

# Traditional Knowledge and Sustainable Rural Development: on the Revitalization of *Laochi* in Shaanxi Province, China

Yapeng Ou, PhD Candidate, Northeastern University/Mediterranea University of Reggio Calabria

[yapeng.ou@unirc.it](mailto:yapeng.ou@unirc.it)

+1 6174120317

803 Parker Street, Roxbury Crossing

Boston (MA) 02120

## Abstract

*Laochi* (涝池) is a flood pond constructed based on traditional knowledge of rainwater collection and waterlogging prevention. It used to be common in villages all over the Guanzhong region, China. However, since the late 1980s, with the rapid modernization in the countryside, it has been either transformed into landfill site or abandoned. Considering the deteriorating water ecology and environment as well as risk of flooding and drought in rural areas, the Provincial Government of Shaanxi Province has initiated the revitalization of *laochi* since 2016, a priority in its implementation of the National 13th Five-Year Plan. This research is aimed to investigate the revitalization of *laochi* in relation to sustainable rural development in the Guanzhong region, especially under the discourse of the New Rural Construction policy. The research first of all undertakes a literature review of academic articles related to traditional knowledge and revitalization of *laochi*. The literature review tries to reveal the traditional knowledge system as *laochi* represents, argues the topicality of traditional knowledge, and discusses revitalization concepts and principles. Then, the research interviews key stakeholders, studies *laochi* construction plans and guidelines, and carries out field studies of the pilot projects in Meixian County and Qishan County. Based on the analyses of public documents, interviews, and the qualitative data collected from field work, the research explores how policies and concepts are translated into practice, and critically analyzes *laochi* reconstruction and related landscape regeneration. Finally, the research summarizes good practices and problems of the revitalization of *laochi* and offers suggestions for future research.

**Keywords:** *Laochi Revitalization; Traditional Knowledge; Landscape Regeneration; Socio-cultural and Environmental Impacts; Sustainable Rural Development*

## 1. Introduction

### 1.1 Literature Review

In the Ming and Qing Dynasties, the Guanzhong region in Shaanxi Province saw frequent droughts. At that time, water engineering gradually transformed and small-scale water conservancy facilities started to emerge across the region (Lu and

Wang 2006; Liu and Yang 2015). *Laochi* became widely spread probably in this historical period. In arid and semi-arid areas, “the effective utilization of limited rainwater resource is an important project directly serving rural economic development” (Zuo *et al.* 2016, 70). Since modern times, *laochi* has once been common in almost all villages and towns in the Guanzhong region. Generally speaking, traditional *laochi* is an artificial flood pond built in low-lying zones in villages and towns to collect rainwater, drain and prevent waterlogging, and provide water for agricultural production and domestic use (Liu and Liu 1992; Jia 2010; Geng 2013). Its construction embodies rich traditional knowledge such as site selection and anti-seepage techniques (Yang 1960; Liu and Liu 1992). In short, *laochi* is an indispensable wetland in rural areas of Guanzhong region, and also a beautiful landscape in arid areas. It is also the crystallization of the survival wisdom of the rural population from generation to generation (Geng 2013).

From the 1980s, with the continuous improvement of agricultural production conditions<sup>1</sup> and living standard of the peasants across the Guanzhong region, *laochi* was gradually abandoned (Figg. 1-2), or converted into arable land, homestead, landfill, or simply filled up. In recent years, water supply for rural production and domestic use is largely improved in rural areas in the Guanzhong region with the advancing and deepening New Rural Construction. For instance, the coverage rate of tap water supply and irrigable area respectively increased to over 85% and over 90%<sup>2</sup>. With regard to water supply for production and living, there seems to be no need to keep *laochi*. However, from the perspectives of drainage and other functions, *laochi* still proves to be indispensable in rural areas. The countryside is different from the city, in that unlike the latter, it has no sound drainage system (Geng 2013), nor rain water and sewage separation system. In fact, rural construction has long blindly imitated cities, abandoning traditions. As a result, since the 1990s, “the organic evolution of rural landscape has gradually degenerated at four levels of layout, fabric, pattern and form” (Wang and Qian 2015, 17). For example, yards of residential buildings and roads have been excessively hardened with impermeable concrete. The impermeabilization in rural areas makes the drainage problem even more prominent. At the same time, not only the water cycle is undermined, but also the rural water ecology and farmland soil are contaminated due to the discharge of mixed rain water and domestic sewage directly into the environment.

