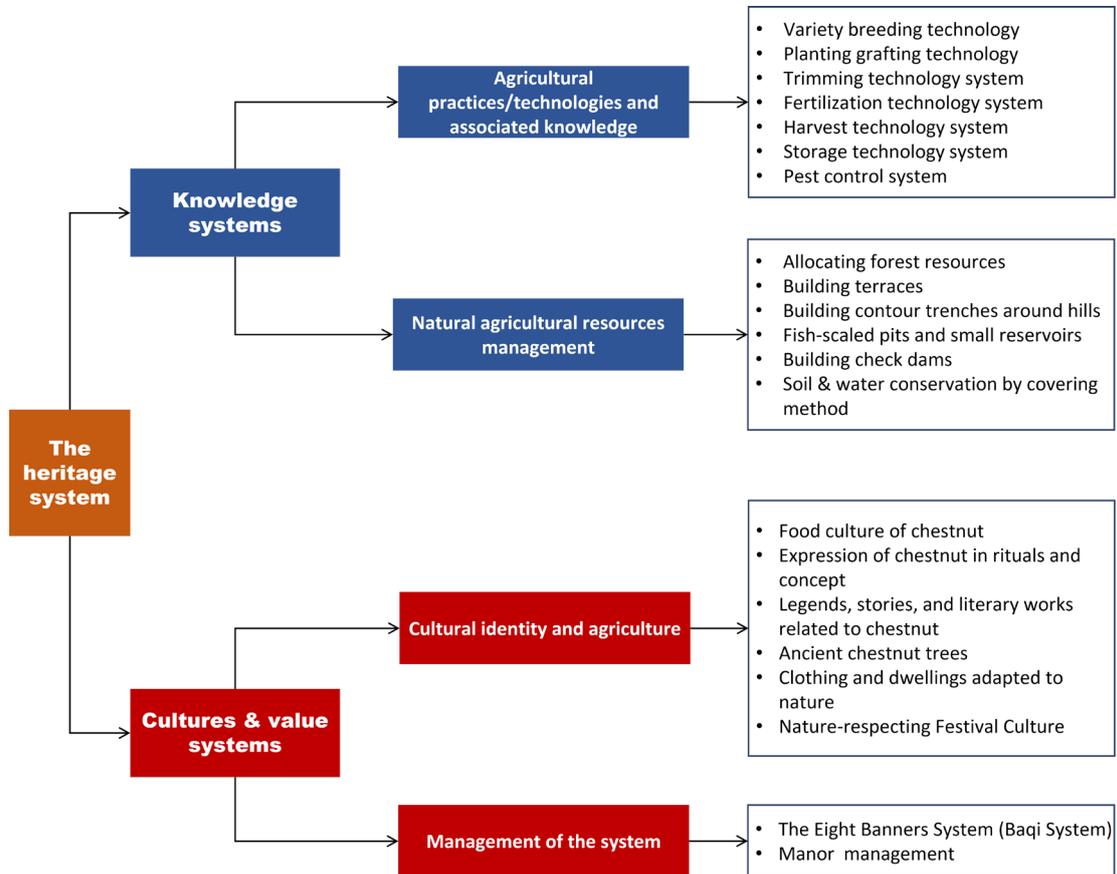


Figure 6 Technical and cultural system of the heritage system

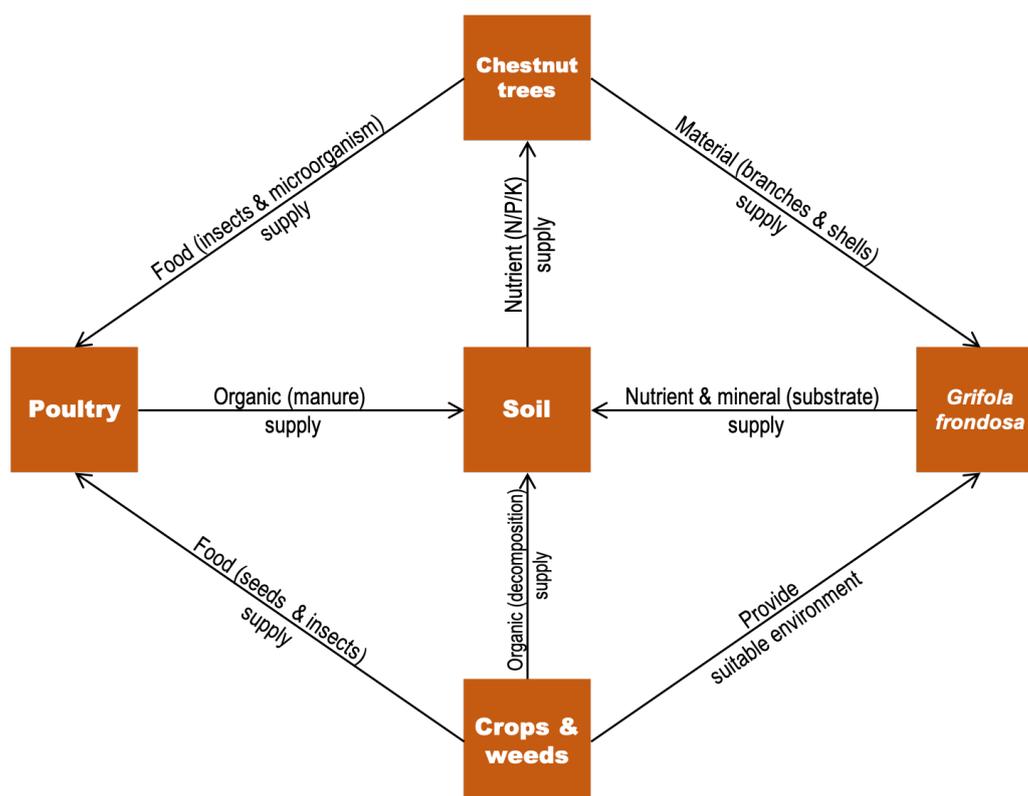


Figure 7 Sketch of nutrient cycling effect of the Kuancheng Traditional Chestnut Eco-Planting System

In terms of agricultural technology, local farmers have established a chestnut cultivation system; on this basis, the ecological and economic benefits of the chestnut cultivation system can be synchronously improved through the cultivation of the *grifola frondosa*, *scutellaria baicalensis gorgi* and other crops and breeding of *gallus domesticus*, laying hens and other poultries in the chestnut forest and the ecological measures to prevent and control pests in a physical and biological way. At larger spatial scales, measures such as reasonable allocation of forest resources, construction of terraces and contour trenches like digging ditches along a hillside, building fish-scale pits, ponds, dams, and check dams have been implemented, realizing the effective and efficient use of water and soil resources in the mountainous area and ensuring the harmonious symbiosis between the chestnut cultivation and the natural environment.



Figure 8 Promotion of chestnut pruning techniques by local farmers through live broadcast

At the level of agricultural culture, the ecological view of respecting nature and the social organization form that promotes agricultural production reflect the rich cultural connotations contained in the Kuancheng Traditional Chestnut Eco-Planting System. The cultural symbol value of the chestnut has been gradually formed in the local area, which is shown in the food culture of the chestnut: the chestnut can be taken not only as food but also as fruit, with the functions of not only the food but also the medicine. It is also shown in the chestnut being taken as the spiritual symbol of auspiciousness and determination, the chestnut-related legends, stories, and literary works, as well as the ancient chestnut trees being taken as a historical and cultural symbol and other aspects.

Most importantly, during the long-term production practice, the heritage system has gradually formed a series of eco-planting codes widely recognized by residents and supported by the local government, which effectively promote the protection of the local natural environment and can be summarized as the following six points: (1) The forests at the top of the mountain maintain and improve the ecological environment,

maintain ecological balance, and protect biodiversity, and are prohibited from being cut down. (2) Ancient chestnut trees are numbered individually for protection, and overuse is prohibited. (3) The production of chestnuts is carried out traditionally, fully adapting to local natural conditions from the perspectives of chestnut variety selection, planting, grafting, pruning, fertilizing, harvesting, and storage. (4) Small-scale agroforestry complex operation is allowed under the chestnut forest, but pesticides and chemical fertilizers are prohibited. (5) Both the chestnut forest and its understory production use organic fertilization made from dead leaves, weeds, and human and animal manure. (6) Large-scale land development and industrialization activities are prohibited in the area where the chestnut forest is located to maintain the water source's ecological function.

The above six codes are part of local chestnut farmers' village rules and regulations, proven in the Kuancheng County annals and related academic research (The Box). In addition, the six codes have also been included in the Management Regulation for Conservation and Development of the Kuancheng Traditional Chestnut Eco-Planting System issued by the Kuancheng County People's Government in 2020 (The Box).

References of eco-planting codes in the heritage system

- [1] The People's Government of Kuancheng Manchu Autonomous County. Management Regulation for Conservation and Development of the Kuancheng Traditional Chestnut Eco-Planting System[S], 2020. (in Chinese)
- [2] Kuancheng County annals compilation committee. Kuancheng County annal[M], Shijiazhuang: Hebei People's Publishing House, 1990. (in Chinese)
- [3] Xu Zhongqi, Min Qingwen. China-NIAHS: Hebei Kuancheng Traditional Chestnut Eco-Planting System[M], Beijing: China Agriculture Press, 2019. (in Chinese)
- [4] Li Wenhua, Liu Moucheng, Min Qingwen. Progress and perspectives of China's ecological agriculture[J]. Resource Science, 2010, 32(6): 1015-1021. (in Chinese)

1.2. Historical relevance

(1) Yanshan area is one of the earliest areas where the chestnut was cultivated in the world

China is the origin of the chestnut. And Chestnut is one of the earliest fruit trees domesticated and utilized in China. Archaeological sites (Table 1) and ancient documents (Table 2) prove that chestnuts have been originated and cultivated in China for at least 6,000 years, mainly in northern China, the northwest, and the middle and lower reaches of the Yangtze River in the south.

Table 1 Some archaeological sites that find chestnuts in China

Era	Name of archaeological site	Archaeological finds
18 million years ago	Linqu Shanwang Archaeological Site in China	Large-leaved chestnut fossil
110,000 years ago	Hong Gou Archaeological Site in China	Chestnut charcoal
9,000 years ago	Pei Ligang Archaeological Site in China	Chestnut fruit
7,000 years ago	Hemudu Archaeological Site in China	Chestnut fruit
6,000 years ago	Banpo Archaeological Site in China	Fossilized chestnut
2,400 years ago	Jiangling Wangshan Chu Tomb Site in China	Complete chestnut

The Yanshan region, where the heritage system is located, was one of China's earliest production areas for chestnuts. According to the records in *the Stratagems of the Warring States - Strategies of Yan*, as late as Han Dynasty, the chestnut had become the main economic fruit trees cultivated in Yanshan (nowadays Yanshan area) (Table 2 & Figure 9). The Yanshan Mountains is one of the native origins of the chestnut trees. As indicated in the historical relics and a large amount of data, Yanshan is one of the earliest areas where the chestnut was cultivated. As early as the Western Zhou Dynasty, chestnut had become an important economic tree species in many places. As mentioned in the *Analects*, not only the chestnut seeds are used but also the chestnut trees are cultivated as the trees representing the God of the land (adaptive trees); chestnut is ever mentioned

in the *Book of poetry*, *Master Lü's Spring and Autumn Annals*, the *Book of Rites*, the *Classic of Mountains and Seas*, the *Stratagems of the Warring States*, *Records of the Grand Historian*, and other historical data. Some research suggests that the fruit trees mentioned in the literature at this period were all cultivated by man.

Table 2 Some ancient Chinese documents that record chestnuts in Yanshan area

Era	Ancient document	Description
11th century B.C. to 6th century B.C.	<i>The Book of poetry</i>	East gate of chestnut, with a trampling family.
239 B.C.	<i>Master Lü's Spring and Autumn Annals</i>	In the summer, they eat rhizomes, and, in the winter, they eat chestnuts.
93 to 96 B.C.	<i>Records of the Grand Historian</i>	The dry tree chestnuts of Yan and Qin (The present Yanshan area), whose people are equated with the Marquis of Ten Thousand Houses.

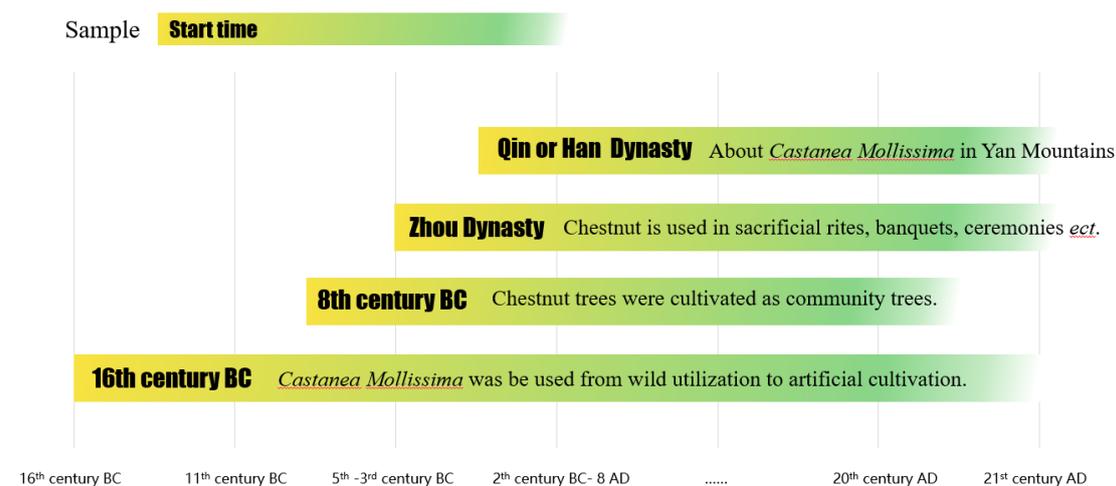


Figure 9 Historical evolution of chestnut in Yanshan area

The history of chestnut cultivation and use in the Yanshan area has evolved along with the local culture. From the 16th century B.C. to the establishment of the Qing Dynasty in 1644 A.D., the northern minorities such as Shanrong, Donghu, Xiongnu, Wuhuan, Xianbei, Kumoxi, Khitan, Jurchens, Goguryeo, Mongol, and Manchu successively lived in Kuancheng. The main ethnic groups living in Kuancheng were living nomadic and hunting life. Moreover, Kuancheng had been an area suffering military and cultural conflict among different ethnic groups. Therefore, though there was somewhat development in agriculture, agriculture had not become the main form to support the livelihoods. The chestnut, a fruit product with regional characteristics, has extremely important significance in maintaining and supplementing livelihood and in managing mountains and forests.

Early use of chestnut began in the Western Han Dynasty (about the 1st century A.D.). It is speculated that chestnut cultivation and harvesting may be a supplementary form for the local minorities to maintain their livelihoods in the Tang Dynasty. There is no clear record of the cultivation and utilization of chestnuts in Kuancheng for a long period of time. However, according to the historical records of the larger area, it is speculated that chestnut may be used as the fruit picked in mountains and forests,

introduced together with the farming culture of the Han people, and started to be identified and used by the local ethnic minorities. Until the Liao, Jin, and Yuan Dynasties (the 10th to 14th century A.D.), the scale of chestnut cultivation expanded. Chestnut, an important commercial forest fruit crop, played an increasingly important role in the livelihood of the residents. By the Yuan Dynasty, chestnut had become an important commercial tree species and trade product in this area. The significance of chestnut as a cultural symbol has gradually increased, but the chestnut cultivation techniques and the chestnut orchard management technology were still in an extensive state. In this process, the traditional forest and fruit cultivation adapts to the mountain environment and seeks a balance between economic activities and nature conservation. This idea of human-land adaptation, seasonal coordination and moderate development has formed a certain regulation in the long-term agricultural and forestry practice. On the one hand, laws and regulations have been passed to prohibit the felling of primary and secondary trees. On the other hand, through civil regulations, the cultivation of economic forest mainly *Castanea mollissima* is controlled in a certain scale and protected; at the same time, due to the needs of military and cultural blending, the construction of functional forests such as military defense forests also make chestnut naturally blend with other tree species². In the early Qing Dynasty (17th century), the forest field pattern of Kuancheng was basically formed, and the landscape structure of "forest-chestnut forest-village" of chestnut cultivation system from the top of the mountain to the foot of the mountain was basically stable.

In this process, the traditional forest and fruit cultivation adapts to the mountain

² Kuancheng chestnut forest is planted according to the Great Wall and is in the military conflict buffer zone. During the Jin and Yuan dynasties, a national defense forest was built for the needs of war defense. "Da Jin Guozhi" said: "Songting, Jinpo, Gubeikou only access to people and horses, not driving." The land is full of grain and fruit, good talent and beautiful trees, everything. " In Yuan and Ming dynasties, restricted by military regulations, the area of 100km north of the Great Wall was prohibited, so the relevant agricultural, economic and cultural activities did not exist. Forests (including chestnut forest) were objectively protected and developed naturally during this period.

environment and seeks a balance between economic activities and nature conservation. This idea of human-land adaptation, seasonal coordination and moderate development has formed a certain regulation in the long-term agricultural and forestry practice. On the one hand, laws and regulations have been passed to prohibit the felling of ancient trees. On the other hand, through civil regulations, the cultivation of chestnut trees is controlled in a certain scale and protected; at the same time, due to the needs of military and cultural blending, the construction of functional forests such as military defense forests also make chestnut naturally blend with other tree species³. In the early Qing Dynasty (17th century), the forest field pattern of Kuancheng was basically formed, and the landscape structure of "forest-chestnut forest-village" of chestnut cultivation system from the top of the mountain to the foot of the mountain was basically stable.

At the beginning of the Qing Dynasty (the 17th century A.D.), the forest and field pattern took a basic shape in Kuancheng. According to the *Chronicles of Chengde* and the *Chronicles of Qian'an*, a large number of fruit trees that can output dried and fresh fruits such as chestnuts, peaches, pears, plums, jujubes, walnuts, crabapples, and *malus asiatica* were planted during this period. Since then, the ancient chestnut trees and related cultural traditions in the Kuancheng area have been passed down continuously to date.

(2) Chestnut planting is a natural choice under natural conditions in Kuancheng

Chestnut is suitable for growing in slightly acidic soil. It is a high light-loving plant

³ Kuancheng chestnut forest is planted according to the Great Wall and is in the military conflict buffer zone. During the Jin and Yuan dynasties, a national defense forest was built for the needs of war defense. "Da Jin Guozhi" said: "Songting, Jinpo, Gubeikou only access to people and horses, not driving." The land is full of grain and fruit, good talent and beautiful trees, everything. " In Yuan and Ming dynasties, restricted by military regulations, the area of 100km north of the Great Wall was prohibited, so the relevant agricultural, economic and cultural activities did not exist. Forests (including chestnut forest) were objectively protected and developed naturally during this period.

with strong resistance to cold and drought and can well adapt to the local hillside soil and the cold & arid climate conditions. Kuancheng is located in the eastern section of the Yanshan Mountains, with an average elevation of 300~400m and the highest point at an elevation of 1,846m. It is a typical mountainous area with steep slopes. The soil is mainly the leached cinnamon soil developed from the parent material of the granite weathering material. With a large area of sand and gravel, the soil is slightly acidic regarding the soil pH. This area is located in a warm-temperate zone with a semi-arid and semi-humid climate. It is cold in winter and has fewer rainfalls throughout the year with extremely uneven distribution in the year, draught and seldom raining in winter and spring, but it has sufficient sunshine throughout the year. The soil and climate of the hillside in Kuancheng is not appropriate to grain crops, while it is very appropriate to the chestnut which can grow under such adverse natural conditions and can present good quality.

Yet, from a cultural perspective, Kuancheng is located in the Yanshan region, where the chestnut planting history is very long, and it is one of the earliest areas of China to plant chestnuts. Residents have formed the tradition and custom of eating chestnuts since ancient times. So chestnuts are an essential food source and a symbol of local people's expectations for a better life. From the point of view of socio-economic development, chestnut is the native species of China. Chinese and even East Asian people generally eat chestnuts, and the chestnut market value is very high. Chestnuts produced in Kuancheng are of high quality and good flavor and exported earlier, with solid market influence, and residents planting chestnuts can obtain stable and high economic returns. Therefore, residents generally participate in chestnut production without the guidance of government programs.

1.3. Contemporary relevance

(1) Chestnuts and related products are important guarantee for food security for residents in mountain areas

The forest fruit production based on forest and woodland plays an important role in supporting the production and life of residents living in the mountain areas represented by the area where heritage system is located. Across the world, the area of forest and woodland is 2.76 times that of cultivated land; in China, the area of forest and woodland is 1.5 times that of cultivated land. Chestnut trees, an important fruit tree species, are widely distributed in China. In addition, chestnut is also one of the earliest edible nuts in East Asia and even in the world. Therefore, forest fruit production is an important guarantee for food security for residents living in mountain areas. According to historical records, the heritage system has a history of more than 3000 years for chestnut cultivation. The plentiful ancient chestnut trees have provided residents with stable, high-yielding, and nutritious material products in different historical periods. Chestnut is also affectionately called “herbal grain” and “sure source of income” by local residents (Figure 10). In addition, local residents cultivated crops such as *pleurotus ostreatus* and *scutellaria baicalensis gorgi* in the forest, intercropped with grain crops such as maize, millet and soybeans, and other food crops, planted vegetables such as sunflowers, green onions, radishes, Chinese cabbage, capsicums, and pumpkins, and raised poultry like native chickens, which has enhanced the utilization ratio of resources, improved the ecological stability of the system and enriched the sources of food. Therefore, the heritage system has played a particularly prominent role in ensuring food security for residents in the area where other grain crops planting is not suitable.



Figure 10 Ancient chestnut trees

(2) Chestnut production is the main pillar of agricultural economic development in mountainous areas

With the production of chestnut and the products derived from the chestnut forest as its core, an agricultural economic development model integrating chestnut planting, chestnut product processing, and sales, and sightseeing and fruit picking in the chestnut forest has been gradually formed in the heritage system, which becomes important support for the economic development of the agriculture in mountain areas. In terms of production of the chestnuts, the current chestnut planting area in heritage system reaches 18,485.5 ha, accounting for approximately 11% of the total chestnut planting area in China; the average annual production of chestnuts is 22,810 tons, accounting for approximately 2% of the chestnut output in China. In addition, in 2009, the output of the chestnuts in areas where the heritage system is located reached RMB 433.38 million, and the income from chestnuts has become one of the most important sources of income for 74.3% of farmers. In terms of processing of the chestnut product, the area where heritage system is located, with its average output of the highly processed chestnut products exceeding 20,000 tons, has gradually become one of the main bases providing highly processed chestnut products in China and even in East Asia. In terms of agritourism, the agritainment characterized by chestnut picking has flourished, which has not only broadened the income sources of farmers, but also effectively promoted the initiative of young and middle-aged adults and women to participate in the agricultural industry. Currently, 35.3% of the main local labor force is directly engaged in chestnut and related agricultural production activities, 45.4% of the female labor force, and 49.5% of the young and middle-aged labor force are driven to participate in agricultural production. Therefore, this heritage system can be taken as the demonstration for sustainable development of the agricultural economy in mountain areas.



Figure 11 Chestnut harvest

(3) Chestnut planting promotes conservation of soil and water

Kuancheng, located in the “Beijing-Tianjin-Hebei Water Conservation Functional Area and Ecological Environment Support Area”, plays an important role as an ecological barrier. However, Kuancheng has steep mountains, narrow valleys, and more rainfalls in some areas, with the broken ground surface, many gullies generated from flowing rainwater, suffering severe soil erosion. Therefore, local residents planted chestnut forests according to local conditions to reduce soil erosion; check dams, horizontal contour trenches, fish-scale pits, small reservoirs, and water collection cellars are built to catch the runoff and reduce the erosion to the surface soil; perennial shrubs are planted on the slopes of contour trenches to improve the physical structure for proper soil and water conservation purpose. Planting in the chestnut forest increases land covers, thus reducing the direct scouring to the ground surface by rainfalls. In addition, the intercropping and relay intercropping in the complex chestnut cultivation system contributes to the generation of dense vegetation layers and huge underground root systems, which promotes the improvement of soil and water conservation capacity.

Therefore, the Kuancheng Traditional Chestnut Eco-Planting System carrying outstanding ecological value has effectively promoted soil and water conservation in Kuancheng.



Figure 12 Chestnut Forest in mountain areas

(4) Response of the heritage system to the Sustainable Development Goals (SDGs)

The Kuancheng Traditional Chestnut Eco-Planting System has a prominent and clear response to 15 items in the 17 sustainable development goals (SDGs) put forward by the United Nations (Figure 13).

Among the five basic characteristics, livelihoods and food security have shown explicit response to SDG 1, 2, 3, 5, and 8, which are embodied in providing: (A) diverse economic sources and livelihood security, (B) stable and diverse food products, (C) rich nutritional value in chestnut, (F) abundant job opportunities for women, and (H) diverse employment channels and job positions.

Agricultural biodiversity has shown explicit response to SDG 6, 13, 14, and 15, which are embodied in: (G) having an important water conservation function, (M) effectively regulating the microclimate by the forest ecological system in this area, (O) as a site of water sources, promoting the protection of the diversity of the aquatic species, and (Q) the heritage system being rich in biodiversity.

The traditional knowledge and technical system have shown explicit response to SDG 4, 10, 11, and 12, which are embodied in: (D) providing abundant traditional agricultural technologies, (I) cooperation among farmers, (J) recycling of resources emphasized in the traditional agricultural technologies, and (L) sustainability of agriculture emphasized in the traditional agricultural technologies.

The culture, value system, and social organization have shown clear response to SDG 4, 11, 16, and 17, which are embodied in: (E) the plentiful traditional culture, (K) the respect for nature shown in the traditional culture, (S) cooperation within and among communities emphasized in the traditional culture, and (T) the mutual support within and among the communities emphasized in the traditional culture.

The landscape features have shown clear response to SDG 13, 14, and 15, which are embodied in the aspects as follows: (N) the elements like forests in the landscape can significantly mediate the climate, (P) the elements like rivers in the landscape can promote the protection of aquatic biodiversity, and (R) the elements like forests can promote the protection of biodiversity.



Figure 13 Response of the heritage system to the Sustainable Development Goals (SDGs)

1.4. Comparative analysis

(1) A precious ancient chestnut grove and a unique eco-planting system

Since 2005, FAO has designated 78 systems as GIAHS sites. Among them, there are 14 sites with a focus on forest conservation (Table 3). But in the Agro-silvo-pastoral system Mountains of León in Spain, some chestnut groves are distributed dispersedly in the forests, including beech forests, birches, junipers, and oak groves. However, the chestnut is a forest fruit that is over 6,000 years old and has made an essential contribution to food security. A heritage system with the chestnut at its core would effectively enrich the current GIAHS sites.

Table 3 GIAHS sites with a focus on forest fruit conservation

No	GIAHS site
1	Urban Agricultural Heritage of Xuanhua Grape Gardens, China
2	Shaoxing Kuaijishan Ancient Chinese Torreya, China
3	Traditional Mulberry System in Xiajin's Ancient Yellow River Course, China
4	Diebu Zhagana Agriculture-Forestry-Animal Husbandry Composite System, China
5	Minabe-tanabe Ume System, Japan
6	Fruit Cultivation System in Kyoutou Region, Yamanashi, Japan
7	Grape Production System and Grape-based Products, Iran
8	Al Ain and Liwa Historical Date Palm Oases, the United Arab Emirates
9	Dates Production System in Siwa Oasis, Egypt
10	Malaga Raisin Production System in La Axarquía, Spain
11	The Agricultural System Ancient Olive Trees Territorio Sénia, Spain
12	Agro-silvo-pastoral system Mountains of León, Spain
13	Olive Groves of the Slopes between Assisi and Spoleto, Italy
14	Soave Traditional Vineyards, Italy

Europe is an essential chestnut staging area. The European chestnut (*Castanea sativa*) is native to south-eastern Europe and Asia Minor and is now widely distributed in Europe and the south-west Mediterranean region. And this is a different kind of chestnut from the chestnut planted in Kuancheng and north China. In the United Kingdom, chestnuts are widely distributed in various parks and forests, especially Greenwich Park. As the oldest royal park, Greenwich Park in the baroque style chestnut avenue, you can see fruit chestnut trees everywhere. Planted in 1660, the oldest chestnut tree here is over three hundred years old. In Tottenworth, Gloucestershire, a chestnut tree is 600 years old but mainly presents an ornamental value. The Italian-speaking region of southern Switzerland is a crucial chestnut-growing area in Europe, where chestnuts have been grown for centuries. In the canton of Ticino, for example, chestnuts are an essential

food for the local population, and the harvest is celebrated every year with a large-scale chestnut festival.

Compared to chestnut orchards in Europe, the Kuancheng Traditional Chestnut Eco-Planting System is unique in five ways: 1) KuanCheng has many ancient chestnut trees. The heritage site has 45,306 ancient chestnut trees over 100 years old. Of these, 43,931 are 100 to 150 years old, 1,126 are 150 to 200 years old, and 249 are over 200 years old. 2) The distribution of ancient chestnut trees in Kuancheng is concentrated. Local ancient chestnut trees over 100 years old are mainly distributed in five townships along the Great Wall, showing the characteristics of patchy distribution. 3) Kuancheng's ancient chestnut trees not only have ornamental value but also have a production function. The two oldest ancient chestnut trees in Kuancheng have more than 700 years of history, and they can still harvest many chestnut fruits every year (Figure 14). 4) In addition to chestnut production, chestnut forests in Kuancheng have also developed composite agroforestry management activities such as planting and farming under the forest. Therefore, the system has a three-dimensional, circular agroecosystem structure and types of rich material products. 5) Kuancheng has formed a whole industrial chain of chestnut production, processing, deep processing, sales, and export, and chestnuts are not only a source of food for local people but also a pillar industry of the local economy.



Figure 14 The oldest chestnut tree in the heritage system

In addition, the heritage system is characterized by eco-planting that contains three aspects. Firstly, the area in which the heritage system is located is an important water source, supplying water to metropolitan areas such as Beijing and Tianjin. Therefore, the presence of the heritage system effectively contributes to the conservation of water and soil in the water source. Secondly, chestnut planting in the heritage system fully embodies the concept of agroforestry. In different historical periods and in different areas, grain, vegetables, and mushrooms are grown under the chestnut trees. Although this model of composite planting has not been developed on a large scale, farmers are adapting and dynamically adopting this approach to achieve ecological sustainability according to the natural state of their grove, their family situation, and regional climatic conditions. Thirdly, over a long period of time, the heritage system has developed the code of conduct that protects the environment. The code both preserves the ecology of the chestnut trees and promotes the sustainability of the heritage system.

(2) An important part of the global chestnut germplasm resource

Chestnuts fall into four categories as European chestnut, American chestnut, Japanese chestnut, and Chinese chestnut by regions. Of the four categories, Chinese chestnuts

and Japanese chestnuts are most abundant in varieties. There are more than 300 varieties of Chinese chestnuts and 100 varieties of Japanese chestnuts. European chestnuts have few varieties, and American chestnut has almost become extinct. Chinese chestnuts are classified as northern chestnuts and southern chestnuts. There are more than 10 main varieties of northern chestnuts and more than 40 main varieties of southern chestnuts (Figure 15).

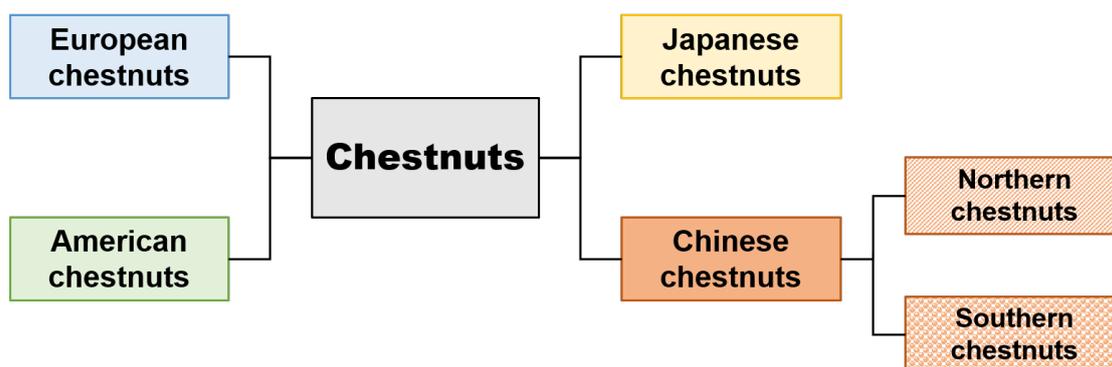


Figure 15 Main types of chestnut varieties in the world

As the core area for chestnut cultivation in the north of China, The Kuancheng Traditional Chestnut Eco-Planting System has become an important part of the chestnut germplasm bank in China and even the world with its precious resources of ancient trees and rich resources of chestnut varieties. The total number of local chestnut varieties accounts for more than 1/10 of the total in China. Kuancheng chestnut stands for the bright color, easy storage, easy shelling, and golden pulp. It is reputed that the best chestnut in China is from Hebei, and the best in Hebei is produced in Kuancheng. The Kuancheng chestnut tastes glutinous, tender, and sweet. These valuable chestnut species resources are the core conservation elements of the heritage system and are an important material basis for the system as a GIAHS candidate.

In terms of chestnut germplasm resources, six native chestnut species including “Dabanhong”, “Yanjin”, “Yankuan”, “Xiong 84”, “Xiong 330” and “Datun” are

extensively planted in Kuancheng. In general, compared to chestnut varieties from other parts of the world, the six native chestnut varieties in heritage system are characterized by their superior taste, ease of planting and stable yield. Among them, “Dabanhong” and “Yanjin” are the most widely planted varieties in the region and are the dominant varieties. They both have stable and high yields, soft and sweet chestnut flavors and can be easily transplanted. Therefore, these species are not only planted in Kuancheng, but also introduced to other regions. For example, “Dabanhong”, “Yanjin” and “Yankuan” have been promoted to the entire chestnut planting area in northern China. In addition, thirty-nine good varieties of chestnuts including the “Dongling Mingzhu”, “Yanshan Spurt”, “Yankui”, “Yanshan Zaofeng”, “Shifeng”, “Phoenix Mountain # 2”, “Yanhong”, “Yanfeng” and “Tafeng” introduced from other places are widely planted in the area.

(3) A model for the development of eco-agriculture in semi-arid and semi-humid mountainous regions in the world

Kuancheng, home to the chestnut cultivation system, is located in the eastern section of the Yanshan Mountains. It is a rocky mountainous area with dense mountains, narrow valleys, and steep slopes. To adapt to the relatively harsh natural environment, local residents, through their long-term production practices, have selected the chestnut species suitable for the semi-arid and semi-humid continental monsoon type mountain climate in the warm-temperate zone, arranged the chestnut cultivation system and forest resources in a reasonable way, and implemented such technical measures as constructing terraces, horizontal contour trenches, fish-scale pits, small reservoirs, dams, and water collection cellars, and adding land covers, realizing the full utilization of the light, heat and soil resources in the mountain area. In addition, in the context of rapid social and economic development, the chestnut features stable output, relatively short and concentrated time for planting work, less labor force required, conventional ecological planting method applied, the market price of products higher than that of similar products, and high return on input, which has made the chestnut appropriate to

the rules of development of the residents' diversified types of livelihoods in the mountain area. Therefore, the Kuancheng Traditional Chestnut Eco-Planting System is a typical model of sustainable ecological agriculture that is fully adapted to the natural and social environment prevailing in the mid-latitude mountainous area featuring vast areas and complex terrain. It has an important demonstration effect on the development of eco-agriculture in a mountain area with a semi-arid and semi-humid climate in the world.



