ECOLOGICAL ASPECTS OF TRADITIONAL CHINESE WATERSCAPE

A VÍZ ALKALMAZÁSÁNAK HAGYOMÁNYOS FORMÁI A KÍNAI TÁJÉPÍTÉSZETBEN. ÖKOLÓGIAI VONATKOZÁSOK

SZERZŐ/*BY:* NING DONG GE, ALBERT FEKETE, YANG YANG

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ABSTRACT

Water is a basic element of Chinese traditional landscape and the management of water resources had played an important role in the development of China's ancient civilization (Pengfei, Di, 2011)

This paper presents four case studies in four specific geographical and climatic regions of China with the intention to provide a closer and detailed view of the water resources management in each locations, trying also to discover the ecological benefits and the common characteristics of the projects. The four case studies are: Jing-Hang Grand Canal (South Eastern China), Ganzhou City (Lower Yangtze Plain), Turpan City (North Western China) and Chengdu City (South Western China).

The paper discusses and analyses the most important and representative water management projects of these areas, including: (1) the canal and moat system and its flood control project in Chengdu, (2) the water supply system in Turpan, (3) the water system combined with artificial canals and ponds in the city of Ganzhou and (4) the artificial river and multifunctional water system of Jing-Hang Grand Canal. In addition, the paper also sums up some drawbacks and lessons of the water resources management of ancient China.

Keywords: Landscape ecology, Landscape heritage, Water management, Flood control, Sustainable landscape

1. INTRODUCTION

China's complex topography and diverse climate has created a large number of unique water landscapes under the joint action of nature and humans. Water not only shapes the landscape, but also shapes the behavior and logic of harmony between man and nature. (Qiao et al., 2020) (Figures 1-2)

The ancient Chinese understanding of the world is that mountains and water constitute the main body of nature. Moreover, old representations and descriptions show that water has complex functions: drinking, irrigation, food production, cleaning, transportation, defense, energy production, leisure, artistic role. The ancient Chinese people transformed the natural environment and accumulated the experience about how to live in harmony with nature (Jie, 2003). Exploration of the historical Chinese relationship with water is of great value for tackling today's climate anomalies. These experiences offer a good opportunity to understand the important ecological role that water plays in long-term social development. (Li, 2018)

In retrospect, scholars' research on climate anomalies are carried out mostly from the perspective of reducing carbon emissions and fossil energy. But also from the perspective of ecology, focusing on minimizing negative environmental impacts through integration with living processes (Walther, 2002; Blair & Pachauri, 2006). Compared to ancient or traditional water resources management, it has the same logic.

The western water management already started to move from technical approach to a true integration of the human dimension (Pahl-Wostl, 2007). This means that we have to look at water resource management solutions from the comprehensive dimension of time and space. Ancient Greece and Rome considered the geographical characteristics, introducing advanced urban water supply and drainage systems (Crouch, 1993). The rainwater management, the irrigation system and the rainwater storage system in antique Egypt and in the Middle East are all worthy of reference for today's water landscape (Mays, 2010).

Water management technologies and facilities in China are also changing with the changes of the natural and social environment. Up to now, there are still well-functioning traditionally rooted water management facilities. This is of great significance for contemporary urban and landscape planning and the development of water conservancy facilities. From a relatively continuous historical perspective, it is possible to study the origin and the evolution of traditional water landscapes, to predict the future applications for the current situation and to facilitate ecological solutions to combat global warming and urban heat island effects. (Li & Xu, 2006)

2. GOALS

The main aim of the paper is to find out the traditional ecologic wisdom from water-related heritage. In order to achieve this, the article illustrates and highlights the essence of traditional Chinese waterscapes, analyzes the water landscape heritage and old hydrological maps in order to obtain the essence of the ancient Chinese water management from the Qin Dynasty to the Qing Dynasty during 2400 years. The paper intends to show how vernacular water management solutions can be applied in specific design situations and locations in contemporary landscape architecture in order to increase the ecological impact and benefit, and how tradition can be used as a source of inspiration for shaping and developing today's waterscapes.

Regarding the designated aims and research questions, a harmonious water management model was hypothesized. Based on this, the ecological model of water management in traditional Chinese water landscapes can be derived:

- Circulation
- Adaption to the environment
- Harmony of man and nature

This ecological logic can provide empirical support for water resources management and water landscape planning in the context of today's climate change.

3. MATERIALS AND METHODS

Through literature review and case analysis, this study provides heritage utilization framework from the perspective of ecology, according to different climate zones and historical periods, which provides a comprehensive approach to the climate crisis. The survey methodology was based on the principle that the sites concerned must be interpreted in context with the relevant periods and landscapes, as the only way to understand their historical importance and current value.

The paper is built on the topic of traditional waterscapes and water management methods in China, as the basis of ecological landscape management.

For a systematic survey of the most important waterscapes, we have established the following theoretical framework:

- Identification of all potential regions with unique and traditional waterscape and water management
- Selection of the highlited locations in each region for detailed studies
- Historic overview of the selected areas
- General landscape and ecological assessment of the present conditions of the selected areas
- Conclusions related to possible applications of the analyzed waterscapes and water management solutions

4. WATERSCAPES IN DIFFERENT PERIODS AND CLIMATIC REGIONS IN CHINA: A SHORT HISTORIC OVERVIEW

We have done a bibliography research to identify and compile the potential regions with typical and traditional water manegement regimes in different climatic zones of China. Significant architectural, landscape architectural, ecological and historical works, essays, descriptions and depictations have been studied (Figures 3-8 and list of references from 17 to 27).