Since the Fifth Plenary Session of the 16th CPC Central Committee called for promoting the construction of New Socialist Countryside and building up Beautiful Countryside<sup>3</sup>, the State has attached more and more importance to rural ecological

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<sup>1</sup> For example, since mechanized production took place of livestock, *laochi* lost its function of drinking water provision for livestock.

<sup>2</sup> The data was provided by Mr. Fu Youquan, Vice-Director of the Water Resources Bureau of Meixian County.

<sup>3</sup> The Beautiful Countryside is a request made by the Fifth Plenary Session of the 16th CPC Central Committee to achieve the important historical task of building a New Socialist Countryside. The construction of Beautiful Countryside should conform to “production development, well-off living, clean and tidy village, democratic management”. “Beautiful Countryside Construction”, accessed July 7,

environment management and rural landscape protection. Sewage treatment and rivers and ponds in the countryside are key links in water management for the Beautiful Countryside construction. In this regard, Shaanxi Province in 2016 launched an ambitious initiative of *laochi* revitalization to help restore rural water ecology. In view of the deteriorating rural water ecology in the Guanzhong region, some scholars suggested that artificial wetlands like *laochi* should be restored as “ecological treatment technology, which has the advantages of low construction cost, simple maintenance



Figure 1: An abandoned *laochi* in Wanjiayuan Village, Meixian County  
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Figure 2: An abandoned *laochi* surrounded by domestic waste in Tongzhai Village, Qishan County  
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and low operation cost. Besides, a beautiful rural landscape can be formed by planting plants.” (Zhu *et al.* 2015, 65) In so doing, the living conditions of peasants and rural ecological environment can be improved (Zuo *et al.* 2016). Regarding the shortcomings of traditional *laochi*, it is necessary to transform it with modern technology according to demand (Liu and Liu 1992). By revitalizing new ecological *laochi* and water cellar, a comprehensive utilization mechanism of rainwater is to be formed. This can help “alleviate the lack of water resources and achieve the construction goals of the New Countryside and new residential buildings” (Yu and Lei 2008, 522).

## 1.2. Objective and Significance

It is not difficult to tell from the above discussions that the existing literature on *laochi* is mainly focused on its ecological environment and landscape beautification functions, or the technical level of construction. In fact, there are currently still some limitations in the academic research. On the one hand, there is no thorough study on the traditional knowledge system embedded in *laochi*. On the other hand, few research explores how to integrate *laochi* into the Beautiful Countryside construction, not to mention how to realize the integration and complementarity between the traditional and the modern at levels of function and form, so as to help achieve sustainable development of the countryside. To fill this gap, this research is aimed to investigate the revitalization of *laochi* in relation to sustainable rural development in the Guanzhong region in Shaanxi Province, especially under the discourse of the New Rural Construction policy. To this end, it tries to pose such questions as:

- 1) What is the traditional knowledge system that traditional *laochi* represents and how is it integrated into the revitalization process?
- 2) How does the revitalization of *laochi* promote the construction of Beautiful Countryside and contribute to sustainable rural development?

By answering the above questions, this research can first of all reveal the traditional knowledge system embedded in *laochi*. Secondly, it can provide empirical references for a rational revitalization of *laochi* in rural areas of the Guanzhong region, fully revealing the important role that *laochi* will play in sustainable rural development. Thirdly, this research can contribute to the conceptualization and implementation of the Beautiful Countryside construction, especially in terms of the diversity, livability and resilience of rural cultural landscapes that are in rapid transformations. Finally, the “National New Urbanization Plan (2014-2020)” proposed an urbanization principle that adheres to follow the laws of nature and differentiated urban and rural development (Chapter 22)<sup>4</sup>. “Sponge City” (also called permeable city) is a pivotal project in the construction of new urbanization in China. In this sense, the focuses of this research, namely, the revitalization of *laochi* in rural areas, especially the revival of traditional knowledge and return of traditional culture in the revitalization process, as well as rural public space building based on the actual needs of local community, can not only promote the differentiated development of urban and rural areas, but also provide empirical experience for “Sponge City” construction.

