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Research on the Ecological Agricultural Landscape Planning and Design Strategy of Nihegou Village in Northern Shaanxi Province

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Abstract: The village of Nihegou in northern Shaanxi is an important agricultural and cultural heritage site, a traditional Northwest China village and a model village for rural tourism. With the participation and efforts of many parties, various strong and beneficial agricultural policies have been implemented, the local infrastructure and public services have been continuously improved, the village environment has basically been maintained as neat and orderly, and actions to improve the rural living environment have been conducted in succession, but the unbalanced, inadequate and disharmonious situation in the local area still needs to be alleviated, there are no stable industries in the area, the population is aging, "hollowing out" exists to a certain extent in the villages, the ecological landscape has been destroyed, and the rural agricultural tourism industry lacks hardware support. In this paper, we study the work of the "three rural areas" in the context of the harmonious countryside, sort out the ecological and agricultural landscape resources and problems in Nihegou village in northern Shaanxi, and implement specific design strategies for the agricultural landscape of the selected site. The project will continue to improve the quality of the rural habitat and public services, promote the harmonious development of the rural economy and ecology.

Keywords: Rural revitalization; Nihegou village; Ecological agriculture; Landscape planning and design; Traditional village

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Environmental Overview

The village of Nihegou in Zhujiqiao Township is located 18 km north of the county town of Jia County, Yulin City, northern Shaanxi Province (**Figure 1**), at the following latitude and longitude coordinates: 110° 49' E and 38° 18' N.

Adjacent to the Yanghuang Highway (China's "Highway 1"), the village belongs to a cluster of mountain hoop kilns, with gullies, closed mouths and wind and dust; it is surrounded on three sides by mountains, with a good landscape pattern and natural features, and the village retains generations of genealogy and folk culture, ancient buildings and a complete heritage system (**Figure 2, Table 1**).

Jia County, where Nihegou is located, has been known as Jia Prefecture since ancient times and has a complex topography with continuous hills. It is a pure mountainous region, 85 km long from north to south and 32.95 km wide from east to west, with an area of 2,028 km². It has long winters and short summers, with four distinct seasons, large temperature differences between day and night, plenty of light but little rainfall, and concentrated rainfall between June and September, with an average annual rainfall total of 395 mm (**Figure 3**).

Table 1. Statistics on the titles awarded to the villages in Nihegou, Shaanxi Province, when they were awarded and by which units (Drawn by Min Wu)

Date	Award title	Awarded by
May 2001	Title of "Famous Township of Red Date" in China	State Forestry Administration
2009	Issuance of certificates of registration of geographical indications for agricultural products	National Ministry of Agriculture
May 2013	First batch of "Chinese Agricultural Cultural Heritage" awards	National Ministry of Agriculture
April 2014	"Globally Important Agricultural Cultural Heritage" award	UN Agri-Food Organization (FAO)
November 2014	Third batch of "Chinese Traditional Villages" protection list	Ministry of Housing and Urban-Rural Development, State Administration of Cultural Heritage, etc.
2016	"Model Village for Rural Tourism"	Relevant Departments and Bureaus of the Ministry of Agriculture and Rural Affairs
2016	"Top 100 examples of beautiful countryside in China"	Relevant Departments and Bureaus of the Ministry of Agriculture and Rural Affairs
2017	"Provincial Water Department Scenic Area"	Shaanxi Provincial Department of Water Resources

The village is prone to natural disasters such as soil erosion, drought, frost and hail and has a relatively poor ecological environment, having experienced "nine droughts in ten years." The terrain in the mountains provides a good base for the irrigation and drying of jujube plantations (**Figure 4**). Due to the special geographical and climatic conditions of the village, the survival rates of crops other than jujube trees are low, and few other crops are planted. In spring, the mountains circulate breezes around the village, allowing for good temperature storage and early germination of the jujube trees, extending the growth period of the jujube. By autumn, the temperature difference within the village is extremely variable, and the ripening of jujube fruit is extremely conducive to the transformation of sugar and material. Red jujube fruit that has undergone the baptism of wind and frost is particularly valuable, making oil jujube one of the ten most famous jujubes in China. The annual production of red jujube is 1.2 million pounds, and red jujube is the most important source of income for rural farmers. This food crop is mainly grown in jujube woodland, but the yield is not high [1].

The Eco-Agricultural Landscape Environment in the Village of Nihegou

The ecological landscape setting of the date palm garden

The ecological landscape setting of the date palm garden [2]. It is also the largest and best-preserved jujube tree community in the world. This is why Nihegou Village is known as the "No. 1 village of jujube trees in the world."