1 2

Fig. 1-2: Ancient waterscape maps of China. The water resource representations suggests the importance of water resources in the life of China in 14th century (Ming Dynasty, Southeast of China) (SOURCE: THE METROPOLITAN MUSEUM OF ART, NEW YORK, https://tuchong.com/15985243/61967785?utm_source=weixin&utm_medium=android_share)

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Fig. 3: "Hua yi tu" - a stone carved map from Fuchang, China, 1136 (SOURCE: LIBRARY OF CONGRESS, GEOGRAPHY AND MAP DIVISION WASHINGTON, D.C. 20540-4650 USA DCU, HTTPS://WWW.LOC.GOV/ITEM/GM71005081/)

Fig. 4: "Yu ji tu" - a stone carved map from Fuchang, China, 1136 (SOURCE: LIBRARY OF CONGRESS, GEOGRAPHY AND MAP DIVISION WASHINGTON, D.C. 20540-4650 USA DCU, HTTPS://WWW.LOC.GOV/RESOURCE/G7821C.CT001493/)

One of the most interesting and unique sources of water landscapes from China are the stone carved maps. One of the first stone carved Chinese maps is presented in Figure 3. It was engraved in Fuchang in 1136, and covers China in the Nan Song Dynasty, from the sea at the east to, including Korea, to the Pamier area at the west, and from the Great Wall at the northeast and Heilongjiang region at the northeast, to Hainan Island at the south. The representation shows mountains, rivers, lakes, and more than 400 administrative place names of China.

The map from Figure 4, engraved also in Fuchang at the same time, shows coastlines, the Yellow River and its branches, Tai Lake, Dongting Lake, and Fanyang Lake.

The ancient Chinese experienced primitive worship, religious deification, imagination, miniaturization of landscapes, and reproduction of waterscapes for the natural element of water. (Li, 2011)

From Chinese ancient times, 2500 BC, {Dayu's water control} when people were suffering from floods, up to now, many myths and stories related to floods have been handed down, about water gods, river gods and other primitive worship images. Until Dayu, according to the topography of high west and low east, dredge river course, connect water system, dig canal and build dike.

The systematic water management in the Yellow River Basin has reduced the threat of flood to human settlements, and laid an important physical and environmental foundation for the development of agriculture in China in the next period. (Wu et al., 2016; Qing, 1999) In the Qin Dynasty (221-206 BC), Li Bing and his sons built Dujiangyan in Shudi (today's Sichuan Province), which enabled people to control floods and droughts, so that the kingdom of abundance came, and agriculture flourished (Li, K., & Xu, Z. 2006). (Figure 5)

In addition to water conservancy facilities, emergency strategies for sudden floods were also applied (Figure 6). This pictorial map shows the location of forts on the Yangtze River from Jiujiang-Yangzhou to the borders of the Nanjing district. The red stickers with different lengths are used to mark the hydrological information of different river sections for flood control reference. At the same time, there were special personnel responsible for hydrological monitoring of rivers, who were also responsible for monitoring and organizing people for flood control operations during the flood season.

In the early Han Dynasty, the theory of Geomantic omen emerged, that is, the doctrine of choosing residence according to the environment, and it has continued to this day. It has a profound impact on the location of the city, on the architecture, and the traditional Chinese environmental aesthetics (Ge & Hu, 2014) (Figure 7). The importance of the water and waterscape and its preservation as a natural scenery and artistic image has been surveyed by several researchers. No classical Chinese garden would be complete without mountains and water. In the creation of rock landscapes (landscape penjing), miniature scenes arranged on a tray, both elements are equally vital. *"The superior qualities of water are to be emulated by man: It follows its own course and always fills the bottom level, equivalent to the wise man being true to himself and maintaining a low profile. Water is the emblem of the unassertive. Taking the path of least resistance, always yielding, its effectiveness is unsurpassed… Yang and Yin*

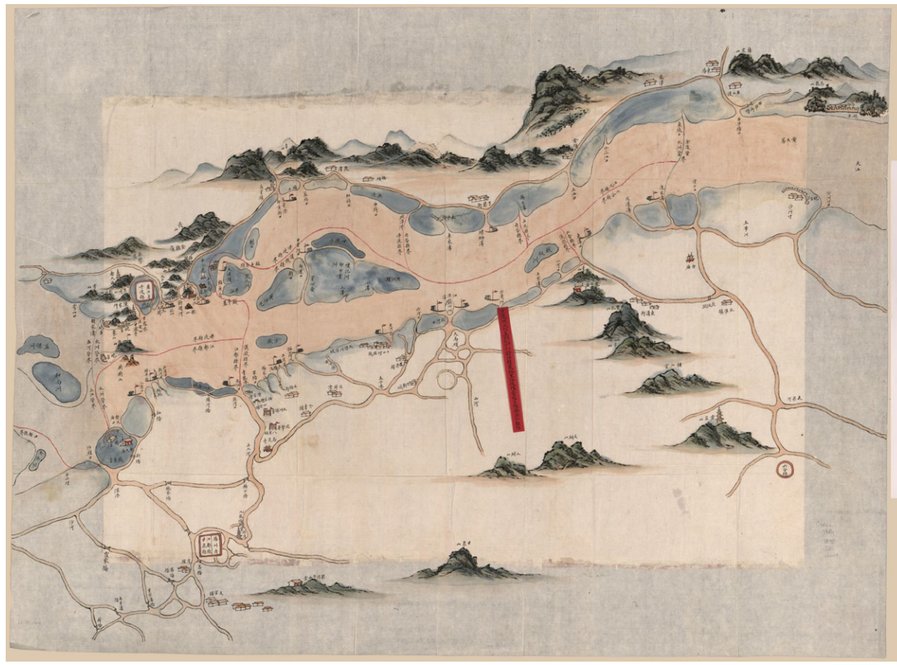

Fig. 5: Map of the waterways and main points of interest of Min and Yangtze Rivers from Songpan, Sichuan to Jingzhou, Hubei. One of the 14'th river section published on the website (SOURCE: LIBRARY OF CONGRESS, GEOGRAPHY AND MAP DIVISION WASHINGTON, D.C. 20540-4650 USA DCU, HTTP://HDL.LOC.GOV/LOC.GMD/G7822YM.GCT00273)

Fig. 6: Complete flood control map of the Yangtze Naval Brigade. 1864 (SOURCE: LIBRARY OF CONGRESS, GEOGRAPHY AND MAP DIVISION WASHINGTON, D.C. 20540-4650 USA DCU, HTTP://HDL.LOC.GOV/LOC.GMD/G7822Y.CT003300)

are associated, among other elements, with heaven and earth, the masculine and the feminine, the light and the dark, the solid and the liquid, the firm and the yielding. Mountains and water form such an ideal yang-yin pair." (Albert, 1988)

The best principle for locating cities is: living by the water, backing the mountains and facing the water, sitting north facing south. (Figure 8.) During the Tang and Song Dynasties, foreign trade gradually developed and the Silk Road emerged. The foundation of this Silk Road is the water source of the oasis in the arid area of the northwest (Li, Qian & Zhou, 2017), which is like a string of pearls, connecting all the oases in series. The water was not only connected with trade, but also linked to the economic cultures and civilizations of Eurasia.