### **1.3. Methodology**

The research first of all undertakes a literature review of academic articles related to traditional knowledge and revitalization of *laochi*. The literature review aims to reveal the traditional knowledge system as *laochi* represents, argues its topicality, and discusses concepts and principles of revitalization. Then, the research interviews key stakeholders, studies *laochi* construction plans and guidelines, and carries out field studies of the pilot projects in Meixian County and Qishan County. Based on the analyses of public documents, interviews, and the qualitative data collected from field work, the research explores how policies and concepts are translated into practice, and critically analyzes *laochi* reconstruction and related landscape regeneration.

## **2. Traditional Knowledge and Revitalization of *Laochi***

### **2.1. Traditional Knowledge and Traditional *Laochi***

As a cross-cutting issue within the UN *Convention on Biological Diversity* (CBD), traditional knowledge is defined as the knowledge, innovations and practices of indigenous and local communities developed from experience gained over the centuries and adapted to the local culture and environment and transmitted orally from generation to generation<sup>5</sup>. According to the World Bank (1995), development and

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<sup>4</sup> “National New Urbanization Plan (2014-2020)”, National Development and Reform Commission, accessed July 7, [http://www.ndrc.gov.cn/fzgggz/fzgh/ghwb/gjjh/201404/t20140411\\_606659.html](http://www.ndrc.gov.cn/fzgggz/fzgh/ghwb/gjjh/201404/t20140411_606659.html).

<sup>5</sup> “Traditional Knowledge and the Convention on Biological Diversity”, Article 8(j) - Traditional Knowledge, Innovations and Practices, accessed July 21, 2017, <https://www.cbd.int/traditional/intro.shtml>.

the preservation of traditional knowledge are not contradictory. Clarke (1990) maintains that traditional knowledge needs to be integrated into present development, because it is “environmentally sound” and highlights respect for the long-term requirements of nature, an intrinsic value of sustainable development. Besides, traditional knowledge, frequently associated with regional identity, is a “resource for economic development” that helps shape regional development trajectories (Calafati 2007). Traditional knowledge, especially in the context of ecosystem management, is also indispensable to a more fundamental model of mutual benefit that relies on joint knowledge creation and exchange between local community (traditional knowledge systems) and scientists (scientific knowledge systems) (Buytaert *et al.* 2014). This knowledge generation model paves the way for citizen science<sup>6</sup> that often has an important role to play in facilitating a better representation of local experiences and priorities (*ibid*). Traditional knowledge is also vital for evolving rural landscapes that undergo continuous interaction between people and natural environment. Rural landscapes are typical cultural landscapes, “imbued with value systems, traditional knowledge systems and abstract frameworks” (Taylor 2009, 7). All in all, as “community knowledge”, traditional knowledge is “an important resource for maintaining biodiversity and cultural diversity” (Zhang 2006, 3) as well as for economic development (Calafati 2007). Therefore, it can make a significant contribution to sustainable development (CBD), serving as “a source of social progress and knowledge innovation” (Xue and Guo 2009, 141).

Traditional knowledge is deeply embedded in traditional *laochi*. To begin with, *laochi* is a good example of reasonable use of rainwater resources and disaster reduction and prevention at the meantime. Through the collection and utilization of rainwater, over-reliance on groundwater and consequent possible excessive exploitation are avoided to some extent, thus ensuring a benign water cycle in rural areas. When storm occurs, *laochi* can instead prevent waterlogging by discharging flood, preventing the village from being flooded. Secondly, the construction techniques of traditional *laochi* also show the extraordinary wisdom of traditional knowledge. In his outstanding *Nongzheng Quanshu* (translated as *Comprehensive Treatise on Agricultural Administration*), Xu Guangqi (1562-1633) wrote on how to construct an artificial pond with an anti-seepage bottom, “... ram to build its [artificial pond’s] bottom, ... drill holes [in the bottom], and tamp them with clay, so that no leakage occurs 筑土者, 杵筑其底, 椎泥者, 以椎椎底, 作孔胶泥实之, 皆令无漏也<sup>7</sup>”. Construction techniques of traditional *laochi* are similar to the record in *Nongzheng Quanshu*: collect clay (an economical and convenient local material), beat it repeatedly with wood hammer until it becomes fine, remove the impurities with sieve, add 20% of lime and mix well. When the fine clay and lime are evenly mixed, lay and level the mixture on the bottom of *laochi*, sprinkle it to saturation, ram the watered mixture to

