

Original Research Article

Hydraulic Landscape

The Role of Water System in Shaping the Landscape of Qazvin Traditional Orchards*

Mohammad Akbaryan

M.A. in Landscape Architecture, Department of Architecture, Faculty of Architecture and Urbanism, Imam Khomeini International University, Qazvin, Iran.

Ayda Alehashemi**

Assistant Professor, Department of Architecture, Faculty of Architecture and Urbanism, Imam Khomeini International University, Qazvin, Iran.

Aref Nouri

Ph.D. Candidate, Faculty of Architecture and Art, University of Bu-Ali Sina Hamadan, Iran.

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Abstract | An important part of Iranian civilization has been shaped in connection with the management and exploitation of water resources on various scales. Qazvin traditional orchards are one of the unique examples of the connection between hydraulic infrastructure and the development of human settlements on the Iranian plateau. In the last half-century, the orchards have been destroyed in various ways and the importance of protecting its landscape has been discussed in recent decades. Asking how to protect the landscape of the orchards, the study reads the landscape of Qazvin orchards from the perspective of shaping hydraulic infrastructure in an interpretive historical research methodology. By relying on historical documents, images and maps, along with contemporary studies on Qazvin orchards and oral history, interviews with trustees and orchardists, this research tries to analyze the role of hydraulic infrastructure in the formation of components and processes shaping the Qazvin orchards landscape. Finally, this article considers the landscape of Qazvin orchards as a hydraulic landscape A landscape that has been affected by the management and exploitation of water resources at all scales, from local to micro. Thus, the protection and rehabilitation of the landscape of Qazvin Orchards depends on the protection and rehabilitation of its traditional water system as a fundamental component of the landscape.

Keywords | Qazvin traditional orchards; Hydraulic infrastructure; Hydraulic landscape; Landscape reading; Landscape protection.

Introduction | Qazvin traditional orchard refers to a continuous collection of fruitless orchards without walls around the city of Qazvin, which is several thousand years old. The traditional water system based on seasonal floodwater, which has led to the development of an interconnected network of these orchards around the city of Qazvin, is one of the novel examples in Iran. Today, a significant portion of this heritage is threatened with extinction.¹ Finding a solution to save, preserve and rehabilitate the orchard has become a concern for the people and officials in the city and

**Corresponding author: +989151581633, ayda_alehashemi@yahoo.com

Qazvin province, and from time-to-time plans and programs to rehabilitate the orchard, restore economic justification or improve productivity are generally suggested regardless of the cultural and structural values of the orchard. Facing these growing threats, issue of preserving and registering the cultural landscape of Qazvin Orchards nationally and even internationally is already discussed. One of these measures is the registration of "indigenous knowledge of Qazvin traditional orchards water sharing" in the list of national monuments in 2017. But how can a complex and multifaceted landscape like the orchards landscape be

preserved and rehabilitated? What are the key components Qazvin Orchards landscape which should be considered during conservation and rehabilitation? To answer this question, this article, relying on the concept of landscape and its reading methods, deals with reading the landscape of Qazvin Orchards and recognizing its shaping components. Specifically, assuming the traditional hydraulic infrastructure as a vital component in the orchards landscape, by reading the landscape of Qazvin orchards from the perspective of the hydraulic infrastructure shaping it, the role of hydraulic infrastructure in shaping the landscape of Qazvin orchards is investigated. The article specifically reads the relationship between hydraulic infrastructure and the landscape of Qazvin traditional orchard in three scales: Territorial scale, Quarter scale, and Neighborhood scale (*individual orchard*). It explores the interrelationship of hydraulic infrastructure with nature and society. Finally, it proves the hypothesis that the landscape of the orchards is affected in different aspects of its traditional irrigation system and the protection and rehabilitation of this landscape depends on the protection and rehabilitation of its traditional irrigation system.

Research method

The present research is qualitative, and the research method in this article is interpretive-historical and research-based case study. The article deals with the phenomenological study on case study (traditional orchard of Qazvin) and specifically the role of a special component affecting its formation (traditional hydraulic infrastructure) to understand and interpret the landscape of Qazvin orchards and the existential dimensions of this phenomenon are analyzed through the traditional hydraulic infrastructure component.