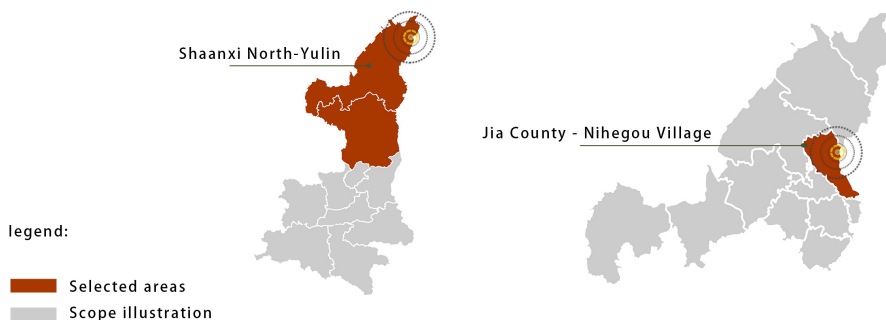


Figure 1. Village location analysis, traffic circle diagram (Drawn by Min Wu)



Figure 2. A map of the current state of the ancient architectural complex and natural features in the village of Nihegou in northern Shaanxi (Photographed by Min Wu)

Date garden culture

According to historical records, date palms have been planted here since approximately 400 AD. The existing ancient jujube plantations are of unprecedented scale, covering an area of 36 acres around the village buildings alone, with thousands of standing ancient jujube trees [3]. One of them, identified by experts as the “King of Jujube Trees,” is over 1400 years old and has been hailed as a “living fossil” by the Chinese Jujube Journal, with a height of 8.3 meters, a stem circumference of 3.41 meters and a crown width of 13.4 meters. The tree produces more than a hundred pounds of dates every year, it takes three adults to embrace a circle together. In addition, the ancient date palm community in Nihegou has undergone a complete domestication process from wild-type dates, semicultivated dates, and cultivated dates to cultivated dates [4]. There is strong evidence that this is the source and home of the jujube. The village has accumulated a wealth of experience in the garden management, harvesting and drying, and processing and storage of dates. However, the jujube trees are weathered, and although they have been protected by a specific sign to the farmers, they have not been protected by systematic science; with the popularization of jujube seeds, the yield of jujube forests is not high, and the amount of farming development is small, with no large-scale enterprises, no tertiary industry development regarding jujube culture, few traditional activities related to jujube culture, a lack of unique jujube garden landscapes, and unharmonious buildings surrounding the jujube gardens. Thus,

relevant traffic instructions should be clearly implemented, and there is a need to improve the local infrastructure (Figure 5).

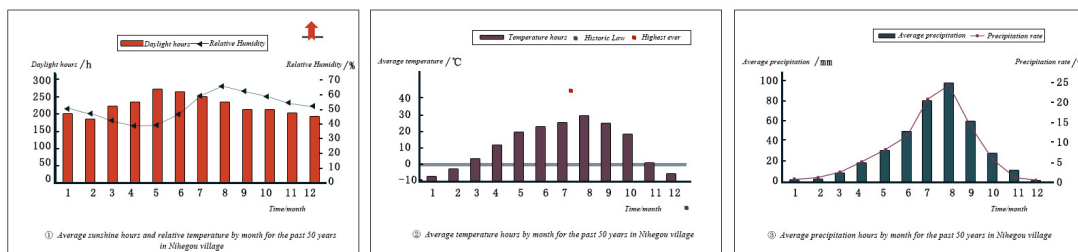


Figure 3. Analysis of the sunshine/temperature/precipitation conditions over the last 50 years in Nihegou village (Drawn by Min Wu)