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<sup>6</sup> Citizen science refers to the participation of the general public (i.e., non-scientists) in the generation of new scientific knowledge (Buytaert *et al.* 2014, 1).

<sup>7</sup> The book, written in the late Ming Dynasty, is divided into 60 volumes, including agriculture-oriented thoughts, agricultural tasks, field system, water conservancy, farm tools, arboriculture, sericulture, horticulture, animal husbandry, famine control, etc.

compaction, so that the infiltrating mud blocks cracks causing seepage. This is repeated several times and eventually an anti-seepage layer of 10-15cm thick is built (Yang 1960; Liu and Liu 1992). Indeed, the anti-seepage layer reflects the most valuable traditional knowledge embedded in *laochi*, because it can at the same time prevent seepage and allow appropriate seepage. For this reason, the water in the pond is always connected to the ground, which prevents it from becoming stagnant. Thirdly, *laochi* is a model of comprehensive utilization of natural resources. In the past, the water from *laochi* is used in manifold ways both for agricultural activities and daily life, just to name a few, for aquaculture, drinking water of livestock, kneading clay for house building, farmland irrigation, washing laundry and vegetables, etc. *Laochi* is also a recreational space, serving as a “swimming pool” in summer and “skating rink” in winter. Besides, the sediments accumulating in the pond over time are used as farm manure, and therefore *laochi* is protected from being silted up. Last but not the least, *laochi* is also a small water purification facility. Through natural sedimentation, solar radiation and aquatic adsorption, the water in the pond is purified as impurities and harmful substances sediment and degrade. This to a certain extent avoids farmland soil contamination due to direct discharge of domestic sewage into the environment. These traditional knowledge, demonstrating harmonious interaction between man and nature, are undoubtedly a significant asset for sustainable rural development in the Guanzhong region.

## **2.2. Concepts and Principles**

In response to the deteriorating water ecology and water environment as well as risk of flooding and drought in rural areas, the Provincial Government of Shaanxi Province has initiated *laochi* revitalization since 2016, a priority in its implementation of the National 13th Five-Year Plan. Therefore, Shaanxi Province has planned to restore and reconstruct 9,070 *laochi*. These *laochi* are classified into five categories according to their specific functions, including flood control and waterlogging prevention, cultural landscaping, water storage and irrigation, water system connection, and ecological wetland. According to the “Technical Guidelines for *Laochi* Construction in Shaanxi Province (Tentative)” (hereinafter referred to as the “Guidelines”) formulated by the Shaanxi Provincial Soil and Water Conservation Bureau (2016), *laochi* is defined as, “A small water conservancy project in arid and semi-arid areas, aimed to make full use of surface runoff, control flooding and prevent waterlogging, prevent soil erosion, help build up Beautiful Countryside and ecological civilization, and regulate and connect water system”. The “Guidelines” considers *laochi* as an effective means to help construct an ecological and livable countryside that is harmonious, safe, healthy and comfortable. By revitalizing *laochi*, rural water management, ecological civilization and Beautiful Countryside construction are to be promoted across the Guanzhong region. This is the important role that *laochi* is expected to play in the sustainable rural development process in the region.