During the Ming and Qing Dynasties, the construction of flood control facilities and the diversion of the Beijing-Hangzhou Grand Canal was further improved, which not only prevented floods, but also embodied the concept of today's South-to-North Water Diversion, and at the same time exploited the shipping value of connecting the North and the South. (Qiao-yi, 2005).

Looking back on the history of Chinese water landscapes, it is mainly divided into four historical periods, namely, the pre-Qin period, the Qin and Han periods, the Tang and Song Dynasties, and the Ming and Qing dynasties. The ideas related to water landscapes have shown the progress of primitive worship – simulation of fairyland – combination of man-made landscapes and nature – simulation of nature, and their functions can be divided into visual amenity, drinking, irrigation, boat traffic. In different climatic regions, the functionality of water landscapes has also different emphasis. The examples selected in this study are taken from different climatic regions, having a water landscape heritage with different functions still in operation, and the ecological component presented in each case (Figures 9a-b).

The study examples cover water storage in arid regions in the northwest, adjacent water settlements in the southeast monsoon region, and irrigation facilities in the mountainous regions in the southwest to include various climatic conditions and water resource functionality.

5. DISCUSSION

Our framework shows, that a division into four climatic zones, according to Figures 10a-b, and a presentation of a case study from each area (related to different historic periods) can offer a comprehensive overview about the most traditional waterscapes and water management methodologies used in China during the centuries.

5.1. Case study no. 1: The southeast of China

This is a monsoon region, with an average precipitation between 1600 mm – 800 mm. The northwest region is a dry region because of the low inland precipitation. The precipitation has decreased from southeast to northwest since

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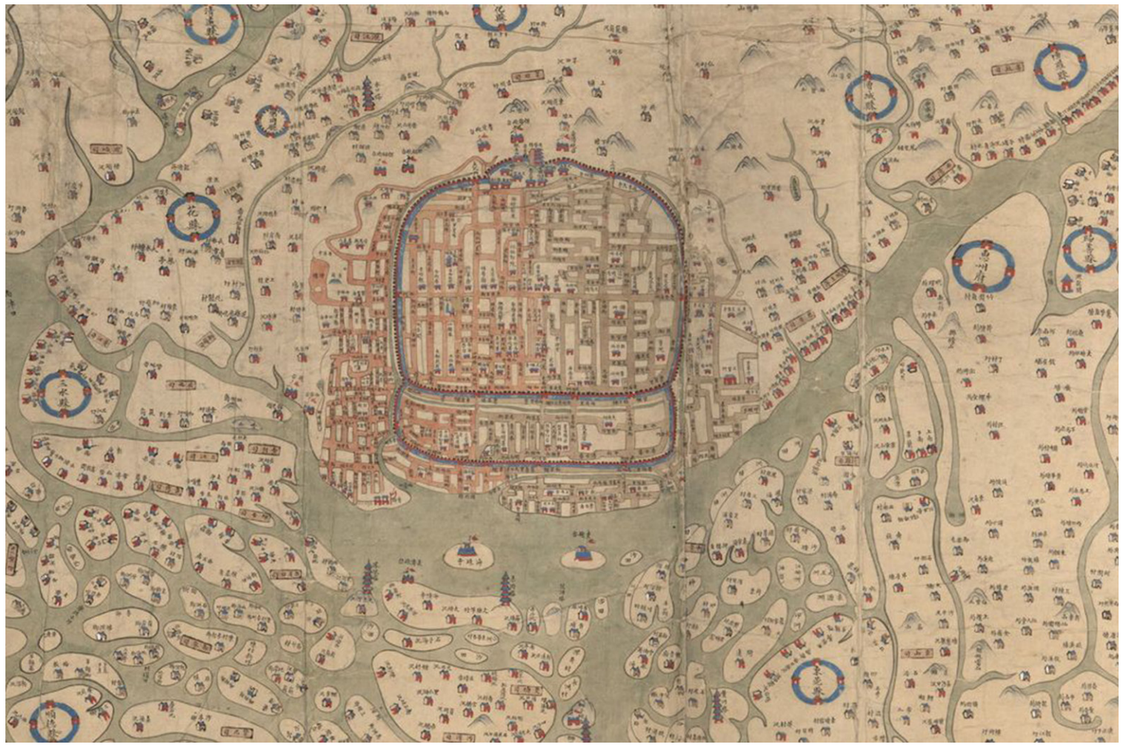
Fig. 7: Mountain and river – traditional Chinese painting (SOURCE: HTTPS://WWW.ARTISOO.COM/MOUNTAIN-RIVER-CHINESE-PAINTING-P-4683.HTML)

Fig. 8: Map of the waterways in Guangdong city (1815). The map shows a very rich water system represented by rivers, channels, lakes, shores, islands, drainage system and the spatial relationship between water and the water related human features (towns, villages, roads, passes) in Guangdong Province, including the Leizhou Peninsula and the Hainan Island (SOURCE: LIBRARY OF CONGRESS, GEOGRAPHY AND MAP DIVISION WASHINGTON, D.C. 20540-4650 USA DCU, HTTP://HDL.LOC.GOV/LOC.GMD/G7823G.CT003406)



ancient times (Figures 10a-b). Thus, the spatial distribution of the precipitation is uneven, and due to the monsoon, the climatic characteristics of high temperature and rain in summer and cold and dry winter result in uneven distribution of water resources. Accordingly, the water landscape in China's humid regions is dominated by the surface water of rivers and lakes, and groundwater in the northwestern region.

The water and soil provides subsistance for people, and the uneven distribution of water resources in time and space has also resulted in large differences in water resources management strategies in the northwest and southeast.

Looking at the local conditions, it is not difficult to see from the water landscape heritage that it has preserved time-tested wisdom of ancient people in water management.