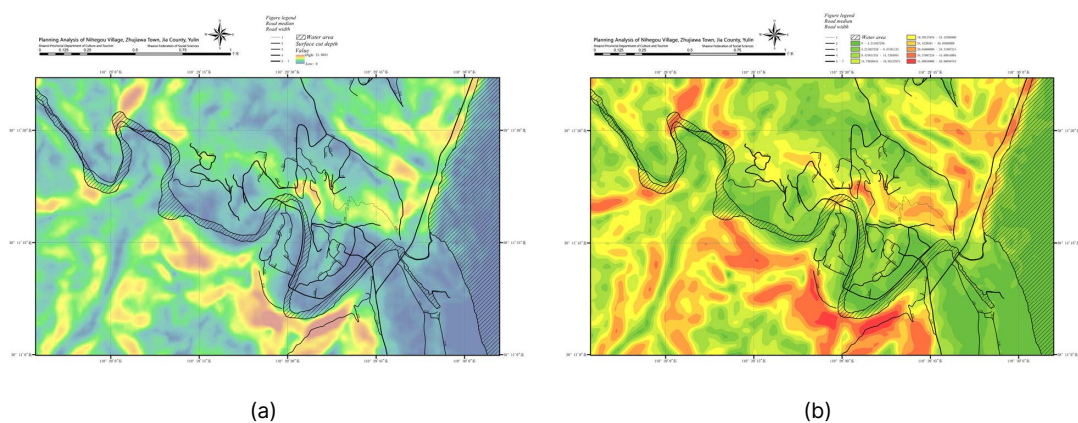


Figure 4. Analysis of climatic conditions in the Nihegou (Drawn by Min Wu)

Irrigation systems

The water storage dam, the Shunshui dam and the inverted rainbow irrigation system built in the 1970s are the result of the agricultural wisdom of previous generations of working people. In 1974, an inverted rainbow irrigation system was built to collect rainwater (Figure 6), nourish the jujube groves, store water and create a soil rich in nutrients. This system plays an important role in irrigating fields, maintaining ecosystem balance, providing a suitable space for the biodiversity of waterways to grow and ensuring the stability of the ecosystem. The dams have been washed away and rebuilt several times to date, leaving the inverted rainbow irrigation system with a poor ecological environment, a lack of greenery and an imbalance of living species.

Geocological landscape setting

At the entrance of the village, there are two precious mountains, Golden Lion Mountain and Silver Elephant Mountain. Standing at the top of the Golden Lion Mountain, you can see the Mother River strung by China Highway No. 1; standing at the observation deck at the top of the Silver Elephant Mountain, you can see an overall bird’s eye view of the village of Nihegou, and the vegetation on

this mountain has been better maintained. The rare sun-dated cliffs and the Yangcliff Trail in the mountains have become a cornerstone for tourists to tread and stop, and the partial parapets on the mountains have been damaged, with single facilities and no local characteristics. The village is located in a dry environment, with directional winds on the mountain constantly blowing and causing erosion, forming a strip of concave and convex grooves; in the back of the mountain, there is a canyon highlighting the Yardan landform, named the “Meng Han word cliff.” These landforms are arranged in rows, with the polishing of feng shui, and have been gradually exposed due to precipitation over time. Without development planning, it would be difficult for visitors to discover these Yardan landforms.

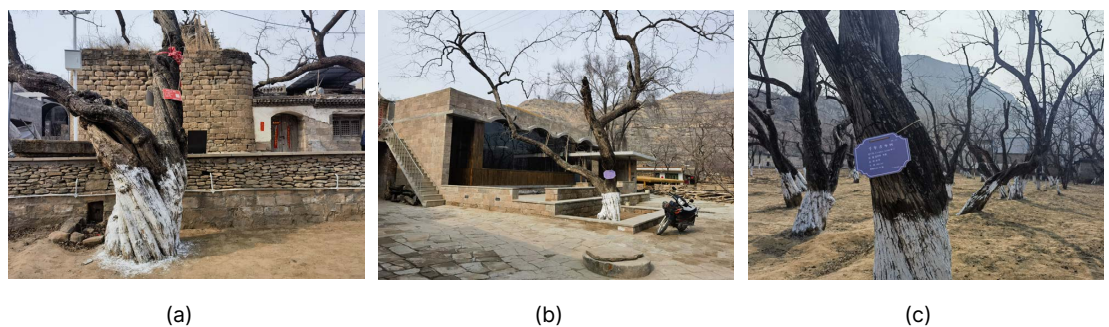


Figure 5. The current state of the landscape setting of the Ancient Jujube Garden (Photographed by Min Wu)

The Yellow River at the mouth of the village of Nihegou differs from the upstream and downstream areas in terms of its curvature, and because of this feature, the village is bordered by a large area of Yellow River beach, creating fertile soil for cultivation and a large sandy beach. Surrounding the village is the Chehui River, which flows from north-west to south-east to join the Yellow River and is part of a delta of silted river valleys, and the particular shape of the village is largely the result of the Chehui River valley. In this zone of harmonious coexistence between humans and nature, rich biodiversity and a good ecological environment were preserved 2000 years ago. Today, Yellow River erosion in China is a serious problem. The scenes from earlier years of children playing and fishing and women washing and drying in the small river have disappeared (**Figure 7**). In recent years, the river flow has been small, in contrast from its former life, and serious ecological damages have occurred.