Figure 16 Chestnut forest in and around Aiyukou Village, Nianziyu Town, Kuancheng

2. Characteristics of the Proposed GIAHS Site

2.1. Food and Livelihood Security

(1) Contribution of the proposed agricultural systems to the food security and livelihood security of the rural communities

In the Kuancheng Traditional Chestnut Eco-Planting System, 13,455 people are directly engaged in the agricultural activities (including agricultural production, agricultural product sales, and agri-tourism) closely related to the agricultural heritage system, accounting for 86.7% of the total local agricultural labor force. Among the labor force directly engaging in the agricultural activities closely related to the agricultural heritage system, young and middle-aged labor between the ages of 31 and 50 is in a dominant position, accounting for 66.7% (Figure 17). At the same time, women play an important role in the protection and development of the agricultural heritage system, especially in the sales of agricultural products and in agri-tourism. The female labor force accounts for 88.9% of the total labor force, and the young and middle-aged women between the ages of 31 and 60 constitute the main part. In addition, among the six towns covered by the heritage system, Boluotai has the highest proportion (47.9%) and Bancheng has the lowest proportion (23.5%) of the labor force engaging in agricultural production.

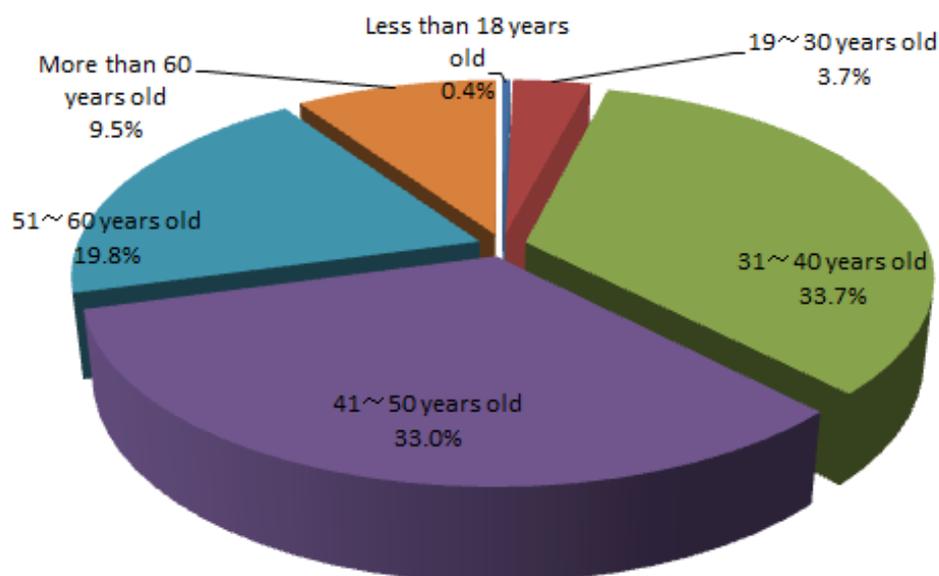


Figure 17 Distribution of ages of the agricultural labor force in the heritage system

The chestnut-based agricultural production takes an important position in the national economy in Kuancheng. In 2021, the added value of agriculture, forestry, animal husbandry, and fishery in Kuancheng was RMB 1,779.03 million, accounting for 10.1% of the gross national product (GNP) of the county; the output value of chestnut was RMB 760 million, accounting for 42.7% of the added value of agriculture, forestry, animal husbandry, and fishery. The added value of agriculture, forestry, animal husbandry, and fishery in the six towns covered by the heritage system is RMB 612.68 million, accounting for 34.4% of the total value of the county; the output value of chestnut is RMB 433.38 million, accounting for 57.0% of the total value of the county. Nianziyu Town has the highest output value of chestnut, up to RMB 118.02 million, followed by Boluotai Town with RMB 82.67 million.

At the farm household level, the income from chestnut production, sales, and related tourism services have now become one of the most important sources of income of the area where the heritage is located. In 2021, the total income of farmers in the heritage system was RMB 1,076.04 million, of which the income directly coming from the production and sales of chestnut reached RMB 311.35 million, accounting for 22.4%

of the total income of the households (Figure 18). The income of the farmers in Songling Town and Nianziyu Town from the production and sales of chestnut accounts for more than 50% of the total household income. If income from the business and tourism closely related to chestnut operation is considered, the income from chestnut of the farmers living in the area where the heritage is located makes up 44.7% of the total income from agriculture and forestry. Therefore, the income from chestnut has been listed as one of the most important sources of household income by up to 74.3% of farmers.

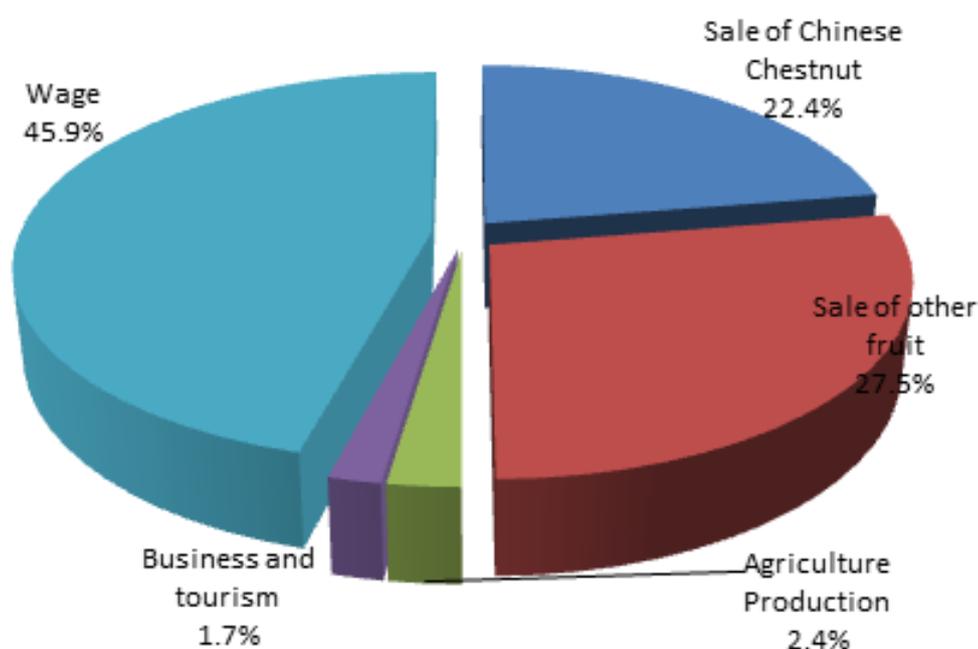


Figure 18 Structure of income sources of farmers living in the heritage system

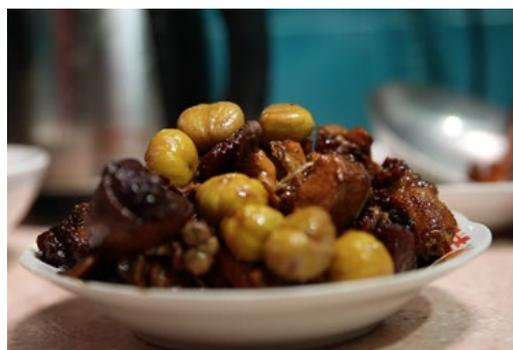
- **Long-term food security**

Historically, chestnut, as a “sure source of income” and “woody grain”, was one of the main food sources of local residents in Kuancheng. As the heritage site is in a mountainous area with more mountains and less land, the output of traditional food is seriously insufficient. The geographical location and climate environment are particularly suitable for the cultivation of chestnut. The chestnut of good quality and rich nutrition can be used as food, fruit, and medicine and enjoys the reputation of “king

of dried fruit”, “Chinese medicine in mountains” and “rice from trees” in the local area. Therefore, chestnut planting has become an important barrier to ensure the food security of residents in the heritage site, playing an important role in the era of food shortage (Figure 19).



Chestnut fruit



Chestnut dishes

Figure 19 Chestnut fruit and dishes

Nowadays, people are no longer worried about the lack of food. What they pursue is nutritious, healthy, and delicious ecological food. The planting of chestnut in Kuancheng has always followed the principle of nature and the way of heaven and earth, with traditional management techniques adopted to maintain soil fertility. Local people built contour trenches and terraces according to the terrains, planted chestnuts, intercropped crops, and raised poultry in the chestnut forest, and cultivated *grifola frondosa* with pruned branches, forming a complex agricultural system with rich product types and realizing harmony between human beings and nature. At the same time, because of its original ecology, chestnut products are always favored by the market, so the planting scale is expanding, and more and more vacant woodland and garden land are used for planting chestnut trees.

- **Diversified food sources**

The heritage system produces a variety of foods, such as chestnuts, *grifola frondosa* and vegetables, thus providing a rich variety of foods for local residents, improving the

nutrition intake of residents, and giving huge support for their health. Chestnuts are rich in vitamins, carotene, unsaturated fatty acids, oil, as well as iron, calcium, and other mineral elements. Chestnuts are also of high starch content and can be eaten both cooked and uncooked. The studies show that the carbohydrate content of dried chestnuts is as high as 77%, which is comparable to the nutritional value of cereals, while its protein content is higher than that of rice. By eating chestnut, people can get limiting amino acid, which is not enough in cereals and beans. Chestnuts can supplement the nutritional quality of cereals and beans. In 2013, the Chinese Academy of Inspection and Quarantine tested the nutritional indexes on chestnut kernel products of the heritage site, and the results showed that they had high nutritional value (Table 4).

Table 4 Test report of nutritional indexes of chestnut kernel

Test Item	Test Method	Unit	Measure Minimum	Test Value
Protein	GB 5009.5-2010	g/100g	0.1	4.60
Energy	GB 28050-2011	KJ/100g	/	746
Dietary Fibre	GB/T 22224-2008	%	0.1	7.90
Carbohydrate	GB 28050-2011	g/100g	/	32.5
Vitamin E, γ -totaxin	GB/T 5009.82-2003	mg/100g	0.023	9.19
Total Fat	GB/T 5009.6-2003	g/100g	0.1	1.9
Vitamin C	GB/T 5009.86-2003	mg/100g	0.1	13.3
Ca	GB/T 5009.92-2003	mg/100g	0.050	21.37
Na	GB/T 5009.91-2003	mg/100g	0.050	2.18
Fe	GB/T 5009.90-2003	mg/100g	0.050	1.16
Zn	GB/T 5009.14-2003	mg/100g	0.50	7.1

Data source: Test results from the Comprehensive Testing Center of Chinese Academy of Inspection and Quarantine (2013).

● A complete production and value chain

The chestnut production in the heritage system is mainly used to satisfy the needs of the market. With a prominent commodity attribute, it is the pillar industry of local

economic development. Since 2000, local chestnut processing companies, such as the Shenli group, have been forming. Thereby, a whole industrial chain system from chestnut production, processing, sales, trade, and rural tourism has been formed locally. And such an industrial chain system brings farmers into the industrial chain in the form of “companies+ cooperatives + farmers”. In this industrial chain, companies establish commercial brands for chestnut products and therefore play a leading role in processing, marketing and trading. Farmers can sell chestnuts on their own on the one hand or sell them to the companies on the other. At the same time, farmers can also participate in the production of the cooperatives, processing, and marketing activities. At the same time, the value chain of the entire chestnut industry has been established due to the presence of companies, and the market price of branded chestnut products is more than 50% higher than the original price of chestnuts sold separately and scattered.

Production and processing. Thriving on abundant high-quality raw material, the Kuancheng food processing industry which focuses on chestnut has been greatly developed. Related chestnut deep processing enterprises have developed a series of new chestnut-based food which is remarkable in both diversity and deliciousness, more than 10 kinds of foods mainly including the chestnut kernel, hawthorn-honey chestnut hamburger, freeze-dried chestnut powder (fresh chestnut corn powder and chestnut adzuki bean powder, etc.), chestnut puffed food, and *grifola frondosa* are sold throughout China (Figure 20). With the development of the food processing industry, chestnut becomes an important staple food, which not only enriches the local food culture, taps and publicizes the historical and cultural connotation of the chestnut, but also drives the development of the local economy and expands the source of livelihood for local residents. Meanwhile, the solid industrial foundation has spawned a number of excellent food processing enterprises, among which Shenli Group takes the lead. It is the largest chestnut processing enterprise in Kuancheng and even in China, with an annual processing capacity of 20,000 tons and an output value of RMB 320 million.

Chestnut deep processing industry effectively extends the industrial chain, improves the added value of chestnut (Figure 21).



Figure 20 Marketing of chestnut and its processed products in domestic market



Figure 21 Chestnut industry expands farmers' livelihood and drives the economic development

Sale and trade. With fine organic quality, Kuancheng chestnut has been an important export product and has a wide consumer market in Japan and other countries. Today, Kuancheng has built a brand “Shenli” relying on Shenli Group, a leading enterprise that has been vigorously developing the export-oriented economy and has successively passed the HACCP, ISO9001, BRC of Britain, FDA of the U.S.A. and many other authoritative certifications of Japan, the E.U., Islamic Halal, and Kosher, laying a solid foundation for the chestnut export trade. Through precision marketing and special supply, Kuancheng’s chestnut products are largely exported to the European Union, the United States, Japan, South Korea, Islamic countries, Taiwan and Hong Kong, occupying a place in the international market. The export volume of chestnut in Kuancheng, with the heritage site as the essential contribution, reached 9,587 tons. As a result, its output value has reached RMB 383.46 million.

- **Extensive livelihood sources**

With the booming development of the primary and secondary industries of chestnut, the

tertiary industry, which is developed by taking advantage of the uniqueness of historical, cultural, and landscape features of the natural resources and heritage system in Kuancheng, has also begun to be deeply integrated. Kuancheng has a long history of chestnut cultivation. Until today, there are nearly 100,000 chestnut trees of more than 100 years old. They are distributed in the front and back of the residents' houses and hillside gullies in the heritage site, silently telling the vicissitude of this beautiful land. In Datun Village of Nianziyu Town, a chestnut tree with an age of more than 710 years, being called by experts as “the king of Chinese chestnut”, is still luxuriant and fruitful. Along with the long history of chestnut cultivation, distinctive chestnut culture and Manchu rural culture constitute important cultural and tourism resources. Today, under the background of the integration of three industries, Kuancheng people waste no time to perfectly combine the chestnut industry with leisure agriculture and display these unique cultures by hosting “chestnut flower festival”, “chestnut picking festival” and “chestnut tree claim”. This not only inherits the traditional culture, but also drives the development of leisure agriculture, and promotes the economic and social development of Kuancheng, the source of livelihood of farmers has been expanded (Figure 22).



The festival of chestnut picking in autumn



The festival of chestnut flower in spring



The scenery in chestnut forest



The claim identification of chestnut tree

Figure 22 The landscape of the heritage system drives development of regional tourism

(2) Products and services provided by the system

● Chestnut

Kuancheng has a long history of planting chestnut trees. After hundreds of years of development, there are more than 40 chestnut varieties, including “Dabanhong”, “Yanjin” and “Yankuan”, among which “Dabanhong”, “Yanjin” and “Yankuan” “Xiong 84”, “Xiong 330” and “Datun” are local fine varieties cultivated from the local natural chestnuts. Due to its high quality and consumers' preference for it, the planting area of the chestnut trees in the area where the heritage is located was 18,485.5 ha in 2021. Chestnut trees usually start to bear fruit 2 to 3 years after they are grafted, and the yield in the full bearing period is about 2.25 t per ha. And the yield of the chestnut in the heritage system was 22,810 tons.

Kuancheng is rich in local chestnut varieties, and the main local chestnut varieties currently planted include “Dabanhong”, “Yanjin”, “Yankuan”, “Xiong 84”, “Xiong 330” and “Datun” (Table 5). These local varieties have the advantages of early fruiting, high yield, large and uniform kernel, strong resistance to diseases and insect pests, and excellent fruit quality (Figure 23). These local varieties are not only widely planted in Kuancheng, but also introduced as excellent varieties to other areas. For example, the

“Dabanhong”, “Yanjin” and “Yankuan” have been extended to the whole chestnut planting area in northern China.

Table 5 Varieties and characteristics of native chestnuts in Kuancheng County

Name	Distribution area	Area (10 ⁴ ha)	Area proportion (%)	Main characteristics
Dabanhong	Kuancheng County	1.67	31.25	This variety was selected from the seed trees in Daban Village, Nianziyu Town. The ratio of fruit bearing is 34.6%. On average, each bract contains 2.2 nuts; the average single nut weighs 8.1 grams and is neat in size. It has a sweet taste, 16% sugar, 64% starch, 9% protein, and good quality; the fruit matures in mid-September.
Yanjin	Kuancheng County	1.53	10	This variety has the characteristics of high-yield, early maturing, and strong in cold resistance. The single nut weighs 8.20 grams, soluble sugar is 22.75%, starch is 55.12%, the pulp is waxy, the texture is fine, and it is suitable for frying. The fruit yield is 235 kg per mu. It is suitable for cultivation in the mountains and hills of the chestnut cultivation area in northern China.
Yankuan	Kuancheng County	0.4	7.5	This variety has the characteristics of high yield, early maturity and strong cold resistance. The average weight of its nuts is 8.3 g, soluble sugar is 19.5%, starch is 48.5%, and protein is 6.05%. Generally, it matures in the first ten days of September. And it is an excellent variety suitable for cultivation in the mountains and hilly areas of northern China.
Xiong 84	Huajian Town, Songling Town, Nianziyu Town	0.03	0.6	These two varieties were selected from the chestnut trees in Xionghudou Village, Songling Town, Kuancheng County. They are characterized by high yield, early maturity, and strong cold resistance. The average weight of their nuts is 8.25 g, soluble sugar is 19.2%, starch is 48.3%, and protein is 6.01%. They generally mature in mid-September and are excellent varieties suitable for cultivation in the mountains and hilly areas of northern China.
Xiong 330	Huajian Town, Songling Town, Nianziyu Town	0.04	0.75	

Datun	Huajian Town, Songling Town, Nianziyu Town	0.06	1.125	This variety was selected from chestnut trees in Datun Village, Nianziyu Town, Kuancheng County. It is characterized by high quality, high yield, early maturity and strong cold resistance. The average weight of its nuts is 8.5 g, soluble sugar is 19.6%, starch is 48.6%, and protein is 6.08%. It generally matures in early September and is an excellent variety suitable for cultivation in the mountains and hilly areas of northern China.
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Dabanhong



Yankuan



Datun



Xiong 84

Figure 23 Main varieties of chestnuts in Kuancheng County

● Products in the chestnut forest

The chestnut orchard has a relatively low crown density, and the chestnut trees are pruned in winters, which allows the chestnut forest to have sufficient sunlight and forms good conditions for utilizing the space resources under the trees in a chestnut orchard to develop the under-forest economy. At present, the under-forest economy of the chestnut orchard falls into two types: under-forest planting and under-forest breeding.

There are abundant varieties of under-forest planting products, mainly including the grain crops like maize, millet, and soybeans, various vegetables such as sunflowers, green onions, radishes, Chinese cabbages, capsicums, and pumpkins, and traditional Chinese herbal medicines like *scutellaria baicalensis gorgi*. Especially the *pleurotus ostreatus*, which is cultivated under the trees, has developed rapidly. *Pleurotus ostreatus* is also known as “*grifola frondosa*”, with its shape like coral, crisp, and tender in texture. It tastes like shredded chicken, with a unique flavor. Its main component is *grifolan* and it is rich in iron, copper, selenium, and vitamin C. It is a kind of high-grade health food, which is known as “Prince of Edible Fungi” and “North China Ginseng”. Greenhouses are also built in the forest. The trimmed chestnut branches are used as the substrate to cultivate the *pleurotus ostreatus*. About 10kg dried *pleurotus ostreatus* can be output from each mu of land. A special production base imitating wild *pleurotus ostreatus* has been built as the demonstration base in Shenli Group, increasing the output of the

products from the chestnut forest. In 2021, the planting area is about 1,333 ha for the under-forest crops and 33 ha for under-forest *pleurotus ostreatus* in Kuancheng, having an annual output of dried *pleurotus ostreatus* up to 4,950 kg.

Breeding native chickens and rabbits in the chestnut forest has also been developed rapidly in recent years. The native chickens eat insects and the chicken's excrement is prepared as fertilizer, thereby reducing pests and increasing soil fertility. This under-forest circular agriculture model has increased resource utilization rate and improved the ecological stability of the system. Its output has greatly enriched the food sources of farmers and increased their income, realizing the goal of "increasing output on and under trees, ensuring industrial circulation and delivering a better life for the people through an ecological way". As of the end of 2021, about 5 ha of land is used for the comprehensive development of raising chickens and rabbits in the chestnut forest, and about 10,000 of the chickens and rabbits can be output every year. As the products output from the forest are organic agricultural products, their prices are 7~10 times higher than those of similar agricultural products in the market (Figure 24).



Figure 24 Planting and breeding under the chestnut forest

(3) Farming structure and management

- **Land use forms adapted to local conditions**

The heritage system is located in the Yanshan Mountains, a semi-arid and semi-humid stony mountain area. In the 48,538 ha of agricultural land, the cultivated land accounts for only 5%, while the forest land accounts for 49%. These topographic and climatic characteristics make its agricultural production more efficient mainly in the operation of woodland and garden plots. For thousands of years, due to the high adaptability of chestnuts to the ecological environment in this region, the planting area of chestnut have accounted for 70.2% of the total orchard area (Figure 25).

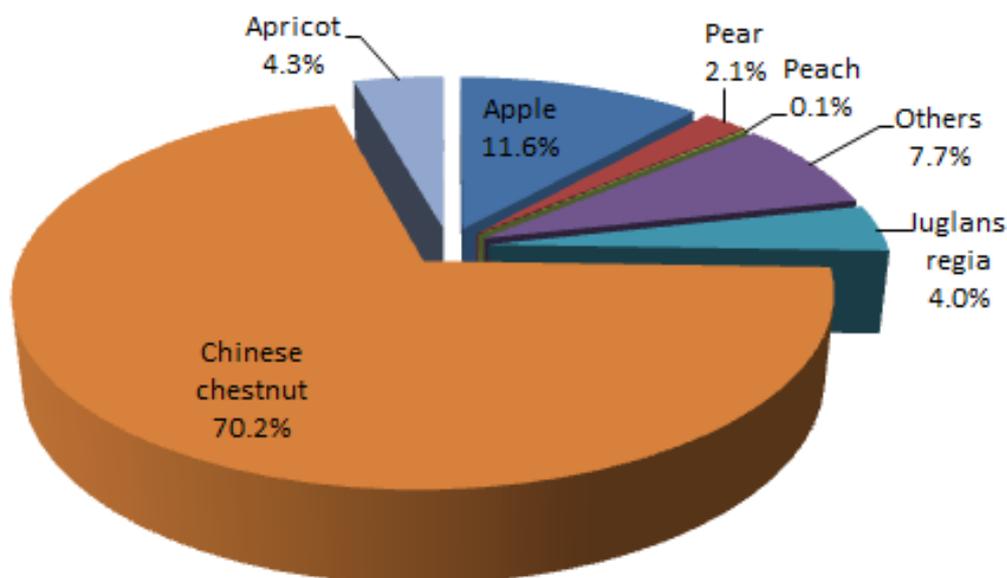


Figure 25 Land use structure of orchard in heritage system

Data sources: statistical data from Forestry Bureau of Kuancheng Manchu Autonomous County

- **Flexible smallholder farming model and efficient cooperative operation support system**

The average chestnut planting area per household in the heritage system is 0.51 ha, and the farming households that have a planting area of less than 1 ha is about 85.4%. Some farmers have expanded their operating area through land circulation and family farms engaged in specialized production have then been formed. The number of introduced farmers is very small. At present, less than 1% of farmers have an operating area of more than 3 ha. In general, the heritage system is dominated by the typical smallholder farming model.

The smallholder farming model is flexible in operations. The flexibility is reflected in the fact that they produce chestnuts that can be sold to the market as well as for home consumption. Meanwhile, their land can be operated either by themselves or transferred to bases, companies, or other farmers. However, it cannot face the dilemma of being unable to adapt to technological updates and market changes. Ecological production

and industrialized operations require a good service system to provide professional support. For this reason, the new type of specialized farmers' cooperatives has been developed by leaps and bounds, providing strong support for smallholder farming operations. At present, 35.6% of the farmers have joined and 80% of the farmers have a strong willingness to join the specialized farmers' cooperatives in the heritage system, indicating that the role of the cooperatives in smallholders is gradually emerging when facing the big market. In 2022, there were 69 chestnut cooperatives in the heritage system, of which the one with the largest number of participants and the largest scale is the chestnut cooperative established by the "Shenli group". The chestnut cooperatives provide farmers with technology and market services for the entire industry chain by connecting with food processing enterprises, building demonstration bases, organizing skill trainings and expert on-site instructions. Meanwhile, chestnut cooperatives sign supply and sales agreements with companies, which makes companies and farmers form a stable cooperative relationship. The company complies with the three commitments of "purchasing all the chestnuts of the cooperative, the purchase price is higher than the surrounding areas, and the profit of the enterprise is returned to the chestnut farmers," which ensures the stability of the sales price of chestnuts of the cooperative members and not only avoids the phenomenon of "abundant production but not abundant harvest," but also realizes the annual The sales price of chestnuts is 5-10% higher than the surrounding areas. In addition, members of the cooperative are responsible for the cultivation, management, and harvesting of chestnuts during the busy season, while they can engage in a workshop production in the enterprise during the idle season, effectively sharing the benefits of the extension of the chestnut industry chain and value-added chain and maximizing the income of the farmers (Figure 26). The survey shows that 67% of the farmers in the area where the heritage system is located have participated more than once in the trainings related to chestnut management. Most of the trainings are organized and provided by the cooperatives. In addition, 61% of the farmers expressed that they are willing to participate in relevant

trainings even charged, indicating that farmers have a strong desire to improve their skills.

In summary, the flexible smallholder farming model and the efficient cooperative operation support system in the heritage system constitute a stable and highly adaptable social and economic operation mode.



Professional training courses for farmers



Demonstration base



Expert on-site instruction



Technical services

Figure 26 Cooperative operation support system

(4) Sustainability and resilience

- **The system can provide stable sources of income to local farmers**

Some researchers studied the rate of return on labor input of smallholders' production in the heritage system⁴. The study shows that the annual income of working outside is 3.8 times that of the chestnut planting, and the absolute income of chestnut planting is lower than that of working outside. However, due to the long production cycle of chestnuts, labor is limited every year. The main work includes pruning branches, fertilizing, field management, and fruit picking, all of which shall be conducted in different periods. The labor input is 121.4 persons · d · household⁻¹, far lower than the 537 persons · d · household⁻¹ for working outside. That is, the labor input of working outside is 4.4 times that of chestnut planting. Therefore, from the perspective of return rate on labor input, chestnut planting is 1.2 times of working outside, and it has a higher return rate on labor input.

On the other hand, chestnut planting allows farmers to make full use of the remaining time to engage in non-agricultural production, thereby increasing their family income.

⁴ He Lulu, Zhang Yongxun, Hong Chuanchun, Min Qingwen. Analysis of the economic driving force for protecting Important Agricultural Heritage Systems based on the return rate on labor input: A case study of the Kuancheng Traditional Chestnut Cultivation System in Hebei Province [J]. Chinese Journal of Eco-Agriculture, 2020, 28(9): 1405-1413.

The work of chestnut tree management mainly involves pruning in winters, fertilizing, and harvesting in autumns, which is not in conflict with agricultural production. Work in different periods can be realized, which can make full use of labor resources, increase working hours and income of the farmers. This also interprets why most farmers are unwilling to give up chestnut planting from an economic perspective.

Kuancheng is located in a mountainous area, with relatively difficult production and living conditions. Farmers have limited sources of income and their livelihoods are in fragile situations. Once natural or man-made disasters occur, it will be difficult for them to maintain their basic livelihoods. The chestnuts, as woody grains, have a strong ability to resist natural disasters. With normal harvesting being ensured, it is a tangible “sure source of income”. Kuancheng has a long history of chestnut planting. Chestnut and its under-forest products can not only satisfy their own consumption, but also bring stable income to local residents as an important commercial crop. Chestnut planting has become an important source of income for farmers in Kuancheng. In 2021, the sales from chestnut and the income from its associated tourism in the heritage system reached RMB 335.3 million, accounting for 44.7% of the total income from agriculture and forestry. There is no doubt that the income from chestnut plays an important role in increasing the income level of the farmers. The survey shows that the income from chestnut has been listed as one of the most important sources of household income by 74.3% of the farmers, and it is even higher than that obtained by working outside (Figure 27). We can see the position of the chestnut in the minds of local farmers, which may be related to the fact that the income from chestnut is more stable than that from working outside.

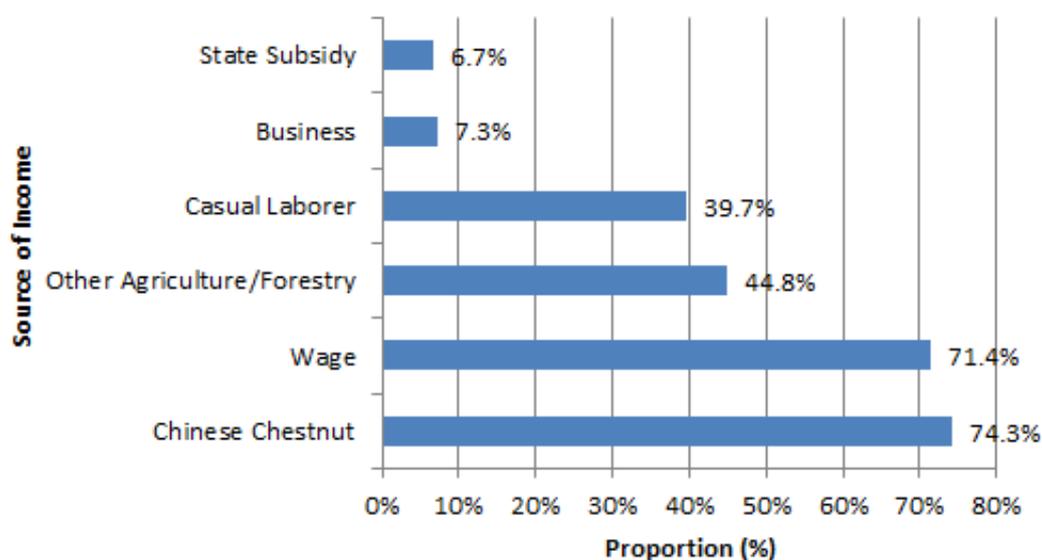


Figure 27 Farmers' understanding of the main source of family income in the heritage system

Data sources: field survey data of this research team

According to the household income structure and the proportion of chestnut income in the household income, farm households fall into four categories: For Type I farm households, agriculture is their main source of income, and the income from chestnut accounts for more than 50% of the total income; for Type II farm households, the non-agricultural income accounts for 50% to 90% of the total income; for Type III farm households, the agricultural income accounts for 50% of the total income, and the income from chestnut accounts for 50% or less of the total income; for Type IV farm households, the non-agricultural income accounts for more than 90% of the total income. The survey shows that the proportions of these four categories of farm households are 15.2%, 53.7%, 17.8%, and 13.3%, respectively. For most farm households, the income from chestnut is related to the structure of income of a farm household. However, a great difference exists in the income from chestnut among the different categories of farm households: the highest for the farm households of Type I, with an average of RMB 27,458/year, and the lowest for the farm households of Type IV, with an average of RMB 4,010/year (Table 6). For farm households of Type I and III, up to 68.9% of the total, agriculture is their main source of income, the income from

chestnut plays a significant role in the improvement of their income.

Table 6 Proportion of different categories of farm households in the heritage system and their annual gross income from chestnut

	Type I	Type II	Type III	Type IV	Average
Proportion (%)	15.2	17.8	53.7	13.3	—
Total Income(yuan/year)	27,458	7,724	7,664	4,010	10,225

Data sources: field survey data of this research team

- **The system can provide long-term job opportunities to local farmers**

The Kuancheng Traditional Chestnut Eco-Planting System provides local residents with ample and diverse job opportunities. As of 2021, about 13,455 people have been directly engaged in agricultural activities closely related to the agricultural heritage system, accounting for 86.7% of the total labor force input in agriculture in the local area. People are mainly engaged in chestnut planting, chestnut product sales, and agri-tourism (Figure 28).



Figure 28 Work related to the heritage system

Among the labor force directly engaging in the agricultural activities closely related to the agricultural heritage system, the young and middle-aged labor force between the ages of 31 and 50 is in a dominant position, accounting for 66.7%. Some young people under 30 are also involved in it. In addition, women play an important role in the protection and development of the agricultural heritage system, especially in the sales of agricultural products and in agri-tourism. The female labor force accounts for 88.9% of the total labor force, and the young and middle-aged women aged 31~60 years constitute the main part (Figure 29). This shows that the Kuancheng Traditional Chestnut Eco-Planting System presents outstanding attractiveness to the young and middle-aged labor force and female labor force and has significant demonstration significance in improving the aging trend of the labor force and promoting the employment of the females.

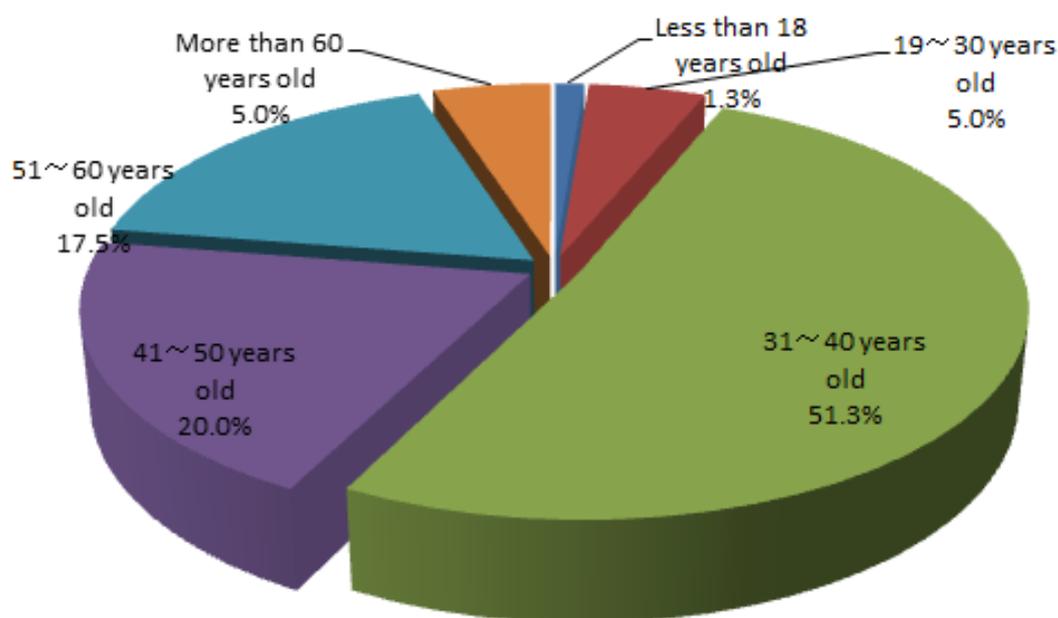


Figure 29 Age distribution of female labor in the heritage system

Data sources: field survey data of this research team

To meet the market demand, Kuancheng has implemented ecological production and

industrial operation to extensively integrate and develop the primary, secondary and tertiary industries related to the chestnut industry, which brings many new employment opportunities. Enterprises have all kinds of short-term employment demand based on their production rules, and such demands are usually met by employing rural labor. Shenli Group and Hengtai E-commerce Company are two large chestnut processing and sales enterprises in Kuancheng. They need about 3,700 and 1,300 short-term employees respectively every year. Other chestnut family farms also have short-term labor demands in different sizes. The operation of new family farms and the management of new farmers' cooperative organizations require the participation of new farmers with ideals, knowledge, and skills. The booming chestnut industry also attracts more and more high-quality rural talents back to the countryside, which improves both the quantity and quality of employment. In addition, the development of tourism has created a large number of job opportunities in leisure farms, catering services, cultural products marketing, and other fields, improving the employment structure of local residents (Figure 30).