The Beijing-Hangzhou Grand Canal was built in the Tang Dynasty and had it golden ages in the Ming and Qing Dynasties (Qiao-yi, 2005). The map from 1884 (Figures 11a-c) shows waterways combined with points of interest and dikes of the Grand Canal and the Yangtze River from Beijing via Yangzhou to Dongting Lake in Hunan.

Since China's terrain is high in the west and low in the east, most of the rivers in China flow from west to east. The Beijing-Hangzhou Canal spans from the 800 mm to other precipitation zones, running through multiple rivers transversally, and connecting the north and south of China through waterways. It has an important impact on the natural environment and the economic and cultural development of the eastern coastal areas.

Since eastern China is located in the monsoon region, the precipitation of the north temperate monsoon of the Huaihe River in the Qinling Mountains and that of the south subtropical monsoon of the Qinling Mountains show significant difference. Due to the influence of the subtropical high pressure zone each year, the rain belt is narrow and long from the east to the west, so that rainfalls often cover the entire basin. This is easy to result in floods, across multiple watersheds from north to south, and the Beijing-Hangzhou Grand Canal can disperse the flow of different watersheds and reduce flood peaks. In the dry season, the rivers in the south are abundant in water and can supply water for agricultural production in the north through the canals. Today, the Beijing-Hangzhou Grand Canal has become a part of the South-to-North Water Diversion Project.

5.2 Case study no. 2: The southwest of China

The study area no. 2 is located in the southwest of China, on the Chengdu Plain in Sichuan Province. It was established in the Qin Dynasty and was completed by Li Bing and his sons for several generations. Its main part is composed of fish mouth, aquarium mouth, and Feisha weir, which can control the flow rate of the canal through intervention into the riverbed. Therefore,

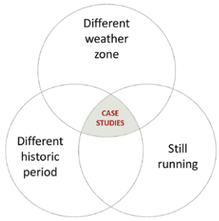
Fig. 9a-b: Timeline of the history of Chinese water landscapes and the scheme of principles for the case studies selection (SOURCE: PREPARED BY THE AUTHORS)

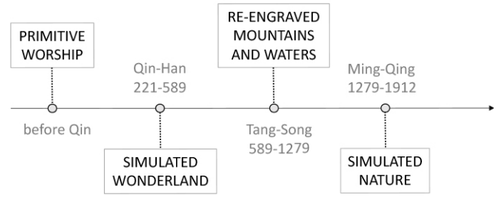
Fig. 10a-b: Location of research areas (case studies) and the map of the dynamic change of the monsoon in East China (SOURCE: PREPARED BY THE AUTHORS BASED ON HTTPS://GEOLOGY.COM/WORLD/CHINA-SATELLITE-IMAGE.SHTML)

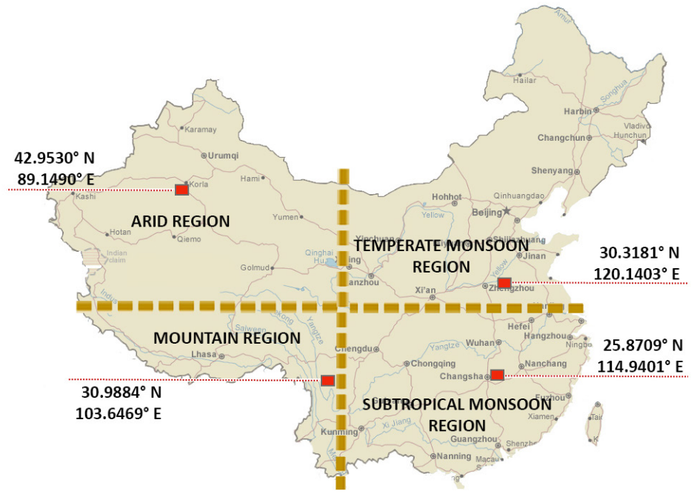
whether it is in the dry season or the rainy season, the Chengdu Plain can receive sufficient water for irrigation. In addition, it has strong ecological significance. Unlike modern dams, Dujiangyan uses Kuanglou and other facilities to build temporary dams. The semi-open structure can allow some aquatic creatures to pass smoothly, which is of great significance for migratory aquatic animals in the basin. It is a model of harmony between man and nature.

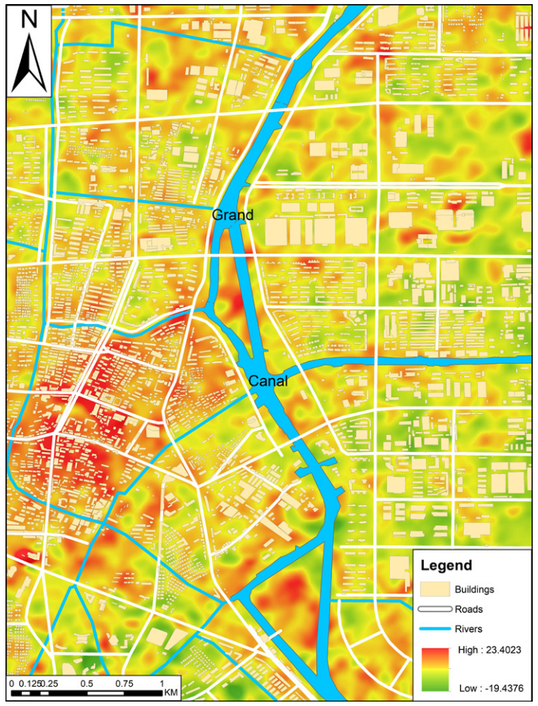
The construction of Dujiangyan also has its peculiarities. The river is curved, slowed down, and interspersed with mountains and minor rivers, which played a basic role in the formation of the weir. However, the fact that Li Bing and his sons were able to choose this place for construction from many areas shows that the ancients already knew well about the importance of topography (Figures 12a-d).