Courtyard ecological landscape setting

The village of Nihegou has a relatively scattered distribution, with over 60% of the residential buildings being kiln buildings and the formation of kiln colonies (**Figure 8**). There are 228 courtyards, 61 of which were built during the Qing Dynasty and 40 of which were built during the Ming Dynasty. Thirteen immovable cultural relics remain, including the “Former Residence of Wu Kaizhang,” an ancient theatre and temples; these are national cultural protection units of the Qing Dynasty, while the remaining buildings are mostly courtyard and kiln dwellings. Several traditional kiln caves from the Ming and Qing dynasties remain intact. Although the courtyard architecture is very elaborate and the spatial form is rich, the landscape is singular, and the greenery is dominated by apricot and jujube trees. Some of the old buildings have fallen into disrepair and no longer have residential functions,

and there are also some dangerous buildings; thus, the modern residents are not in harmony with the overall appearance of the village (Figure 9).



Figure 6. Current status of the inverted rainbow irrigation system (Photographed by Min Wu)

Landscape Planning and Design for Ecological Agriculture in Nihegou Village

The village of Nihegou is typical of the feng shui concept of a traditional Chinese village; it is based on the concept of “building a house on a mountain and forming a village by water” and on the traditional feng shui concept of “hiding wind and gathering qi.” The village has an ancient jujube orchard as the core area for resource protection and agricultural cultivation, a river as the water source and mountains as the base terrain [4]. Based on the analysis, the unique agricultural landscape of Nihegou Village is a complex agroecological system with deep cultural connotations. However, the village is facing a situation with no stable industry and the phenomenon of an aging and hollowing-out population, and the “smoke and fire” of the settlement is lessening, so determining how to protect and develop this village is the top planning and design priority currently.



Figure 7. Plan of the agroecological landscape distribution in Nihegou village (Drawn by Min Wu)

Old tree conservation

The development of field farming civilization and traditional culture forms the living heritage of countryside products because the natural landscape nodes of Nihegou village can be divided into ancient tree protection, jujube viewing routes, irrigation systems and other field landscape designs. The integration of village resources and industries, moderate development and the introduction of human flow have enhanced the development of the jujube industry and the industry expansion, allowing jujube to become the main material of processing plants and production integration, and driving villagers to employment and income, furthering the cultural and tourism development of the harmonious village. The agricultural landscape can be a farming experience site, with minimal intervention required to form a natural Earth landscape, maintain the balance of the ecosystem, or enhance the diversity of biological systems. The “revitalization” of the cultural heritage, conservation and heritage are the goals of the future use of this village.

In terms of agricultural heritage, although ancient trees grow freely, they are cultivated by human beings and require regular human care. Date palm trees are divided into human-planted and wild ancient trees, which regularly produce waste wood and are later designated to make use of valuable natural resources and take conservation measures; for wild ancient date palm trees, it must be determined how to integrate resources and conduct small-area design initiatives.

For the 36-acre ancient jujube garden, which is a globally important agricultural heritage site, the design and construction of the garden follow the principle of minimal intervention, with the main theme of the garden being human activities, including visual, tactile, and auditory activities such as jujube viewing, jujube beating, jujube celebrating and jujube tasting. The design of the ancient jujube garden is based on the principle of minimal intervention.

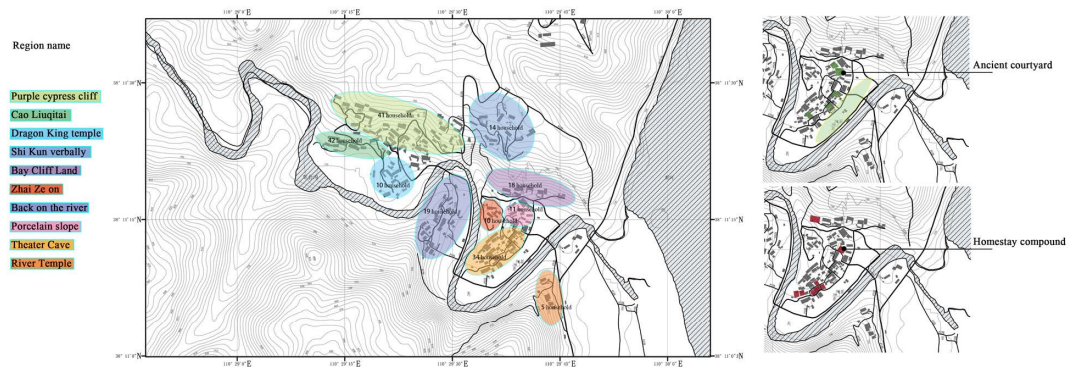


Figure 8. Diagram of the distribution of buildings in the village of Nihegou (Drawn by Min Wu)