Figure 30 New Employment Opportunities Created by Tourism Development

2.2. Agro-biodiversity

(1) Cultivated, reared, and harvested plants and animals

● Chestnut diversity

There is a long history of the Kuancheng Traditional Chestnut Eco-Planting System, and a number of ancient chestnut trees can be found. According to the statistics of the local forestry department, there are 45,306 ancient chestnut trees with more than 100 years old in the heritage site. Among them, there are 43,931 strains of 100~150 years, 1,126 strains of 150~200 years, and 249 strains of more than 200 years (Figure 31). The old chestnut trees are most densely distributed along the Great Wall in the south of the heritage site, which indicates that the towns along the Great Wall began to plant chestnut first. Among them, Nianziyu Town is the largest one, including 19,321 strains with an age of 100~150 years, 869 strains of 150~200 years, and 164 strains of more than 200 years. In addition, there are 5,407, 4,241, and 3,691 ancient trees in Boluotai Town, Songling Town, and Huajian Town, respectively. The ancient trees are thick in trunks and towering, forming a magnificent landscape. The two oldest chestnut trees which are 718 years old still stand luxuriant and leafy in Datun Village of Nianziyu Town in the south of the heritage site. These ancient chestnut trees are always mixed with non-ancient chestnut trees, forming the whole system with trees of different ages.

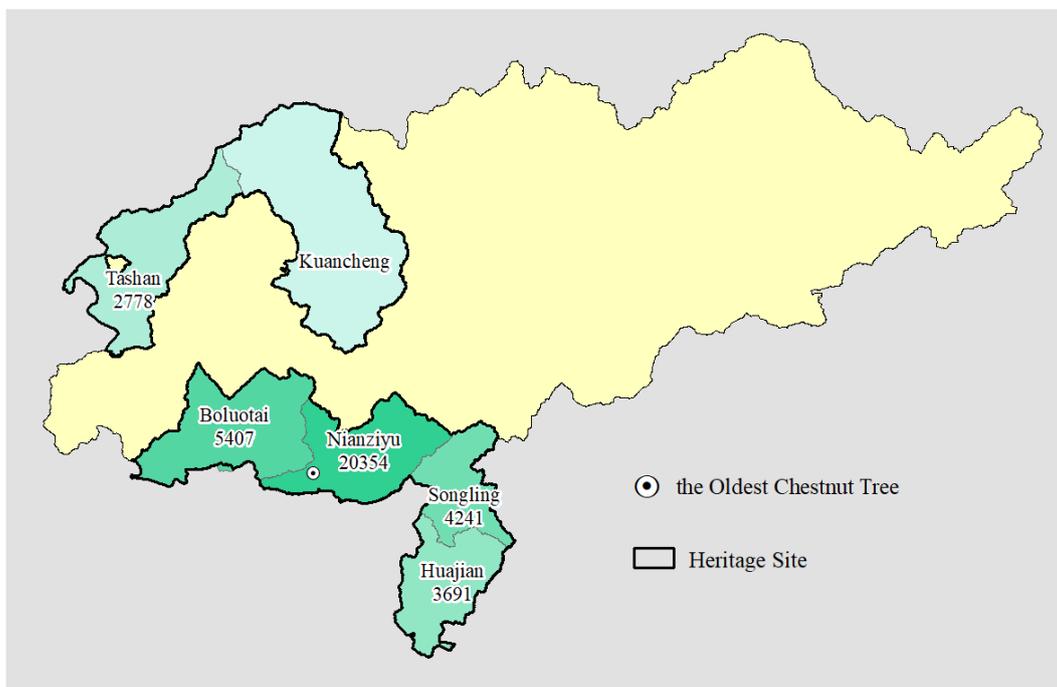


Figure 31 Distribution of chestnut trees over 100 years old



Figure 32 The oldest ancient chestnut tree in the heritage system

The old chestnut forest not only adds a strong sense of history to the heritage system landscape, but also preserves the germplasm resources of this traditional species. The chestnut variety resources in the heritage system are very abundant and have an outstanding diversity advantage. Local farmers and experts took advantage of the good adaptability of local chestnut species to local climate and soil conditions, as well as the strong resistance to diseases and insect pests, and used local wood species as rootstocks

to graft 39 foreign excellent varieties, including “Dongling Mingzhu”, “Yanshan Spurt”, “Yankui”, “Yanshan Zaofeng”, “Shifeng”, “Phoenix Mountain # 2”, “Yanhong”, “Yanfeng” and “Tafeng”. The number of chestnut varieties planted in Kuancheng accounts for more than 1/10 of the total chestnut varieties in China (Table 7).

Table 7 Representative chestnut varieties in Kuancheng County

	Basic Information			
	Variety Name	Planting Range	Planting Area (10,000 ha)	Area Ratio
Native Species	Dabanhong	Kuancheng County	1.67	31.25
	Yanjin	Kuancheng County	1.53	10
	Yankuan	Kuancheng County	0.4	7.5
	Xiong 84	Huajian Town, Songling Town, Nianziyu Town	0.03	0.6
	Xiong 300	Huajian Town, Songling Town, Nianziyu Town	0.04	0.75
	Datun	Huajian Town, Songling Town, Nianziyu Town	0.06	1.125
Representative introduced varieties	Dongling Mingzhu, Yanshan Spurt, Yankui, Yanshan Zaofeng, Shifeng, Phoenix Mountain # 2, Yanhong, Yanfeng, Tafeng, Yanchang, Yanjing, Daqinggan, Ziyu, Castanea henryi, and single-seed chestnut.			

- **Crop diversity**

With chestnut as the core, the heritage system features plentiful agricultural biodiversity.

The chestnut in the heritage system is mixed with other fruit trees such as hawthorn,

wild apricot, apple, and jujube, forming a mixed commercial forest dominated by chestnut trees. In addition, agricultural crops in the chestnut forest constitute a complex agroforestry system rich in species. Grain crops intercropped in the chestnut forests include maize, sorghum, millet, proso millet, soybean, mung bean, adzuki bean, buckwheat, potatoes, and other crops; intercropped vegetables include capsicum, pumpkin, onion, eggplant, perilla, *Grifola frondosa*; intercropped medicinal materials include *bupleurum*, *salvia miltiorhiza*, *forsythia suspensa*, *herba schizonepetae*, *chrysanthemum*, *scutellaria baicalensis gorgi*, and *common anemarrhena rhizome*, which are rich in biodiversity (Figure 33).



Intercropping of chestnut and hawthorn



Intercropping of chestnut and radish/capsicums



Intercropping of chestnut and sweet potato



Intercropping of chestnut and buckwheat



Intercropping of chestnut and *scutellaria
baicalensis gorgi*



Intercropping of chestnut and perilla



Intercropping of chestnut and millet



Intercropping of chestnut and maize

Figure 33 Agricultural biodiversity of the heritage system

(2) Ecological functions

● Biodiversity conservation

The Kuancheng Traditional Chestnut Eco-Planting System is reasonably allocated with the surrounding natural vegetation and landscaping elements to create an organic body, and its natural and ecological production and management mode has little impact on the natural vegetation, which is conducive to protecting the wild animals and plants in the surrounding area. In addition, the abundant biodiversity in the system also provides conditions for the survival of wild animals and plants.

The heritage site is rich in wild plant resources, including 4 phyla, 104 families, and

615 species, in which there are 4 National Second-class protected plants, including *Glycine soja*, *Phellodendron amurense*, *Tilia amurensis*, *Frarinus mandshurica*, and 6 National Third-class protected plants, including *Juglans mandshurica*, *Magnolia sieboldii*, *Boschniakia rossica*, *Kolkwitzia amabilis*, *Heteroplexis microcephala* and *Acanthopanax senticosus*. The typical wild plants in the local area are shown in Figure below.

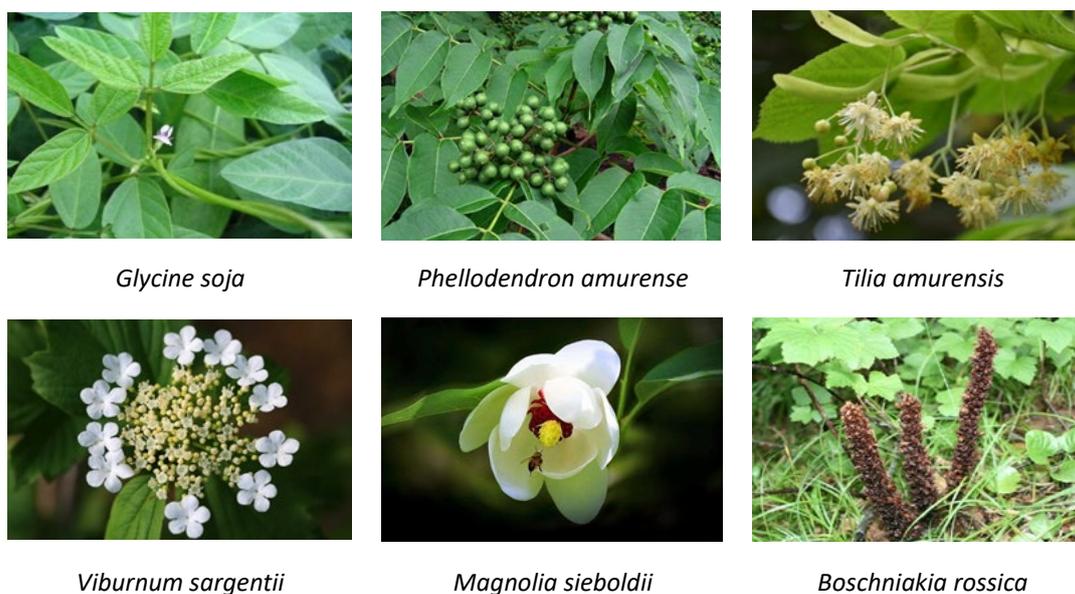


Figure 34 Typical wild plants in Kuancheng County

In addition, there are also abundant wild animal resources in Kuancheng, with more than 200 species of wild animals. There are 9 orders, 17 families, 24 genera, and 94 species of bird resources, in which there are 2 First-class protected birds, including *Ciconia nigra* and *Buteo lagopus*; 15 Second-class protected birds, including *Cygnus olumbianusi*, *Milvus migrans*, *Accipiter gentilis*, *Accipiter nisus*, *Buteo hemilasius*, *Aquila clanga*, *Circus cyaneus*, *Falco vespertinus*, *Falco columbarius*, *Falco tinnunculus* and *Pucrasia macrolopha*; and 53 Third-class protected birds. In addition, there are more than 50 species of wild mammals, a total of 17 families, 44 genera, and 53 species. The typical wild plants in the heritage site are shown in Figure below.

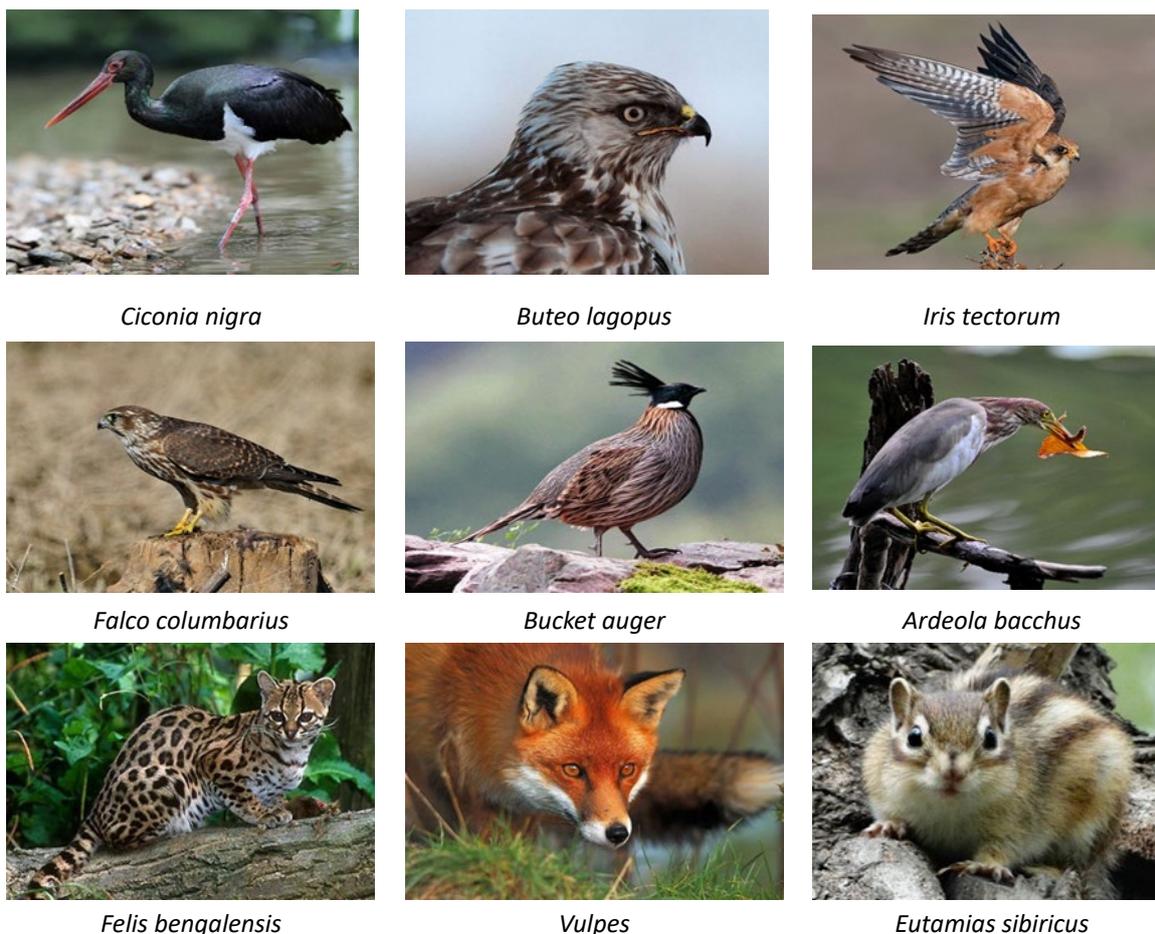


Figure 35 Typical wild animals in Kuancheng County

- **Control of diseases, pests, and weeds**

The heritage system also has the ecological function of controlling diseases, pests, and weeds. During the process of performing under-forest intercropping, fruit growers will sow sunflowers, *melilotus suaveolens* Ledeb, maize, and other plants in the chestnut forest. These plants can attract chestnut-eating pests like the *grapholita dimorpha* Komai to settle on them, and then these plants can be harvested for incineration. By using this method, the harm to the chestnut from the insets like *grapholita dimorpha* Komai can be effectively decreased, without using any pesticides. In addition, fruit growers will usually sow some low crops, medicinal materials, vegetables, or edible fungi in the forest. While managing these agricultural crops, the fruit growers will also control the harm to the chestnut arising from pests and weeds. Furthermore, the poultry (mainly chickens) raised by fruit growers under the trees will feed on the weeds under

the trees and the pests on the trees, which has significantly controlled the harm from pests and weeds. While preventing and controlling the harm from pests and weeds, the fruit growers also obtain extra economic benefits. Fruit growers also use physical methods to prevent birds and beasts from damaging the chestnuts. For example, scarecrows are put up to deter birds, without adding burden to the environment.

(3) Sustainability and resilience

- **The system can maintain sustainable chestnut production through nutrient cycling**

Based on the various chestnut varieties and crop varieties, many chestnut orchards over a hundred years old can still maintain high yields to promote the sustainability and resilience of the system. Meanwhile, the heritage system has a significant effect on nutrient cycling, so that the soil fertility of the chestnut orchard can be maintained. Therefore, First, the chestnut forest has obvious water and soil conservation effect which can reduce the erosion to the minerals and the nutrient elements contained in the soil. Secondly, according to the traditional practice of chestnut orchards, the fruit growers shall remove the weeds under the forest before harvesting the chestnuts, and then bury the removed weeds in the soil around the forest. In this way, on the one hand, the chestnut fruits are easy to be collected after the understory weeds were cleared. On the other hand, the weeds buried in the soil will gradually decompose, releasing nutrients into the soil and increasing the nutrient content of the soil, which is equivalent to applying organic fertilizer. In addition, local fruit growers will stack the chestnut husk under the chestnut tree after harvesting the fruit. The decayed husks will replenish the organic matter and mineral nutrients in the soil. Thirdly, the cultivation of edible fungi and breeding of poultry under the trees by the fruit growers also promote the circulation of nutrients in the soil. Fruit growers will crush the pruned chestnut branches and use the crushed material as the substrate to cultivate *grifola frondosa*. After the *grifola frondosa* is harvested, such substrate will replenish to the soil under the trees,

increasing the organic matter and nutrients in the soil; when poultry is raised in the forest, poultry manure is also an important supplement for soil nutrients in the chestnut forest.

- **The virtuous circle of mutual promotion can improve the mountain environment**

In the long history of diversified chestnut planting practice, a virtuous circle of mutual promotion has formed between the heritage system and the local ecological environment in Kuancheng. On the one hand, Kuancheng is located in the warm temperate zone and has a semi-humid, semi-arid, continental monsoon-type Yanshan mountain and hilly climate. It is rich in sunlight resources, with rains and hot weather coming in the same season and large temperature difference between day and night in autumn, which is conducive to the accumulation of photosynthetic products, providing superior conditions for the growth and quality improvement of the chestnut; on the other hand, the long-term planting practice of chestnuts has also significantly increased the vegetation coverage of Kuancheng, which has effectively reduced soil erosion and water loss and ultimately improved the natural environment of the mountain area (Figure 36).





Figure 36 Chestnut Forest in mountain area

2.3. Local and Traditional Knowledge Systems

(1) Agricultural practices/technologies and associated knowledge

- **Variety breeding technology**

There are about 40 kinds of chestnut varieties planted in Kuancheng. Through long-term practice, local chestnut farmers choose native and scattered mother trees that have grown for many years (generally more than 60 years), and select chestnut trees with natural tree appearance, strong bearing ability year after year, high and stable yield, uniform, and full chestnut size as excellent single plants. The local chestnut farmers use multi-point grafting, high grafting, and other techniques to breed scions. After years of continuous observation on growth habits, fruit traits, high yield, genetic stability and adaptability, excellent strains with excellent appearance, good cultivation traits, and good pulp quality and flavor of mother trees and nuts are selected as breeding resources. Two-year-old strong seedlings with a diameter of about 1cm, more than 5 main root systems, a root length of about 20cm, full development of branches, and no diseases

and insect pests are selected as the variety resources for the next year.

- **Planting grafting technology**

Local chestnut farmers have developed planting and grafting techniques adapted to chestnuts through long-term practice, and have continued to develop and improve them in the process of inheritance. They usually choose sunny slopes or semi-sunny slopes with better vegetation to build chestnut gardens. Sandy loam and loam are most suitable for chestnut gardens. Transplanting is carried out in spring (the middle and late March). Currently, the root system starts to move, the shooting part is about to sprout, and then the survival rate of transplanting is the highest. Before transplanting, they dig tree holes in advance according to the standard of 40~60 plants per mu, and do not apply fertilizer in the tree holes to prevent burning roots. They also cut the overground parts severely, leaving about 1/2 of the branches and keeping a proper root-top ratio (Figure 38). When transplanting, they dig out young trees cultivated in advance, and leave as many roots and soil balls as possible to help them survive after transplanting. After transplanting, they pour water immediately and thoroughly, then pour water for sewing again the next day, and then pour water every 7~10 days until the rainy season comes.



Figure 37 Chestnut grafting

- **Trimming technology system**

The traditional technical system of chestnut tree construction focuses on three time periods, namely the juvenile period, the fruiting period and the senescence period.

Trimming of young trees: The purpose of trimming young trees is to cultivate tree shapes. Chestnut farmers mainly use thinning to remove over-dense, crossed, overlapped, weak branches and disease and insect branches. It is advisable to keep 8~12 mother branches per square meter, and properly keep more vegetative branches to promote strong branches to bear fruit. They core branches with excessive growth in summer to control overgrowth and promote the growth of branches.

Trimming of fruit trees: Trimming chestnut trees in a fruiting stage is helpful to disperse the nutrition of trees and slow down tree growth. For chestnut trees that grow well, they use the trimming method of “every three to one” and “every five to two” to leave more fruiting branches and developing branches as appropriate; for weak

branches of weak trees, they properly space and retract to concentrate the nutrition of trees.

Trimming of aging trees: Trimming the decaying trees is helpful to the renewal of old trees. From the full fruit period, chestnut farmers prune according to the specific conditions, and rotate and renew the trees in some places, to help the trees grow.

- **Fertilization technology system**

Local farmers use dead leaves, weeds, human and animal manure to make organic fertilizer, and summed up the fertilization technology system of applying base fertilizer in autumn, green manure in summer, and fruiting fertilizer in pursuit. It should be emphasized that the fertilizers used are organic fertilizers, not chemical fertilizers.

Applying base fertilizer in autumn: Base fertilizer is the basic fertilizer for chestnut growth and development all year round, which can enhance the photosynthetic efficiency of leaves, help restore tree vigor, accumulate more nutrients, and lay the foundation for high yield in the coming year. Generally, local chestnut farmers collect fruits in autumn, clean up organic matters such as fallen leaves under trees, and dig holes to bury them. Currently, chestnut trees are deficient in nutrients. Chestnut farmers apply human and animal manure and organic fertilizer in combination with deep ploughing to improve the soil. Trees with moderate growth, medium fertility, and more fruits require about 2000kg of decomposed farmyard manure per mu.

Applying green fertilizer in summer: It is difficult to transport organic fertilizer to chestnut gardens in mountainous area. Villagers in the heritage site cut highland barley and weeds in summer, collect twigs and green leaves, chop them, and bury them underground. The villagers take local materials and use green manure directly, with the purpose of increasing soil organic matter, improving soil structure, and fertilizing soil

force, which is helpful to promote nutrient absorption of the chestnut root system (Figure 38).



Figure 38 Applying green fertilizer in the chestnut forest

Applying swelling fertilizer: July and August are the periods when young chestnut shoots grow rapidly and need a large amount of fertilizer. At this time, chestnut farmers apply organic fertilizer, which is beneficial to shoot expansion and increase fruit weight.

● Harvest technology system

There are many varieties of chestnut in Kuancheng County. Mature and early maturing varieties mature in late August, the latest in mid-late October, and most varieties mature in mid-September. It takes 7~10 days from the first crack of a tree to the maturity of the whole tree. There are two traditional methods for residents to pick chestnuts, namely, picking and beating chestnut bracts.

Picking method: It is suitable for chestnut fruits with high maturity. Chestnut farmers wait for chestnut bract on the tree to ripen and crack naturally, pick up the nuts after

landing, namely pick them as they ripen (Figure 39). Chestnuts harvested by traditional picking methods are rich in development, beautiful in appearance, shiny, excellent in quality, and resistant to storage and transportation. Since chestnut fruit is exposed underground for a long time, it will lose water and dry, which will affect the taste, so chestnut farmers pick it up every day.



Figure 39 Local farmers pick up chestnuts

Beating chestnut bracts: It is suitable for the period when chestnut leaves are cracked, and chestnut fruits are not dropped. After chestnuts are cracked, chestnut farmers break off chestnut bracts with bamboo poles, pick them up and stack them in a cool place, and spray a small amount of clear water on each pile of 20cm to increase the humidity in the pile. The thickness of the canopy should not exceed 80cm. After 5~7 days, the chestnut will be picked out.

- **Storage technology system**

Chestnuts stored by chestnut farmers can be divided into temporary storage and winter

storage. The former is to store chestnuts picked up from trees and broken from buds in a cool room or cellar. In the traditional storage technology system, river sand is an important material for storing chestnuts. After cleaning the river sand, it should be dried for 2~3 days, and then sprayed with water to keep its humidity. Chestnut farmers spread about 10cm of wet sand on the ground indoors or in the cellar, and then pile up one layer of chestnut fruit and one layer of wet sand, covering the top with more than 10cm of sand, and the pile height is no more than 1 m. Chestnut farmers spray water to keep moisture in time according to the dryness of sand, turn and check it once every 5~7 days, and check the humidity of sand to pick out rotten fruits until chestnut is sold or stored in winter. Winter storage means storing for the winter for consumption next year. They chose a well-drained shady place and dug a ditch with a depth of 1m and a width of 0.6m. The length depends on the number of chestnut fruits. 5cm wet sand is laid at the bottom of the ditch, and a layer of chestnut fruit is placed on the sand, the thickness of chestnut fruit is not more than 20cm, and the ratio of sand and fruit is guaranteed to be 4: 1, so that it is carried out alternately until it is 20cm away from the ground, 10cm is filled with sand and 10cm of soil is filled at the top. Before the soil freezes, cover the pile with soil for 20~300cm to prevent chestnut from getting damp.

- **Pest control system**

There are many kinds of diseases and insect pests in Chinese chestnut, nearly 150 kinds of pests in 8 orders and 34 families in China. Among them, there are more than 10 kinds of diseases and insect pests that seriously affect chestnut yield and fruit quality. Through long-term cultivation practice, the varieties left and selected by farmers in the heritage site have considerable resistance to pests and diseases. In addition, according to the types of pests and diseases and the outbreak time of pests and diseases, they have summed up a set of physical and biological pest control techniques.

Physical pest control: In winter or early spring, chestnut farmers eliminate

overwintering eggs and various germs by scraping bark and burning intensively, then apply yellow mud to the wound surface and wrap it with cloth to prevent pests from climbing to branches and leaves; in addition, they apply high-temperature composting organic fertilizer, which can effectively reduce the population density of scarab larvae; they also cut off the killed chestnut bracts and burn them centrally; physical methods such as cutting off weak branches and burning them centrally can achieve the purpose of killing insects. Fruit farmers also use physical methods to prevent the harm of birds and animals to chestnuts, such as using scarecrows to prevent bird damage (Figure 40).

Biological pest control: First, chestnut farmers plant sunflower, sweet clover, corn, and other plants in the chestnut forest, and then harvest these plants for incineration. Because these plants can attract pests (such as fruit borers) who eat chestnuts to settle on them, this method can effectively reduce the harm of insects such as fruit borers to chestnuts without applying any pesticides.

Secondly, under-forest farming not only makes full use of space-time resources, but also plays an effective role in preventing insects. Fruit farmers raise poultry (mainly chickens) under the forest, and poultry will feed on weeds and pests on trees under the forest, so that the hazards of insect pests and weeds can be obviously controlled. In addition, fruit farmers generally plant some low-rise crops, medicinal materials, vegetables, or edible fungi under the forest, and while managing these crops, fruit farmers can also deal with the threat of insect pests and weeds to chestnut at any time.

These physical methods and biological methods can effectively control diseases, insect pests, and weeds, and at the same time will not have adverse effects on the environment, providing very high ecological benefits.



Figure 40 Pest control

(2) Natural agricultural resources management

● Allocating forest resources to make full use of nutrients

To conserve water and soil, residents in Kuancheng built water conservation forest with the *pinus tabuliformis* as the main group species on the upper and top of the hillside where the soil layer is thin, the nutrient content is low, and the water condition is tough. To realize the rational allocation of chestnut forests and other forest resources, chestnut trees are planted in the middle and lower part of the hillside with thick and fertile soil layer and good soil moisture conditions.

● Building terraces to regulate runoff

The local farmers usually built terraces before planting chestnut trees. The local terraces are long and wide and are at equal altitude. The terraces can be divided into stone-wall terraces and soil-wall terraces. Chestnut growers choose stone walls in rocky hills

where it is convenient to get stones and build soil walls in earthy hills where it is difficult to get stones. Terraces not only favor cultivation and irrigation, but also reduce the erosion to slope land by alleviating surface runoff during a rainstorm (Figure 41).



Figure 41 Terraces

- **Building contour trenches around hills to conserve water and soil**

The local farmers also built contour trenches around hills, with a method like that for building horizontal terraces, but simpler than the latter. To prevent the concentrated overflow of rainwater in the trenches, small horizontal water retaining ridge can be set in them to ease the water potential. Chestnut trees are planted in the thick soil inside the ridge, and *amorpha fruticosa linn.* or grass is planted on the slope between the two trenches to protect the slopes. On the one hand, the horizontal steps and contour trenches can improve the infiltration of precipitation and soil water content and ensure the water supply to chestnut trees; on the other hand, trenches can retain runoff, reduce surface runoff, lower down runoff velocity, and prevent surface soil erosion, playing an

important role in soil and water conservation (Figure 42).



Figure 42 Contour trenches around hills

- **Water and soil conservation with fish-scaled pits and small reservoirs**

Kuancheng has a continental monsoon-type Yanshan mountain and hilly climate. The precipitation is unevenly distributed in time, and most of it is concentrated in summer, which is easy to cause soil erosion. The local farmers in Kuancheng dug half-moon-shaped pits from top to bottom along the contour lines on the steep slope of ridge and hill and the fragmented gully slope, which were arranged in the shape of fish scale. This is how these pits receive the name. The fish scale pit is a manifestation of the outstanding wisdom of our ancestors, and has a history of more than a thousand years . It is an ecological land preparation method commonly used in the mountainous areas with poor soil quality, combining engineering measures (pit building) and biological measures (tree planting). The fish-scaled pit has a certain water storage capacity which not only allows water and fertilizer to be deposited in the pit, but also allows chestnut

trees to be planted in it, which has good sustainability. In addition, residents-built dams and water collection cellars to retain runoff, reduce surface runoff, lower down runoff velocity, and reduce surface soil erosion.

- **Building check dams to reduce erosion**

There are many gullies in the heritage system, with steep slopes, rapid flow, and serious erosion. It is a mountain water distribution area that needs high attention to soil and water conservation. Therefore, according to the topographical characteristics, chestnut growers first built stone dams (check dam) every 5 ~ 10m from top to bottom in gullies as per the slope gradient to prevent the expansion of the gully banks. This practice also can make the longitudinal slopes of the gully gentle, reduce the flow speed, retain the sediment, and gradually create steps at the bottom of the gullies, benefiting the development of production by using the land in the gullies (Figure 43).



Figure 43 Check dams in mountains

- **Soil and water conservation by covering method**

Chestnut has a well-developed root system which has an obvious fixation effect in soil (especially surface soil). The local farmers plant perennial grass shrubs such as *amorpha fruticosa linn.* and *melilotus suaveolens Ledeb.* in contour trenches and slope ridges and take measures such as covering the tree base with straw, covering the soil below trees with weeds, and cultivating grass to reduce the erosion of surface soil (Figure 44).



Figure 44 Planting *scutellaria baicalensis gorgi* in chestnut forest to reduce soil erosion

(3) Sustainability and resilience

- **Dominant chestnut cultivation mode adapted to natural conditions**

Kuancheng is in the hinterland of Yanshan Mountain, with undulating mountains, crisscrossing rivers, high and steep slopes, complex geological structures, diverse soil

types, and unevenly distributed nutrients. It is a mountainous county with more mountains occupying most of the land, some rivers, less farmland, roads, and villages. In addition, water shortages occur from time to time, and frequent floods and droughts alternate in Kuancheng due to the uneven distribution of water resources caused by the landform and terrains. The severe natural conditions such as high altitude, less cultivated land, and drought have brought great challenges to the choices of livelihoods for local ancestors. However, the special natural conditions of the mountainous areas are conducive to the cultivation of fruit trees and other crops that cannot survive on flat land. Moreover, the area enjoys sufficient sunlight, with abundant rainfalls coming together with hot weather, which provides extremely positive conditions for the growth of fruit trees. The ancestors lived close to the mountains and hills and made full use of the advantages of the environment to creatively develop the cultivation of chestnuts. This has made chestnuts become a crop supporting the livelihoods of the local people, and that is why the cultivation of chestnut can be continued for thousands of years.

In the long-term practices in production, the local people have established a complex agricultural system with chestnut cultivation as the core. The soil horizons are thick with abundant nutrients in the middle and lower part of the hillside, where residents cultivate chestnut trees; the soil horizons are thin with poor water conditions in the upper part of the hillside, where a natural secondary forest with live oak and *quercus mongolica* as the main group species has formed, which mainly plays a role in conserving soil and water. For the lower layer, the valley between the mountains has a flat terrain, deep soil horizons, and the best water and fertilizer conditions. Maize, soybeans, millets, and other grain crops are planted here. The natural forest in the upper layer and the commercial forest in the middle layer can effectively regulate the inter-forest microclimate and play a role in water conservation, providing environmental foundation and protection for the cultivated food crops in the lower layer.

- **Stereoscopic planting & breeding system that makes efficient use of time and space resources**

In the complex understory planting & breeding system, the under-forest land resources and shade space can be fully utilized. Complex operations of various projects such as agriculture, forestry, and husbandry under the forest canopies make the woodland not only an ecological protection zone, but also a comprehensive economic zone, which can transform the advantages of forestry resources into economic advantages, appropriately integrating the long-term, medium-term, and short-term benefits and greatly increasing the added value of the woodland.

In the chestnut cultivation process, local chestnut farmers have established a diversified stereoscopic planting & breeding model. To increase the economic benefits of chestnut forests, under-forest crops are intercropped, and poultry is raised under the trees, which can on the one hand make full use of the local time resources to increase economic benefits, and on the other hand, reduce the occurrence of harm arising from diseases and insect pests and improve soil fertility. Intercropping and relay intercropping are the main ways for local chestnut growers to achieve stereoscopic chestnut planting purposes. Usually, the commercial crops such as soybean, adzuki bean, maize, green onion, radish, pumpkin and *scutellaria baicalensis gorgi* (Figure 45) are sowed under the trees, which can not only ensure the supply of food, but also increase farmers' income, realizing the efficient use of the land resources. Some farmers also raise poultry under the trees, like *gallus domesticus* and laying hens (Figure 46), which can not only catch the insect pests to reduce the occurrence of diseases and insect pests in chestnuts, but also leave their wastes becoming organic fertilizer to promote the growth of chestnuts.



Figure 45 Millet, green onion, maize, and radish intercropped under chestnut trees



Figure 46 Raising poultry under chestnut trees is conducive to control diseases and insect pests

- **Cultivating *Grifola frondosa* realizing the recycling of agricultural resources**

Cultivating *grifola frondosa* under trees is a typical example of recycling agricultural resources. The cultivation of edible mushrooms in Kuancheng County started in the 1880s, mainly producing flat mushrooms. In 1996, *grifola frondosa* were introduced,

and through three years of experimental demonstration, they were promoted in 1999. *Grifola frondosa* is a fungus with high nutritional value and economic value. Chestnut growers collect the dry branches and fall leaves of chestnut trees and grind them to produce the substrate that is essential for the growth of the *grifola frondosa* and put-up greenhouses under the trees to simulate the growth conditions of the *grifola frondosa*. When you walk into the chestnut forest in Kuancheng, you can find a row of small sheds covered with shading nets under each chestnut tree. Now you uncover the shed, clusters of *grifola frondosa* will appear in front of you. Through cultivation of *grifola frondosa* under trees, the branches cut off from pruning can be fully utilized, realizing the recycling of the substances. The substrate for cultivating the *grifola frondosa* can also increase the organic matter and nutrients in the soil, promoting the growth of the chestnuts (Figure 47). At present, the area of *grifola frondosa* cultivation in the county is 134 ha, and the area of *grifola frondosa* cultivation under the chestnut forest in the heritage system is more than 26.67 ha.



Figure 47 Cultivating *grifola frondosa*

2.4. Cultures, Value Systems and Social Organisations

(1) Cultural identity and agriculture

Kuancheng has a long history of cultivating and eating chestnut, forming a unique chestnut culture, which is incorporated into the local and national culture in aspects such as medicine, food, etiquette, concepts. Therefore, the Kuancheng Traditional Chestnut Eco-Planting System is closely related to the social and cultural life of local residents, and the cultural characteristics and systems related to chestnut, such as material culture, customs, behaviors, and historical memory, also permeate into the major personal and social cultural behaviors such as local traditional production, knowledge, festivals and life rituals.