The main structure of Dujiangyan is a river division system composed of three artificial dams and a buffer zone. This system splits the Minjiang River three times. As shown in the figure, the first division is located at Yuzui, splitting the river into external and internal branches. The location and construction of the dam conform to the principle of concave bank erosion and convex bank accumulation in hydrology, and the difference in flow velocity between the inner river and the outer river is taken into account. It will lead to an altered sedimentation of the Neijiang River, so that the riverbed of the Neijiang River will be deepened to prevent the sedimentation of the riverbed and ensure the stability of the water resource. The second division is located in Feishayan, from Neijiang to the second division. As the river is narrow and the flow rate slows down, sediment will be deposited here to form a buffer zone. As a result, the river bed rises in the buffer zone, which prevents the river from flowing into the external branch during the dry season, while during the flood period, the rise of the water level will sweep the sediment away in the buffer zone and deepen the riverbed to accelerate drainage. The lower third division is located at the mouth of the Aquarius, where it took eight years to manually excavate the rock to form a relatively solid waterway. Due to the first two divisions, the amount of water entering the mouth of the Aquarius will remain relatively stable, thus providing sufficient water for irrigation and the households throughout the year.









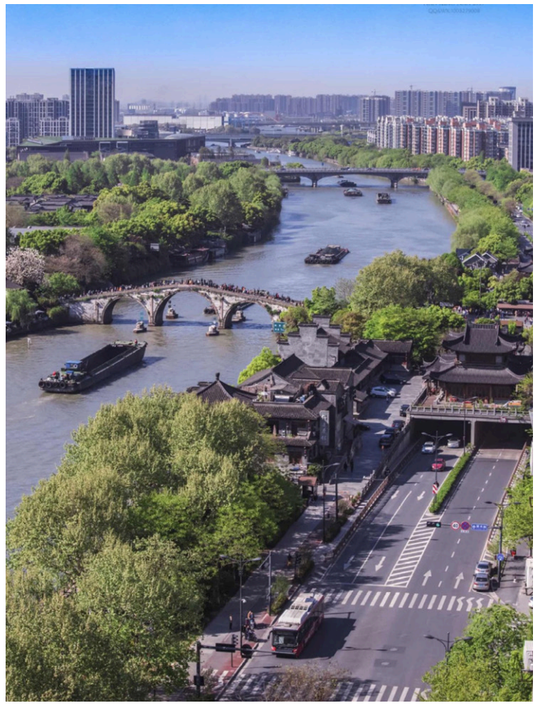


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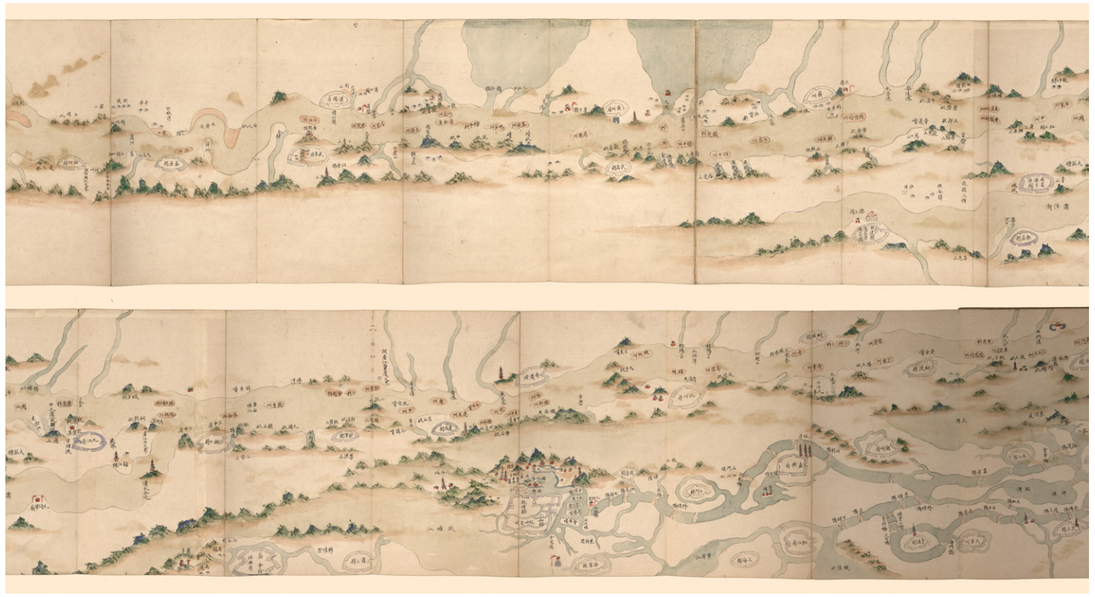
Fig. 11a-c: The Beijing-Hangzhou Grand Canal (Tang period) nowadays and in a map representation (Map of the Grand Canal water course) from 1884 (SOURCE: PHOTO BY AUTHORS AND THE LIBRARY OF CONGRESS, GEOGRAPHY AND MAP DIVISION WASHINGTON, D.C. 20540-4650 USA DCU, HTTP://HDL.LOC.GOV/LOC.GMD/G7822GM.GCT00252)



5.3 Case study no. 3: The northwest of China

Xinjiang has a temperate continental climate, with aridity and less rainfall throughout the year, and with a total precipitation of 170 mm. The main water supply is glacier melt water. Kanerjing has been popular in Xinjiang since the Han Dynasty and it is still used today. It is very similar to some water facilities from Iran, namely Qanat. (Haidari & Fekete, 2015). The principle of Kanerjing is to establish underground tunnels to protect precious water resources from being quickly evaporated through soil layers. Usually, the search for borehole sites starts at the foothills. The vertical wells are drilled first, and then the horizontal wells are drilled down below the diving level. The vertical wells are connected to form underground water tunnels from the foot of the mountain to the oasis. The oasis around the Tarim Basin in Xinjiang is nourished by these Kanerjing. (Figures 13a-c)