Figure 9. Map of the integration and analysis of the current problems of the village (Drawn by Min Wu)

To summarize the above points (Figure 10):

- Date culture-related themed activities should be set up in the ancient date garden at regular intervals; and
- The lighting in the ancient jujube garden should be increased to create a night scene of the ancient jujube garden and reserve an exclusive and strong sense of regional culture; and
- The surrounding supporting facilities environment and governance system should be enhanced.

Wild sour jujube, as one of the five fruits of ancient China, has a long cultivation history. The Northern Wei Dynasty Jia Siwei writings “Qi Min Yao Shu” and the Ming Dynasty writing “Ben Cao Gang Mu” record that the beach jujube trees of mud river ditches can be used as medicine and has some

value in Chinese medical research and development. In ancient times, Jia County, where Jiaozhou is located, was a suitable area for the growth of jujube trees along the Yellow River’s soil and rocks. This area was also used to host activities regarding knowledge dissemination and picking experience (Figure 11).

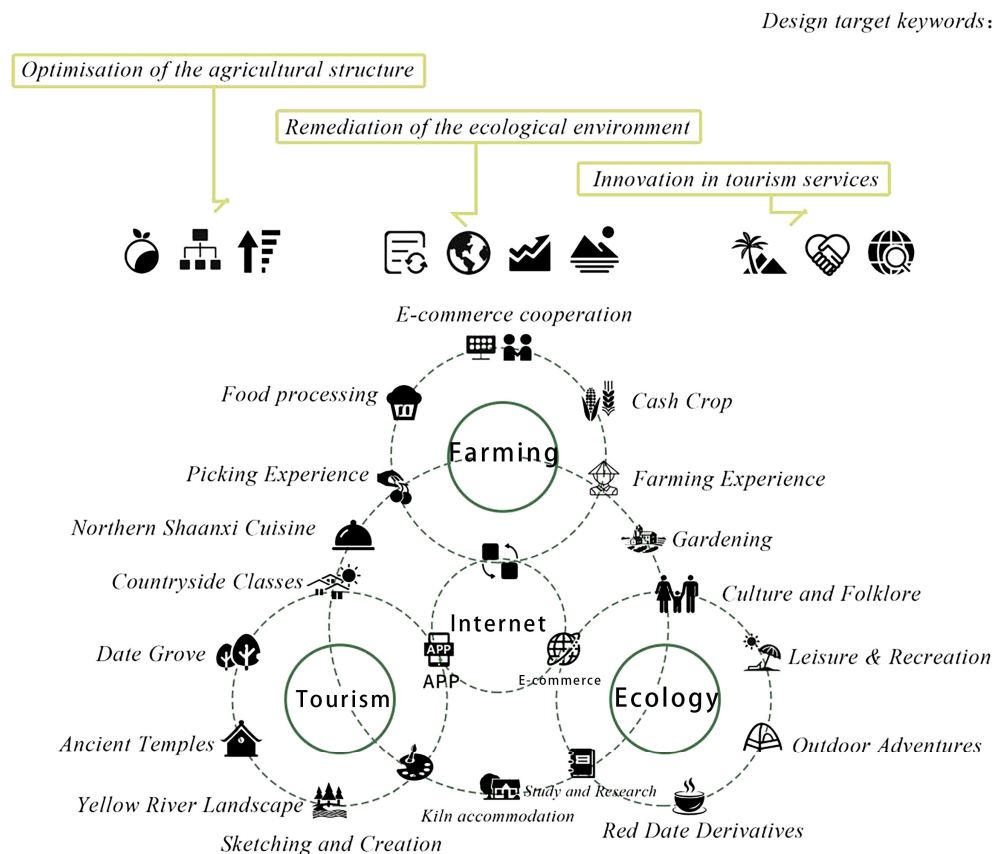


Figure 10. Schematic diagram of the design objectives for the conservation of old trees (Drawn by Min Wu)

In response to the above situation, two points need to be taken seriously:

- The differentiation, and protection of native tree species should be enacted; and
- Excursions for picking wild ancient trees and sour dates should be planned.