Although traditional *laochi* embodies rich traditional knowledge mentioned above, it has the following shortcomings: First, its anti-seepage layer is not ideal, and often

there are no supplementary water supply facilities. This refrains *laochi* from performing its comprehensive functions in the Guanzhong region, due to its quite dry weather and great evaporation in summer. Second, the main function of traditional *laochi* is water storage and waterlogging prevention, and water supply for production and living. As a result, there is a lack of vegetation and landscaping in its immediate environment. The banal landscape fails to improve the rural living environment. Third, there are no safety facilities and warning signs, which often times causes security risks. Fourth, the productive, social and cultural functions of traditional *laochi* seem outdated in the increasingly well-off countryside, therefore unable to satisfy local community's need of a higher quality of life. To address these shortcomings, a key issue that must be tackled in the process of *laochi* revitalization is, how to improve traditional *laochi* with the aid of modern techniques according to actual needs while properly inheriting its traditional knowledge and keeping its advantages.

To address the limitations of traditional *laochi*, the "Guidelines" requires *laochi* revitalization conform to the "6 Cans principle", namely, the revitalized *laochi* can "store water and prevent waterlogging, restore natural ecology, connect water system, benefit livelihood, transmit historical and cultural heritage, and be continuously managed". The technical focus is "4 Nots", namely, water does not "overflow, leak, dry, stink". This involves such technical issues as water storage and drainage, water source, water quality, etc. The reconstructed *laochi*, therefore, can not only store and regulate runoffs, but also improve and beautify rural environment, beautify water landscape, help the Beautiful Countryside construction, and purify sewage.

In the following, by taking the *laochi* of Changxing and Heiyu villages in Meixian County and Tongzhai and Xiaoqiang villages in Qishan County as case studies, this research will analyze *laochi* reconstruction and related landscape regeneration during *laochi* revitalization.

### **2.3. *Laochi* Reconstruction and Landscape Regeneration<sup>8</sup>**

There should be a reasonable plan in place and scientific site selection before *laochi* construction. The fundamental principle is choosing a low-lying site most conducive to rain water gathering, with dense and solid soil. A site of this kind is a natural "waterway" prone to gather and drain rain water (Liu and Liu 1992; Jia 2010). The *laochi* reconstructed in Meixian County and Qishan County are all a renewal of the original abandoned ones. Once the site is selected, the original site needs cleaning up before the construction. The humus soil must be removed, so that the primary soil layer is exposed. Then the primary soil layer is sprinkled to saturation and rolled to compaction with a rolling density of greater than 1.6t/m<sup>3</sup>.

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<sup>8</sup> The discussions on the construction concepts and techniques applied in *laochi* revitalization in this section were based on the study of the "Technical Guidelines for *Laochi* Construction in Shaanxi Province (Tentative)" (2016), and the *laochi* construction plans and technical explanations provided by Mr. Fu Youquan from the Water Resources Bureau of Meixian County. In addition, the literature and technical explanations provided by Mr. Geng Naili from the Shaanxi Provincial Department also helped the discussions. Finally, the discussions were complemented by the author's field investigations.

The construction of the anti-seepage layer and landscaping of *laochi* and its surroundings determine its long-term function after the reconstruction. The former is to ensure that water in the *laochi* does not leak, dry, or stink; therefore, it determines whether it can perform its water management function of water storage and waterlogging prevention. The latter enables *laochi* to improve living environment, enrich cultural activities and perform other new functions. The construction of the anti-seepage layer of its bottom and slopes is carried out following successively laying, leveling, sprinkling and ramming. Necessary adjustments and improvements are made to traditional techniques, for instance, the proportion of lime and soil is adjusted to 3:7. Compared with traditional *laochi*, the reconstructed *laochi* has an additional loess protection layer above the conventional lime-soil anti-seepage layer. Both layers are constructed with several pavings following the same procedures. Each paving should be laid and leveled with a thickness of less than 25cm, sprinkled to saturation and then rammed to compaction. Finally, a lime-soil anti-seepage layer of 30cm thick and a loess protection layer of 20cm thick on the top of it are constructed. This type of anti-seepage layer takes into account the need of flood infiltration, therefore mainly applicable to *laochi* aimed at flood control, waterlogging prevention and water system connection, such as the *laochi* of Heiyu Village. In order to facilitate flood discharge and reduce soil erosion on the nearby farmland, the slopes of this *laochi* is reinforced with a stone dam well fitted into the actual terrain (Fig. 3).