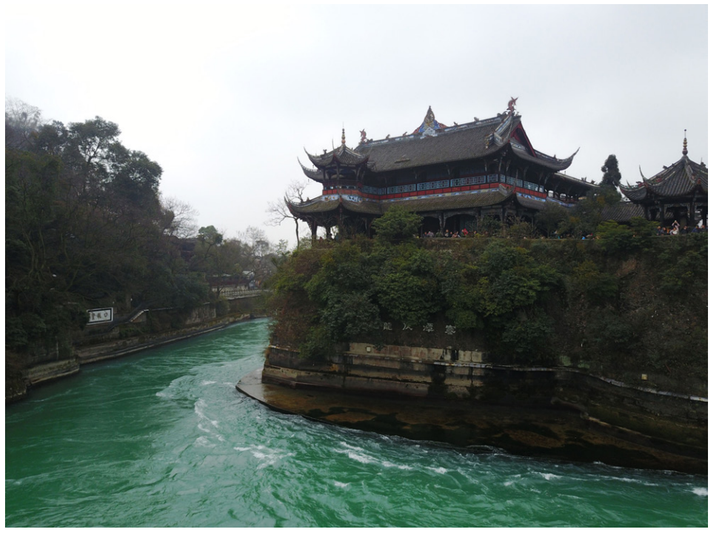
The most important function of the Kanerjing is to provide a reliable and clean water resource for agriculture in Xinjiang through underground canals. The construction of underground canals utilizes the difference in terrain and expands the living space and time of Xinjiang people by reducing evaporation. In ancient Chinese society, it was built and used by manpower, and its development concept of conforming to the natural environment is worth learning and applying in today's water landscape construction.

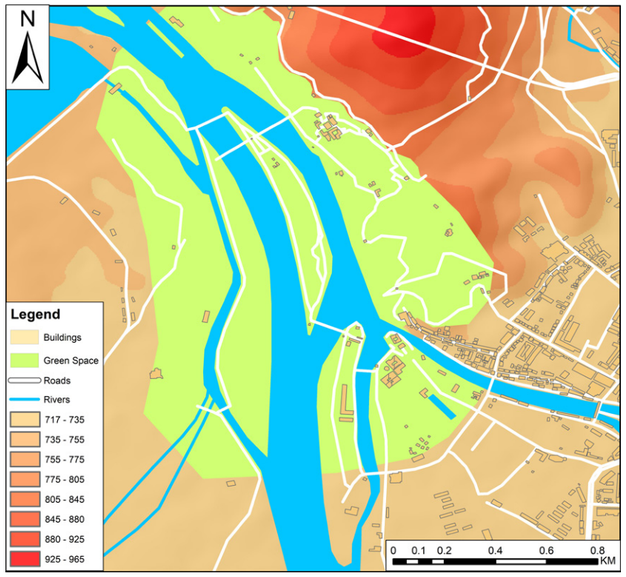
5.4. Case study no. 4: The southeast of China

Song Dynasty ancient city, Ganzhou, Jiangxi Province is located at the middle and lower reaches of the Yangtze River. It has been a flood-prone place since ancient times. Its drainage system is still in operation. It has been protecting the ancient city from floods from 975 years ago to the present day. (Ge & Hu, 2014)

The flood prevention system of the ancient city of Ganzhou is divided into three parts, from the inside to the outside: the reservoir, the water window, and the city wall. There are 6 pools connected to each other in the city, which can collect precipitation and provide water for domestic and other uses. When the rainwater collected in the pool in the city is too much, it will be discharged outside the city through the water window by the water channel. The water window design uses only water pressure to achieve drainage. Establishing a buffer zone for floods can ensure that even if the river water level is higher than the level of the ancient city when the flood peak arrives, there will be no backflow. Moreover, the city wall adopts a bionic design. The entire wall is elliptical and streamlined like a tortoise, so that it can withstand the impact of floods. (Figure 14a-f)

The most important flood control measure of Ganzhou ancient city is the water window in the city wall. It has two important functions: to drain the water in the city and to prevent the flood from flowing back. The functionality of water windows is achieved by





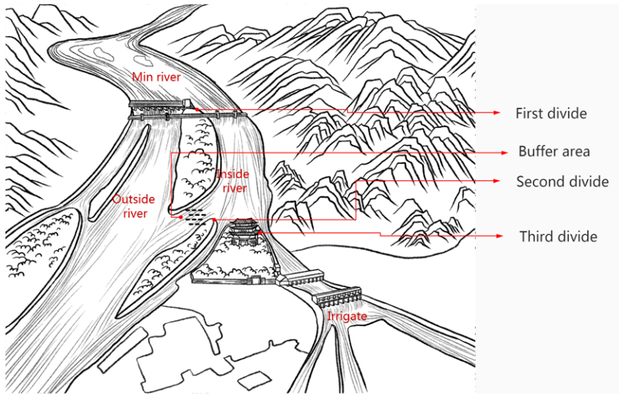


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Fig. 12a-d:
Irrigation canal 'Du Jiang Yan', Sichuan province, Qin period (SOURCE: PHOTO AND SKETCH BY AUTHORS)

the interaction of walls, buffers, and drainage pipes. As shown in the figure, in normal years, the water level of the river is low. As the terrain of the inner city is higher than the riverbed, the accumulated water in the city will be discharged into the buffer zone along the pipeline through the water window, and a certain amount of water will continue to be discharged into the river through the drainage pipeline in the city wall.

When the water level of the river rises and exceeds the ground level of the city, the river water will flow back into the buffer zone along the drainage pipeline. Since the water window has a special structure similar to the vein valve in the blood vessel, when the water level in the buffer zone exceeds the height of the water window, it will be automatically closed under pressure to prevent the flood from flowing back to the inner city, so as to ensure the urban drainage and prevent the flood from flowing back.

6. CONCLUSIONS

The ancient Chinese water resource utilization model is a logic of harmony based on the ecological approach of the water use and management. Summarizing the above examples of water landscapes in China, although the climate has an impact on the use of the water, the logic of creating various water landscapes by Chinese ancestors is indeed the same, and besides the direct use of the water – such as drinking, irrigation, transport etc – one of the most important indirect and secondary advantages of the water management system is the ecological benefit represented by different kinds of water uses.

a. Harmonious water-space relationship

Cleverly using the original topography to make the most benefit of the situation. Making full use of the principle of hydrodynamics that water flows towards lower places, especially in diversion, establishment of canals, flood discharge and prevention of disasters, which can accurately reflect.

b. Harmonious dynamic and static relationship: Circulation and adaption.