Every year, village farmers obtain date palm wood of varying thickness and length that is left unused to make their fields more conducive to the growth of trees in the coming year. This wood can be reused as railings for the Yangtze Trail, as natural benches for tourists to chat with the “people of the city,” as road guide system to mark the wild old tree tour route, and to build a native pavilion for resting on the mountain.

Finally, it should be noted that unused timber from the village should be reused to create benches, road signs, trestle fences, native pavilions, etc.

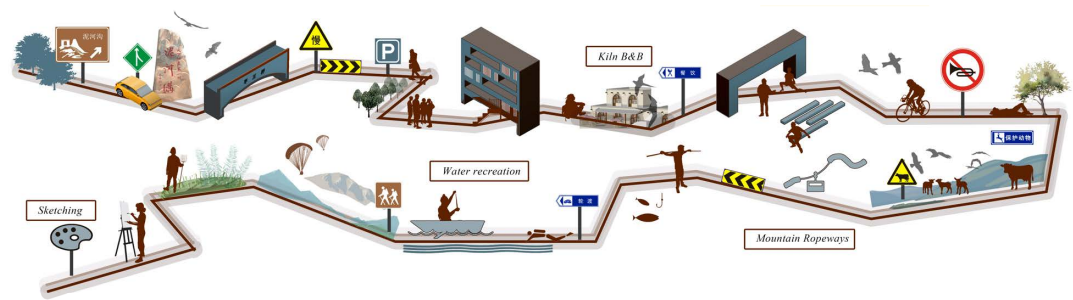


Figure 11. Schematic diagram of the nodal string of ecological landscape viewing routes in Nihegou village
(Drawn by Min Wu)

Mountain stone mountain agricultural landscape design

The north-south flow of the Yellow River separates Shanxi and Shaanxi, Shaanxi's Jia County and Shanxi's Linxian River and its confluence, with the same warm, temperate, continental, semiarid monsoon climate conditions, causing Earth and stone landforms and gullies to develop along this section of the Yellow River on both sides. The village of Nihegou is located on the west bank of the Yellow River, where the Chehui River from the west meanders eastward into the Yellow River, with a mountainous overhang to the north and a mountainous bend to the south, thus forming a closed microgeographical unit along the tributaries of the Yellow River.

Nihegou has a single entrance due to the closed environmental landforms of Golden Lion Mountain and Silver Elephant Mountain; this topography is conducive to the overall shelter and insulation of the village and for the gathering of people to live. The diversity of the village mountain settlement features, including the village mountain rock formations resulting from long-term erosion by strong river valley winds, are more prominent in the village and include the stone mountain Yarden geomorphic features. The formation of rare natural landscapes, Yang cliff stacks, ropeway designs, Yarden stone stairs, and stone mill landscapes have all been topics of studies on mountain rock ecological landscape development and the design of key objects.

The Yangya Trail was first used as a stone cliff for drying jujube grain but was later changed to a scenic mountain road; visitors can travel along this narrow and winding mountain road to experience the village's mountain roads, stepping where the ancestors worked in the steep mountains, standing in the Yangya Trail, and overlooking the village, flowing water, small bridges, and smoke. In terms of design, the landscape of the Yang Ya Trail itself is somewhat unpleasant; first of all, "the most beautiful Tiejiazhou, the impression of Nihegou" is shown in large words in the middle of the mountain road, hindering the smoothness of the mountain road. In addition, the iron fence has been damaged, and the overall tone of the village does not match this road; this could be improved through the abovementioned use of unused wood.

The Yadan landforms are connected by a long period of erosion, with the upper part of the mountain being covered by wind erosion and little vegetation, while the lower part of the mountain consists of exposed laminated stone. Using the principle of "repairing the old as the old," it is necessary for the

designers to add man-made Yandan roads to connect these areas, ensuring that visitors can see the real changes in the mountain as well as the design details and natural artifacts.

The word “stone mill” is a household word, and stone mills are found in the courtyards of every household in Nihegou. In the old days, stone mills were the main tool used to press grain, and behind the existence of each stone mill, there was an inherent meaning to its existence; the mills are not as functional as they were in the past, but they are a spiritual symbol of perseverance. Unfortunately, many compounds have now dismantled their stone mills, and here, the conservation of the stone mill agricultural landscape is proposed. Although they are not used as much as in previous years, the stone mills themselves form an agricultural landscape vignette, and a sculptural vignette derived from this stone mill vignette could be established (**Figure 12**).