● Food culture of chestnut

Chestnut can be eaten raw or cooked and can be used as both food and fruit. In the local area, eating zongzi during the Dragon Boat Festival, eating moon cakes during the Mid-Autumn Festival in August, eating Laba porridge on the eighth day of the twelfth lunar month, and eating chestnuts during the Spring Festival are all essential things. Sweet potato chestnuts, stewed chicken with chestnuts, jujube rice porridge, roasted cabbage with chestnuts, and chestnut cake are the famous delicacies on the dining table of local people, and the most famous one is “fried chestnuts with sugar” (Figure 49~50). “Fried chestnuts with sugar” was called “filled with sugar” by the ancients. There is a poem saying: “Stack chestnuts and stir-fry them in deep yellow, guests have a long talk and ask for wine. The candles are half-burnt at midnight, and people yelled fried chestnuts with sugar.” There are also eight key words summed up by local people to fry chestnuts with sugar: “Mixed with sugar and coarse sand”, so as to achieve the ideal effect of “full of medium, shell extremely soft and crisp, slightly peeled by hand, easy separation of shell and meat but non-sticky”. Guo Langao, a man in Qing Dynasty, said in the *Record of Shaishutang*: “You can see a firewood pot outside the city gate, one person

goes to the fire, and one person sits high on the machine, stirring it frequently with a long bean iron spoon, which makes it even and partial”, which describes the scene of frying chestnuts very vividly and vividly. According to the records in *Liao History*, there were special chestnut gardens and professional people to cook chestnuts fried with sugar before the Liao Dynasty (AD 916-1125).



Stewed firewood chicken with chestnuts



Chestnut stuffed bun



Chestnut lean porridge



Chestnut sparerib soup

Figure 48 Representative food of chestnut in Kuancheng



Figure 49 Chestnuts fried with sugar

Kuancheng chestnut is rich in vitamins, carotene, amino acids, unsaturated fatty acids, iron, calcium, and other trace elements, which has obvious health care function and medicinal value. It also has the functions of strengthening the spleen and stomach, invigorating qi, tonifying the kidney, strengthening the waist, strengthening the tendons, stopping bleeding, and swelling, and strengthening the heart. It is suitable for treating soreness of the waist and knees, unfavorable waist and legs, increased urination caused by kidney deficiency, chronic diarrhea caused by deficiency cold of spleen and stomach, and fracture, swelling, the pain of blood stasis, and the pain of bones and muscles caused by trauma. Eating raw chestnuts to treat abdominal distension and eating cooked chestnuts to treat diarrhea are the most used local prescriptions.

- **Expression of chestnut in rituals and concept**

In Chinese, chestnut has the same sound as “Li (set up)”, “Li (profit)” and “Li (politeness)”. Therefore, people regard chestnut as a symbol of good fortune, which can be used as a metaphor of good luck, childbearing, being determined, making profits, being an official, and winning. Local people give chestnuts as gifts at important

moments such as visiting teachers, studying, being promoted, opening a business, marrying, and celebrating their birthday, to bless them to make a great success. After the Qing Dynasty, planting, eating, and using chestnut became fashionable. When large families marry a wife or have children, they will plant chestnut trees as a memorial. When a man and a woman get married, in the bridal chamber, chestnuts should be placed on the four corners of the heated brick bed to show good luck and wish to have children early. When offering sacrifices and paying homage to ancestors, people also regard chestnuts as the first choice. These traditions have continued since ancient times. Therefore, although people all know that chestnuts are planted by one generation but eaten by the descendants, Kuancheng people regard them as auspicious things and have inherited them from generation to generation. In addition, local people think that chestnut flowers can repel mosquitoes and eliminate plague after lighting. Every chestnut flower season, people pick up chestnut flowers and tie them into ropes and store them. In summer and autumn, every household light flowers to drive away mosquitoes and eliminate the plague.



Figure 50 Farmers choose chestnuts at home



The bride and groom “feed chestnuts to each other” to show good luck

“Wedding bed with chestnut” in the bridal chamber means giving birth to your son early

Figure 51 Marriage customs related to chestnut



Figure 52 Teenagers learn to braid chestnut rope

- **Legends, stories, and literary works related to chestnut**

There are many historical stories and anecdotes about chestnuts in Kuancheng. After the Southern Song Dynasty settled in Lin’an, during the Shaoxing period, Chen Fugong and Qian Kai went to the “Jin Dynasty” on a diplomatic mission. When passing through Yanshan (now Kuancheng area), two people took ten bags of chestnuts fried with sugar respectively and presented them to the two envoys, they claimed to be “the son of Li He” and then said goodbye with tears (*Lu Fangweng’s Notes of Laoxuean*). On the one hand, this anecdote shows that “Li He fried chestnut” has long been famous all over the

world, almost synonymous with “home country”; on the other hand, it also shows the patriotic feelings of the local people, suggesting that the two envoys should live up to their mission.

In the forty-fifth year of Kangxi reign in the Qing Dynasty, Emperor Kangxi passed through Kuanhe City just when chestnut was ripe. After eating it, he praised, “The most delicious food in the world.” In Qing Dynasty, Emperor Qianlong enjoyed the chestnut fried with sugar, and wrote the poem *Eating Chestnuts*: “If you simmer, the bigger chestnuts will be undercooked; if you cook with high heat, the smaller chestnuts will be burnt. Chestnuts of all sizes need to be heated evenly, so the temperature must be adjusted. Only pans and desks, together with peppers, are enough for paying tributes. And no need to overdo it as great masters do.” The chestnut here is Kuancheng chestnut. Since then, the court has set up more than 30 imperial estates in Kuancheng to supply grain, oil, and special products to the Imperial Household Department, among which Kuancheng chestnut is the most popular among Emperors and Empresses. According to legend, Empress Dowager Cixi was ill-governed but skillful in keeping in good health. She loves chestnuts. She once ordered the imperial kitchens to use the finest chestnuts, finely grind and supplement with rock sugar, and then steam into chestnut noodles and small steamed corn buns, which was her must-eat. It is said that this is one of the secrets of Cixi’s health preservation.

There are many literary creations about the chestnut in ancient times. For example, Su Zhe, an essayist in Song Dynasty, said, “As I age, I suffered from waist and foot diseases, and it is said that eating chestnuts will cure the disease. When guests come to visit in the morning, I am sorry for getting up late. In fact, I was slowly drinking the chestnut juice.” This poem described the diet therapy efficacy of chestnuts vividly.

Lu You, a poet in Southern Song Dynasty, also made a vivid account of chestnuts fried

with sugar in *Notes of Laoxuean*. He likes chestnuts and knows the health-preserving function of chestnuts. In his later years, he often eats chestnuts for treatment of the loose teeth. As he wrote in his poem: “With loose teeth, I can’t help sighing that I’m aging. It is said that roasting a few chestnuts can cure my physical pain. After a few drinks, it reminds me of how high-spirited I was when I was an official in my early years.”

Wu Kuan, a poet in Ming Dynasty, is very particular about the eating method of chestnuts, and likes to cook porridge with chestnuts and rice to increase nutrition. He wrote in the poem *Cooking Chestnut Porridge*: “People suffering from back pain eat chestnut. People whose teeth loosen eat chestnut. Cutting finely and simmering with new rice is the recipe of chestnut porridge of the predecessor.” This poem reflects the poet’s love for chestnuts and shows that chestnut porridge can tonify the kidney and benefit the waist and feet.

Shu Ting, a famous contemporary woman writer, once described chestnut fried with sugar in this way: “The stone in the pot is bright, and a slippery and yellow copper plate is embedded in the front of the pot. When you buy it, you can dig it out from the hot pot and put it on a copper plate. When a small shovel presses it, the chestnut will open its small mouth, and the gesture is skillful and the rhythm is extremely crisp, which will add fuel to your expectation. Suddenly, a big chestnut burst open in the pot, and everyone was surprised and laughed, as happy as a snuff.

● Ancient chestnut trees

The oldest existing chestnut tree is 718 years old, still flourishing, and fruitful, and is praised by experts as “the king of Chinese chestnut” (Figure 53). The ancient chestnut tree bears witness to the hard work of ancestors in this land for generations and bears the deep dependence of Kuancheng people. As one of the main local food sources, chestnut also nurtures the industrious and simple Kuancheng people for generations.

The ancient chestnut tree is the soul of Kuancheng, which not only makes contemporary people feel the long history of chestnut cultivation, but also increases the sense of belonging and glory of residents, making it a spiritual sustenance. The ancient chestnut tree is also a symbol of the industrious and simple spirit of Kuancheng people.



Figure 53 “King of the Chestnut” with a long history

- **Clothing and dwellings adapted to nature**

Manchu costumes, folk houses, and so on are all practical expressions of respecting for and adapting to nature. The ancestors of Manchu mostly took the regional natural resources as the basic source to form an adaptive production and lifestyle. The costume is a vivid embodiment of a nation’s material culture and spiritual culture, which not only reflects the national psychology, but also reflects the degree of civilization and development of the nation. Manchu clothing pays attention to warmth and retains the exclusive cultural symbols of mountain hunting nation. Traditional Manchu people also show a long-standing religious concept in women’s hairstyles (Figure 54).



Fur cap

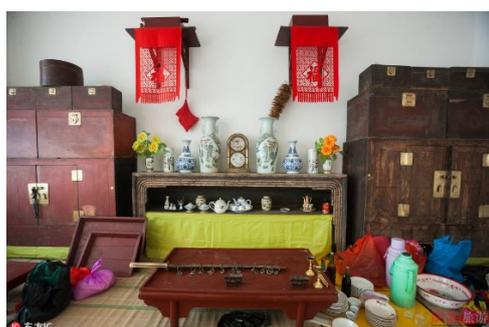
Cheongsam arrow
sleeves

Culotte

Shoes

Figure 54 Manchu costumes

The living conditions of Manchu ancestors are only sporadically recorded in the history books, but they also basically reflect the historical traces and evolution of Manchu residential buildings (Figure 55). Their dwellings are from cave-dwelling, semi-cave dwellings, horse shelf, and land-cutting, to “birch-skin house” and “grass house”, and then to Sanheyuan and Siheyuan with wood as the railings. *Da Jin Guo Zhi* contains that “the Nyuzhen people live in the valley with connected wood as the fence, or it is covered with boards or birch skins, and the walls are also made of wood. The winter is extremely cold, the house is several feet high, and the southeast window is opened alone. The window is unlatched and covered with grass silk, the bed is made up of wood for sleeping and eating.”

Heated brick bed, kang table, kang cabinet,
board for the worship of ancestors

Manchu traditional dwellings

Figure 55 Manchu dwellings

● **Nature-respecting festival culture**

Festivals and ceremonies are profound expressions of Kuancheng people's optimism, diligence, kindness, compliance with the weather, and respect for nature, mainly including Harvest Festival, Spring Dragon Festival, Tomb-Sweeping Day, Worm King Festival, Ma Wang Festival, and Mountain Opening Festival (Table 8).

Table 8 Main festivals of Manchu in Kuancheng and their ecological significance

Festivals	Time	Contents
Tiancang Festival	Lunar January 25	On this day, each family added grains and other crops to their own warehouses to beg for good weather, indicating that the wise Manchu people pursued harmony with nature.
Chunlong Festival	Lunar February 2	Since ancient times, China has regarded the dragon as a symbol of auspiciousness. Legend has it that the dragon is the ruler of clouds and rain. This festival is a typical expression of the integration of Han culture into the traditional Manchu Mountain Forest culture.
Qingming Festival	The turn of Spring and Summer	On this day, the Manchus used a wicker twig to tie a large flower of five-color paper and used the remaining-colored paper to make a colored ribbon, which was tied together at one end of the branch, so that the colored ribbon would naturally hang down along the branch and inserted it on the tomb to worship the ancestor. It embodies the worship of nature and the taboo on mountain fires, which are all related to the protection of mountain forests and are extremely important for forest fire prevention in mountainous areas.
Chongwang Festival	Lunar June 6	On this day, the Manchus are accustomed to paying respects to the Chongwang Temple and killing pigs to pray for the Chongwang and begging the Chongwang to control the pests. Later, people knew that pests depended on prevention and control instead of praying for gods, so this section was changed to "Clothing Festival." Urban residents changed it to the "Booming Book Festival" to cool down clothes and books to prevent insect bites.
Mawang Festival	Lunar June 23	The Manchu ancestors used horseback and archery for hunting and fighting. On this day, the Manchus used roasted mutton, carp, rooster, and white wine to bow their heads three times when offering worship to Mawang.
Kaishan Festival	Lunar Mid-September	On this day, the Manchus enshrine the collected ginseng in their own shrines and express their awe of nature in their hearts through worship and prayer.

(2) Management of the system

The Eight Banners System (Baqi System) originated from the hunting organization of Nyuzhen, and it was the military and living organization system of Manchu people in the Qing Dynasty, serving soldiers in wartime, and serving the people in peacetime. The manor belonged to the garrison of Baqi, the head of the manor was the manager of the manor, and most of the families gathered inside the manor. These manors are distributed in Nianziyu Town and Yuerya Town, which retain a large number of related records, and have some influence on the way of livelihood, the distribution of social rights and the form of aggregation. In the process of agricultural and forestry production, also through the family-manor form of production organization, gradually evolved into a modern village, promoting the orderly organization of production and life. In the process of chestnut cultivation, management and agricultural and forestry production, the family is still the basic labor unit. The organization of Baqi system manages and restricts it from the settlement to the manner and extracts a certain amount of products as public capital (or for aristocrats to enjoy). In order to realize the basic connection of the village society. Relevant regulations, customs, economic and social interactions are all implemented in this basic social network.

At different levels, Niulu Ezhen, Jiala Ezhen, and Gushan Ezhen (the highest) are the leaders. After the establishment of the Qing Dynasty, the Eight Banners soldiers and civilians were stationed across the nation. Kuancheng Xifengkou Great Wall Fortress is a garrison pass in the north of Beijing, but the officers and soldiers here were sent from each banner, and an organization was gradually formed with Meile Zhangjing (second only to Gushan Ezhen who is a deputy) as the supreme leader, taking charge of Xifengkou, Lengkou, and Luoyukou.

In Kuancheng, there are 10,140 mu (676 hectares) of banner land in Xifengkou alone, which is managed in the form of the manor. The manor belongs to the garrison and is

managed by the manor head, and the manor is mostly populated by families. These manors are distributed in Nianziyu Town, Yuerya Town, etc., with a large number of relevant records left. They have an impact on the way of livelihood, the distribution of social rights, and the gathering patterns, thus promoting the orderly organization of production and life.

Manchu society is rich in traditional culture, and the family concept and moral concept, which are mainly manifested by filial piety, play an extremely important role in the minds of Manchu people. The spirit of respecting the old and worshipping the ancestors and the family concept inherited by blood are still the most important embodiment of its functionality. Traditional Manchu society is composed of clans linked by blood relationships. The cultural characteristics based on blood relationship are expressed from family power distribution, ancestor worship activities, New Year's festival, and life rituals, residence, and village arrangement, etc., which maintains the basic internal relations of rural society and expands outward, forming different levels of social connections based on the strength of emotional connection, and playing a role in all aspects of production and life.

(3) Sustainability and resilience

Manchu is one of the main nationalities in Kuancheng, and Manchu culture is also an important component of Kuancheng culture. In Manchu culture, the ecological view of respecting nature is one of its core cultural characteristics. Manchu is a nation that retains many original beliefs and thinks that everything is spiritual. It was originally a northern nation that believed in Shamanism, and the ecological concept of respecting nature was internalized in the national spirit. This intergenerational inheritance of traditional values plays a very positive role in ecological protection and ecosystem maintenance.

Protecting the natural environment and harmonious coexistence between man and nature are rooted in the concept of the native peoples in the north who worship nature, and it has evolved into the behavior norms of residents in history. In the early society, they believed that everything has its own soul, and once the natural things that need to be respected and endowed with deity are offended, the corresponding gods will bring disaster. For example, the unwritten rules prohibiting the killing of totem animals, even if they must be eaten or killed, they need to be sacrificed first. This view of protecting nature was originally bound and regulated by the power of faith, and the stories of revenge or asylum by the gods in nature circulated among ethnic groups also played a role in binding and educating ethnic groups. During the Jin, Yuan, and Qing Dynasties, the religious binding force gradually weakened, but some traditional concepts were re-presented through the ruling laws, and the taboos against nature in the original nation were written into the legal provisions. For example, it was forbidden to kill horses in the Yuan Dynasty and not to hunt tigers unless for self-defense; crows were forbidden to be killed in Qing Dynasty. The constraint force of faith has gradually evolved into a mandatory legal provision, and the ecological consciousness of spontaneous environmental protection has gradually formed under constant constraints. Thus, it forms its own set of environmental philosophy within the nation and holds that only by adapting to the environment and living in harmony with nature can the nation survive and grow better.

2.5. Landscape Features

(1) General description of the landscape

The Kuancheng Traditional Chestnut Eco-Planting System located at the western end of Kuancheng Manchu Autonomous County, Hebei, China, has a total area of 53,581 ha and a chestnut cultivation area up to 12,231 ha, involving 6 administrative towns including Nianziyu Town, Songling Town, Huajian Town, Boluotai Town, Kuancheng

Town and Tashan Town (Figure 56 & 57).

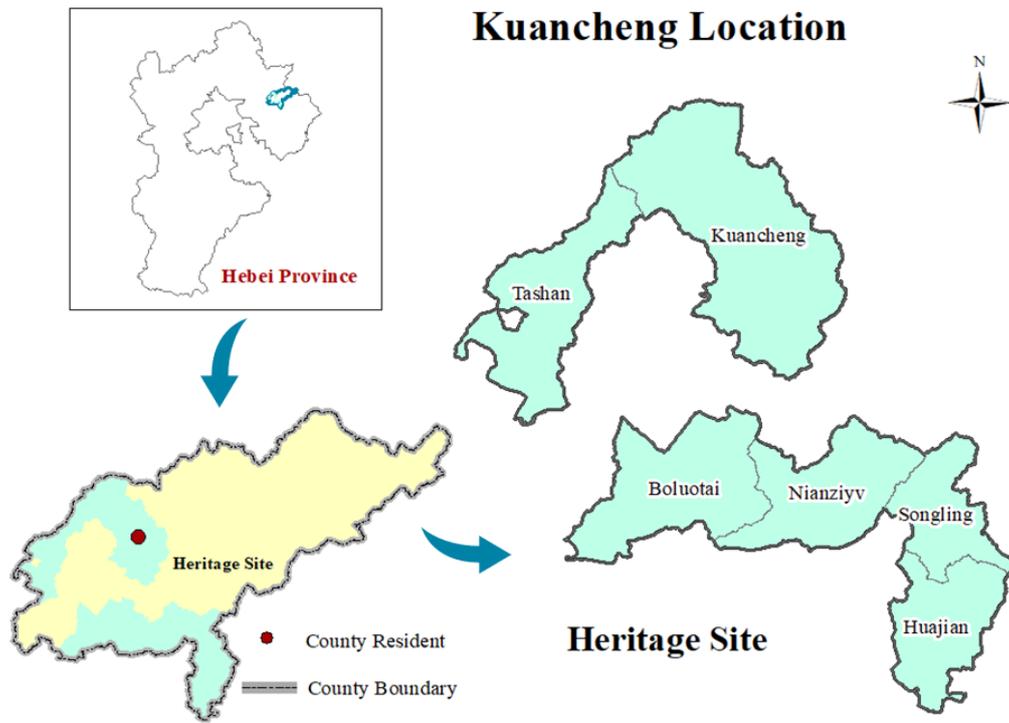


Figure 56 Geographical location of the heritage system

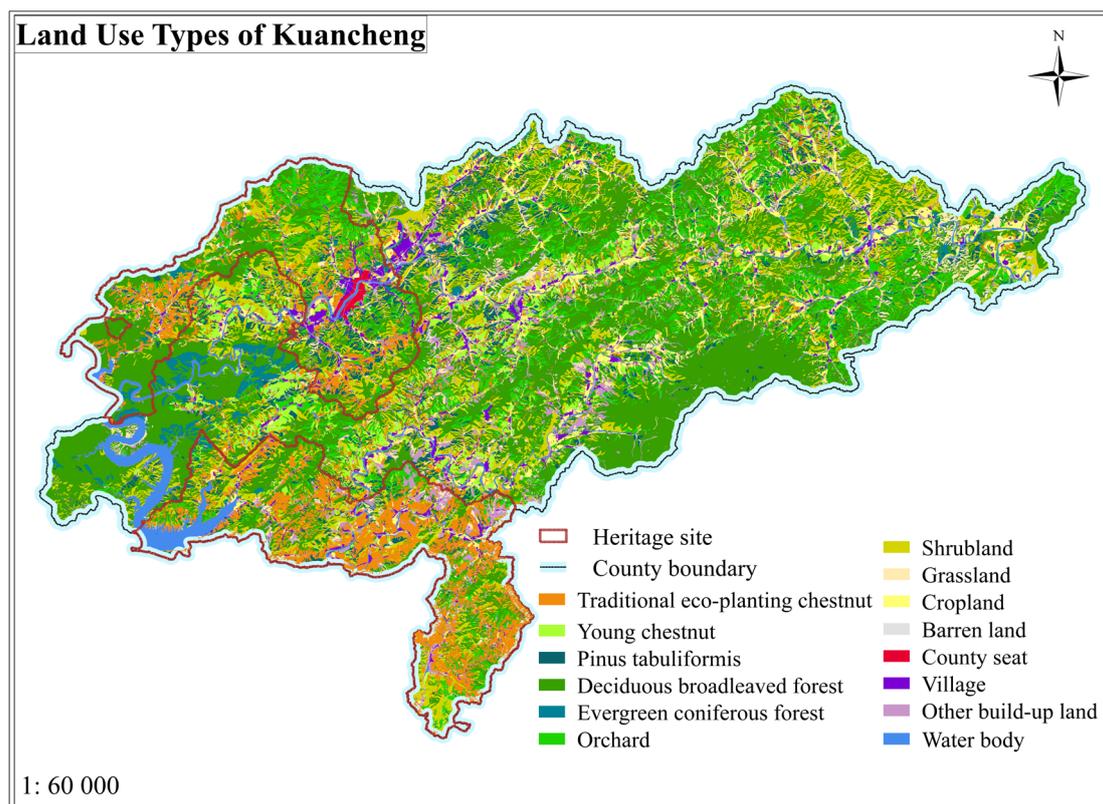


Figure 57 Land-use map of Kuancheng County and the heritage system

The heritage system, located in the eastern section of the Yanshan Mountains, enjoys abundant sunlight resources, with the rainfalls coming together with the hot weather. This area is dominated by mountainous landforms, including medium mountains, low mountains, and river valleys. Residents in this area make full use of the topography, climate, soil, and other natural conditions to carry out production and living activities according to the local conditions, adapt to and transform nature in thousands of years of practices, and establish a relatively stable landscape structure.

The upper part of the hillside has steep slopes, thin soil horizons, low fertility, and poor water conditions, so a *pinus tabuliformis* plantation has been built or the hillsides have been closed to facilitate afforestation to form a natural secondary forest with the live oak and *quercus mongolica* as the main group species, which mainly plays a role in conserving soil and water; The middle and lower parts of the hillside have deep soil horizons, good fertility, and good water storage conditions, and terraces are built to

catch water and consolidate soil. Therefore, chestnut forests are planted here, supplemented by apple trees, jujube trees, hawthorn trees, and other fruit trees, contributing to the economic benefit; the valley between the mountains has a flat terrain, deep soil horizons, and good water and fertilizer conditions. Maize, soybeans, millets, and other grain crops are planted, and residential areas are settled here, to meet the needs of daily life; in addition, reservoirs and ponds are constructed in valleys to collect the water flowing down from slopes, providing water supply for the irrigation of chestnut forests and farmland and for domestic water applications. As a result, a stable landscape system with a reasonable allocation of ecological forests, commercial forests, farmland and residential sites, and water supply is formed by making full use of the natural environmental conditions in mountain areas, realizing the harmony between man and nature (Figure 58). Thus, from the perspective of a macro scale, a spatial landscape structure is formed, with “woodland/shrubs-chestnut forest-farmland-villages-waters” distributed in order from the top of the mountain to the river valley. From the perspective of a micro scale, the upper layer of the chestnut forest is composed of fruit trees such as chestnut trees and hawthorn trees, and the lower layer is medicinal materials or agricultural crops such as soybeans, millet, sweet potatoes, *grifola frondosa* and *scutellaria baicalensis gorgi*, or poultry is raised in the forest to form a complete ecosystem.

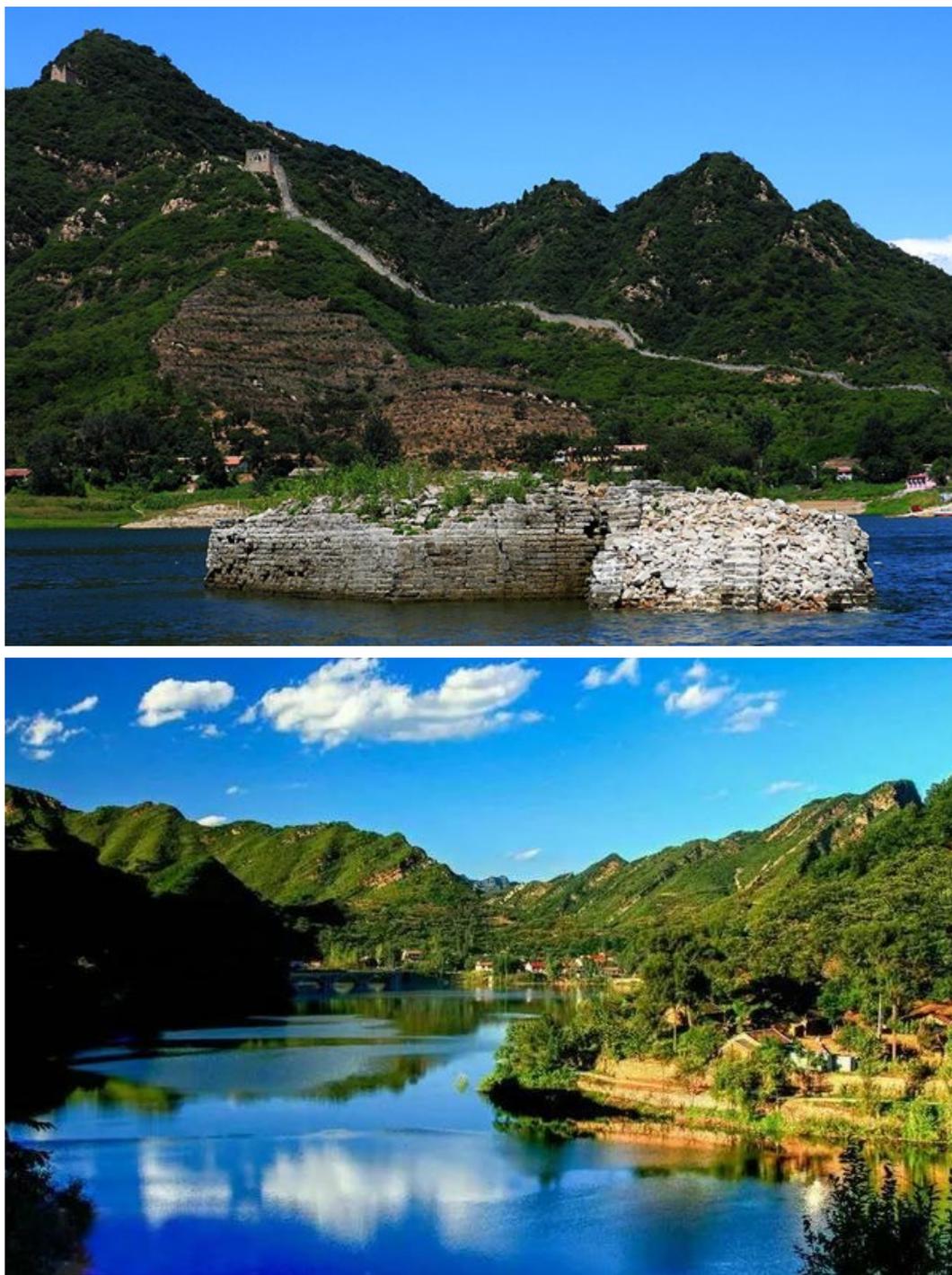


Figure 58 Typical landscape in heritage site

The blank area between the two sub-areas of the agricultural heritage system is dominated by three land-use types, one of which is the Panjiakou Reservoir, the second is the ecological public welfare forests along the reservoir, and the third is two nature reserves (Qianheshan Reserve and Dushan Reserve). Panjiakou Reservoir is one of the

major reservoirs in North China, undertaking the function of supplying water to residents of large cities such as Tangshan and Tianjin, and has strict requirements for water source protection. The woodlands around the reservoir are ecological public welfare forests, which are forests and shrub forests, mainly broad-leaved evergreen forests, including some young chestnut trees, with the primary management objectives of protecting and improving the human living environment, maintaining ecological balance, and preserving species resources and other needs. Ecological public welfare forests are operated and managed by local governments and generally cannot be used for productive activities like chestnut production. Qianheshan Reserve is a provincial nature reserve in Hebei Province aimed at protecting birds. Dushan Reserve is a provincial nature reserve in Hebei Province with the goal of protecting the forest ecosystem. On the one hand, among these two nature reserves, there are extensive evergreen broad-leaved forests, including chestnut forests, because chestnut has always been the dominant tree in the region. However, subject to the protection requirements of nature reserves, agricultural production cannot be engaged in the area. On the other hand, because the terrain conditions of these two reserves are not suitable for chestnut production, they have not been the main areas for chestnut cultivation by local residents since ancient times. Most of the chestnut forests here are young chestnut forests formed naturally and have not been managed by large-scale artificial production. Therefore, the presence of ecologically beneficial forests, reservoirs, and nature reserves creates a blank area of the two sub-regions of the agricultural heritage system.

(2) Natural context and land uses

● Natural context

For chestnut, soil conditions and climatic conditions are virtual factors among natural contexts. In terms of soil conditions, brown soil and cinnamon soil are the main soil types in Kuancheng. With a pH value between 4 and 7, the soil is rich in organic matter and high in trace elements such as N, K, Fe, Mn, and Mg. As the arable land is mostly

the hillside, with severe gritty soil and poor water holding capacity, it is not suitable for planting grain crops. Chestnut, however, can better adapt to the characteristics of the local soil, which is conducive to outputting the chestnut with good flavor and excellent quality (Table 9, Figures 59 & 60).

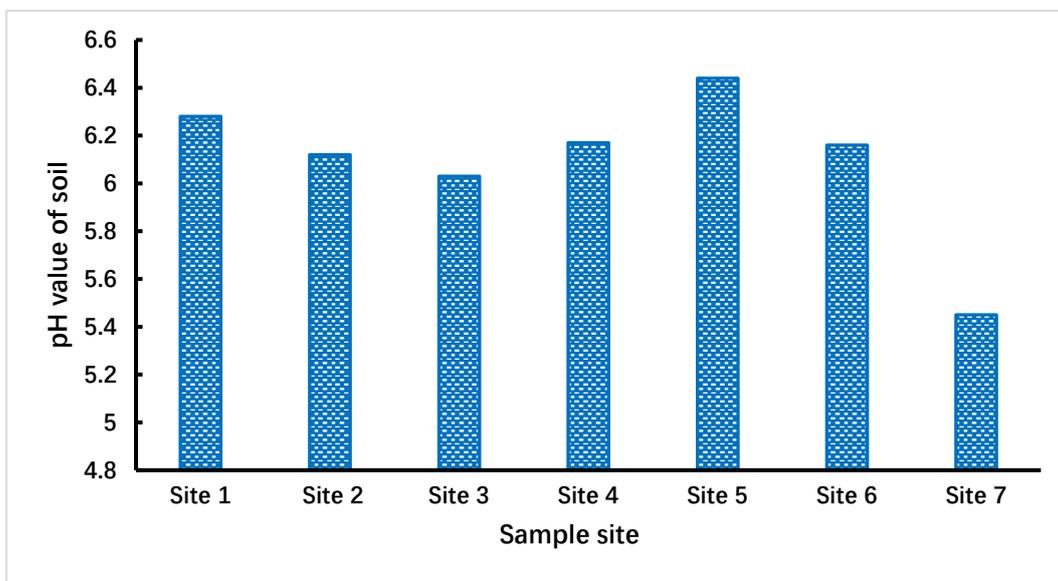


Figure 59 Soil pH in the core area of the heritage system

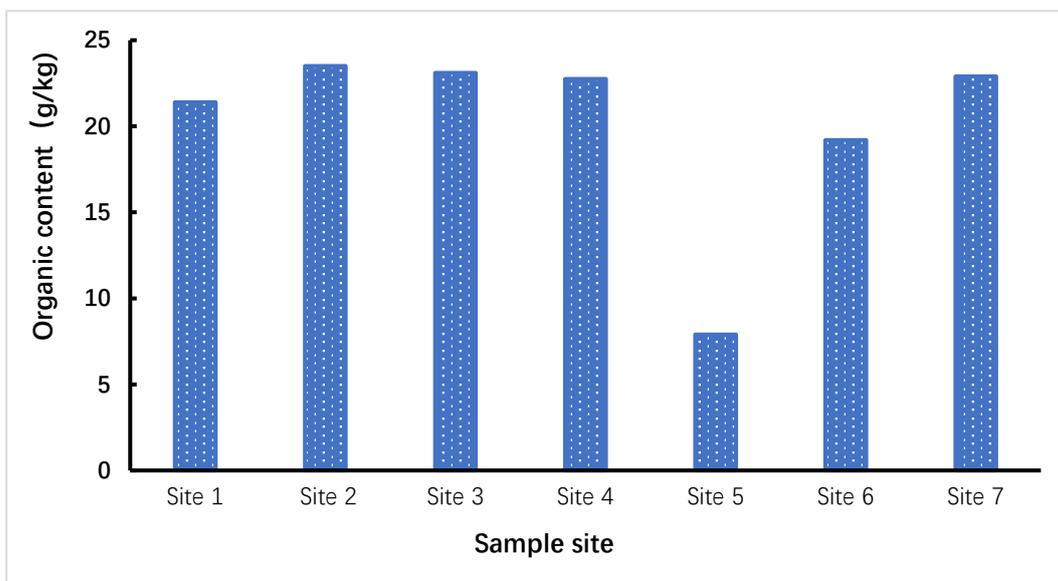


Figure 60 Organic matter content of the soil in the heritage system

Table 9 Soil fertility and trace element content of the heritage system

(Unit: nitrogen g/kg, other elements mg/kg)

Item	Tashan	Huapi	Polotai	Nianziyu	Dongdadi	Yueya	Bancheng
Total nitrogen	1.32	1.32	1.73	1.36	0.64	1.42	1.62
Available phosphorus	20.05	20.6	5.55	15.4	4.3	13.3	16.9
Available potassium	152.35	145	135	97.1	37.5	94.2	81.4
Effective magnesium	384.5	406	260.5	286	363	378	269
Effective iron	36.6	46.7	37.9	46.7	20	44	54.5
Effective manganese	11.575	17.7	11.6	6.84	3.05	10.2	22.7
Available copper	1.47	2.22	1.35	1.59	1.09	1.81	1.33
Available zinc	1.55	1.64	1.65	1.035	0.60	2.67	2.16
Available boron	0.446	0.478	0.359	0.382	0.15	0.439	0.512

In terms of climatic conditions, Kuancheng has sufficient sunlight, and the heat conditions can completely satisfy the needs of the chestnut to grow and get mature. Though it is cold in winter, the chestnut tree can survive the winter safely. In addition, though it is dry and seldom rains in winter and spring, adequate water will be supplied during the fruit growth period, and significant temperature difference occurs during the fruit maturity period. Considering the climate conditions in a comprehensive way, this area is quite suitable for chestnut planting (Table 10, Figure 61).