Different from the *laochi* of Heiyu Village, the major function of the *laochi* of Changxing, Tongzhai and Xiaoqiang villages is cultural landscaping. All of the three are located on loess layer that is characteristic of loose soil structure and poor erosion resistance. Since the principal function of cultural landscaping *laochi* is to beautify rural environment, create water landscape, and build up livable environment, the anti-seepage capacity is the major concern of the three *laochi*. Therefore, the anti-seepage layers of their bottom and slopes are reinforced with modern impermeable material, namely, an HDPE geomembrane impermeable layer is added between the lime-soil anti-seepage layer and loess protection layer. In addition, to make the slopes more solid and improve water purification and storage, a stone layer is rammed into their loess protection layer below the water level (Fig. 4).



Figure 3: *Laochi* under construction with a stone dam in Heiyu Village, Meixian County  
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Figure 4: *Laochi* under construction with a stone layer in Xiaoqiang Village, Qishan County  
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In terms of landscaping, major efforts are aimed at ecological restoration and

vernacular culture revitalization. To this end, natural landscaping and cultural landscaping, and ecological functions and socio-cultural functions are well integrated into *laochi* revitalization. Original trees, especially old ones, are kept as much as possible. Meanwhile, slopes and water surface are revegetated. Ryegrass, crownvetch (*coronilla varia*), winter jasmine (*jasminum nudiflorum*), willow trees, etc. are planted on the slopes and banks. In the pond, lotus, calamus (*acorus calamus*), water lilies and other aquatic plants are planted in shallow waters. *Laochi* is also home to goldfish and other aquatic animals. All this helps to improve *laochi*'s water absorption and water storage capacity, beautify its natural landscape and surrounding environment, and improve its water purification capacity at the same time. In order to beautify villages, improve living environment and quality of life, cultural pathways, cultural squares (Fig. 5), fitness space, artistic works (Fig. 6), etc. are built in the surrounding areas. This makes *laochi* a vital public space where villagers are willing to socialize and relate to each other, and carry out outdoor recreational and fitness activities. The outer walls of adjacent buildings are beautified as well, so that they can fit well into the overall landscape. Finally, to ensure personal safety, the reconstructed *laochi* is enclosed by fences (Fig. 7), and safety warning signs (Fig. 8) are set up.

#### **2.4. Reflections on the Revitalization of *Laochi***

From the above discussions on the completed *laochi* and those under construction, several achievements are readily discernible in terms of traditional knowledge improvement, landscape regeneration, as well as functional innovation.

First of all, traditional knowledge is applied and improved while modern techniques are critically adopted according to the specific function of each *laochi*. For example, besides the lime-soil anti-seepage layer, a supplementary HDPE geomembrane impermeable layer is added, and the slopes of all the reconstructed *laochi* are further solidified with an outer stone layer.

Secondly, *laochi* helps the regeneration of rural landscape. As an organic landscaping component, *laochi*, especially cultural landscaping *laochi*, is well integrated into the rural fabric and located in immediate proximity to local community (therefore in the center of rural life) (Figg. 9-10). In the regenerated rural landscape, *laochi*, on the one hand, as an organic link in the rural water cycle system and ecology maintenance, promotes rainwater storage and waterlogging drainage, while contributing to the improvement of rural environment and restoration of rural hydro-ecological system. This helps reinforce the ecological resilience in rural areas by reducing the risk of flooding and waterlogging. On the other hand, as a natural landscape, the water landscape of *laochi* is enriched and beautified while its water is purified. In addition, the natural landscape of *laochi* serves as an empathetic space for the presentation and interpretation of folkloric culture and local identity, transforming it into a cultural landscape. This cultural landscape results from a harmonious blending of the natural and the cultural. In addition, through the provision of various amenities necessary for

cultural and social activities, *laochi* becomes a livable and constructive public space that is relevant to the rural community's actual social and cultural needs.