Figure 12. Schematic design of the stone mill landscape vignette (Drawn by Min Wu)

Ecological barges are designed

The idyllic landscape of Nihegou Village contains not only the 36 acres of ancient date palm orchards but also the large “oasis” characterized by the communication ditch. In the summer, this ditch is a “signpost” for vehicles driving along the Yellow Road, and when you see the lush jujube orchards, you are undoubtedly in Nihegou Village. The “oasis” connects the Yellow River with the village, and villagers come and go on both sides, recounting the charm of this idyllic landscape with their sweat. This field is dominated by date palm trees, supplemented by fruits and vegetables, and is dark green to the naked eye. Further east is a large area of stone along the Yellow River beach, in stark contrast to the soft sand. With the Mother River, this area forms a gradual geomorphic landscape with a mixture of “yellow, green and blue” colors visible to the naked eye; a variable and detailed landscape in terms of texture; and a varied human landscape in terms of activity. However, as the soil erosion problem in the Yellow River is serious, the design of the barge is based on protection, followed by the designs of small water-friendly barges and piers that give people different feelings and activities. With minimal interference with natural resources, the barges are designed to provide a variety of functions, such as touring, fishing, boat transport and rafting facilities.

To summarize the above, the design of the Yellow River beach barges must satisfy the following requirements:

- Minimal interference with nature and protection from geological erosion; and
- The docks should cater to rafting and boat traffic; and
- Fixed fishing spots and fishing landscape barges should be established; and

- Visitors' desire for water-friendly activities should be catered to.

There is a small reservoir that holds water and is the greenest source of water in the village of Nihegou; in this reservoir, you can see small fishes and insects in the mud in the shallow places, while the water is approximately the height of a human adult in the deep areas. The dam was built in the autumn of 1975 and was later washed away and rebuilt, and the dam is still in use today, having been rebuilt three times. It was completely rebuilt in 2022, with the water flowing in several ways: the branch goes along the river, and another branch flows on the inverted rainbow.



Figure 13. Intentional design drawing of the sullen wheel storage dam (Drawn by Min Wu)

In summary, the design of the sullen wheel storage dam should involve (**Figure 13**):

- The transformation of the natural river characteristics of the permeable barge and the construction of invisible construction on the storage dam to play a protective role; and
- The introduction of living creatures to achieve biodiversity and symbiotic reproduction of a wide range of organisms and harmonious coexistence between humans and nature; and
- The enrichment of the greenery around the reservoir to maintain ecological balance; and
- The use of natural pool shore composition should be applied to shorten the distance between people and water, as this would be conducive to meeting people's hydrophilic needs and could provide comfortable, pleasant and safe places for farmers, children and tourists to rest and play.

The rainbow irrigation system was built in the ancient date palm orchard in 1964 to water the fields and drain the rainwater. The construction of this rainbow was the result of the wisdom of our ancestors, who used the low topography of the village to the south and the high topography of the village to the north to bring the water from the Chehui River into the ancient jujube garden and back to the Chehui River. Ten years ago, there were still tadpoles and frogs on the Daohui River canal, so the interaction with nature could be felt here, though it was not present in the city. This area is a wonderful place to

feel the harmony between humans and nature, to feel the life of nature, and to facilitate play between children and small creatures. The rainbow system is much more than just an irrigated field; it can be the safest and most nature-friendly area for children.

The two banks of the Chehui ditch barge were worked on in 2019; the western half was built on the north side of the river, and the eastern half of the wind was built on both sides of the river, with steps every few dozen meters to reach directly onto the river, where the water was both deep and shallow in areas, with daily crowds of people swimming and playing, washing their cars and performing other activities. Almost all of the villagers can swim due to the skills they learned as children on the Chehui River. One of the reasons for this diminishing phenomenon is the issue of the dam design and ecological water storage.

From the above summary, the Chehui ditch barge design should be established as follows:

- The dam step design should be less partitioned; because the natural road type was changed into a dam with a height difference, the interactions of villagers and tourists with the river were hindered, so a step-type flood control and water storage dam should be designed to unblock this area; and
- Multifunctional dam design, flood control and water gathering should be considered while designing old grooves between the masonry of the dam, and greenery should be planted to visually increase the number and area of green spots, thereby effectively reducing soil and water environmental breakdowns, maintaining ecological balance, and controlling noise; and
- The stepped barge design should be established to increase the sense of human participation, and a seating bench design should be set up. At leisure at dusk, people could thus see the beauty of the sunset over the ravine with the sound of running water.