This article relies on the theoretical aspects of landscape knowledge, as well as the systematic methods of landscape reading. This research has been conducted based on the previous studies and primary/historic sources about Qazvin Orchards, and furthermore based on field observations and interviews with orchardist, officials, experts and activists on traditional Qazvin orchards. The article recognizes, analyzes and finally classifies the role of traditional hydraulic infrastructure in shaping the landscape of Qazvin orchards.

Research background

This article tries to explore the role of hydraulic infrastructure in shaping the landscape of Qazvin Orchards. In this regard, the background of the research was considered in two theoretical sections as well as a case study (the traditional orchard of Qazvin):

Various studies have been conducted on the role of hydraulic infrastructure in the formation of Spatial organization and morphology of urban fabrics in Iran. Western researchers published the important studies,

which have been considered as the initiators of attention to the role of water distribution networks in shaping the morphology of habitats in the Central Iranian Plateau, (Bonine, 1979; Bonine, 1982; Bonine, 1989; English, 1966; English, 1998; Spooner, 1974). In the continuation of these studies, Iranian researchers in the last decade have publicly addressed the role and importance of water networks in the formation of the Spatial Organization of Iranian Cities (Alehashemi, 2020; Namdarian, Behzadfar & Khani, 2017; Soltani Mohammadi, 2017; Estaji & Raith, 2016). Attention to the pivotal role of traditional hydraulic infrastructure in shaping the landscape of Iranian cities in particular due to the novelty of the concept of landscape in the country has been questioned in a few studies (Mansouri, Alehashemi & Jamshidian, 2015) that generally urban contexts are relied upon and the landscape structure at the territorial or suburban scale and the prevailing relationships in suburban areas are not considered in these studies. Meanwhile, the role of water in the formation of cultural landscape in Iran has been the subject of few studies in recent years (Labaf Khaneiki, 2020a; Labaf Khaneiki, 2020b) that consider the cultural and social aspects of water in the formation of cultural landscape.

The traditional orchard of Qazvin, due to its special place in the city of Qazvin, has been the subject of comprehensive studies (Akhavizadegan, 2002; Avers Consulting Architects and Urbanists, 2007). After these comprehensive studies, research in articles or dissertations has emphasized aspects or aspects of traditional orchards (Ahmadi, 2009; Beheshti, 2011; Dizani, 2017; Jamshidi, 2012). In the meantime, a group has specifically recognized the cultural landscape (landscape) of Qazvin Orchards (Andaroodi & Sahrakaran, 2017a; Andaroodi & Sahrakaran, 2017b). Regarding the hydraulic infrastructure of Qazvin Orchards, studies have either historically introduced the traditional water distribution system in Qazvin Orchards (Safinezhad, 2004) or with a statistical and engineering approach in the field of water resources, water needs, soil resources. And agricultural species have analyzed the current needs and future developments of the orchards without considering the cultural identity of Qazvin Orchards (Gomrokchi, Akbari & Yunesi, 2019). However, in particular, the strategies for preserving and rehabilitating the orchards landscape or the relationship between hydraulic infrastructure and the Qazvin orchards landscape as a multidimensional phenomenon have not been studied independently. This article explicitly explores the role of hydraulic infrastructure in shaping the landscape of Qazvin traditional orchard (our understanding of the Qazvin Orchards today and the processes leading to this perception).

Qazvin traditional orchards

Qazvin plain is located in the foothills of Alborz mountains

and fertile alluvial lands, and seasonal flood currents are the territorial features of Qazvin plain. This geographical feature and water resources have shaped the common landscape of Qazvin and the traditional orchard on a large scale. The traditional orchard of Qazvin is divided into a subset of quarters, *Fands/nârs*² (local terms), and blocks and is managed as a neighborhood. Although according to the names of the orchards neighborhoods, the history of this orchard complex is attributed to the Sassanid era, the oldest documents are descriptions of Muslim geographers and tourists of Qazvin Orchards, which has wall-less orchards with fertile soil and pistachio and grape products in Around the city of Qazvin and their use of floodwater refers (Naser Khosrow quoted by Dabir Siasi, 2002, 4; Ibn Hawqal, 1987, 113-123; al-Qazwini, 1994, 216). Today, the existence of ancient pistachio trees with about 400 to 500 years of age is evidence of the ancient culture of horticulture in the traditional orchard of Qazvin. However, Qazvin orchards have surrounded Qazvin like a horseshoe fence for centuries. Today, however, with about 2780 hectares, it covers the city of Qazvin in only three directions: east, south, and west.³ Along with the groundwater and the canal network⁴ that drank the city of Qazvin, this complex of orchards around the city of Qazvin has been formed by using the water of the flood channels of the Qazvin plain. This difference in water use has led to differences in the view of the city with the surrounding orchard, which has been pointed out by various tourists (Chardin, 1956, 37; Tavernier, 1958, 77).