Figure 5: Cultural Square in front of a temple next to the *laochi* in Tongzhai Village, Qishan County  
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Figure 6: Fitness space and artistic works close to the *laochi* in Tongzhai Village, Qishan County  
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Figure 7: Fences surrounding the *laochi* under construction in Xiaoqiang Village, Qishan County  
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Figure 8: Safety warning signs next to the *laochi* in Tongzhai Village, Qishan County  
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Thirdly, through revitalization of *laochi*, its ecological, landscaping, cultural, social and economic functions are well integrated and developed. In addition to its conventional function of water management, the reconstructed *laochi* also boasts such innovative functions as environment beautification, leisure and tourism, cultural promotion, etc. These comprehensive functions can not only effectively improve rural living conditions and quality of life, but also trigger rural economic restructuring such as promoting rural tourism development. All in all, *laochi* revitalization helps foster a rural landscape that is resilient, livable and culturally distinct, key characteristics of and vital assets for sustainable rural development.



Figure 9: Overall landscape of the *laochi* in Tongzhai Village, Qishan County  
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Figure 10: Overall landscape of the *laochi* in Changxing Village, Meixian County  
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Despite the above-mentioned achievements, the completed *laochi* and those under construction also show some problems in terms of landscape regeneration, community involvement and accessibility. To begin with, with a rather simple vegetation structure, the natural landscape is not “robust” (Fig. 11). The arrangement of grass, shrubs, trees and flowers on *laochi*’s slopes and banks is not “natural” and “inviting” enough, especially the planting density of shade trees is too small. Besides, there has been destructive construction, such as large-scale removal of surrounding vegetation, excessive hardening of pathways (Fig. 12), etc. Secondly, local participation is absent in planning and construction of *laochi*. It is acknowledged that local participation is crucial to the success of development interventions (World Bank 1995). This absence of local participation tends to cause an asymmetry between the construction content/form and actual needs. As a result, a reconstructed *laochi*, not people-centered, fails more often than not to perform its social-cultural functions. Finally, the accessibility of *laochi* needs to be reasonably improved. The reality is, the strengthened protective measures also refrain the villagers from being hydrophilic.



Figure 11: Weak revegetation of the *laochi* in Xiaoqiang Village, Qishan County  
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Figure 12: Excessive removal of original vegetation and hardening of pathways of the *laochi* in Heiyu Village, Meixian County  
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### 3. Conclusions

*Laochi* is a smart creation from centuries of practice of rural population in the Guanzhong region. Not only a crystallization of traditional survival wisdom, it is also an important carrier of vernacular culture. First, as an important traditional knowledge system, *laochi* can on the one hand make good use of rainwater resources so as to ensure a sound water cycle. On the other hand, it can prevent waterlogging and flooding, therefore contributes to disaster reduction and prevention. Second, the construction techniques of traditional *laochi* is central in its traditional knowledge system. In addition, *laochi* is also a model of comprehensive utilization of natural resources and ecological water purification. Thanks to these traditional knowledge, local population have been able to coexist and maintain a harmonious interaction with nature and environment. This has enabled rural areas of the Guanzhong region to evolve and develop in a sustainable way for ages.

Regarding the limitations of traditional *laochi* in anti-seepage, landscape, safety and functions, the reconstructed *laochi*, as the four cases demonstrate, has applied traditional construction techniques with necessary adjustment and improvement and

reasonable use of modern techniques. There has been an integration of *laochi* reconstruction and landscape regeneration, and an integration of *laochi*'s water management, ecological and socio-cultural functions. Regardless of the existing problems of "simple" landscape, absence of local participation and limited accessibility, revitalized *laochi* proves to play an important role in promoting rural water management and building up Beautiful Countryside and ecological civilization. Therefore, it will help achieve sustainable rural development in the Guanzhong region.

Due to space limitation, this research does not discuss in depth *laochi*'s cultural and socio-economic impacts, nor its management. This should be perfected in future research. Also, future research may well explore *laochi*'s role in the development of sponge cities, so that its traditional knowledge system can fuel urbanization. Besides, future research may well explore *laochi*'s role in shaping positive rural transformations, such as community consolidation, rural tourism-led economic restructuring and rural landscape regeneration.

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