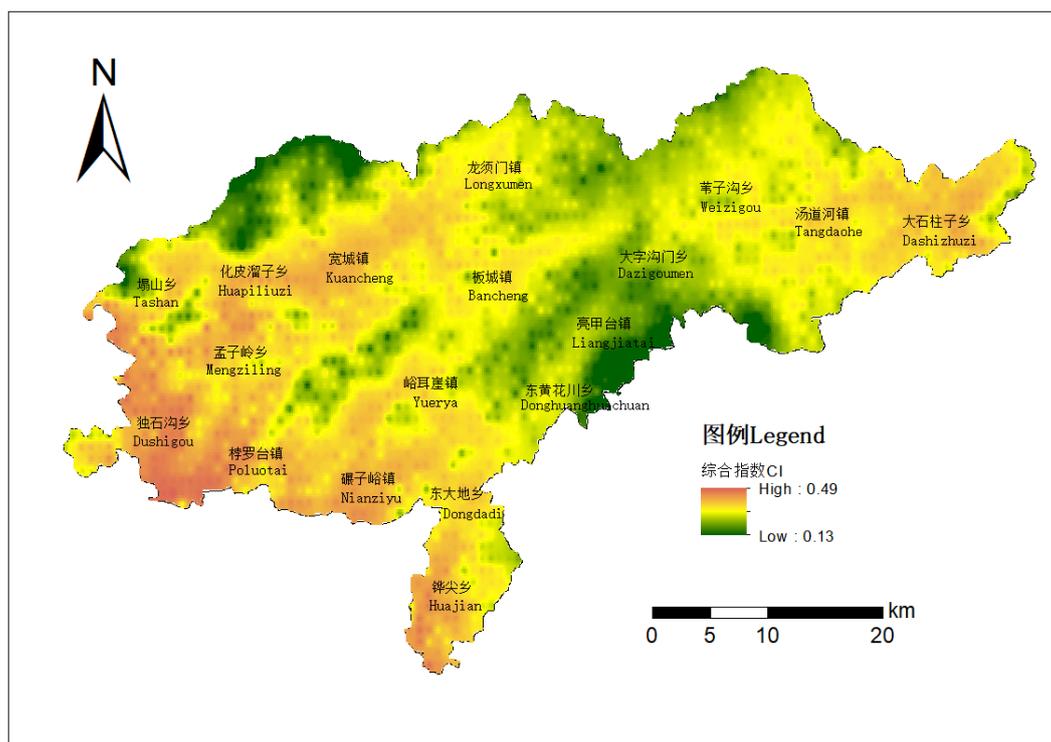


Figure 61 Spatial distribution of comprehensive climate suitability in Kuancheng

Table 10 Climatic characteristics of chestnut at growing period

	Sunshine hours in growing season (h)	Accumulated temperature ≥ 10 °C (°C)	extreme minimum temperature (°C)	Diurnal temperature range in September (°C)	Precipitation in growing season (mm)
Average or extreme	1696	3623	-25.5	12.7	601.1
Probability of $\geq 80\%$	1608	3437	-21.6	11.9	495.7

● Land use

From a spatial perspective on the distribution of the Kuancheng Traditional Chestnut Eco-Planting System, a spatial land-use structure is formed including “woodlands/shrubs-chestnut forests-farmlands-villages-waters” distributed in order from the top of the mountain to the river valley (Figure 62).

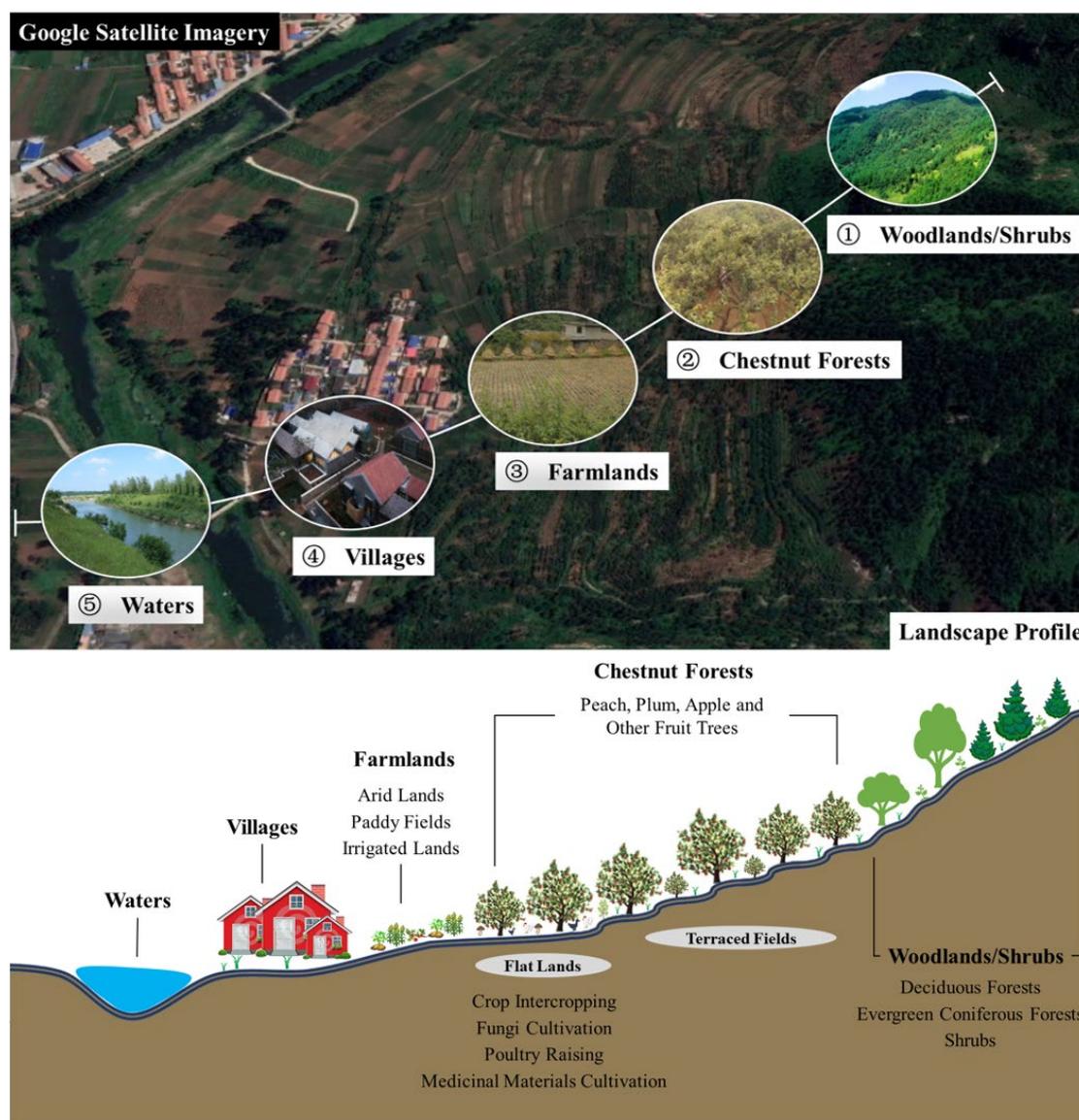


Figure 62 Macroscopic spatial landscape structure of the heritage system

Woodlands and shrublands are distributed in the upper part of the hillside. At the mountain peak with higher altitudes and in areas with steep terrains, it is not suitable to cultivate crops and commercial tree species. The shrubs and the deciduous forests like oak trees and *quercus mongolica* are mostly distributed here, and the evergreen coniferous forests like *pinus tabuliformis* are usually grown on shady slopes. The average altitude and slope of *pinus tabuliformis* forest are 445.94 m and 18.74°, respectively (Table 11). Other woodlands and shrubs have the highest altitude and the steepest slope, with an average altitude and slope exceeding 530 m and 60°, respectively.

The deciduous forest, evergreen coniferous forest, and shrubs in the heritage site play important roles of conservation of soil and water and protection against windblown sand.

Chestnut forests are distributed on the foothills and the lower part of hillsides, with an average elevation of 414.45 m and a slope of 11.88°. Chestnut forests in the heritage site can be divided into chestnut forests on flat land and on terraced fields according to the ground surface morphology. There are complex planting landscapes under some chestnut forests on flat lands, including crop intercropping, fungi cultivation, poultry raising, and medicinal materials cultivation. In hillsides, local villagers adapted to the mountainous environment, and planted chestnut trees by building terraces on the slopes. Chestnut forests in the heritage site not only produce chestnuts to maintain the livelihood of local villagers, but also function to water and soil conservation and windblown sand protection together with woodlands and shrublands.

Farmlands are located in flat valleys around the villages, including paddy field, dry land, and irrigated land. The average elevation of farmlands is 359.06 m, and average slope is 8.60°. Corn, soybean, millet and other crops grown here can supply foods for the system. In addition, crop straw also provides nutritious green manure for chestnut trees.

Villages are often scattered in flat valleys near water bodies, with an average elevation and slope of 343.42 m and 7.69°, respectively. Villages are the living and resting places for the villagers in the heritage site, and they are also the places where the chestnut is processed and stored. Human and animal feces produced in villages provide organic fertilizer for chestnut trees. Additionally, villages are the inheritance of chestnut culture. Cultural characteristics related to chestnut, such as food, rituals and concept, have penetrated into the lives of local residents.

Rivers and other water bodies are located in the flat valley zone. The terrain of waters is the lowest compared with other landscapes, with the average elevation and slope are 223.56m and 7.31°, respectively. The heritage site have several rivers and lakes, including the Puhe, Luanhe and Changhe rivers, as well as Panjiakou reservoirs. These water bodies provide water supply for the residents' life and production. River sand is an important material for chestnut storage.

Table 11 Altitude and slope distribution of the main landscape elements of the heritage system

	Altitude (meter)			Slope (degree)		
	Average	Minimum	Maximum	Average	Minimum	Maximum
Chestnut forest	414.45	173.00	1,184.00	11.88	0.00	59.64
<i>Pinus tabulaeformis</i> forest	445.94	192.00	1,126.00	18.74	0.00	58.93
Other forest	530.58	177.00	1,248.00	19.67	0.00	60.48
Cultivated land	359.06	176.00	982.00	8.60	0.00	52.44
Residential area	343.42	176.00	921.00	7.69	0.00	44.16
Water area	223.56	114.00	828.00	7.31	0.00	47.81

To efficiently use water and soil resources in areas with mountainous terrains, local people have explored a variety of production systems regarding complex intercropping under chestnut trees in accordance with the local conditions and established a complex planting landscape featuring intercropping under chestnut trees. The complex landscape mainly includes: ① Intercropping of agricultural crops in the chestnut forest. Maize, soybean, adzuki bean, green onion, radish, pumpkin, and other crops are usually intercropped under the chestnut trees; ② Fungi cultivation under chestnut trees. The fungi like *grifola frondosa* are usually cultivated; ③ Poultry raising under chestnut trees. Chickens, geese, rabbits, and other poultry are raised; ④ Medicinal materials cultivation under chestnut trees. The medicinal materials like *scutellaria baicalensis*

gorgi are planted here. These complex landscapes are mainly distributed in the lower part of the chestnut forest area, that is, the lower part of the hillside near the villages. Intercropping crops, fungi, poultry, and medicinal materials require a lot of artificial cultivation and breeding. The lower part of the hillside is close to the residential area, which is convenient for local villagers' field management. These complex landscapes are established by making full use of the water and soil resources under the chestnut forest. This can not only expand the limited cultivated land resources in the mountainous area, but also reduce the diseases and insect pests in the fruit trees and improve the fertility of the soil, which is conducive to the healthy growth of the chestnut trees.

- **Ecological functions of chestnut forests**

Soil and water conservation: Chestnut trees are mainly distributed in the mountain area in Kuancheng. The chestnut forest not only can produce huge economic benefits, but also plays an obvious role in soil and water conservation. First of all, the canopy of the chestnut forest can intercept a considerable amount of precipitation, weaken the intensity of rainstorms and prolong the falling time of rainwater. The plants intercropped and relay intercropped under the trees can also buffer the impact of rainwater, reducing the sudden direct impact of the rainwater to the soil, so that the soil structure, especially the soil porosity, will not be destroyed due to the beating of raindrops. In this case, a high soil infiltration rate can be maintained in the woodland, and the intensity of surface runoff can be reduced. Studies show that the average soil infiltration rate in chestnut forests can reach 11.7mm/min, which is significantly higher than 8.59mm/min for slope farmland and 7.98 mm/min for barren land, 46.62% higher than that in the barren land. Moreover, the surface runoff and runoff coefficient of the

chestnut forest are also significantly lower than that of the sloping farmland.⁵ Secondly, the stereoscopic planting structure of the complex cultivated chestnut forest plays a positive role in storing and purifying the water by virtue of its developed root system, the thick layer of fallen branches and leaves, and woodland soil layer which can properly intercept, absorb and accumulate the rainfalls. The well-developed root system has an obvious holding effect on the soil, especially on the surface soil, and it can also prevent soil erosion. According to researches, the amount of root system of the mature chestnut forest can reach 614.7g/m² (by dry weight) in the 0~30cm upper soil horizons, far higher than the 125.3 g/m² of barren land and 42.7 g/m² of farmland; the soil loss can be reduced by 32.65t/hm² and the organic materials in the soil can be reduced by 245.58kg/hm² in the chestnut forest when compared with that in a slope farmland^{4,5}. In addition, before planting chestnuts, farmers usually build terraces, which have an obvious role in regulating the surface runoff (Figure 63). The horizontal steps and trenches, on the one hand, can increase the infiltration of rainwater and the water content of the soil to ensure water supply to the chestnut trees; on the other hand, the trenches can catch runoff, reduce the flow velocity of the runoff, and prevent erosion to the surface soil. Farmers plant perennial grass shrubs like *amorpha fruticosa linn.* and *melilotus suaveolens Ledeb.* in contour trenches and slopes, and take such measures as covering the tree base with straw and cultivating grass, to alleviate the erosion to the surface soil and give play to the role of soil and water conservation. Studies show that, after construction of the terraces, the surface runoff decreased from 6,300m³/km² to 4,500m³/km² per year, with a reduction of 28.57%; the erosion modulus decreased from 1,000~1,300t/km² to 30~200 t/km² per year, with the water conservation capacity up to

⁵ Xu Zhongqi, Li Wenhua, Zheng Junbao, et al. Studies on ability of holding water and preventing erosion of different land use ways in Taihang Mountain Area[J]. Journal of Soil and Water Conservation, 2004(04): 101-104.

6.5×10^3 t/km², showing obvious water conservation effect⁶.

Table 12 Soil and water conservation function of chestnut forest

Land use	Root coefficient (g/m ²)	Infiltration rate (mm/min)	Water absorption of litter (t/ha)	Runoff (m ³ /km ² ·a)	Erosion modulus (t/km ² ·a)
Chestnut forest	614.7	11.71	12.5	4500	30-200
Abandoned land	125.3	7.98	5.8	6300	1000-1300

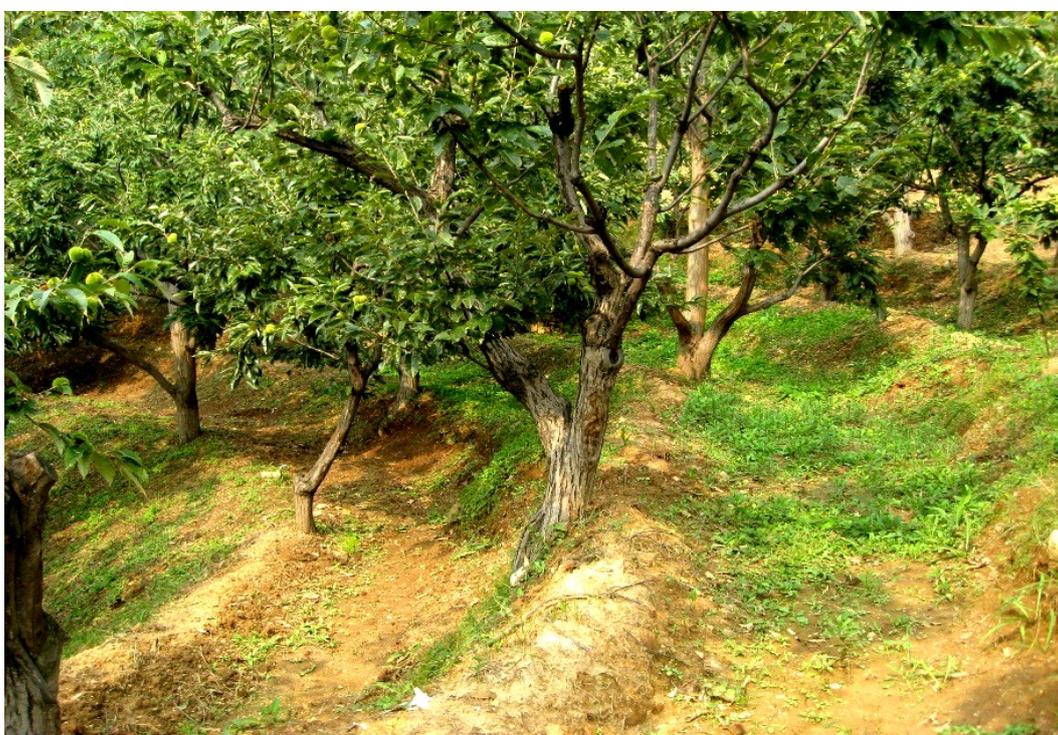


Figure 63 The soil and water conservation of chestnut trees

Climate regulation: The chestnut forest has an area of nearly half of the total forest land in Kuancheng. Chestnut planting plays an important role in capturing and storing carbon, releasing oxygen, and regulating the climate. Through photosynthesis, the

⁶ Qi Jiyang, Zhang Fu, Zhao Chuanyan, et al. Analysis on relationship between soil erosion and land use in Chenggou River Basin based on GIS and RS[J]. Journal of Gansu Agricultural University, 2018, 53(02): 94-102.

chestnut forest absorbs CO₂ to capture and store the carbon in the atmosphere and at the same time produces organic matter and releases O₂. This is also an important mechanism of the earth system to maintain the balance of the atmosphere. According to preliminary estimates, the chestnut forest per square kilometer can assimilate about 2,180 tons of CO₂ per year, equivalent to 600 tons of pure carbon, and release about 1,600 tons of O₂ per year. The chestnut forest has a strong effect on carbon sequestration, and it is of reference significance for the agricultural production in mountain areas to cope with global climate change. The shading of the tree canopy and the evapotranspiration occurring during the growth of the chestnut forest play a role in regulating temperature, humidity, evaporation, evapotranspiration, and rainfalls in this area. Studies show that, due to the planting of chestnut trees, the light intensity is reduced by 22.9% to 58.6%, the temperature is reduced by 1~3°C and the relative humidity is raised by 1.1%~7.6% under the trees⁷; in the traditional cultivation mode, understory intercropping can further reduce the temperature on the ground and increase the humidity under the trees⁸. In addition, the chestnut forest also has the function of purifying the environment, including absorbing pollutants, capturing dust, killing germs, and reducing noise. According to the preliminary estimates, the chestnut forest per square kilometers can absorb about 6.4 tons of SO₂ per year, purify about 450 kg of nitrogen oxides (NO_x), and capture about 690 tons of dust. Kuancheng is rich in iron and gold mineral resources, and it is also an important mining area. A large amount of dust and pollutants will be generated during the exploitation of the mineral resources. Therefore, the environmental purification effect of the chestnut forest plays an extremely important role in maintaining the local air quality.

⁷ Liu Qin. Study on interplanting effect of chestnut in tea garden[J]. *Forestry Prospect and Design*, 2002(2): 88-89.

⁸ Xiang Shanshan, et al. Microclimate and soil property effects of Chinese chestnut-traditional Chinese medicine interplanting in hilly regions of Dabie mountain area [J]. *Journal of Central South University of Forestry & Technology*, 2018, 38(3): 82-87.

(3) Agricultural landscapes

The Kuancheng Traditional Chestnut Eco-Planting System is an organic combination of different landscape elements. The main landscape elements are forests, including chestnut forests, other commercial fruit tree forests, deciduous broad-leaved forests, evergreen coniferous forests, and deciduous coniferous forests. Other vegetation landscapes include shrubs, arid lands, paddy fields, irrigated land, and grassland. There are also non-vegetation landscapes such as residential areas, waters like rivers and reservoirs, and bare lands (Figure 64). The forest is the dominant landscape type of the heritage system, having an area of 36,736 ha (68.56% of total land). Among them, deciduous broadleaved forest accounted for 37.74%, chestnut forest accounted for 22.83%, shrubland accounted for 13.60%, and *Pinus tabuliformis* forest accounted for 5.63% (Figure 65).

Chestnut forest is one of the most important forest species in the area. The total area of the chestnut forest in the heritage system reached 12,231 ha, accounting for 33.30% of the total forest area and 22.83% of the total land area of the heritage system. Chestnut forests are mainly distributed around residential areas and cultivated lands along the Baohe, the Luanhe, the Qinglong, and the Changhe river valleys. The chestnut forest ages from young to 146 years, which fully reflects the long history and sustainability of the heritage system. In addition to the chestnut forest, there are also apple trees, pear trees, jujube trees, peach trees, and other fruit trees growing in the heritage site.

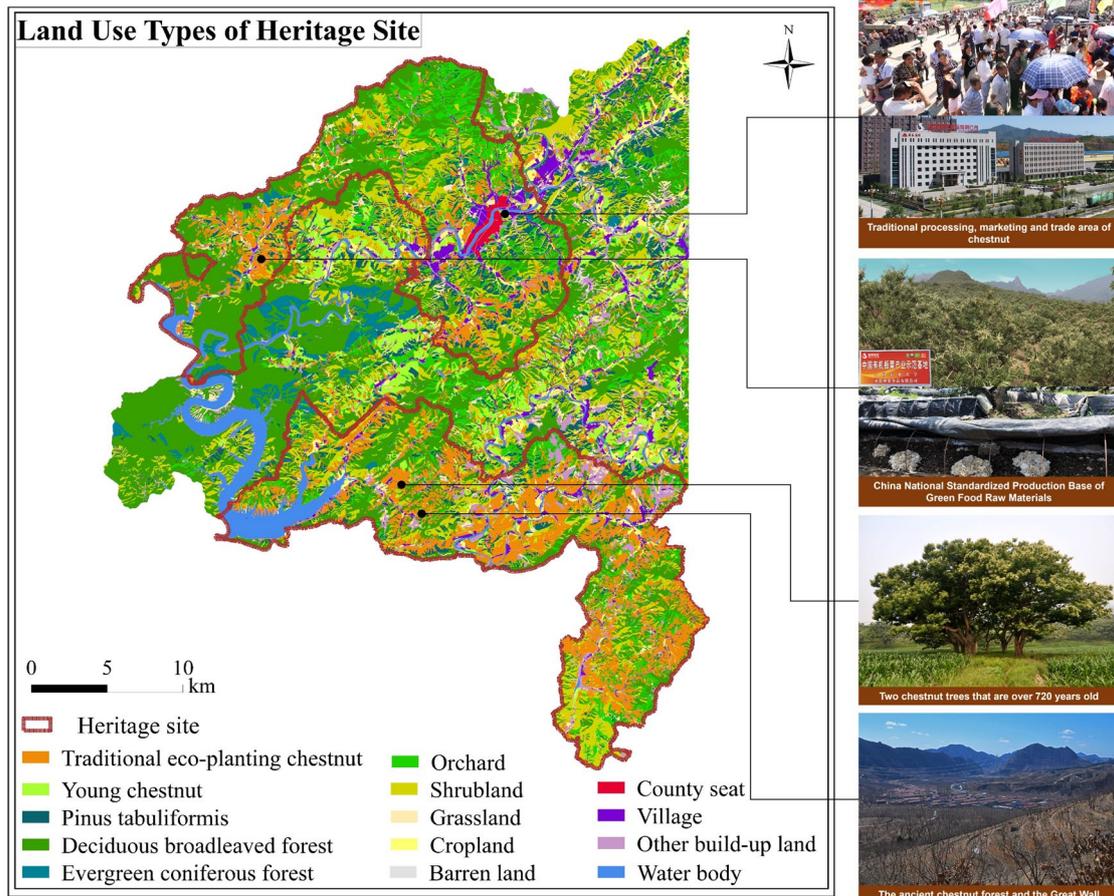


Figure 64 Land-use map of the heritage system

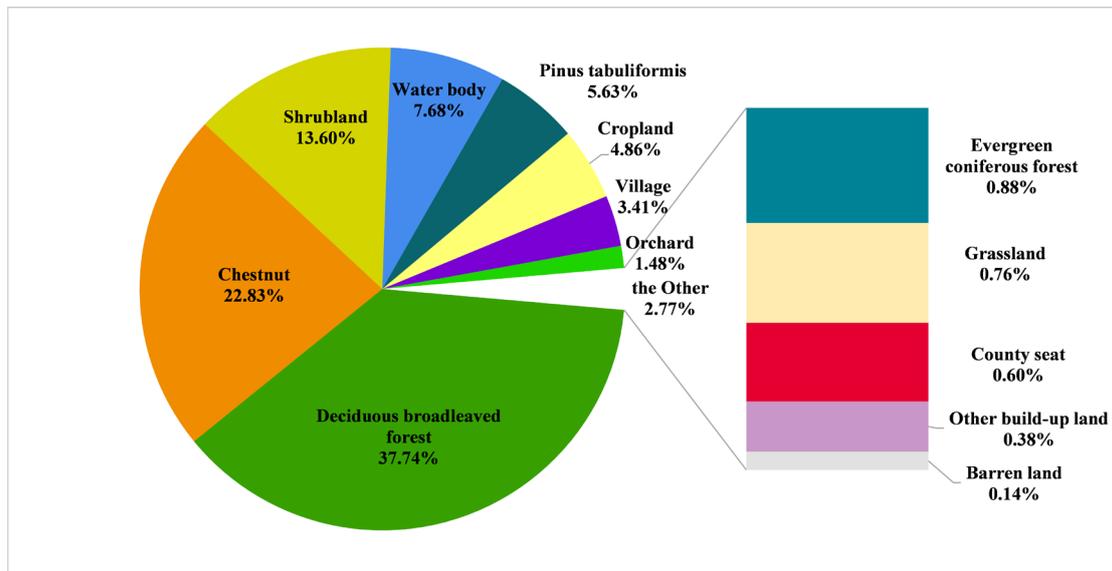


Figure 65 Main landscape types and proportion of their areas in the heritage system

The background of the landscape is deciduous broadleaved forest in the temperate zone,

the zonal vegetation of the heritage site. The main tree species include *Quercus mongolica*, *Robinia pseudoacacia*, *Populus przewalskii*, *Ulmus pumila*, and *Salix babylonica*, located mainly in the middle and upper parts of the sunny slopes of the mountains; the *Pinus tabuliformis* forest can be commonly seen in the shady slopes. The *Pinus tabuliformis* forest, together with the deciduous broad-leaved forest, plays an important role in soil and water conservation. The commercial forests dominated by chestnut trees are mainly distributed in the lower part with deep soil horizons and gentle slopes, while the waters and farmlands are in the valleys between the mountains, forming a landscape pattern of “soil and water conservation forest featuring that the trees that can function against wind are planted on mountain tops and fruit trees are planted on mountainsides and hillsides”. Such spatial pattern ensures the stability of the chestnut cultivation system in Kuancheng County, and at the same time realizes the effective use of water and soil resources.

In the heritage system, the chestnut trees are distributed all over the mountains and hills and denser in the southern and central areas, which is a marvelous sight. The chestnut forests in the area fall into the chestnut forests in flat areas and the chestnut forests in mountainous terrace areas according to the form of the ground surface (Figure 66). The flat land in the river valley is mostly covered with residential areas and farmlands. The chestnut forest in the flat area has a relatively small area and it is concentrated in Aiyukou and other places. The mountain areas are vast in area. In the large area of terraced fields on the gentle slopes with relatively low elevations along the river valley, the chestnut forests are mainly distributed in the terraced fields in mountain areas along the river valley.



Figure 66 Chestnut forest on flat land (left) and chestnut forest in terraced fields of mountainous areas (right)

Affected by early army farming and planting encourage by the government, chestnut forests are most densely distributed in the towns of Huajian, Songling, Nianziyu, and Boluotai along the Great Wall (Figure 67). In Aiyukou and other places, the Great Wall winds and stands upright along the ridge, and the chestnut forests all over the mountains and the Great Wall complement each other, forming a unique human landscape. In terms of area, the chestnut forest in Songling Town is 2,922 ha, the largest one in the six towns in the heritage site. The chestnut forests occupy an area of 2,139 ha, 2,005 ha, 1,967 ha, 1,769 ha, and 1,430 ha respectively in Kuancheng, Huajian, Boluotai, Nianziyu, and Tashan (Table 13). The area of the chestnut forest area is 93.91% of that of the artificial orchard, and the chestnut tree is also the main local commercial tree species.



Figure 67 Chestnut forest and the Great Wall in Aiyukou Village in Nianziyu Town

Table 13 Area and proportion of chestnut forests in each town in the heritage system

Town name	Chestnut forest (ha)	Total land		Forest land		Orchard land	
		Area (ha)	Propotion (%)	Area (ha)	Propotion (%)	Area (ha)	Propotion (%)
Boluotai	1,967	8,080	24.34	6,075	32.37	2,028	96.97
Huajian	2,005	6,221	32.23	4,027	49.80	2,074	96.69
Kuancheng	2,139	17,400	12.29	11,251	19.01	2,644	80.91
Songling	2,922	4,844	60.32	3,494	83.62	2,931	99.69
Nianziyu	1,769	8,730	20.26	4,937	35.84	1,779	99.44
Tanshan	1,430	8,306	17.21	6,952	20.57	1,570	91.08
Sum	12,231	53,581	22.83	36,736	33.30	13,025	93.90

(4) Landscape changes with seasons in the heritage system

The chestnut forests in the heritage system are scattered all over the mountains, and the landscape features are quite different in different seasons, presenting high landscape

aesthetic value. Starting from April, the grasses and shrubs under the trees begin to turn green, and the chestnut trees gradually sprout. Spring is in the air across the whole area. Summer comes in July. The chestnut forests are flourishing with luxuriant foliage, other woodlands and shrubs are also lush, and the heritage site is immersed in the green. In autumn from September to October, the chestnut enters the maturity stage, many thin green thorny balls containing the chestnut fruit in them are covering the tree. After the chestnuts are mature, the outer skin of the chestnut covered with thorns naturally splitting to reveal the brown-red seeds. Then the seeds will fall to the ground, and then we can start the harvest. In winter, the leaves of chestnut trees are withered, the ground is covered with white snow, and the new life of the next year is bred in tranquility.



Chestnut forest in spring



Chestnut forest in summer



Chestnut forest in autumn



Chestnut forest in winter

Figure 68 Landscape of chestnut forests in four seasons

(5) Sustainability and resilience

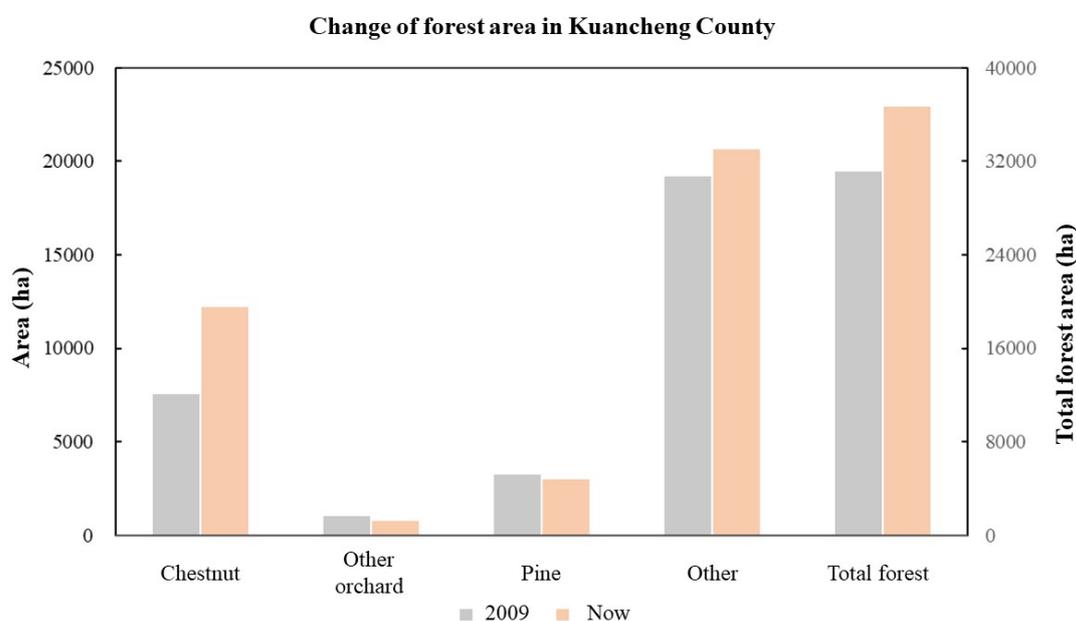


Figure 69 Change of forest area in Kuancheng County

Forest Resource Survey data from 2009 to the present shows that the local forest area increased from 31,191 ha in 2009 to 36,736 ha, an increase of 17.78 percent (5,545 ha). The most significant increase in area was in chestnut forests, which expanded from 7,613 ha to 12,231 ha, an increase of 60.66 percent (4,618 ha). The pine forest and other trees decreased slightly from 3,295 ha and 1,047 ha to 3,016 ha and 794 ha, respectively, while the other woodlands expanded slightly from 19,236 ha to 20,695 ha (Figure 69).

Through the analysis of forest area change (Figure 69), we can conclude that the area of chestnut forest has increased in the past ten years. It can be seen around the six townships of the heritage system and other regions. But it is mainly concentrated outside the six townships involved in the heritage system (Figure 65). The increase in chestnut trees is due mainly to the expansion of forests throughout Kuancheng County and, to a lesser extent, to farmers increasing the density of pre-existing chestnut or other forests. Our analysis of forest data and interviews with local land management

authorities revealed that most of these expanded forests in Kuancheng County used to be wastelands, with a small part being farmland (many forests in China were converted to cropland in the 1950s to ensure food security). The local government and residents have expanded forests over the past ten years to improve the soil and water environment and restore vegetation. The chestnut forest area increased the most because chestnut is the local native and dominant tree, and the local government and residents believe that chestnut forest is the most accessible tree to grow in the local area. It should be pointed out that the new chestnut forest is planted naturally following traditional methods and local native varieties. Thus, we believe the increase in chestnut cannot disrupt the heritage system and significantly pressure natural resources and forests.

3. Action Plan for the Proposed GIAHS Site

The action plan is based on a survey of stakeholders (smallholder farmers, government officials, company managers, and academics) in the heritage system, including perceptions, participation, and suggestions for the heritage system (Figure 70). The action plan was discussed by government officials, entrepreneurs, farmers' representatives, experts, and scholars involved in the heritage system, and the comments made were incorporated into the action plan (Figure 71).



Figure 70 The field survey of stakeholders



Figure 71 The discussion of stakeholders

3.1. Threats and Challenges

(1) Social economy

- **Trend of loss of young and middle-aged labor forces engaged in agricultural production**

Though the labor forces engaged in chestnut production and operation in the heritage system are mainly aged 31 to 50 years old, the characteristics are presented in of two aspects: first, there are very few employees under the age of 30, accounting for only 3.7%; secondly, the number of male employees aged 31 to 40 is far higher than that of 41 to 50. This reflects that there is a risk of labor loss as the willingness of young and middle-aged adults, especially the male young adults, to engage in agricultural production is on a declining trend. The heritage system is in mountain areas with relatively poor land resources and farmers here generally have a relatively low income, so farmers have a strong desire to increase their income. Therefore, driven by the desire to increase income, the young and middle-aged labor force has a strong motivation to work outside. As indicated in the survey data regarding farm households, there are 53% households, more than 50% of the total household income of whom come from working

outside. In addition, 77.3% of households have family members who work outside, and 27.5% of families have more than two family members who work outside. The main reasons for this phenomenon are as follows: first, chestnut planting requires higher requirement in technology and stronger labor intensity; secondly, the young do not have enough understanding about the historical and cultural value of chestnut cultivation and lack emotional sustenance for chestnuts. The possible outflows of young and middle-aged labor forces will threaten the protection and development of the heritage system: first, relatively fixed input of manpower is required for the cultivation and management of chestnuts, especially for the construction of contour trenches, intercropping in the forest, pruning and other measures, manpower is required to operate at the corresponding time nodes. Due to lack of labor, these management measures have been cut down; secondly, the pursuit of economic benefits by local farm households leads to higher requirements for output efficiency and reduction of the initiative for traditional chestnut cultivation, which poses a threat to the protection and development of the heritage system.