The traditional hydraulic infrastructure of Qazvin traditional orchards

The traditional irrigation system of the orchards based on seasonal rivers and according to the water division petition, remained from the first half of the eighth century AH (Safinezhad, 2004, 89), is still the main irrigation system of the orchards. Although in recent years due to water needs other sources such as water of Taleghan Dam canal, as well as water tanks are used for applications such as irrigation of seedlings, cultivation of summer crops and personal use (Fig. 1)⁵. This traditional system relies on the control and transfer of water from the seasonal rivers Aranjak, Bazaar, Zoyuar, *Dalichai* (main rivers) and *Véshteh* (flood river)⁶. In this system, water reaches the orchards through a set of weirs, *Nahrs* (watercourses), and sub-streams (either in the form of head opening of river (direct water from the nahr (watercourse) to the orchard) or *Shérp* (overflow of water from one orchard to another)).

Main valves and weirs initially control river water (weirs were traditionally earthen, but today about 30% of them are reconstructed in concrete and metal gates have replaced the old earthen and manual weirs. Three main dams along the Aranjak River, Three main dams along the Bazaar River, Two main dams along the Zoyar River, Four main dams

along the Dalichai River are responsible for controlling and dividing the river water. The *Véshteh* River lacks a dam due to flooding (Haji Karimi, 2020); River water whose velocity is controlled enters the *Nahrs* (watercourses) through water distribution valves; In the neighborhoods, large *Nahr* (watercourse), after branching off from the main rivers, direct water into the tributaries with a tree-like structure. Partitions in the form of valves, usually metal, are responsible for dividing water between streams⁷; Then *Jâys* (water streams) between the soil boundaries that follow the non-geometric and organic boundary lines of the plots and orchards, bring water to the mouths of the orchards (Ahmadi, 2009, 29); Each plot of land (*Kort*), around which the soil borders are formed at the height of about one to one and a half meters, plays the role of a water storage pond and is connected to the *Nahr* (watercourse) through the water inlet valve. A group of orchards that do not have direct entrance and access to water-sharing streams are irrigated by the adjacent rock openings (*shérp*) between the two orchards by overflowing.⁸ Thus, in this integrated system, the starting point of the dam system is on the river (A) and the endpoint is the water intake *Kort* (rectangular field of orchard) of the orchard (D) (Figs. 2 & 3).

Landscape reading and landscape reservation of Qazvin traditional orchards

The meaning of landscape in this article is its recognized definition as an objective-mental phenomenon resulting from human interaction with nature and society with geography and history (Alehashemi & Mansouri, 2018). That part of the earth, as perceived by the people, and its characteristic is the result of the interaction of natural or human factors (Council of Europe, 2000). In this definition, perspective is as much a product of the physical dimensions of man's relationship with his

(Berque, 1995, 150-160; Berque, 2000; Olwig, 2004). The landscape is a product of human activity and human relations and is a sign of the growth of society (Wylie, 2006; Ingold, 1993). Its protection is not like conservation approaches in museums but a companion to the growth and protection of human activity and its relationship with it. According to the definition provided by the European Union, landscape protection means a set of activities to preserve the essential features of the landscape derived from natural configuration or human activity. Landscape management is moreover a set of activities to ensure continuous landscape preservation, with the aim of balancing the changes formed by social, economic, and environmental flows (Council of Europe, 2000). The task of decoding the landscape depends on recognizing its temporality and dynamic properties (Ingold, 1993), and furthermore recognizing the various layers that form it.