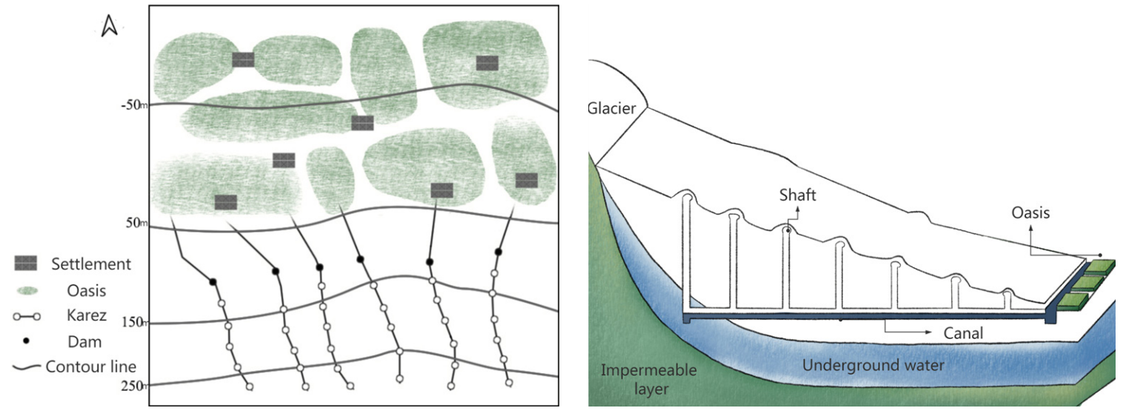
The ancient Chinese realized that water is an integral part of nature, in the process of constant movement, change and circulation, conforming to the natural characteristics, making a good use of the beneficial parts of each element of the water cycle, applying the water cycle processes, but not destroying or blocking them. The process of water cycle is a symbiotic relationship.

c. The Harmony of man and nature: Cohesion

The attitude of the ancient Chinese towards the natural environment is awe. The dualism of the ancient Chinese classified everything in the world into two parts, yin and yang, and yin and yang are in a symbiotic cycle. For example, in nature, mountains can be classified as yang and water is classified as yin. Men are

13a 13b

13c



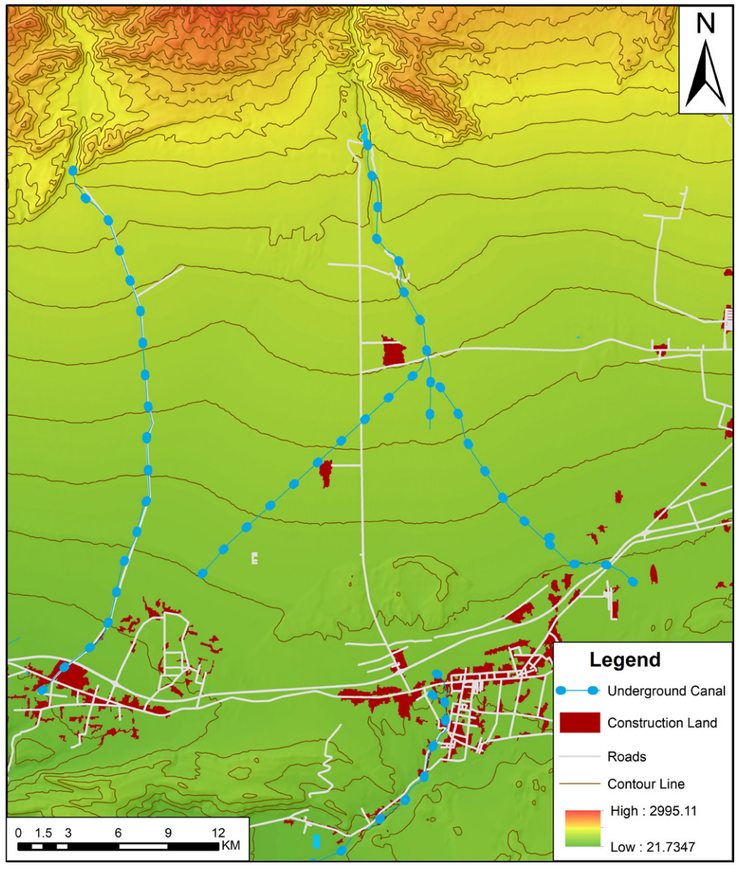


Fig. 13a-c: Kaner Jing (Karez), Xinjiang province, Han period. Map and sketches of the Karez Well System. The karez located around the city of Turpan in China's western region of Xinjiang, is an incredible example of an ancient irrigation system and the Uyghur ingenuity that developed it. The karez well system is considered the greatest Uyghur engineering accomplishment (nicknamed "The Underground Great Wall"), and even today is a marvel to visit and see (SOURCE: HTTPS://WWW.FARWESTCHINA.COM/TRAVEL/TURPAN/UYGHUR-KAREZ-WELLS/)

classified as yang, and women are classified as yin, so everything in the world is mutually opposed and interdependent to some extent. Humans must find a way to live in harmony with nature.

d. Harmony of time and space: Achieving balance in both space and time.

Two thousand years ago, Confucius said that he was not worried about want but only about imbalances. With regard to the temporal and spatial distribution of China's water resources, what nature gives us happens to be unbalanced. Therefore, the Chinese have been thinking about the role of time and space in the course of the construction of water landscapes.

At present, China is experiencing a flood breaking the historical records, and a large number of cities suffer from water logging and flooding.

For example, in the past 10 years, Wuhan city which is located in central China has experienced waterlogging after heavy rains. And in 2016, there have been 3 times of extremely large and continuous precipitation weather with accumulated precipitation exceeding 500mm in one week. (Chen, 2016) Excessive urban area and unreasonable drainage design caused severe urban waterlogging and economic losses.

What is worth exploring is that the ancient cities with normal drainage systems were free from flood disasters. The Three Gorges Dam in China opened its floodgate to discharge flood beyond the critical water level, which aggravated the water level rise in the middle and lower reaches of the Yangtze River Basin. With the background of an abnormal climate, the modern engineering has not achieved the expected ability to reduce flood risk to once in 100 years, while Dujiangyan has continued its function of flood control and irrigation for thousands of years. These realities tell us that we need to learn from traditional wisdom.