On the other hand, there is a shortage of technical talents among the personnel who are engaged in chestnut cultivation and management. Farmers in the heritage site have accumulated a lot of valuable techniques and management experience in chestnut cultivation from the production practices over thousands of years. In a traditional farming society with an ultra-stable structure, these traditional techniques and experiences can be passed down more easily by word of mouth and through production practices and become the most precious wealth and knowledge in the local areas. However, with the continuous advancement of the modern urbanization process, the new generation of farmers are increasingly leaving the countryside, and such ultra-stable structure is gradually being broken. The way to pass down the techniques by word of mouth has been challenged by the increasing population mobility. Many traditional agricultural production techniques and experiences, including traditional

chestnut cultivation techniques and management experience, have few worthy successors. On the other hand, there are also certain obstacles in transmitting new chestnut cultivation technologies to farmers. This has led to a relatively serious shortage of technical talent in chestnut cultivation. Many small farm households plant the chestnut trees by relying on natural conditions, thus affecting the sustainable development of the heritage system.

- **The balance between smallholder farming and scale operation of chestnut production is facing challenges**

The chestnut production in the heritage system is mainly conducted by scattered smallholder farmers, and it has better environmental, economic, and social adaptability for a long period of time. With the further development of the marketization, the shortcomings of the smallholder farming operations have also emerged. On the one hand, with the increase in labor costs, the opportunity cost for planting chestnuts is on a continuous rise, affecting the labor input of small farm households. On the other hand, when facing the big market, the small farm households usually have some problems of insufficient capability arising from their own weakness, such as poor communication of information, weak ability to resist risks and low professional degree, etc., resulting in high management costs and difficulty in obtaining the benefits from the economies of scale. In this context, the development trends are presented in two aspects. Firstly, the chestnut production in large-scale planting and specialized operation is established through forestland transfer and circulation; secondly, the small farm households are organized through the specialized farmers' cooperatives, to improve the planting technology, reduce operating costs and obtain the economy of scale with specialized services. However, scale operation may result in homogeneous chestnut variety, cultivation methods, and technical applications, which is not conducive to the maintenance of the agricultural biodiversity and the inheritance of the traditional knowledge within the heritage system. It is a challenge for the heritage system in the

process of production and operation to find a balance between smallholder farming operation and large-scale operation to give full play to their respective advantages and restrain their shortcomings.

(2) Environment

● Mountain areas face the risk of soil erosion and water loss in summer

Kuancheng has a typical temperate continental monsoon climate, with precipitation concentrated in summer, and floods frequently occurring from July to August every year. Since 1990, from July to August each year, there is a period during which the highest intensity of precipitation will occur in Kuancheng in a year, and there are one or more torrential rains with daily precipitation exceeding 50mm. Most of the areas in Kuancheng are mountainous with steep terrains and narrow valleys. The areas with more rainfalls are characterized by the strong erosion of flowing water, broken ground surface, and many gullies generated from flowing rainwater, which is prone to generating regional surface waterlogging, mudslides, and other phenomena leading to soil erosion and water loss. Local farm households, according to local conditions, plant chestnut forests, construct check dams, horizontal contour trenches, fish-scale pits, ponds, small reservoirs, and water collection cellars to catch runoff, which effectively reduces the erosion of surface soil and alleviates the soil erosion and water loss. However, in summer when precipitation is concentrated, regional waterlogging, mudslides, and other soil erosion problems are still important factors restricting the growth of local chestnut forests.

● Drought restricts the growth of chestnut forests

The heritage site has a semi-arid and semi-humid continental monsoon mountainous climate in the warm-temperate zone, with annual precipitation ranging from 550 to 750 mm and sufficient sunshine throughout the year. Affected by monsoons, topography, and other factors, the heritage site has fewer rainfalls with extremely uneven-distributed

precipitation during the year and across different places. The winter and spring are dry with fewer rains, and the precipitation gradually decreases from south to north with large inter-annual variations. The uneven distribution of precipitation between regions, seasons, and years can easily cause seasonal droughts, which will affect the growth of chestnut forests. As the global climate warms, the average temperature in the area where the heritage site is located is also on a rise, showing a growing risk of drought. How to reduce the impact of climatic drought on the chestnut forest in the heritage site is an urgent problem to be solved in the chestnut cultivation system.

(3) Cultural inheritance

- **The technical support system needs to be strengthened and improved**

Chestnut cultivation is an agricultural production model that requires sufficient technical support to achieve fine management. Technical persons who are knowledgeable of constructing contour trenches, under-forest intercropping, pruning, and other measures are required to provide instructions during the traditional chestnut cultivation process; with the promotion of organic production of chestnuts, the role of professional technology in chestnut cultivation has become more and more significant. However, whether it is traditional cultivation or organic production of chestnut, small farm households lack the corresponding technical support. In addition, the work by using the traditional cultivation technology features complex process and low yield, as well as the high quality and rich cultural value, etc. Therefore, compared with the products of chestnut that is cultivated with modern technology, the products of chestnut cultivated with traditional technologies should have a higher market price. However, the advantage in the price for the traditional chestnut has not yet been reflected, which results in farmers' low enthusiasm for cultivating chestnuts with the traditional technology. Therefore, we should strengthen the propaganda and promotion of the chestnut and raise the price, so as to enhance the initiative of local farmers for cultivating chestnuts in traditional modes.

- **The inheritance and utilization of agricultural culture is relatively weak**

The Kuancheng Traditional Chestnut Eco-Planting System contains diverse and mixed cultures, forming a unique regional agricultural culture. However, as it had long been under the jurisdiction of northern ethnic minorities in history, and it was located at the crucial place carrying cultural and military conflicts, Kuancheng has been slow in agriculture development with relative weak succession of agricultural culture for a long period of time. Since the Qing Dynasty, agricultural production has been conducted in army farming and Huangzhuang farming form. As the production and culture mostly revolved around the will of the ruling class, the development and succession of the folk culture have been hindered. So far for the cultural inheritance, its diverse values and characteristics have been weak. Under the current conditions that the rural revitalization strategy is implemented with vigorous efforts, the cohesion, driving force, and vitality of traditional farming culture to achieve cultural revitalization are weak, the cultural characteristics available for development are insufficiently tapped and utilized, and no complete systems are established for building talents, funds, policies and brands, which does not match with the national needs for the revitalization of rural culture.

3.2. Potentials and Opportunities

(1) Potentials

- **The good natural environment is conducive to the conservation and development of the heritage system**

Kuancheng is rich in sunlight resources, with rains and hot weather coming in the same season and large temperature difference between day and night in autumn, which is conducive to the accumulation of photosynthetic products. The soil of the heritage site has suitable pH value and rich organic matter content, which provides superior conditions for the growth and quality improvement of chestnuts. Kuancheng chestnut has strong resistance to diseases, high sugar content, strong glutinousness, good gloss,

and easy peeling of the inner skin, which promotes the continuous expansion of the chestnut market and provides a guarantee for the livelihoods of local farm households. The traditional farmyard manure and pest control technology are used in the Kuancheng Traditional Chestnut Eco-Planting System, which has effectively reduced the use of fertilizer and pesticides in the local area, promoting the establishment of a standardized chest product base in Kuancheng to provide raw materials for national green food. In addition, the heritage system has good vegetation conditions, a high forest coverage rate, and high negative ion content in the air. It has the advantage of developing ecotourism such as summer escape and recuperation.

- **The heritage system contains rich traditional knowledge and culture**

Sayings and proverbs of farmers and Manchu culture are all external manifestations of the cultural connotation of the Kuancheng Traditional Chestnut Eco-Planting System. They constitute the essence and core of Kuancheng's local cultural heritage, support the agricultural production and life of local people and promote social development. During the social and economic development of Kuancheng, chestnut has been continuously intertwined with people's lives, forming a unique chestnut culture. As a complex agricultural system, the Kuancheng Traditional Chestnut Eco-Planting System incorporates the local people's artistic culture. The profound cultural deposits have played an important role in cultural function in the development and evolution of the complex agricultural system, and the traditional farming culture is inherited in the form of folk art.

- **Comprehensive development of the heritage system is conducive to potential enhancement**

The Kuancheng Traditional Chestnut Eco-Planting System has its unique heritage value reflecting in several aspects such as germplasm resources, agricultural landscape, cultivation technology, and chestnut culture. It has outstanding economic value, ecological value, social value, and cultural value, which are conducive to the self-

maintenance of the system and the popularity of the regional brand. Great potential exists in the industries related to the chestnut cultivation system. In addition to the primary and secondary industries such as chestnut cultivation and chestnut food deep processing, there is also broad room for development in industries such as leisure agriculture and ecotourism. A new rural development pattern of urban-rural integration is established in Kuancheng by building an industrial system integrating the primary, secondary and tertiary industry. That is, the primary sector based on chestnut and other forest fruit industry, the secondary sector based on forest fruit processing industry, and the tertiary sector centering around fruit picking, sightseeing, on-site experiencing, research & study, and other modes, together constitute the inherent advantages of the integrated development of the primary, secondary and tertiary sectors. With the help of the concept of industrial integration and development, we will broaden the channels for farmers to increase their income, accelerate the transformation of agricultural development modes, and drive the development of the regional economy.

- **Kuancheng has relatively convenient traffic with obvious advantages in its location**

The Beijing-Tianjin-Tangshan region, located in the central area of the Bohai Rim Region and the northern part of the Beijing-Tianjin-Hebei urban agglomeration, has taken an important position in the regional development strategy in China and played a radiating, serving, and leading role in the national and regional economy. Kuancheng is in the hinterland of this important northern economic triangle area, and it is the golden area with the strongest market radiation capability in the Beijing-Tianjin-Hebei urban agglomeration. Kuancheng is 80km away from downtown Chengde, and less than 3 hours' drive from Beijing, Tianjin, Qinhuangdao, and Tangshan. Beijing-Chengde Expressway and Chengde-Qinhuangdao Highway and other highways connect Kuancheng and cities like Beijing, Tianjin, Chengde, Qinhuangdao, and Tangshan, providing more convenience. The convenient transportation and superior location

conditions put Kuancheng in a good position for developing leisure agriculture and cultural tourism in the heritage site.

(2) Opportunities

- **Governments at all levels have attached great importance to the conservation of the heritage system**

The Chinese government has long attached importance to the conservation of Important Agricultural Heritage Systems (IAHS). The Kuancheng Traditional Chestnut Eco-Planting System was designated as the China Nationally Important Agricultural Heritage Systems (China-NIAHS) by the Ministry of Agriculture and Rural Affairs of China in 2014. With the issue of *Management Measures for Important Agricultural Heritage Systems* and the launch of the nationwide census on the agricultural heritage system, the tapping and protection of the important agricultural heritage system have gradually advanced to regular and institutionalized mode, and the influence of the agricultural heritage brand has increased day by day. The Ministry of Agriculture and Rural Affairs of China periodically organizes a series of activities such as exchanges and seminars at various heritage sites and has issued several policies to support the protection and development of the heritage.

The People's Government of Hebei Province, the People's Government of Chengde City, and the People's Government of Kuancheng Manchu Autonomous County have attached great importance to the protection of the agricultural heritage system, and provide supports on policies, funds, and personnel to ensure the smooth development of the protection and development of the heritage. After successfully applying for China's important agricultural heritage system, Kuancheng established a coordination system and a special agency to make adequate preparations for the application of the Globally Important Agricultural Heritage Systems (GIAHS) through effective implementation of protection measures and proactive efforts on publicity. Relying on

the academies of scientific research, the People's Government of Kuancheng Manchu Autonomous County, by seeking a multi-participation mechanism, has organized seminars and academic exchange meetings on many occasions based on the opinions of experts.

- **Positioning of Zhangjiakou and Chengde Ecological Function Zone to promote ecological production**

The coordinated development of Beijing-Tianjin-Hebei has become a national strategy, and Zhangjiakou and Chengde Ecological Function Zone has become an important ecological guarantee for the development around Beijing. As highlighted in the *Implementation Plan for Ecological Protection and Restoration in Zhangjiakou and Chengde Region, Hebei* issued in Hebei province, centralized efforts shall be made for the chestnut, an advantaged product growing in hills, to advance its efficient development and promote the expansion in scale and improvement in quality of the “fruit plate” in the Beijing-Tianjin-Hebei region. In addition, policies and fiscal funds shall also flow to develop the under-forest economy and diversified businesses in Zhangjiakou and Chengde Region. The traditional chestnut cultivation of the heritage system in Kuancheng, as a kind of ecological production mode, can help maintain the production function of agricultural products and have ecological functions of protecting the system's biodiversity and water conservation, making significant contributions to the ecological conservation of the Beijing-Tianjin-Hebei region. Additionally, sited in Zhangjiakou and Chengde Ecological Function Zone, Kuancheng can obtain more policy supports including ecological compensation for the heritage site in Kuancheng. The development of this region can be promoted through related supports in such aspects as fiscal funds, land, and talents.

- **The people's increasing demand for food security and richness promotes the consumption of agricultural products**

With the rapid development of the social economy, people's demand for health has gradually transformed into requirements for food security and richness, and the demand for agricultural products has gradually changed from quantity to quality. On the one hand, people have a growing demand for non-staple food, snacks, and leisure food after their needs for food and clothing are satisfied. The diversity and taste of the processed agricultural products has gradually become the focus of the consumers. In this context, chestnut can not only be used as a food supplement, but also further enrich the types of snacks and leisure foods. On the other hand, people are paying more and more attention to safe, green, and healthy processed agricultural products. The ecological production mode of the Kuancheng Traditional Chestnut Eco-Planting System guarantees the safety of the processed chestnut food and the richness of nutrients, which is more in line with the ecological and security needs of the people in the modern society and has greater potential for market development, thus providing a good opportunity for the protection and development of the heritage system.

- **The leisure agriculture project around the heritage system contributes to the rural revitalization**

In recent years, the urban residents have a growing increase in living pressure and their demand for leisure activities in suburban & rural areas has been on a continuous rise. Therefore, leisure agriculture has become an important part of residents' lives. The agricultural heritage system in the Kuancheng Traditional Chestnut Eco-Planting System is multi-functional with various elements and conditions required for the development of leisure agriculture. It is an important resource for tourism, leisure, and health. The abundant fruit tree resources, beautiful natural environment, and unique cultural resources have contributed to the foundation for creating tourism and recreation sites in Kuancheng. Urban residents can be provided with a place for leisure and recreation. The coordinated development of the Beijing-Tianjin-Hebei region plays a role in promoting leisure agriculture in heritage sites. For example, as mentioned in the

framework agreement on the coordinated development of leisure agriculture signed by Beijing, Tianjin, and Hebei, the three cities should cooperate on planning the construction of leisure agriculture and unification of the standard leisure agriculture system, build boutique tourism routes to leisure agriculture sites in concerted efforts and jointly plan major leisure agricultural activities. The geographical advantage of Kuancheng will make it an important beneficiary from such cooperation.

- **The national green development strategy regarding agriculture contributes to the dynamic conservation of the heritage system**

To promote structural reforms on the agricultural supply side and sustainable agricultural development of agriculture, the Chinese government has proposed a series of decision-making arrangements to promote the development of green agriculture. The decisions made and actions taken are all based on the concept of reducing waste in resources, pollution reduction, and ecological degradation, to ensure the supply of green and high-quality agricultural products and ecological products. The Kuancheng Traditional Chestnut Eco-Planting System, as a complex ecological model, is fully adapted to the requirements of this development strategy. Ecological production can not only guarantee the continuous supply of agricultural products, but also guarantee the sustainable conservation of the ecosystem. In addition, the various by-products of agriculture and forestry, and leisure products including chestnut output from the system have also laid a foundation for meeting the growing needs of the people. The measures taken in the national green development strategy regarding agriculture have pointed out the direction for the sustainable use of the heritage system, and provided policy supports for the innovation-driven development of the agricultural heritage sites.

3.3. Actions Taken

Since 2014, the Party Committee and People's Government of Kuancheng Manchu Autonomous County, adhering to the general requirements of "conserving it in

excavation and inheriting it in utilization”, have taken a series of actions in organizational support, scientific research, protection of heritage resources, publicity & promotion and building of brands to promote the conservation and development of the Kuancheng Traditional Chestnut Eco-Planting System.

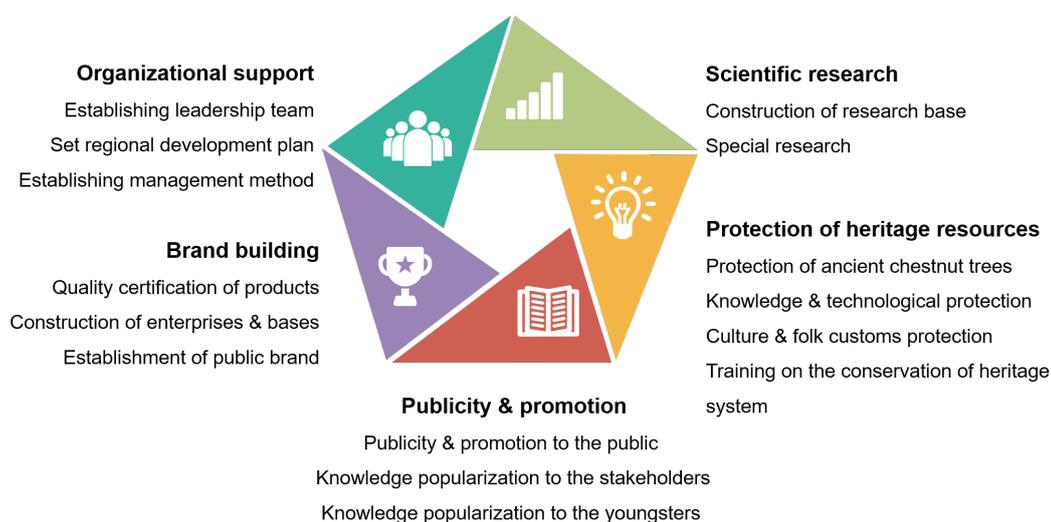


Figure 72 Actions taken to conservation the heritage system

(1) Organizational support

● Establishing a leadership team for heritage conservation and development

The Party Committee and People’s Government of Kuancheng Manchu Autonomous County have established a leadership team for the conservation and development of the Kuancheng Traditional Chestnut Eco-Planting System and led the work on the conservation and development of the heritage system as well as the work regarding the application of GIAHS. The “GIAHS Conservation Center of Kuancheng Manchu Autonomous County” has been set up by the Bureau of Agriculture and Pasture, to explicitly identify the dedicated person to take charge of the conservation, succession, and development of the heritage system and the application of GIAHS.

● Incorporating the conservation and development of the heritage into the

regional development plan

The Party Committee and People's Government of Kuancheng Manchu Autonomous County have included the application and conservation of the heritage system in the "Thirteenth Five-Year Plan" and the *Government Work Report*, to identify the responsibilities & duties, and tasks of departments at all levels.

- **Establishing dedicated heritage management method**

The Party Committee and People's Government of Kuancheng Manchu Autonomous County have taken the lead in working out the *Management Regulation for Conservation and Development of the Kuancheng Traditional Chestnut Eco-Planting System* and the *Management Regulation for Use of Identification of the Agricultural Heritage System in the Kuancheng Traditional Chestnut Eco-Planting System*.

(2) Scientific research and capacity building

- **Construction of research base**

The local government of Kuancheng has established long-term cooperative relations with many domestic and foreign scientific research institutes such as the Chinese Academy of Sciences, Chinese Academy of Agricultural Sciences, and China Agricultural University, set Academician Workstations and Chestnut Industry Technology Research Institute to support the research related to the conservation and development of the heritage system.

- **Special research**

In 2018, ten all-round kinds of research on basic subjects were launched in Kuancheng, including research on the "history, culture, traditional knowledge, conservation and utilization of the Kuancheng Traditional Chestnut Eco-Planting System", and important research results were obtained, which provides important supports for the application of GIAHS.

(3) Protection of heritage resources

● Protection of ancient chestnut trees

Since 2018, Kuancheng has conducted a general survey, numbering and affixing signboards for the ancient chestnut trees that are aged more than 100 years throughout the county, to realize precise protection of the ancient chestnut tree resources.



Figure 73 Signboards affixing to ancient chestnut trees

● Traditional knowledge and technological protection

Kuancheng has started to collect and collate the techniques related to the traditional cultivation and maintenance and the knowledge related to the utilization of the chestnuts throughout the whole county and has basically completed the documented record of the traditional knowledge and techniques.

● Chestnut culture and folk customs protection

Kuancheng has collected and collated the culture and folklore related to the traditional cultivation of the chestnuts throughout the whole county, preliminarily realizing the protection of the culture and folk customs related to chestnuts in such forms as texts,

pictures, and videos.

- **Training on the conservation of heritage system**

A series of lectures on the conservation of heritage system has been held and trainings have been provided on the protection and utilization of the heritage system in Kuancheng for farmers, grassroots managerial personnel, and leading cadres, to popularize the basic knowledge about the heritage system to all the stakeholders involved in the heritage system conservation.

(4) Publicity and promotion

- **Publicity and promotion to the public**

On the one hand, China Central Television (CCTV) was invited to Kuancheng to shoot a documentary on Kuancheng Traditional Chestnut Eco-Planting System; in the front page and special page of the *Farmers Daily*, the “Kuancheng Traditional Chestnut Eco-Planting System” is published to promote and popularize the precious value of the system to the public. On the other hand, the festival activities like “Kuancheng Chestnut Flower Festival” and “Kuancheng Chestnut Picking Festival” have been hosted in Kuancheng for several consecutive years, to popularize the long history of chestnut culture to the public. In addition, the local government has set up an identification signboard in the center position of the county to promote the heritage system.



Figure 75 Scene of “Kuancheng Chestnut Picking Festival”

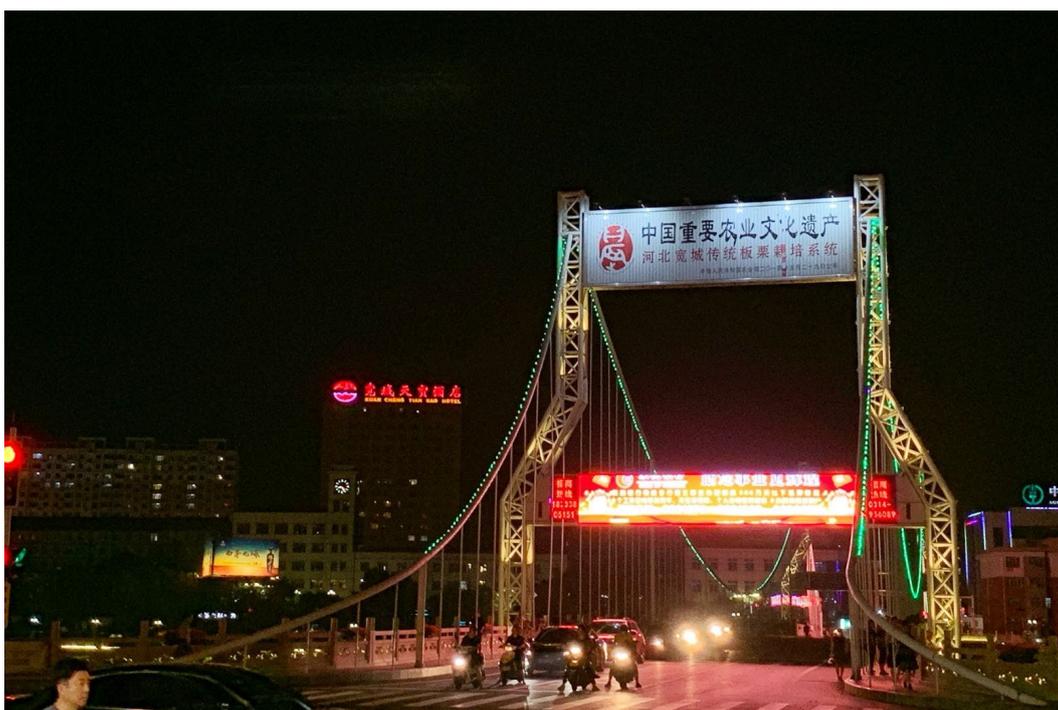


Figure 76 Promotion identification in the center position of Kuancheng County

- **Knowledge popularization to the stakeholders**

Firstly, a professional technical team was organized in Kuancheng to compile and publish the book of Kuancheng Traditional Chestnut Eco-Planting System, to introduce the heritage system to scientific researchers, management cadres, and the general public

from a professional and comprehensive perspective (Figure 73). Secondly, special lectures on agricultural heritage knowledge have been given in *Topics on Agriculture, Countryside and Farmers*, a special column held by Kuancheng Broadcasting Station, and brochures and tips about agricultural heritage system have been printed and distributed; identifications (monuments) for the heritage system have been set up in six core areas including Aiyukou and Datun; large outdoor billboards and LED screens have been provided on expressways and in urban areas, to increase the initiative of the local residents, especially the chestnut growers, to participate in the protection of the heritage system. Thirdly, we have proactively organized the heritage managerial personnel to participate in the conference of East Asia Research Association for Agricultural Heritage System (ERAHS) and China Academic Exchange Seminar on Agricultural Heritage Systems, and conducted field investigations to the GIAHS sites; organized companies concerned to actively participate in Agricultural Products Trade Fairs in Langfang, China National Organic and Green Food Expo, China International Agricultural Products Fair, China's First Important Agricultural Heritage Exhibition and other activities; invited well-known experts and scholars in China to visit Kuancheng and give speeches, to provide scientific suggestions on the conservation and development of the heritage system.



Figure 77 The popular science book of Kuancheng Traditional Chestnut Eco-Planting System



Figure 78 Identifications (Monuments) for China-NIAHS

- **Knowledge popularization to the youngsters**

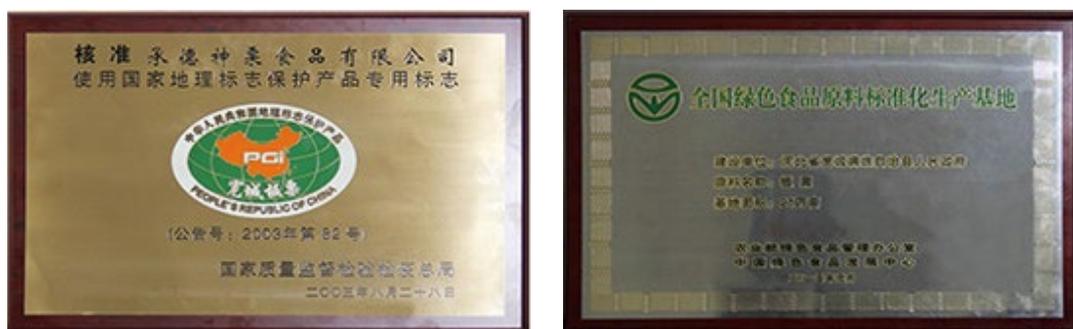
A series of activities have been organized by local government, such as Kuancheng agricultural heritage photography competitions, and composition competitions, speeches, and textbook plays about the Kuancheng Traditional Chestnut Eco-Planting System for all the primary and secondary school students around the county. In addition, local textbooks about the Kuancheng Traditional Chestnut Eco-Planting System have been compiled, to raise the attention of the young people to the Kuancheng Traditional Chestnut Eco-Planting System through classroom education and extracurricular activities.

(5) Brand building

- **Quality certification of agricultural products**

Kuancheng County has actively applied for certification of green and organic agricultural products with the Geographical Indication (GI), promoted the launch and sale of the packaged brand agricultural products, and participated in the appraisal of the chestnut products. Up to now, Kuancheng has been rated as “China National Excellent

Demonstration County for Standardized Chestnut Cultivation” by the General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ), “China National Standardized Production Base of Green Food Raw Materials” by the Ministry of Agriculture and Rural Affairs of the People’s Republic of China. Kuancheng chestnut has been listed as a GI protection product. The trademark of “Shenli” has been approved as a well-known trademark in China. The chestnut series products of Shenli brand have passed the certification of HACCP food safety system, ISO9001 international quality management system, BRC Japan JAC standards for organic foods, and other recognized certifications.



Certification of China National GI Protection Product

China National Standardized Production Base of Green Food Raw Materials

Figure 79 Some of the certifications currently obtained by Kuancheng Chestnuts

● Construction of leading enterprises and planting bases

In Kuancheng, a batch of large leading enterprises integrating production, supply, and sales have been cultivated, and the organic chestnut demonstration base has been established, preliminarily forming an industrialized business model of “enterprise+base+farm households”. In addition, a demonstration of chestnut protection and development has been set up and the demonstration results have been promoted.

● Establishment of public brand

In Kuancheng, the integration model of “public brand + corporate trademark” has been promoted to provide guidance for the enterprises so that the public brand can be used

according to the criteria required, to give play to the aggregation role of the public brand to the maximum extent as possible, so as to contribute to the trademarks and brands of enterprises. Kuancheng chestnut was rated as the “consumers’ most favorite regional public brand of agricultural products in 2017”. The series of agricultural products of the Shenli brand have been exported far to 28 countries and regions.

3.4. Actions to be Taken

(1) Comprehensive actions

- **Establishing the heritage management center for the Kuancheng Traditional Chestnut Eco-Planting System**

1) The Agricultural Heritage System Management Center is set under the Bureau of Agriculture and Rural Affairs of Kuancheng. Dedicated working staff are appointed to take charge of the conservation, development, and capability construction of the Kuancheng Traditional Chestnut Eco-Planting System.

2) The manning quotas will be increased for the heritage system management institutions, and the special management department and personnel for the agricultural heritage system will be added, to establish a staff echelon that consists of the old, middle-aged, and young people, ensuring the stability and sustainability of the management of the heritage system.

3) In the people’s governments of all towns and villages included in the heritage site, special full-time job posts will be set up for the protection and development of the important agricultural heritage system, trainings, instructions, inspections, supervisions, and other work related to the heritage protection and management will be implemented.

Time of implementation: 2023~2026.

Participants: The People's Government of Kuancheng Manchu Autonomous County and Kuancheng Commission Office for Public Sector Reform (KCOPSR).

● **Issuing management methods for protection and use of the Kuancheng Traditional Chestnut Eco-Planting System**

1) According to FAO's GIAHS selection principles and conservation requirements, *The Management Method for Conservation and Development of the Kuancheng Traditional Chestnut Eco-Planting System* and the *Management Method for Use of Identification of the Agricultural Heritage System in the Kuancheng Traditional Chestnut Eco-Planting System* will be further improved in detail on basis of *Management Method for Conservation and Development of the China Nationally Important Agricultural Heritage Systems*.

2) The collection of the LOGO design of the agricultural heritage system of the Kuancheng Traditional Chestnut Eco-Planting System will be promoted, the rules for the use and management of the LOGO of the Kuancheng Traditional Chestnut Eco-Planting System will be issued, to ensure that the heritage system and the rights of the users are well protected.

3) The work related to the conservation and development of the Kuancheng Traditional Chestnut Eco-Planting System will be incorporated in the outline of the "15th Five-Year Plan" of Kuancheng County and listed as one of the important topics in the annual government work report. The special funds for the conservation and development of the heritage system will be set up.

Time of implementation: 2022~2026.

Participants: The People's Government and Bureau of Agriculture and Rural Affairs of

Kuancheng Manchu Autonomous County.

- **Providing special funds for protection and development**

The special fund provided for the conservation and development of the heritage system is mainly used for supporting the cultivation of chestnut forest, construction of farmland water conservancy structures, protection of traditional germplasm resources, subsidies for traditional production mode, control of village style, improvement of the rural environment, the succession of traditional agricultural culture, development of sustainable tourism, and construction of capabilities, etc.

Time of implementation: 2022~2026.

Participants: The People's Government and Bureau of Agriculture and Rural Affairs of Kuancheng Manchu Autonomous County.

(2) Actions for ecological protection

- **Carrying out a general survey of chestnut resources and establishing a germplasm resource bank**

Actions are to be taken, throughout the whole county, to conduct a general survey of the chestnut resources, document the varieties, types, quantity, yield, distribution, and the respective management & cultivation technique of the local traditional chestnuts, so as to tap the traditional chestnut cultivation technique and establish the germplasm resource bank for chestnuts.

Time of implementation: 2022~2024.

Participants: Forestry and Grassland Administration, Bureau of Agriculture and Rural Affairs of Kuancheng Manchu Autonomous County, related towns, and villages.

Source of funds and budget: Special funds for conservation and development of agricultural heritage systems (RMB 600,000).

- **Establish a resource database of ancient chestnut trees and ancient chestnut orchards**

Actions are to be taken to conduct surveys on the resources of the ancient chestnut trees and ancient chestnut orchards throughout the country, get knowledge of the quantity and distribution of the existing ancient chestnut trees and ancient chestnut orchards in Kuancheng, identify, locate, take pictures of, number, and file the ancient chestnut tree that is over 100 years old, establish a spatial resource database for the ancient chestnut trees and ancient chestnut orchards in Kuancheng, thus laying the foundation for the protection of the ancient chestnut trees and ancient chestnut orchards.

Time of implementation: 2022~2024.

Participants: Bureau of Agriculture and Rural Affairs, Forestry and Grassland Administration of Kuancheng Manchu Autonomous County, related towns, and villages.

Source of funds and budget: Special funds for conservation and development of agricultural heritage systems (RMB 500,000).

- **Tracing the origin of the soil and water conservation approach by constructing fish-scale pits as well as the protection and succession**

Actions are to be taken to trace the historical origin of the soil and water conservation approach by constructing fish-scale pits locally in Kuancheng, look up the historical literature, get knowledge of the historical origin of the fish-scale pits in Kuancheng; to attach importance to the protection and succession of the fish-scale pit technique,

conduct scientific research on the aspects such as the applicable environment, conditions, key technical points, effects, and evaluations, establish the theory and practice system about the soil and water conservation approach by constructing fish-scale pits in Kuancheng; and at the same time, provide necessary support for the sound development of the local soil and water conservation and the chestnut cultivation system in Kuancheng.

Time of implementation: 2022~2024.

Participants: Bureau of Agriculture and Rural Affairs, Forestry and Grassland Administration of Kuancheng Manchu Autonomous County, related towns and villages.

Source of funds and budget: Special funds for conservation and development of agricultural heritage systems (RMB 300,000).

- **Establishing a protection zone of ancient chestnut trees and ancient chestnut orchards**

Based on the establishment of the resource database of ancient chestnut trees and ancient chestnut orchards, actions are to be taken to establish protection zones of ancient chestnut trees and ancient chestnut orchards in Huajian Town and Nianziyu Town (mainly in the Nangoumen Village in Huajian Town and Aiyukou Village, Datun Village and Daban Village in Nianziyu Town) where the ancient chestnut trees are relatively concentrated, making it the core protection zones for the agricultural heritage system of the Kuancheng Traditional Chestnut Eco-Planting System. Any activities like mining or road construction are strictly prohibited in the core protection zones, so as to protect the ecological environment of and around the ancient chestnut tree resources.

Time of implementation: 2022~2026.

Participants: The People's Government of Kuancheng Manchu Autonomous County.

Source of funds and budget: Special funds for conservation and development of agricultural heritage systems (RMB 1,000,000).

- **Conducting environmental monitoring of the agricultural heritage system**

Actions are to be taken to establish the monitoring network for soil erosion, flood disasters, agricultural non-point source pollution, and domestic pollution in the heritage site protection zones for the traditional chestnut cultivation system, and form a regular biennial monitoring mechanism to prevent the occurrence of soil erosion and maintain a sound soil, water, and air environment in the heritage site protection zones, and ensure the quality safety of the agricultural products output from the chestnut system in the heritage site.

Time of implementation: Starting from 2022, to be conducted once every other year.

Participants: Environmental Protection Agency of Kuancheng Manchu Autonomous County, related towns and villages.

Source of funds and budget: Special funds for conservation and development of agricultural heritage systems (RMB 300,000).

- **Carrying out reconstruction projects for the rational utilization of water and soil resources**

Actions are to be taken to repair and reconstruct the fish-scale pits, contour trenches, horizontal steps according to the local precipitation, topography, and soil conditions, to make them in line with the requirements of technical standards and give full play to its

role of intercepting and catching water and conserving soil and water. In addition, in areas where conditions permit, build water collecting basins and install drip irrigation facilities to achieve efficient use of water and soil resources.

Time of implementation: 2022~2026.