B&B courtyard design

The development of B&B tourism construction is already in progress in Nihegou village, and 10 famous lodging courtyard designs have been established. To develop cultural tourism, stakeholders should focus on the original building courtyard landscape during the regeneration and application of agricultural ecology. The development of the village B&B, aiming to primarily drive the village tourism industry, cannot be homogenized with the designs of other villages, and the development of mud river gou village characteristics of the cultural tourism industry is the most important, as such villages contain architectural transformation, business models, food cultures, humanities, folklore, and the planning and management of comprehensive coordination.

For the Nihegou compound design study (**Figure 14**):

- Farmers should operate the compound with policy guidance, multiple participants and professionals involved in the design to create a village with an original characteristic architectural compound; and
- Hosts should guide visitors to their respective compounds and the increase economic industry; and
- Hosts can plan activities that are characteristic of the compound so that visitors can experience

local folk customs and culture, authentic farm-to-table meals and humanistic spirit; and

- Recreational and ecological landscape compounds should be created to enhance the living environment and service quality; and
- The infrastructure should be improved, and local agricultural and cultural landscape elements should be implemented to create a unique local B&B courtyard landscape.

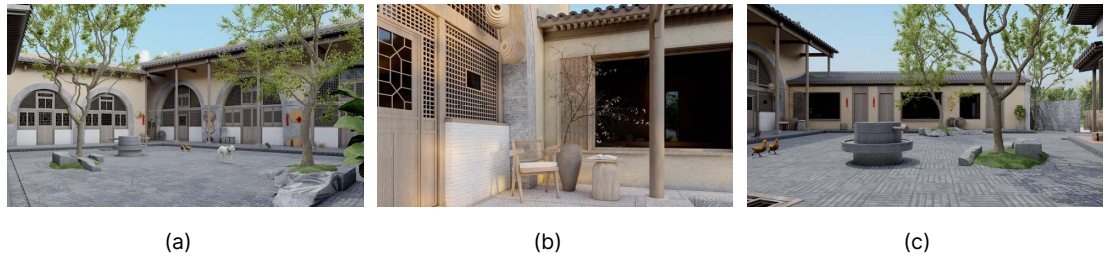


Figure 14. Intentional landscape design of the B&B courtyard (Drawn by Min Wu)

Conclusion

In this planning and design strategy study, we consider the agricultural cultural heritage background resources from the perspective of the harmonious countryside and the ecological agricultural landscape design in the village of Nihegou, such as the ancient trees, irrigation systems, rocks, water, soil, architecture and famous lodging compounds, to protect and apply the jujube viewing route and jujube experience as a living implementation and suggest the specific design intentions of the Nihegou mountain and river landscape boring roll reservoir, the Chehui River dam, the Yellow River beach barge, the mountain stacks, and the natural cliffs. The specific implementation strategies suggested herein for the protection of the mountain cliff and the cliff ropeway will enhance the ecological environment of the village and make it a pleasant place to live and work for both villagers and visitors. The ecological landscape environment is the basis for the comprehensive development of the village and paves the way for the development of cultural tourism and recreation.

Enhancing rural agricultural development, driving the development of industrial and cultural value-added resources, developing local industries and cultural origins, furthering regional cultural characteristics, differentiating rural culture, and enhancing rural industries and adding cultural value are all important resource applications aiming to improve the infrastructure of human life and achieve mutual benefits among “production, ecology and life.” The agricultural heritage of Nihegou has been protected, the ecology has been brought back into balance, and there is now a view of nature to be seen. When developing the agricultural products industry, we will gradually introduce talent and technology to bring the value of local resources into play and realize the protection and use of the cultural heritage of the village. We will promote the essence of the local culture and the excellent pioneering wisdom and ideas of the carrying ancient peoples; in turn, this will drive the whole society to pay attention to and understand the local folk culture. The historical, cultural, economic, ecological, social, and emotional benefits can greatly promote the inheritance and promotion of the Chinese Loess Plateau folk culture.

For Nihegou itself, the rare condition of resources is a rare opportunity to truly solve the multiple

problems and address the most basic problems in the development of heritage; in this process, we can decrease the hollowing out of the population, ensure technology management, increase public awareness and address other problem areas. The planning and design of the agroecological landscape should be balanced between humanistic construction and comprehensive development, and only by solving and protecting the problems in front of us can we lay a solid foundation for the construction of the landscape and complement the construction of cultural tourism and health and wellness.

Author Contributions:

Hui Wang contributed to the data collection and data analysis for this study. Min Wu was responsible for creating the icons and writing the manuscript. Fang Yang conducted the literature search and provided translation services.

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Conflicts of Interest:

The authors have no conflicts of interest with respect to the research, authorship, or publication of this article.

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