Comparing the traditional construction methods of water conservancy facilities to the methods of nowadays, the most significant difference is that the traditional water landscape construction uses the original natural environment as much as possible, but with some intervention, flood control and irrigation, the natural process of river movement can be imitated, and the coexistence of

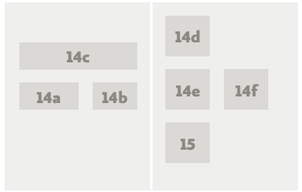
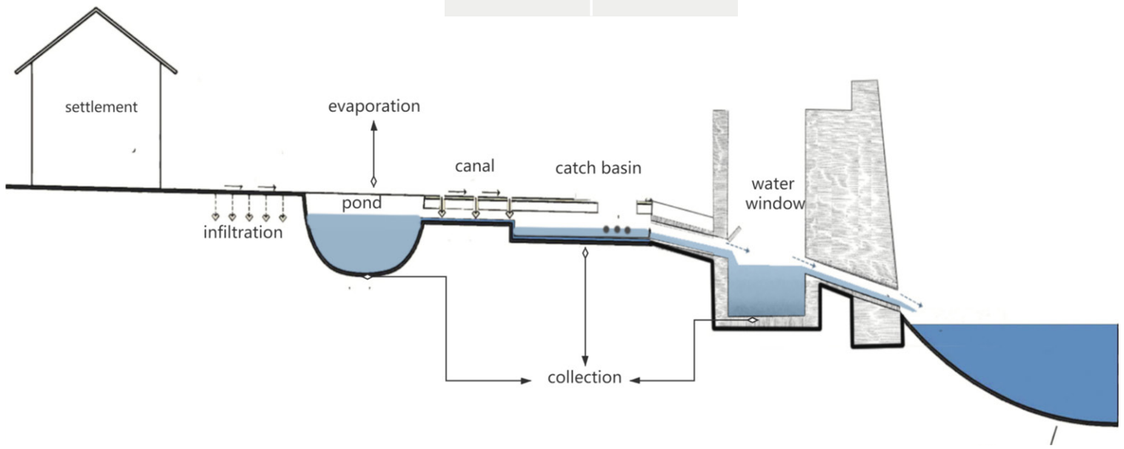


Fig. 14a-f: 'GanZhou', JiangXi province, Song period (SOURCE: PHOTOS AND SKETCHES BY THE AUTHORS)



humans and nature can be achieved. The concept of modern water conservancy facilities is mostly based on interception, blocking and utilization. When blocking a river by dam, the original environmental balance is destroyed. But the advantage is that power generation provides clean energy. Therefore, under the guidance of the traditional harmonious thinking between man and landscape, the water landscape construction is inspired from the perspective of landscape ecology. Taking natural water as the main element, water diversion and saving can realize the water conservancy function of irrigation, flood regulation, power generation and the ecological effect of water landscapes. (Figure 15)

The Harmony logic of ancient Chinese water landscapes is of great significance to urban construction, storm water management, and construction of water conservancy facilities, with regard to today's abnormal climate.

Before landscape planning and construction take place, a baseline surface analysis must be carried out. The urban drainage system must have storage and decentralized units. The riverside settlements must be designed to prevent floods and water logging. At the same time, the existing surface runoff should not be directly intercepted and built. Use the riverbed to leave a biological channel.

Water landscape design in arid areas can focus on the use of groundwater, and make targeted designs based on the specific context.

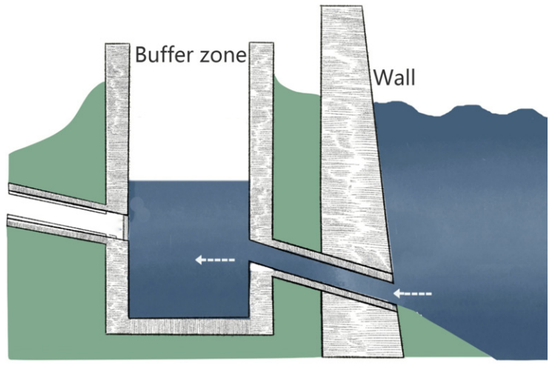
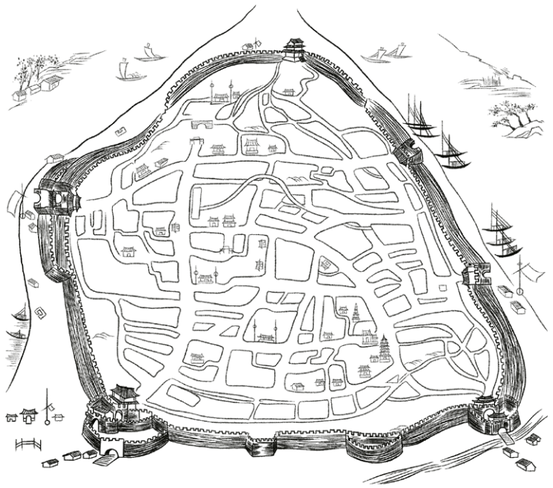
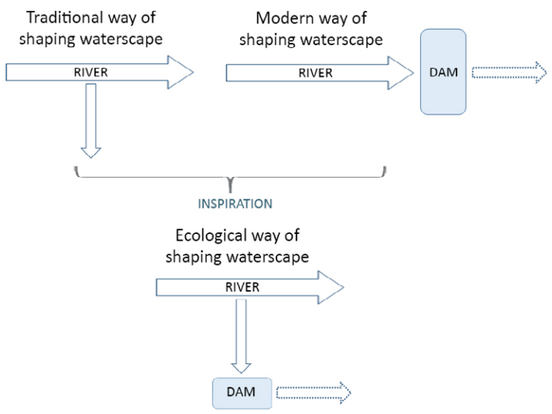


Fig. 15: Inspirational sketch of traditional Chinese waterscapes (SOURCE: SKETCH BY THE AUTHORS)





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ÖSSZEFOGLALÓ

A VÍZ ALKALMAZÁSÁNAK HAGYOMÁNYOS FORMÁI A KÍNAI TÁJÉPÍTÉSZETBEN. ÖKOLÓGIAI VONATKOZÁSOK

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