Participants: Bureau of Agriculture and Rural Affairs of Kuancheng Manchu Autonomous County, related towns and villages.

Source of funds and budget: Special funds for conservation and development of agricultural heritage systems (RMB 2,500,000).

(3) Actions for cultural inheritance

- **Compiling popular science books and make publicity of the popular science**

Actions are to be taken to compile the popular science books about the Kuancheng Traditional Chestnut Eco-Planting System catered to different groups of people, including the popular science books for the general public; the tips for the farmers; and the publications of various kinds like the local textbooks about the agricultural heritage system for the young students.

Time of implementation: 2022~2024.

Participants: Bureau of Agriculture and Rural Affairs, Education and Sports Bureau of Kuancheng Manchu Autonomous County, related towns, villages, and schools.

Source of funds and budget: Special funds for conservation and development of agricultural heritage systems (RMB 150,000).

- **Constructing the museum of Kuancheng Traditional Chestnut Eco-Planting System**

Actions are to be taken to construct a theme museum of the Kuancheng Traditional Chestnut Eco-Planting System in the core area of the county, collect, collate and exhibit in a systematic approach the main elements (including traditional crop varieties, related animal resources, plant resources, traditional knowledge and technology systems, related folk culture, architectural culture, chestnut culture, related folk customs and culture, construction culture, chestnut culture, mountain landscape, farmers' life and industrial development) of the system, to make Kuancheng the first window for displaying the heritage system.

Time of implementation: 2022~2026.

Participants: The People's Government, Bureau of Agriculture and Rural Affairs, and Administration of Culture and Tourism of Kuancheng Manchu Autonomous County.

Source of funds and budget: Fiscal funds (RMB 10,000,000).

- **Tapping, collating and inheriting the farming culture and restoring part of the traditional folk culture**

Actions are to be taken to tap and collate the traditional culture (including folk festivals like temple fairs, legends, chestnut food culture) in the heritage site, and gradually restore valuable folk activities (Kuancheng Beigan, Yangko, Dakou Laozi, Dragon Lantern Show). These cultural activities are organized to inherit the traditional farming culture, such as Chestnut Culture Festival and Harvest Festival.

Time of implementation: 2022~2026.

Participants: Administration of Culture and Tourism, Bureau of Agriculture and Rural Affairs of Kuancheng Manchu Autonomous County, and related towns and villages.

Source of funds and budget: Special funds for conservation and development of agricultural heritage systems (RMB 1,000,000).

- **Carrying out media promotion activities for the agricultural heritage system**

Actions are to be taken to promote the Kuancheng Traditional Chestnut Eco-Planting System through newspapers, brochures, promotional videos, cinematographic and television works, photography works and essay contests, and make special reports in the local media from time to time.

Time of implementation: 2022~2026.

Administration of Culture, Broadcasting and Tourism, Bureau of Agriculture and Rural Affairs of Kuancheng Manchu Autonomous County, and related towns, villages, and enterprises.

Source of funds and budget: Fiscal funds/Social capital/Special funds for conservation and development of agricultural heritage systems (RMB 900,000).

(4) Actions for developing ecological agricultural products

- **Formulating and updating the procedure for standardized production techniques for ecological agricultural products**

Actions are to be taken to formulate and update the standard systems like the procedure for standardized production techniques for the Kuancheng Traditional Chestnut Eco-Planting System, including procedures for chestnut planting techniques, procedures for chestnut grafting techniques, and procedures for chestnut production techniques, so as

to instruct and standardize the production of the chestnut and its ancillary products in the heritage site and ensure the quality of related ecological products.

Time of implementation: 2022~2024.

Participants: Forestry and Grassland Administration and Bureau of Agriculture and Rural Affairs of Kuancheng Manchu Autonomous County.

Source of funds and budget: Special funds for conservation and development of agricultural heritage systems (RMB 250,000).

- **Building public brands of agricultural products and expanding their influence**

Actions are to be taken to build a public brand of the agricultural products by relying on the agricultural heritage system, develop methods for using and managing the public brand of the agricultural products, increase the efforts in the publicity and promotion, standardize the methods for use of the public brand, and provide stringent supervisions for the use of the public brand, and safeguard the reputation of the public brand.

Time of implementation: 2022~2024.

Participants: Bureau of Agriculture and Rural Affairs and Administration for Market Regulation of Kuancheng Manchu Autonomous County.

Source of funds and budget: Special funds for conservation and development of agricultural heritage systems (RMB 600,000).

- **Establishing an agricultural product sales network and platform**

Actions are to be taken to increase the efforts in the promotion and sales of the chestnut products, establish an offline sales network and online sales platform for chestnut products, and set up links between the online sales platform and major e-commerce platforms.

Time of implementation: 2022~2024.

Participants: Bureau of Agriculture and Rural Affairs of Kuancheng Manchu Autonomous County, supply and marketing cooperatives, and related specialized farmers' cooperatives and big operating units.

Source of funds and budget: Social capital/Special funds for conservation and development of agricultural heritage systems (RMB 1,000,000).

● **Expanding certification of ecological agricultural products**

Actions are to be taken to expand the scale of certification of the ecological agricultural products such as the organic chestnuts and bionics wild grifola frondosa in the heritage site, increase the number of the certified ecological agricultural products, and expand the scope of impact of the certification of the ecological agricultural products in heritage sites.

Time of implementation: 2022~2026.

Participants: Bureau of Agriculture and Rural Affairs of Kuancheng Manchu Autonomous County.

Source of funds and budget: Special funds for conservation and development of agricultural heritage systems (RMB 500,000).

- **Expand the scale of “China National Standardized Production Base of Green Food Raw Materials”**

Based on the existing “China National Standardized Production Base of Green Food Raw Materials” for chestnuts, areas with appropriate conditions will be selected for further reduction of the use of pesticides and fertilizer, so as to expand the area of the base by 25%. In addition, with the demonstration base as a carrier, trainings for farmers will be organized. Efforts will be made to drive the production of ecological agricultural products by cultivating typical farmer households and specialized farmers’ cooperatives.

Time of implementation: 2022~2026.

Participants: Bureau of Agriculture and Rural Affairs of Kuancheng Manchu Autonomous County, related towns and villages.

Source of funds and budget: Special funds for conservation and development of agricultural heritage systems (RMB 1,000,000).

- **Providing subsidies to support agroforestry intercropping production mode for the traditional chestnut forest**

Actions are to be taken to issue the detailed subsidy rules for the intercropping production methods in the traditional chestnut and provide policy support and capital subsidies for the farm households that implement the agroforestry intercropping production mode; provide subsidy supports for the farm households who cultivate medicinal materials and mushrooms and raise poultry under the chestnut trees. In addition, the farm households who maintain the terraces of the chestnut forest will be provided with subsidies and supports.

Time of implementation: 2022~2026.

Participants: Bureau of Finance, Bureau of Agriculture and Rural Affairs, Forestry and Grassland Administration of Kuancheng Manchu Autonomous County, related towns and villages.

Source of funds and budget: fiscal funds (RMB 5,000,000).

(5) Actions for developing sustainable tourism

- **Incorporating sustainable tourism of the agricultural heritage system into Kuancheng's tourism development plan**

Actions are to be taken to revise the tourism development plan, integrate the principles, direction, key projects, and development paths of the sustainable tourism of the agricultural heritage system into the overall planning of the tourism in Kuancheng.

Time of implementation: in 2022.

Participants: Administration of Culture, Broadcasting and Tourism, Bureau of Agriculture and Rural Affairs of Kuancheng Manchu Autonomous County, and related research institutes.

Source of funds and budget: fiscal funds (RMB 100,000).

- **Constructing theme homestays of the Kuancheng Traditional Chestnut Eco-Planting System**

Combining the identification system of the agricultural heritage system, one to three typical farm households can be selected as the homestays with the theme of the traditional chestnut system in Kuancheng and the quantity of the homestays can be

increased later. Select the best and cooperate to construct the agricultural heritage theme restaurants and experience centers.

Time of implementation: 2023~2026.

Participants: Bureau of Agriculture and Rural Affairs, Administration of Culture, Broadcasting and Tourism of Kuancheng Manchu Autonomous County, related villages, and research institutes.

Source of funds and budget: Social capital/Special funds for conservation and development of agricultural heritage systems (RMB 2,000,000).

● **Organizing heritage-themed tourism activities for different subjects**

Actions are to be taken to organize the tourism activities focusing on study and research of the traditional chestnut system in Kuancheng for primary and middle school students, the weekend ecological experience and ecotourism experience activities for citizens from Beijing, Tianjin and Hebei, and the health tourism activities in the chestnut forest for the middle-aged and elderly people.

Time of implementation: 2022~2026.

Participants: Administration of Culture, Broadcasting and Tourism, Bureau of Agriculture and Rural Affairs of Kuancheng Manchu Autonomous County, related towns, villages, and research institutes.

Source of funds and budget: Social capital/Special funds for conservation and development of agricultural heritage systems (RMB 1,000,000).

- **Constructing tourism-themed IP of the Kuancheng Traditional Chestnut Eco-Planting System**

The tourism brand with the agricultural heritage system of the Kuancheng traditional chestnut system as the theme will be promoted through the convergence media and landed and promoted in the tourism activities by use of the heritage site related information.

Time of implementation: 2022~2026.

Participants: Administration of Culture, Broadcasting and Tourism, Bureau of Agriculture and Rural Affairs of Kuancheng Manchu Autonomous County, and related towns and villages.

Source of funds and budget: Special funds for conservation and development of agricultural heritage systems (RMB 500,000)

- **Developing cultural and creative products and souvenirs related to the Kuancheng Traditional Chestnut Eco-Planting System**

Actions are to be taken to develop the tourism products of the agricultural heritage system of the traditional chestnut system in Kuancheng, including cultural and creative products and commemorative products, construct one to two souvenir shops in the heritage system, and develop the cultural products by combining such elements as the Great Wall, Yanshan and chestnut in form of movies, TV dramas, short videos, performances, and teaching courses, etc.

Time of implementation: 2023~2026.

Participants: Administration of Culture, Broadcasting and Tourism, Bureau of

Agriculture and Rural Affairs of Kuancheng Manchu Autonomous County, and related towns and villages.

Source of funds and budget: Special funds for conservation and development of agricultural heritage systems (RMB 500,000)

(6) Actions for capability construction

- **Establishing the association for conservation and development of the Kuancheng Traditional Chestnut Eco-Planting System**

An association for conservation and development of the agricultural heritage of the Kuancheng Traditional Chestnut Eco-Planting System, organized by Agricultural Heritage System Management Center and joined by multiple sectors including related management authorities, enterprises, specialized farmers' cooperatives, and farm households, will be established (referred to as the "Agricultural Heritage System Association"), mainly responsible for coordinating the stakeholders, deploying market resources and organize manpower to carry out related activities.

Time of implementation: in 2022.

Participants: Bureau of Civil Affairs of Kuancheng Manchu Autonomous County.

Source of funds and budget: Fiscal funds (RMB 100,000).

- **Establishing a volunteer team to protect the Kuancheng Traditional Chestnut Eco-Planting System**

A volunteer team for the protection of the Kuancheng Traditional Chestnut Eco-Planting System (referred to as "Agricultural Heritage System Volunteer Team") will be established to carry out activities related to cultural inheritance, and promotion

activities, and science popularized activities, so as to enrich the community culture, enhance community image, promote positive interaction between community development and heritage protection and enhance the willingness of residents to protect the heritage.

Time of implementation: in 2022.

Participants: Bureau of Agriculture and Rural Affairs, Forestry and Grassland Administration, Bureau of Civil Affairs, and the Agricultural Heritage System Association of Kuancheng Manchu Autonomous County.

Source of funds and budget: Special funds for conservation and development of agricultural heritage systems (RMB 50,000).

- **Establishing a scientific research platform for the protection and utilization of the Kuancheng Traditional Chestnut Eco-Planting System**

A heritage conservation and development platform (abbreviated as “Agricultural Heritage System Research Platform”) will be established under cooperation with the Institute of Geographic Sciences and Natural Resources Research of the Chinese Academy of Sciences, and Chinese Academy of Agricultural Sciences to promote the collaborative research jointly conducted by the research teams in different fields. Efforts will be made to guide the enterprises involved in the heritage site to carry out scientific collaborations with the scientific research academies, establish production & scientific research base, carry out research on the seed selection and breeding improved varieties, genetic breeding, deep processing, comprehensive utilization, and other aspects, and promote scientific research results and new technologies.

Time of implementation: 2022~2026.

Participants: Bureau of Agriculture and Rural Affairs, Forestry and Grassland Administration of Kuancheng Manchu Autonomous County, and related research institutes.

Source of funds and budget: Special funds for conservation and development of agricultural heritage systems (RMB 500,000).

- **Carrying out popular science education activities for farmers and primary and middle school students**

Based on the compilation of farmers' practical technical manuals, popular science books for the youngsters, and other local textbooks for the conservation and development of agricultural heritage system, teaching bases and related courses will be set up in the heritage site, and the primary and middle school students in the heritage site will be encouraged and organized to participate in the heritage protection and culture inheritance related activities.

Time of implementation: 2022~2026.

Participants: Bureau of Education and Sports, Bureau of Agriculture and Rural Affairs, and Forestry and Grassland Administration of Kuancheng Manchu Autonomous County.

Source of funds and budget: Special funds for conservation and development of agricultural heritage systems (RMB 250,000).

- **Carrying out trainings on the capability of managing the Kuancheng Traditional Chestnut Eco-Planting System**

Description: The Agricultural Heritage System Conservation and Development Center will organize the responsible persons for the heritage related work in all the towns, the

persons responsible for this work from the main enterprises concerned and from the specialized farmers' cooperatives to set up training courses on the operating & management capability, invite related experts to instruct the work related to protection and development of the agricultural heritage system, cultivate professional technical persons and product development personnel, to improve the enterprise's innovation capability and enhance the overall quality of administrative staff.

Time of implementation: 2022~2026.

Participants: Bureau of Agriculture and Rural Affairs, Forestry and Grassland Administration, Agricultural Heritage System Management Center of Kuancheng Manchu Autonomous County, and related research institutes.

Source of funds and budget: Special funds for conservation and development of agricultural heritage systems (RMB 250,000).

- **Carrying out exchange activities on the Kuancheng Traditional Chestnut Eco-Planting System**

Actions are to be taken to carry out various forms of exchange activities, participate in various agricultural products fairs and various cultural industry expos, etc.; inherit the folk activities with the local characteristics, hold "Kuancheng Traditional Chestnut Cultural Festival" every year, host chestnut product exhibitions, and provide lectures, etc.; design and operate the information publicity platform for the Kuancheng Traditional Chestnut Eco-Planting System to display the characteristics and value of the agricultural heritage system and the information of agricultural products, cultural and creative products, and tourism.

Time of implementation: 2022~2026.

Participants: Bureau of Agriculture and Rural Affairs, Forestry and Grassland Administration, and Administration of Culture, Broadcasting and Tourism of Kuancheng Manchu Autonomous County.

Source of funds and budget: Special funds for conservation and development of agricultural heritage systems (RMB 500,000).

Table 14 Actions to be taken

Actions to be Taken	Description	Challenges to be met	Source of Funds	Budget (RMB 10,000)	Participants	Time of implementation and Annual Funding				
						2022	2023	2024	2025	2026
Comprehensive Activities	Establishing the heritage management center	Challenge 1 to 6	-	120	The People's Government, and KCOPSR	-	30	30	30	30
	Issuing management methods	Challenge 1 to 6	-	-	The People's Government, and Bureau of Agriculture and Rural Affairs	-	-	-	-	-
	Providing special funds for protection and development	Challenge 1 to 6	-	2500	The People's Government, and Bureau of Agriculture and Rural Affairs	500	500	500	500	500
Actions for Ecological Protection	Establishing a germplasm resource bank	Challenge 5 & 6	Special funds	60	Forestry and Grassland Administration, Bureau of Agriculture and Rural Affairs, towns, and villages	20	20	20		
	Establishing a resource database of ancient chestnut trees	Challenge 5 & 6	Special funds	50	Bureau of Agriculture and Rural Affairs, Forestry and Grassland Administration, towns, and villages	10	20	20		
	Tracing the origin and protection of fish-scale	Challenge 5 & 6	Special funds	30	Bureau of Agriculture and Rural Affairs, Forestry and Grassland	10	10	10		

	pits				Administration, towns, and villages					
	Establishing a protection zone of ancient chestnut trees	Challenge 3 & 4	Special funds	100	The People’s Government	20	20	20	20	20
	Conducting environmental monitoring in the heritage site	Challenge 3 & 4	Special funds	30	Environmental Protection Bureau, towns, and villages	10		10		10
	Carrying out reconstruction projects for the rational utilization of water and soil resources	Challenge 3 & 4	Special funds	250	Bureau of Agriculture and Rural Affairs, towns, and villages	50	50	50	50	50
Actions for Cultural Inheritance	Compiling popular science books	Challenge 5 & 6	Special funds	25	Bureau of Agriculture and Rural Affairs, Education and Sports Bureau, towns, villages, and schools	5	5	5	5	5
	Constructing theme museums	Challenge 1, 5 & 6	Fiscal funds	1000	The People’s Government, Bureau of Agriculture and Rural Affairs, and Administration of Culture and Tourism		600	400		

	Restoring part of the traditional folk culture	Challenge 5 & 6	Special funds	100	Administration of Culture, Broadcasting and Tourism, Bureau of Agriculture and Rural Affairs, and related towns and villages	20	20	20	20	20
	Carrying out media promotion activities for the agricultural heritage system	Challenge 1, 5 & 6	Fiscal/Special/social funds	90	Administration of Culture, Broadcasting and Tourism, Bureau of Agriculture and Rural Affairs, towns, villages and enterprises	10	20	20	20	20
Actions for Developing Ecological Agricultural Products	Formulating and updating the technical procedure for standardized production of ecological agricultural products	Challenge 1 & 2	Special funds	25	Bureau of Agriculture and Rural Affairs	5	5	5	5	5
	Cultivating public brands of agricultural products and expanding their influence	Challenge 1 & 2	Special funds	60	Bureau of Agriculture and Rural Affairs, and Administration for Market Regulation	20	20	20		
	Establishing an agricultural product sales network and platform	Challenge 1 & 2	Special/social funds	100	Bureau of Agriculture and Rural Affairs, supply and marketing cooperatives, specialized farmers' cooperatives, and big operating units	20	20	20	20	20

	Expanding certification of ecological agricultural products	Challenge 1 & 2	Special funds	50	Bureau of Agriculture and Rural Affairs	10	10	10	10	10
	Expanding the scale of the “Production Base of Green Food Raw Materials”	Challenge 3 & 4	Special funds	100	Bureau of Agriculture and Rural Affairs, towns, and villages	20	20	20	20	20
	Providing subsidies to support agroforestry intercropping production mode for the traditional chestnut forest	Challenge 1 & 2	Fiscal funds	500	Bureau of Finance, Bureau of Agriculture and Rural Affairs, Forestry and Grassland Administration, towns, and villages	100	100	100	100	100
Actions for Developing Sustainable Tourism	Incorporating GIAHS tourism into the tourism planning of the county	Challenge 1 & 2	Fiscal funds	10	Kuancheng Administration of Culture, Broadcasting and Tourism, Bureau of Agriculture and Rural Affairs, and research institutes.	10				
	Constructing theme homestays of the Kuancheng Traditional Chestnut Eco-Planting System	Challenge 1 & 2	Social/special funds	200	Kuancheng Bureau of Agriculture and Rural Affairs, Administration of Culture, Broadcasting and Tourism, and research institutes.		50	50	50	50
	Organizing theme	Challenge 1 & 2	Social/special funds	100	Administration of Culture,	20	20	20	20	20

	tourism activities for different subjects				Broadcasting and Tourism, Bureau of Agriculture and Rural Affairs, towns, villages, and research institutes					
	Constructing theme IP of the Kuancheng Traditional Chestnut Eco-Planting System	Challenge 1 to 6	Special funds	50	Administration of Culture, Broadcasting and Tourism, Bureau of Agriculture and Rural Affairs, and towns	10	10	10	10	10
	Developing cultural and creative products and souvenirs related to the heritage system	Challenge 5 & 6	Special funds	50	Administration of Culture, Broadcasting and Tourism, Bureau of Agriculture and Rural Affairs, and towns	10	10	10	10	10
Actions for Capability Construction	Establishing Protection and Development Association	Challenge 1 to 6	Fiscal funds	10	Bureau of Civil Affairs	2	2	2	2	2
	Establishing volunteer organizations	Challenge 1 to 6	Special funds	5	Bureau of Agriculture and Rural Affairs, Forestry and Grassland Administration, Bureau of Civil Affairs, and Agricultural Heritage System Association	1	1	1	1	1
	Establishing a scientific	Challenge 1 to 6	Special funds	50	Bureau of Agriculture and Rural	10	10	10	10	10

research platform for protection and utilization				Affairs, Forestry and Grassland Administration, and research institutes					
Carrying out popular science activities for farmers and primary and middle school students	Challenge 1 & 2	Special funds	25	Education and Sports Bureau, Bureau of Agriculture and Rural Affairs, and Forestry and Grassland Administration	5	5	5	5	5
Carrying out trainings on the capability of management	Challenge 1 & 2	Special funds	25	Bureau of Agriculture and Rural Affairs, Forestry and Grassland Administration, Agricultural Heritage System Management Center, and research institutes	5	5	5	5	5
Carrying out a series of exchange activities	Challenge 1 & 2	Special funds	50	Bureau of Agriculture and Rural Affairs, Forestry and Grassland Administration, and Administration of Culture, Broadcasting and Tourism	10	10	10	10	10

Note: **Challenge 1**-Trend of loss of young and middle-aged labor forces engaged in agricultural production. **Challenge 2**-The balance between smallholder farming and scale operation of chestnut production is facing challenges. **Challenge 3**- Mountain areas face the risk of soil erosion and water loss in summer. **Challenge 4**-Drought restricts the growth of chestnut forests. **Challenge 5**-The technical support system needs to be strengthened and improved. **Challenge 6**-The inheritance and utilization of agricultural culture is relatively weak.

3.5. Supporting Measures

(1) Multichannel fundraising and guarantee

To successfully implement the GIAHS Conservation and Development Action Plan for the Kuancheng Traditional Chestnut Eco-Planting System, sufficient funds are needed as a guarantee. Endeavors can be made to obtain financial support for projects at various levels including international, national, and local government, establish private foundations, and receive donations from private funds to obtain funding support for the protection of the agricultural heritage system. The specific methods are as stated below:

1) A special fund to be used for the conservation and development of the Kuancheng Traditional Chestnut Eco-Planting System will be set up. An annual budget of RMB 10,000,000 will be used as the financial guarantee for the implementation of various protection action plans for the Kuancheng Traditional Chestnut Eco-Planting System.

2) The industry funding support related to the Kuancheng Traditional Chestnut Eco-Planting System will be increased. A budget of RMB 10,000,000 will be listed in the financial system for developing the commercial forest, with the priority given to the development of the chestnut forest and its related circular agriculture.

3) The local government will actively apply for special fund support for provincial agricultural projects (comprehensive agricultural development and industrialization development projects, provincial pastoral complexes) to support relevant conservation and development action plans for the Kuancheng Traditional Chestnut Eco-Planting System.

4) The local government will actively apply for national agricultural and rural development projects (demonstration park for industry integration development in rural

areas, and pilot zone of integrated development of the primary, secondary and tertiary industries in rural areas) to obtain relevant financial support for implementing the the Kuancheng Traditional Chestnut Eco-Planting System action plan.

5) The local government will cooperate with scientific research institutions to apply for related projects of international organizations (the Global Environment Fund, the World Agricultural Heritage Foundation, and the Food and Agriculture Organization of the United Nations), striving for the support of international funds.

6) The local government will mobilize non-governmental forces, raising funds from enterprises and individuals to support the development of public welfare activities and the construction of public welfare projects regarding the traditional chestnut cultivation in Kuancheng.

7) The local government will promote the governments at all levels in Kuancheng to attach importance to the green planting and the prevention and control of diseases and insect pests in a harmless way for the chestnuts, enhance the understanding of people from all walks of life and the farmers for the ecological and social benefits by implementing the traditional ecological planting methods, so as to promote the establishment of the system of “high quality and good price” of the agricultural products and advance the ecological planting practices in a continuous and effective manner.

(2) Participation of multiple stakeholders

A multi-stakeholders participation mechanism will be established for the Kuancheng Traditional Chestnut Eco-Planting System, to allow governments, enterprises, communities, farmers, non-governmental organizations, scientific research institutions, and other forces to participate in the conservation and development of the heritage system, thus providing assurance for the effective implementation of the actions.

1) At the government level. The Ministry of Agriculture and Rural Affairs of the People's Republic of China has never stopped improving the GIAHS management methods, striving to set up a national GIAHS conservation fund and establish a GIAHS monitoring and evaluation system, so as to promote GIAHS conservation at the system level. The provincial, municipal, and county governments have set important agricultural heritage system management sectors and full-time staff, implement national GIAHS related management methods, organize the application, conservation, and management work of the GIAHS, and provide GIAHS with special project funds and policy supports.

2) At the enterprise level. Under the premise of complying with the GIAHS conservation and management methods and related regulations, enterprises tap the potential of the agricultural heritage resources, develop related products, conduct promotions and marketing of the GIAHS brand, drive the economic development of the heritage site and increase the income of chestnut growers, creating a sustainable development model of "enterprise + farm households" for the heritage system.

3) At the community level. The community managerial personnel organize and coordinate the operating activities of the residents in the community, make plans to develop the collective economy of the community, fight for benefits on behalf of chestnut growers with the government and enterprises, and explore sustainable livelihood models for the farm households; supervise and manage the production & operation behaviors of the chestnut growers and implement GIAHS conservation and dynamic management methods and related regulations.

4) At the level of farm households. In accordance with GIAHS conservation and dynamic management methods, farmers carry out chestnut production and management

activities, maintain the ecological landscape of the chestnut trees, inherit traditional chestnut planting and food processing knowledge and technology, protect local traditional customs and related culture, and meantime enjoy the benefits brought by the heritage system and the subsidies according to related policies.

5) At the level of non-governmental organizations. The non-governmental organizations such as Agricultural Heritage System Association, Agricultural Heritage System Volunteer Team, 69 chestnut cooperatives, 34 chestnut family farms carry out GIAHS related seminars, promote and popularize the knowledge, provide trainings for the farmers in the heritage site on professional techniques and application of modern information technology, to raise their capability for conserving the heritage system.

6) At the level of scientific research institutions. The Academician Workstations and Chestnut Industry Technology Research Institute have been established to explore the dynamic conservation and sustainable development path and mechanism of the Kuancheng Traditional Chestnut Eco-Planting System. The scientific research institutions and universities such as the Chinese Academy of Sciences, Chinese Academy of Agricultural Sciences, China Agricultural University, and Hebei Agricultural University have carried out research on the economic, ecological, cultural, and social issues related to the conservation of the heritage system, producing a batch of research results with demonstration effects.

(3) Monitoring and evaluation mechanism

In the past few years, the Ministry of Agriculture and Rural Affairs of the People's Republic of China has established the dynamic monitoring system for the GIAHS in China, and organized GIAHS expert committee members to carry out monitoring and evaluation of the GIAHS heritage sites one after another. At the same time, the scientific research institutions entrusted are exploring the quantitative monitoring and evaluation

index systems and the evaluation methods, which has provided the system and institutional guarantees, data platform, and method support for the implementation of the protection action plan for the Kuancheng Traditional Chestnut Eco-Planting System.

The conservation and development action plan for the Kuancheng Traditional Chestnut Eco-Planting System will also be monitored and evaluated according to the framework as stated below:

- 1) According to the *Interim Management Measures on the Kuancheng Traditional Chestnut Eco-Planting System*, the ecological conditions of the chestnut orchards, the construction of the infrastructure, and the production and operation behaviors of the chestnut growers in the heritage site will be monitored in real time by the Bureau of Agriculture and Rural Affairs of Kuancheng.
- 2) At the end of the year during the period of implementing the action plan, self-assessment will be made for the completion progress of the conservation action plan for that year, write a self-evaluation report, and put forward opinions and suggestions on revising the action plan in response to actual problems.
- 3) It is required to conscientiously collect and fill the annual data of the GIAHS dynamic monitoring system required by the Ministry of Agriculture and Rural Affairs and accept the monitoring and evaluation of the Ministry of Agriculture and Rural Affairs.
- 4) It is required to accept the on-site monitoring and evaluation of the expert committee organized by the Ministry of Agriculture and Rural Affairs from time to time, listen to the evaluation and instruction opinions of the agricultural heritage expert committee, and effectively implement the action plan.

III. ATTACHMENTS

1. List of Chestnut Variety Resources in the Heritage site

Table 15 Main chestnut varieties in the Kuancheng Traditional Chestnut Eco-Planting System

Category	Variety name
Native varieties	Dabanhong, Yanjin, Yankuan, Xiong 84, Xiong 330, Datun.
Representative introduced varieties	Dongling Mingzhu, Yanshan Spurt, Yankui, Yanshan Zaofeng, Shifeng, Phoenix Mountain # 2, Yanhong, Yanfeng, Tafeng, Yanchang, Yanjing, Daqinggan, Ziyu, Zhuili, Dutouli.

2. List of Major Plant Resources in the Heritage Site

BRYOPHYTA

1. Fissidentaceae

(1) *Fissidens bryoides* Hedw.

2. Pottiaceae

(2) *Barbula unguiculata* Hedw.

(3) *Bryoerythrophyllle recurvirostre* (Hedw.) Chen

(4) *Didymodon constrictus* (Mitt.) Saito

(5) *Gymnostomum subrigidulum* (Broth.) Chen

(6) *Oxystegus tenuirostris*(Hook et Tayl.) A.J.E.Smith.

(7) *Timmiella anomala* (B.S.G.) Limpr.

(8) *Tortula mucronifolia* Schwaegr

(9) *Tortula norvegia* (Web.) Wahl. Ex Lindb.

(10) *Weissia planifolia* Dix.

3. Funariaceae

(11) *Funaria hygrometrica* Hedw.

4. Bryaceae

(12) *Anomobryum filiforme* (Dicks.)

(13) *Bryum argentums* Hedw.

(14) *Bryum caespiticium* Hedw.

(15) *Bryum cirrhatum* Hopp. et Hornsch.

(16) *Bryum algovicum* Sendtn. ex C. M.

(17) *Pohlia cruda* (Hedw.) Lindb.

(18) *Pohlia nutans* (Hedw.) Lindb.

(19) *Rhodobryum roseum* (Hedw.) Limpr.

5. Brachytheciaceae

(20) *Brachythecium salebrosum* (Web.et Mohr.) B. S. G.

(21) *Brachythecium albicans* (Hedw.) B. S. G.

(22) *Brachythecium velutinum* (Hedw.) B. S. G.

(23) *Eurhynchium pulchellum* (Hedw.) Jenn.

(24) *Eurhynchium eustegium* (Besh.) Dix.

(25) *Eurhynchium hians* (Hedw.) S. Lac

(26) *Homalothecium sericeum* (Hedw.) B. S. G.

(27) *Myuroclada maximowiczii* (Borszcz.) Steer et Schof.

6. Hypnaceae

(28) *Eurohypnum leptothallum* (C. Muell.) Ando

(29) *Pylaisiella polyantha* (Hedw.) Grout

(30) *Pylaisiella selwynii* (Kindb.) Crum

(31) *Homomallium connexum* (Card.) Broth

(32) *Taxiphyllum taxirameum* (Mitt.) Fleisch.

7. Rhytidaeae

(33) *Rhytidium rugosum* (Hedw.) Kindb.

TERIDOPHYTA

8. Selaginellaceae

(34) *Selaginella davidii* Franch.

(35) *Selaginella sanguinolenta* (L.) Spring.

(36) *Selaginella sinensis* (Desv.) Spring.

(37) *Selaginella stauntoniana* Spring

(38) *Selaginella tamariscina* (Beauv.) Spring

9. Equisetaceae

(39) *Equisetum arvense* L.

(40) *Equisetum hiemale* L.

(41) *Equisetum ramosissimum* Desf.

10. Pteridaceae

(42) *Pteridium aquilinum*(L.)Kuhn var.*latiusculum* (Desv.)Underw. ex Heller

11. Adiantaceae

(43) *Adiantum edgeworthii* Hook.

12. Hemionitidaceae

(44) *Gymnopteris bipinnata* Christ var. *auriculata*(Franch.)Ching

13. Onocleaceae

(45) *Matteuccia struthiopteris* (L.) Todaro

14. Dryopteridaceae

(46) *Dryopteris austriaca* (Jacq.) Woynt.

(47) *Dryopteris crassirhizoma* Nakai.

(48) *Dryopteris fragrans*(L.) Schott

(49) *Polystichum braunii* (Spenn.)Fee

(50) *Polystichum craspedosorum* (Maxim.) Diels.

GYMNOSPERMAE

15. Pinaceae

(51) *Laix principis-rupprechtii* Mary.

(52) *Pinus tabulaeformis* Carr.

(53) *Pinus tabulaeformis* var. *mukdensis* Uyeki

(54) *Picea megeri* Rehd et wils

(55) *Picea wilsonii* Mast.

16. Cupressaceae

(56) *Platycladus orientalis* (L.) Franco

(57) *Sabina chinensis*(L.) Ant

17. Ephedraceae

(58) *Ephedra intermedia* Schrenk et Mey

ANGIOSPERMAE

18. Chloranthaceae

(59) *Chloranthus japonicus* Sieb.

19. Salicaceae

(60) *Populus cathayana* Rehd.

(61) *Populus davidiana* Dode

(62) *Populus pseudo-simonii* Kitag

(63) *Populus simonii* Carr.

(64) *Populus tomentosa* Carr.

(65) *Salix floderusii* Nakai

(66) *Salix matsudana* Koidz

20. Juglandaceae

(67) *Juglans mandshurica* Maxim. 国家III级保护植物

21. Betulaceae

(68) *Betula chinensis* Maxim.

(69) *Betula costata* Trautv.

(70) *Betula dahurica* Pall.

(71) *Betula dahurica* Pall.

(72) *Betula utilis* D. Don

(73) *Betula platyphylla* Suk.

(74) *Carpinus cordata* BL.

(75) *Carpinus turczaninowii* Hance

(76) *Corylus heterophylla* Fisch.

(77) *Corylus mandshurica* Maxim. et Rupr.

(78) *Corylus davidiana* Decne

22. Fagaceae

(79) *Quercus acutissima* Carr.

(80) *Quercus dentate* Thunb.

(81) *Quercus mongolica* Fisch.

(82) *Quercus liaotungensis* Roidz

(83) *Quercus aliena* Bl.

(84) *Quercus variabilis* Bl.

23. Ulmaceae

(85) *Celtis koraiensis* Nakai

(86) *Celtis bungeana* Bl.

(87) *Ulmus davidiana* Planch. Var. *japonica*(Rehd.) Nakai.

(88) *Ulmus laciniata* (Trautv.) Mayr.

(89) *Ulmus pumila* L.

(90) *Ulmus smacrocampa* Hance

24. Moraceae

(91) *Cannabis sativa* L.

(92) *Humulus scandens* (Lour.) Merr.

(93) *Morus australis* Poir.

(94) *Morus mongolica* (Bur.) Schneid. Var. *diablica* Koidz.

25. Urtiaceae

(95) *Boehmeria gracilis* C. H. Wright

(96) *Girardinia cuspidate* Wedd.

(97) *Parietaria micrantha* Ledeb.

(98) *Pilea hamaoi* Makino

(99) *Pilea japonica* (Maxim.) Hand.-Mazz.

(100) *Pilea mongolica* Wedd.

(101) *Urtica angustifolia* Fisch.et Hornem

(102) *Urtica laetevirens* Maxim.

26. Santalaceae

(103) *Thesium longifolium* Turcz.

27. Loranthaceae

(104) *Viscum coloratum* (Kom.) Nakai

28. Polygonaceae

(105) *Fagopyrum tatarium* (L.) Gaertn.

(106) *Polygonum amphibium* L.

(107) *Polygonum aviculare* L.

(108) *Polygonum bistorta* L.

(109) *Polygonum bungeanum* L.

(110) *Polygonum convolvulus* L.

(111) *Polygonum dentato-alatum* Fr. Schm. ex Maxim.

(112) *Polygonum dissitiflorum* Hemsl.

(113) *Polygonum excurrense* Steward

(114) *Polygonum hydropiper* L.

(115) *Polygonum lapathifolium* L.

(116) *Polygonum nepalense* Meisn.

(117) *Polygonum orientale* L.

(118) *Polygonum perfoliatum* L.

(119) *Polygonum senticosum* (Meisn.) Franch. et Sav.

(120) *Polygonum thunbergii* Sieb. et Zucc.

(121) *Polygonum ussuriense* (Regel) Nakai.

(122) *Polygonum vivipaeum* L.

(123) *Rumex acetosa* L.

(124) *Rumex acetosella* L.

29. Chenopodiaceae

(125) *Axyris amaranthoides* L.

(126) *Chenopodium acuminatum* Willd.

(127) *Chenopodium album* L.

(128) *Chenopodium foetidum* Schrad.

(129) *Chenopodium glaucum* L.

(130) *Chenopodium hybridum* L.

(131) *Kochia scoparia* (L.) Schrad.

(132) *Salsola ruthenica* Iljin var. *filifolia* A.J.Li

30. Amaranthaceae

(133) *Amaranthus lividus* L.

(134) *Amaranthus retroflexus* L.

31. Portulacaceae

(135) *Portulaca oleracea* L.

32. Caryophyllaceae

(136) *Arenaria juncea* Bieb.

(137) *Dianthus chinensis* L.

(138) *Dianthus superbus* L.

(139) *Gypsophila oldhamiana* Miq.

(140) *Lychnis cognata* Maxim.

(141) *Malachium aquaticum* (L.) Fries.

(142) *Silene aprica* Turcz. ex Fisch. et Mey.

(143) *Silene firma* Sieb. et Zucc

(144) *Silene jensseensis* Willd.

33. Ceratophyllaceae

(145) *Ceratophyllum demersum* L.

(146) *Ceratophyllum manschurium* (Miki) Kitag.

34. Ranunculaceae

(147) *Aconitum barbatum* Pers. var. *puberulum* Ledeb.

(148) *Aconitum kusnezoffii* Reichb.

(149) *Aconitum soongaricum* Stapf. Var. *jeholense* (Nakai et Kitag.) W. T. Wang

(150) *Actaea asiatica* Hara

(151) *Anemone cathayensis* Kitag.

(152) *Aquilegia yabeana* Kitag.

(153) *Batrachium bungei* (Stedle) L. Liou.

(154) *Cimicifuga dahurica* (Turcz.) Maxim.

(155) *Cimicifuga simplex* Wormsk.

(156) *Clematis brevicaudata* DC.

(157) *Clematis fusca* Turcz.

(158) *Clematis hexapetala* Pall.

(159) *Clematis ochotensis* (Pall.) Poir.

(160) *Delphinium grandiflorum* L.

(161) *Pulsatilla chinensis* (Bunge) Regel

(162) *Ranunculus chinensis* Bge.

(163) *Ranunculus sceleratus* L.

(164) *Thalictrum petaloideum* L.

(165) *Thalictrum przewalskii* Maxim.

(166) *Thalictrum squarrosom* Steph. ex Willd.

(167) *Trollius chinensis* Bge.

(168) *Coptis chinensis*

35. Peoniaceae

(169) *Paeonia obovata* Maxim.

36. Berberidaceae

(170) *Berberis amurensis* Rupr.

(171) *Berberis poirerii* Schneid

37. Menispermaceae

(172) *Menispermum dauricum* DC.

38. Magnoliaceae

(173) *Magnolia sieboldii* K. Koch

(174) *Schisandra chinensis* (Turcz.) Baill.

39. Papaveraceae

(175) *Chelidonium majus* L.

(176) *Corydalis bungeana* Tucz.

(177) *Corydalis ochotensis* Turcz. var. *raddeana* (Regel) Nakai.

(178) *Corydalis repens* Mandl. et Muhdlof.

40. Cruciferae

(179) *Arabis hirsuta* (L.) Scop

(180) *Capsella bursa-pastoris* (L.) Medic.

(181) *Dontostemon dentatus* (Bge.) Ledeb.

(182) *Draba nemorosa* L.

(183) *Draba nemorosa* L. var. *leiocarpa* Lindeb.

(184) *Hesperis oreophila* Kitag.

(185) *Lepidium apetalum* Willd.

(186) *Rorippa globosa* (Turcz.) Thell.

(187) *Rorippa islandica* (Oeder) Borbas

(188) *Thlaspi arvense* L.

41. Crassulaceae

(189) *Orostachys fimbriatus* (Turcz.) Berg.

(190) *Sedum aizoon* L.

(191) *Sedum purpureum* (L.) Schult.

(192) *Sedum spectabile* Bor.

42. Saxifragaceae

(193) *Astilbe chinensis* (Maxim.) Franch. et Sav.

(194) *Deutzia parviflora* Bge.

(195) *Deutzia hamata* Koehne var. *baroniana* (Diels.) Zaikon.

(196) *Hydrangea bretschneideri* Dipp.

(197) *Oresitrophe rupifraga* Bge.

(198) *Parnassia palustris* L.

(199) *Philadelphus pekinensis* Rupr.

(200) *Ribes mandshuricum* (Maxim.) Kom. var. *subglabrum* Kom.

(201) *Saxifraga sibirica* L. var. *pekinensis* (Maxim.) Engl. et Irm

43. Rosaceae

(202) *Agrimonia pilosa* Ledeb.

(203) *Geum aleppicum* Jacq.

(204) *Malus baccata* (L.) Borkh.

(205) *Physocarpus amurensis* (Maxim.) Maxim.

(206) *Potentilla ancistrifolia* Bge.

(207) *Potentilla chinensis* Ser.

(208) *Potentilla discolor* Bge.

(209) *Potentilla flagellaris* Willd. ex Schlecht.

(210) *Potentilla fruticosa* L.

(211) *Potentilla supina* L.

(212) *Prunus davidiana* (Carr.) Franch

(213) *Prunus sibirica* L.

(214) *Prunus humilis* Bge.

(215) *Prunus padus* L.

(216) *Prunus tomentosa* Thunb.

(217) *Rose davurica* Pall.

(218) *Rubus crataegifolius* Bge.

(219) *Rubus parvifolius* L.

(220) *Sanguisorba officinalis* L.

- (221) *Sorbaria kirilowii* (Regel) Maxim.
(222) *Sorbus alnifolia* (Sieb. et Zucc.) Koch.
(223) *Sorbus pohuashanensis* (Hance) Hedl.
(224) *Spiraea chamaedryfolia* Pall.
(225) *Spiraea dasyantha* Bge.
(226) *Spiraea fritshiana* Schneid. Var. *angulata*(Schneid.)Rehd.
(227) *Spiraea pubescens* Turcz.
(228) *Spiraea trilobata* L.

44. Leguminosae

- (229) *Aeschynomene indica* L.
(230) *Amphicarpaea trisperma* (Miq.) Barker. ex Jackson
(231) *Astragalus complanatus* R. Br.
(232) *Astragalus melilotoides* Pall.
(233) *Camphylotropis macrocarpa* (Bge.) Regd.
(234) *Caragana frutex* (L.) C. Koch.
(235) *Caragana rosea* Turcz.
(236) *Gleditsia japonica* Miq.
(237) *Glycine soja* Sieb. et Zucc.
(238) *Glycyrrhiza pallidiflora* Maxim.
(239) *Gueldenstaedtia multiflora* Bge.
(240) *Gueldenstaedtia stenophylla* Bge.
(241) *Indigofera kirilowii* Maxim. ex Palibin
(242) *Kummerowia striata* (Thunb.) Schindl.
(243) *Lathyrus palustris* L. var. *pilosus* (Cham.) Ledeb.
(244) *Lespedeza bicolor* Turcz.
(245) *Lespedeza davuica* (Laxm.) Schindl.
(246) *Lespedeza hedysaroides* (Pall.) Kitag.
(247) *Lespedeza inschanica* (Maxim.) Schindl.
(248) *Lespedeza tomentosa* (Thunb.) Sieb. ex Maxim.
(249) *Lespedeza floribunda* Bge.
(250) *Medicago lupulina* L.
(251) *Melilotus albus* Desr.
(252) *Melilotus suaveolens* Ledeb.
(253) *Trifolium lupiaster* L.

(254) *Pueraria lobata* (Willd.) Ohwi

(255) *Vicia amoena* Fisch.

(256) *Vicia cracca* L.

(257) *Vicia unijuga* A. Br.

45. Oxalidaceae

(258) *Oxalis stricta* L.

46. Geraniaceae

(259) *Erodium stehpanianum* Willd.

(260) *Geranium dahuricum* DC.

(261) *Geranium sibiricum* L.

(263) *Geranium wilfordii* Maxim.

47. Linaceae

(264) *Linum stelleroides* Planch.

48. Zygophyllaceae

(265) *Tribulus terrestris* L.

49. Rutaceae

(266) *Dictamnus dasycarpus* Turcz.

(267) *Phellodendron amurense* Rupr.

50. Simarubaceae

(268) *Alnus altissima* (Mill.) Swingle

51. Polygalaceae

(269) *Polygala japonica* Houtt.

(270) *Polygala tatarinowii* Regel.

(271) *Polygala tenuifolia* Willd.

52. Euphorbiaceae

(272) *Acalypha australis* L.

(273) *Euphorbia esula* L.

(274) *Euphorbia humifusa* Willd.

(275) *Euphorbia pekinensis* Rupr.

53. Anacardiaceae

(276) *Rhus chinensis* Mill.

54. Celastraceae

(277) *Celastrus orbiculatus* Thunb.

(278) *Euonymus alatus* (Thunb.) Sieb.

55. Staphyleaceae

(279) *Staphylea bumalda* DC.

56. Aceraceae

(280) *Acer mono* Maxim.

(281) *Acer ginnala* Maxim.

(282) *Acer truncatum* Bge.

57. Balsaminaceae

(283) *Impatiens furcillata* Hemsl.

(284) *Impatiens noli-tangere* L.

58. Rhamnaceae

(285) *Rhamnus arguta* Maxim.

(286) *Rhamnus globosa* Bge.

(287) *Rhamnus parvifolia* Bge.

(288) *Rhamnus ussuriensis* J. Vass.

(289) *Ziziphus jujuba* Mill. Var. *spinosa*(Bge.) Hu. ex H.F.Chow.

59. Vitaceae

(290) *Ampelopsis aconitifolia* Bge.

(291) *Ampelopsis japonica* (Thunb.) Makino

(292) *Vitis amurensis* Rupr.

60. Tiliaceae

(293) *Grewia biloba* G. Don. var. *parviflora*(Bge.) Hand. –Mazz.

(294) *Tilia amurensis* Rupr.

(295) *Tilia mandschurica* Rupr. et Maxim.

(296) *Tilia mongolica* Maxim.

61. Malvaceae

(297) *Abutilon theophrasti* Medic.

(298) *Hibiscus trionum* L.

62. Actinidiaceae

(299) *Actinidia arguta* (Sieb. et Zucc.) Planch ex Miq.

(300) *Actinidia kolomikta* (Maxim. et Rupr.) Maxim.

(301) *Actinidia polygama* (Sied. et Zucc.) Maxim.

63. Tamaricaceae

(302) *Tamarix chinensis* Lour.

64. Violaceae

- (303) *Viola acuminata* Ledeb.
(304) *Viola biflora* L.
(305) *Viola chaerophylloides* (Regel) W. Beck.
(306) *Viola collina* Bess.
(307) *Viola dissecta* Ledeb.
(308) *Viola mirabilis* L.
(309) *Viola mongolica* Franch.
(310) *Viola phalacrocarpa* Maxim.
(311) *Viola prionantha* Bge.
(312) *Viola variegata* Fisch. ex Link.
(313) *Viola verecunda* A. Gray.
(314) *Viola yedoensis* Makino.

65. Begoniaceae

- (315) *Begonia sinensis* DC.

66. Thymelaeaceae

- (316) *Stellera chamaejasme* L.

67. Onagraceae

- (317) *Circaea alpine* L.
(318) *Circaea cordata* Royle
(319) *Epilobium amurense* Hausskn.
(320) *Epilobium angustifolium* L.
(321) *Epilobium hirsutum* L.

68. Araliaceae

- (322) *Acanthopanax senticosus* (Rupr. et Maxim.) Harms
(323) *Acanthopanax sessiliflorus* (Rupr. et Maxim.) Seem.
(324) *Aralia continentalis* Kitag.
(325) *Aralia elata* (Miq.) Seem.

69. Umbelliferae

- (326) *Angelica polymorpha* Maxim.
(327) *Bupleurum scorzoniferolium* Willd.
(328) *Czernaevia laevigatga* Turcz.
(329) *Cicuta virosa* L.
(330) *Heracleum moellendorffii* Hance.
(331) *Ligusticum jeholense* Nakai et Kitag.

- (332) *Oenanthe decumbens* (Thunb.) K.-Pol.
(333) *Ostericum grosseserratum* (Maxim.) Kitag.
(334) *Peucedanum terebinthaceum* (Fisch.) Fischet Turcz.
(335) *Sanicula chinensis* Bge.
(336) *Saposhnikovia divaricata* (Turcz.) Schischk.
(337) *Sium suave* Walt.
(338) *Torilis japonica* (Houtt.) DC.

70. Cornaceae

- (339) *Cornus bertschneideri* L.

71. Pyrolaceae

- (340) *Pyrola rotundifolia* L.

72. Ericaceae

- (341) *Rhododendron micranthum* Turcz.
(342) *Rhododendron mucronulatum* Turcz.

73. Primulaceae

- (343) *Androdace umbellata* (Lour.) Merr.
(344) *Lysimachia barystachys* Bge.
(345) *Lysimachia pentapatala* Bge.
(346) *Primula maxiloviczii* Regel.
(347) *Primula saxatilis* Kom.

74. Oleaceae

- (348) *Syringa reticulata* (Bl.) Hara var. *mandshurica* (Maxim.) Hara.
(349) *Syringa villosa* Vahl.
(350) *Fraxinus rhynchophylla* Hcei.
(351) *Fraxinus bungeana* DC.
(352) *Fraxinus mandshurica*

75. Gentianaceae

- (353) *Gentiana macrophylla* Pall.
(354) *Gentiana pseudoaquatica* Kusnez.
(355) *Gentianopsis contorta* (Royle) Ma
(356) *Halenia sibirica* Borkh.
(357) *Swertia diluta* (Turcz.) Benth. et Hook.

76. Asclepiadaceae

- (358) *Cynanchum ascyrifolium* (Franch. et Sav.) Matsum

- (359) *Cynanchum atratum* Bge.
(360) *Cynanchum bungei* Decne.
(361) *Cynanchum paniculatum* (Bge.) Kitag.
(362) *Cynanchum thesioides* (Frey.)K. Schum.
(363) *Cynanchum thesioides* var. *australe* (Maxium.) Tsiang et P. T. Li
(364) *Metaplexis japonica* (Thunb.) Makino
(365) *Periploca sepium* Bge.

77. Convolvulaceae

- (366) *Calystegia hederacea* Wall. ex Roxb.
(367) *Calystegia sepium*(L.) R. Br.
(368) *Convolvulus arvensis* L.
(369) *Cuscuta chinensis* Lam.
(370) *Pharbitis purpurea* (L.) Voigt.

78. Polemoniaceae

- (371) *Polemonium liniflorum* V. Vass.

79. Boraginaceae

- (372) *Bothriospermum chinense* Bge.
(373) *Bothriospermum secundum* Maxim.
(374) *Cynoglossum divaricatum* Steph. ex Lehm.
(375) *Lappula myosotis* Moench.
(376) *Lappula redowskii* (Horn.) Green
(377) *Lithospermum arvense* L.
(378) *Lithospermum erythrorhizon* Sieb. et Zucc.
(379) *Trigonotis peduncularis* (Tetev.) Benth. ex Baker et Moore

80. Verbenaceae

- (380) *Vitex negundo* L. var. *heterophylla* (French.) Rehd.

81. Labiatae

- (381) *Agastache rugosa* (Fisch. et. Mey)O. Ktze.
(382) *Ajuga multiflora* Bge.
(383) *Amethystea caerulea* L.
(384) *Dracocephalum moldavica* L.
(385) *Dracocephalum rupestre* Hance
(386) *Elsholtzia ciliate* (Thunb.) Hyland.
(387) *Elsholtzia stauntoni* Benth.

- (388) *Glechoma longituba* (Nakai) Kupr.
(389) *Lagopsis supina* (Steph.) IK.-Gal. ex Knorr.
(390) *Leonurus japonicum* Houtt.
(391) *Leonurus macranthus* Maxim.
(392) *Leonurus pseudomacranthus* Kitag.
(393) *Leonurus sibiricus* L.
(394) *Lycopus lucidus* Turcz ex Benth.
(395) *Mentha haplocalyx* Briq.
(396) *Nepeta prattii* Levl.
(397) *Rabdosia inflexa* (Thunb.) Hara.
(398) *Rabdosia japonica*(Burm f.)Hara var.*glaucoalyx*(Maxim.)Hra
(399) *Salvia miltiorrhiza* Bge.
(400) *Salvia miltiorrhiza* Bge.
(401) *Schizonepeta tenuifolia* (Benth.) Briq.
(402) *Scutellaria baicalensis* Gorgi.
(403) *Scutellaria dependens* Maxim.
(404) *Scutellaria pekinensis* Maxim.
(405) *Scutellaria sordifolia* var. *wulingshanensis*(Nakai et Kitag.) C. Y. Wu et W. T. Wang
(406) *Stadhys chinensis* Bge. ex Benth.
(407) *Thymus quinquecostatus* Celak.

82. Solanaceae

- (408) *Datura stramonium* L.
(409) *Hyoscyamus bohemicus* F. W. Schemidt.
(410) *Physalis alkekengi* L. var. *franchetii* (Mast.) Makino.
(411) *Physaliastrum japonicum* (Franch. EtSav.) Honda.
(412) *Solanum nigrum* L.

83. Scrophulariaceae

- (413) *Lindernia procumbens* (Krock.) Phileox.
(414) *Mazus stachydifolius* (Turcz.) Maxim.
(415) *Melampyrum rosem* Maxim.
(416) *Pedicularis spicata* Pall.
(417) *Pedicularis striata* Pall.
(418) *Rehmannia glutinosa* (Gaertn.) Libosch. ex Fisch.
(419) *Scrophularia modesta* Kitag.

(420) *Salvia miltiorrhiza* Bge.

(421) *Veronica anagallis-aquatica* L.

(422) *Veronicastrum sibiricum* (L.) Pennell

84. Bignoniaceae

(423) *Incarvillea sinensis* Lam.

85. Orobanchaceae

(424) *Orobanche coerulescens* Steph.

(425) *Orobanche pycnostachya* Hance

(426) *Boschniakia rossica*

(427) *Cistanche deserticola*

86. Gesneriaceae

(428) *Boea hygronetrica* (Bge.) R. Br.

87. Lentibulariaceae

(429) *Utricularia vulgaris* L.

88. Phrymaceae

(430) *Phryna leptostachya* L. var. *asiatica* Hara.

89. Plantaginaceae

(431) *Plantago asiatica* L.

(432) *Plantago depressa* Willd.

(433) *Plantago hostifolia* Nakai et Kitag.

90. Rubiaceae

(434) *Galium boreale* L.

(435) *Galium verum* L.

(436) *Rulia chinensis* Regel et Maack.

(437) *Rulia cordifolie* L.

(438) *Rulia cordifolie* L. var. *pratensis* Maxim.

(439) *Rulia sylvatica* Nakai.

91. Caprifoliaceae

(440) *Abelia biflora* Turcz.

(441) *Lonicera chrysantha* Turz.ex Ledeb.

(442) *Lonicera maackii*(Rupr.) Maxim.

(443) *Sambucus williamsii* Hance

(444) *Viburnum sargentii* Roehne

(445) *Viburnum mongolicum* (Pall.) Rehd.

(446) *Weigela florida* (Bge.) DC.

(447) *Kolkwitzia amabilis* Graebn 国家III级保护植物

92. Adoxaceae

(448) *Adoxa moschatellina* L.

93. Valerianaceae

(449) *Patrinia heterophylla* Bge.

(450) *Patrinia rupestris* Juss.

(451) *Patrinia scabiosaefolia* Fisch. ex Link.

(452) *Valeriana officinalia* L.

94. Campanulaceae

(453) *Adenophora paniculata* Nannf.

(454) *Adenophora trachelioides* Maxim.

(455) *Campanla punctata* Link.

(456) *Codonopsis pilosula* (Franch.) Nannf.

(457) *Platycodon grandiflorus* (Jacq.) A. DC.

95. Compositae

(458) *Achillea alpine* L.

(459) *Achyrophorus ciliatus* (Thunb.) Sch.-Bip.

(460) *Arctium lappa* L.

(461) *Heteroplexis microcephala* 国家III级保护植物

(462) *Artemisia annua* L.

(463) *Artemisia argyi* Lév. et Vant

(464) *Artemisia capillaris* Thunb.

(465) *Artemisia igniaria* Maxim.

(466) *Artemisia japonica* Thunb.

(467) *Artemisia sacrorum*

(468) *Artemisia scoparia* Wald. et Kit.

(469) *Artemisia selengensis* Turcz. ex Bess.

(470) *Artemisia sieversiana* Willd.

(471) *Artemisia vestita* Wall.

(472) *Aster ageratoides* Turcz.

(473) *Aster tataricus* L.

(474) *Atractylodes lancea* (Thunb.)DC.

(475) *Bidens bipinnata* L.

- (476) *Bidens cernua* L.
- (477) *Bidens parviflora* Willd.
- (478) *Bidens tripartita* L.
- (479) *Cacalia hastata* L.
- (480) *Callistephus chinensis* (L.) Nees
- (481) *Carduus crispus* L.
- (482) *Carpesium cernuum* L .
- (483) *Cirsium japonicum* Fisch. ex DC.
- (484) *Cirsium setosum* (Willd.) Bieb.
- (485) *Conyza canaensis* (L.) Cronq.
- (486) *Dendranthema chanettii*(Levl.) Shih
- (487) *Dendranthema indicum* (L.) Des Moul.
- (488) *Doellingeria scabeo* (Thunb.) Nees.
- (489) *Echinops latifolius* Tausch.
- (490) *Eupatorium lindleyanum* DC.
- (491) *Heteropappus altaicus* (Willd.)Noveopokr.
- (492) *Heteropappus hispidus* (Thunb.) Less.
- (493) *Hemistepta lyrata* (Bge.) Bge.
- (494) *Inula japonica* Thunb.
- (495) *Ixeris sonchifolia* (Bge.) Hance.
- (496) *Kalimeris mongolica* (Franch.) Kitag.
- (497) *Lactuca indica* L.
- (498) *Lactuca raddeana* Maxim
- (499) *Leibnitzia anandria* (L.) Nakai
- (500) *Leontopodium leontopodioides* (Willd.) Beauv.
- (501) *Ligularia fischier* (Ledeb.) Turcz.
- (502) *Myripnois dioica* Bge.
- (503) *Picris japonica* Thunb.
- (504) *Saussurea iodosregia* Hance.
- (505) *Saussurea mongolica* (Fr.) Franch.
- (506) *Saussurea nirea* Turcz.
- (507) *Saussurea salerolepis* Nakai et Kitag.
- (508) *Saussurea albicaulis* Bge.
- (509) *Saussurea austriaca* Willd.

- (510) *Senecio nemorensis* L.
(511) *Serratula coronata* L.
(512) *Siegesbeckia pubescens* Makino.
(513) *Sonchus brachyotus* DC.
(514) *Sonchus oleraceus* L.
(515) *Stemmacantha uniflora* (L.) Ditrich.
(516) *Syneilesis aconitifolia* (Bge.) Maxim.
(517) *Synurus deltoides* (Ait.) Nakai.
(518) *Taraxacum brassicaefolium* Kitag.
(519) *Taraxacum erythropodium* Kitag.
(520) *Taraxacum mongolicum* Hand.-Mazz.
(521) *Taraxacum pseudo-album* Kitag.
(522) *Turczaninowia fastigiata* (Fisch.) DC.
(523) *Xanthium sibiricum* Patrin ex Widd.

96. Potamogetonaceae

- (524) *Potamogeton distinctus* A. Benn.
(525) *Potamogeton malaianus* Miq.

97. Juncaginaceae

- (526) *Triglochin palustre* L.

98. Alismataceae

- (527) *Sagittaria trifolia* L.
(528) *Sagittaria trifolia* L. var. *sinensis* (Sims.) Makino.

99. Gramineae

- (529) *Achnatherum extremiorientale* (Hara) Keng.
(530) *Achnatherum pekinense* (Hance) Ohwi.
(531) *Alopecurus aequalis* Sobol.
(532) *Arthraxon hispidus* (Thunb.) Makino.
(533) *Arundinella hirta* (Thunb.) Tanaka.
(534) *Avena fatua* L.
(535) *Bothriochloa ischaemum* (L.) Keng.
(536) *Calamagrostis pseudophragmites* (Hall. f.) Koel.
(537) *Chloris virgata* Swartz
(538) *Cleistogenes polyphylla* Keng.
(539) *Diarrhena mandshurica* Maxim.

- (540) *Diarrhena ciliaris* (Retz.) Koel.
(541) *Diarrhena ischaemum*(Schreb.) Schreb. ex Muhl
(542) *Diarrhena sanguinalis* (L.) Scop.
(543) *Echinochloa crusgalli*(L.) Beauv.
(544) *Echinochloa crusgalli* (L.) Beauv. Var.*caudata* (Roshev.) Kitag.
(545) *Eragrostis cilianensis* (All.) Vign.-Lut.
(546) *Eragrostis ferruginea* (Thunb.) Beauv.
(547) *Eragrostis pilosa* (L.) Beauv.
(548) *Eragrostis poaeoides* Beauv.
(549) *Eriochloa villosa* (Thunb.) Kunth,
(550) *Hemarthria altissima* (Poir.) Stapf.et C.E.Hubb.
(551) *Imperata cylindrical* var. *major*(Nees)C.E.Hubb ex Hubb et Vaughan.
(552) *Leymus chienesis* (Trin.) Tzvel.
(553) *Melica turczaninowiana* Ohwi.
(554) *Miscanthus sacchariflorus* (Maxim.) Benth.
(555) *Phragmites australis* (Cav.) Trin. Ex Steud.
(556) *Poa annua* L.
(557) *Roegneria turczaninovii*(Drob.) Nevski.
(558) *Setaria lutescens* (Weigel) F. T. Hubb.
(559) *Setaria viridis* (L.) Beauv.
(560) *Spodiopogon sibiricus* Trin.
(561) *Themeda japonica* (Franch.) Hack.

100. Cyperaceae

- (562) *Carex bostrychostigma* Maxim.
(563) *Carex heterolepis* Bge.
(564) *Carex heterostachya* Bge.
(565) *Carex neurocarpa* Maxim.
(566) *Carex siderosticta* Hance
(567) *Carex pumila* Thumb.
(568) *Cyperus difformis* L.
(569) *Cyperus glomerantus* L.
(570) *Cyperus iria* L.
(571) *Cyperus microiria* Steud.
(572) *Cyperus nipponicus* Fr. et Sav.

(573) *Eleocharis intersita* Zinserl.

(574) *Juncellus serotinus* (Rottb.) C. B. Clarke.

(575) *Kyllinga brevifolia* Rottb. var. *leiolepis* (Franch. et Savat) Hara.

(576) *Pycerus globosus* (All.) Reichb.

(577) *Pycerus sanguinolentus* (Vahl) Nees.

101. Araceae

(578) *Acorus calamus* L.

(579) *Pinellia ternate* (Thunb.) Breit.

102. Juncaceae

(580) *Juncus decipiens* (Buch.) Nakai.

(581) *Luzula multiflora* (Ratz.) Lej.

103. Liliaceae

(582) *Allium condensatum* Turcz.

(583) *Allium macrostemon* Bge.

(584) *Allium neriniflorum* (Herb.) Baker.

(585) *Allium plurifoliatum* Rendle var. *stenodon* (Nakai et Kitag.) J. M. Xu

(586) *Allium senescens* L.

(587) *Allium tenuissimum* L.

(588) *Allium victorialis* L.

(589) *Allium victorialis* L. var. *listera* (Searn.) J. M. Xu.

(590) *Asperagus scoberoides* Kunth.

(591) *Anemarrhena asphodeloides* Bge.

(592) *Asparagus trichophyllus* Bge.

(593) *Convollaria majalis* L.

(594) *Fritillaria maximowiczii* Freyn.

(595) *Hemerocallis minor* Mill.

(596) *Lilium concolor* Salisb.

(597) *Lilium pumilum* DC.

(598) *Matanthemum bifolium* (L.) F. W. Schmidt.

(599) *Paris verticillata* M.-Beb.

(600) *Polygonatum acuminatifolium* Kom.

(601) *Polygonatum humile* Fisch. ex Maxim.

(602) *Polygonatum involucreatum* (Franch. et Sav.) Maxim.

(603) *Polygonatum macropodium* Turcz.

(604) *Polygonatum odoratum* (Mill.) Druce.

(605) *Polygonatum sibiricum* Delar. ex Redonte.

(606) *Polygonatum stenophyllum* Maxim.

(607) *Scilla scilloides* (Lindl.) Druce

(608) *Smilacina japonica* A.Gray.

(609) *Smilac riparia* A. DC.

(610) *Veratrum nigrum* L.

104. Iridaceae

(614) *Iris ruthenica* Ker-Gawl. var. *nana* Maxim.

(615) *Belamcanda chinensis* (L.) DC

3. List of Major Animal Resources in the Heritage Site

Table 16 List of birds in Kuancheng County

Genus	Specie		
	I	II	III
<i>Podicipedidae</i>			<i>Tachybaptus ruficollis</i>
<i>Ardeidae</i>			<i>Ardea cinerea</i> <i>Ardeola bacchus</i> <i>Ixobrychus sinensis</i> <i>Botaurus stellaris</i>
<i>Ciconiidae</i>	<i>Ciconia nigra</i>		
<i>Anatidae</i>		<i>Cygnus cygnus</i> <i>Cygnus olumbianusi</i>	<i>Anser cygnoides</i> <i>Anser fabalis</i> <i>Anas crecca</i> <i>Anas falcata</i> <i>Anas platgrhycha</i> <i>Anas poecilorhyncha</i> <i>Anas Penelope</i> <i>Anas querquedula</i> <i>Anas clypeata</i> <i>Aythya baeri</i> <i>Aythya fuligula</i> <i>Aix galericulata</i> <i>Mergus merganser</i>
<i>Accipitridae</i>	<i>Buteo lagopus</i>	<i>Milvus migrans</i> <i>Accipiter gentilis</i> <i>Accipiter nisus</i> <i>Buteo hemilasius</i> <i>Aquila clanga</i> <i>Circus cyaneus</i>	
<i>Falconidae</i>		<i>Falco vespertinus</i> <i>Falco columbarius</i> <i>Falco tinnunculus</i>	
<i>Phasianidae</i>		<i>Pucrasia macrolopha</i>	<i>Alectoris chukar</i> <i>Coturnix coturnix</i> <i>Phasianus colchicus</i>
<i>Rallidae</i>			<i>Gallinula chloropus</i> <i>Fulica atra</i>
<i>Charadriidae</i>			<i>Vanellus vanellus</i> <i>Vanellus cinereus</i>

			<i>Charadrius hiaticula</i> <i>Charadrius dukius</i> <i>Charadrius alexandrinus</i>
<i>Scolopacidae</i>			<i>Numenius arquata</i>
<i>Picidae</i>			<i>Jynx torquilla</i> <i>Picus canus</i> <i>Picoides major</i> <i>Picoides hyerythrus</i> <i>Picoides canicapillus</i>
<i>Hirundinidae</i>			<i>Hirundo rupestris</i> <i>Hirundo rustica</i> <i>Hirundo daurica</i> <i>Delichon urbica</i>
<i>Motacillidae</i>			<i>Dendronanthus</i> ⁸⁰ . <i>Motacilla alba</i> <i>Motacilla flava</i> <i>Motacilla citreola</i> <i>Motacilla cinerea</i> <i>Anthus novaeseelandiae</i> <i>Anthus hodgsoni</i>
<i>Bombycillidae</i>			<i>Bombycilla garrulous</i> <i>Bombycilla japonica</i>
<i>Laniidae</i>			<i>Lanius tigrinus</i> <i>Lanius cristatus</i> <i>Lanius excubitor</i>
<i>Oriolidae</i>			<i>Oriolus chinensis</i>
<i>Dicruridae</i>			<i>Disrurus macrocercus</i>
<i>Sturnidae</i>			<i>Sturnus sturnus</i>
			<i>Sturnus cineraceus</i>

Table 17 List of Mammal in Kuancheng County

Family	Specie	Protection level
<i>Erinaceidae</i>	<i>Erinaceus europaeus</i>	
<i>Soricidea</i>	<i>Sorex araneus</i>	
<i>Vespertilionidae</i>	<i>Pipistrellus abramus</i>	Provincial protected animal
	<i>Vespertilio superans</i>	Provincial protected animal
<i>Cercopithecidae</i>	<i>Macaca mulatta</i>	National Class II protected animals
<i>Leporidae</i>	<i>Lepus capensis</i>	Provincial protected animal
<i>Sciuridae</i>	<i>Pteromys Volans</i>	Provincial protected animal
	<i>Trogopterus xanthipes</i>	Provincial protected animal
	<i>Aeretes melanopterus</i>	Provincial protected animal

	<i>Spermophilus dauricus</i>	
	<i>Eutamias sibiricus</i>	Provincial protected animal
	<i>Sciurotamias davidianus</i>	
	<i>Sciurus vulgaris</i>	Provincial protected animal
	<i>Tamiops swinhoei</i>	
	<i>Allactaga sibirica</i>	
Muridae	<i>Apodemus agrarius</i>	
	<i>Apodemus peninsulae</i>	
	<i>Apodemus draco</i>	
	<i>Micromys minutus</i>	
	<i>Mus musculus</i>	
	<i>Rattus norvegicus</i>	
	<i>Meriones unguiculatus</i>	
Cricetidae	<i>Rattus niviventer</i>	
	<i>Clethrionomys rufocanus</i>	
	<i>Cricetulus barabensis</i>	
	<i>Cricetulus longicaudatus</i>	
	<i>Cricetulus triton</i>	
	<i>Eothenomys shanseius</i>	
	<i>Microtus mandarinus</i>	
	<i>Microtus maximowiczii</i>	
	<i>Microtus gregalis</i>	
	<i>Myospalax fontanieri</i>	
	<i>Myospalax psilurus</i>	
<i>Myospalax aspalax</i>		
Canidae	<i>Canis lupus</i>	
	<i>Nyctereutes procyonoides</i>	Provincial protected animal
	<i>Vulpes vulpes</i>	Provincial protected animal
Ursidae	<i>Selenarctos thibetanus</i>	National Class II protected animals
Mustelidae	<i>Arctonyx collaris</i>	Provincial protected animal
	<i>Meles meles</i>	Provincial protected animal
	<i>Martes flavigula</i>	Provincial protected animal
	<i>Mustela eversmanni</i>	Provincial protected animal
	<i>Mustela sibirica</i>	Provincial protected animal
Viverridae	<i>Paguma larvata</i>	Provincial protected animal
Felidae	<i>Felis bengalensis</i>	Provincial protected animal
	<i>Felis manul</i>	National Class II protected animals
	<i>Felis lynx</i>	National Class II protected animals
	<i>Panthera pardus</i>	National Class I protected animals
Suidae	<i>Sus scrofa</i>	Provincial protected animal
Cervidae	<i>Capreolus capreolus</i>	Provincial protected animal

	<i>Cervus elaphus</i>	National Class II protected animals
Bovidae	<i>Naemorhaedus goral</i>	National Class II protected animals
	<i>Procapra guttursla</i>	National Class II protected animals