According to Agustin Berque, the landscape is formed by

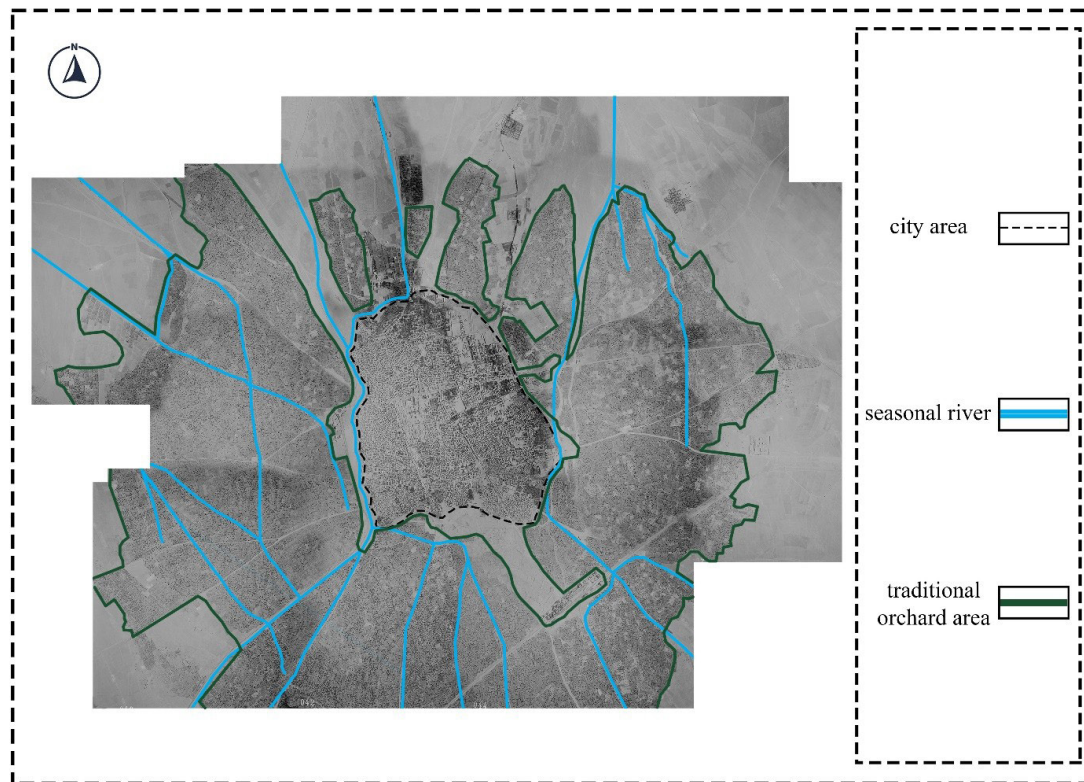


Fig. 1. Qazvin Orchards around the city of Qazvin in 1958 and its five flooded rivers based on the aerial photo of 1958 in the city of Qazvin. Source: Authors.

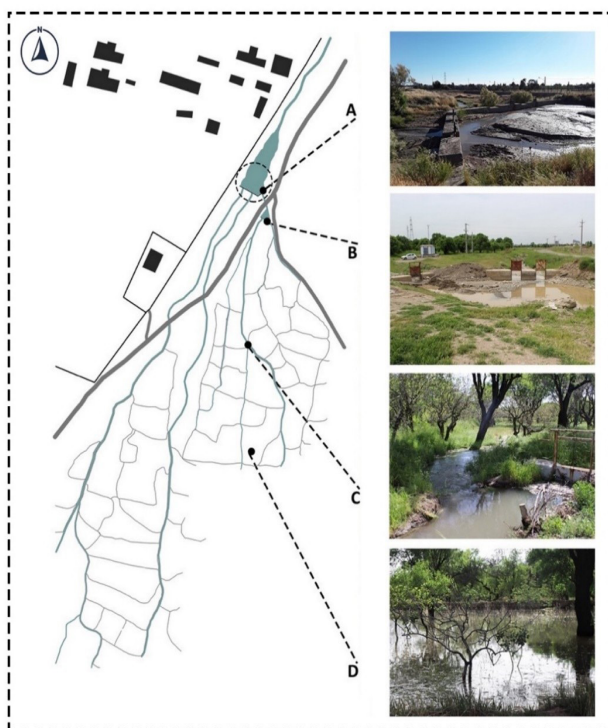


Fig. 2. The traditional water distribution system of Qazvin Orchards from the river to the orchard plots. Source: Authors.

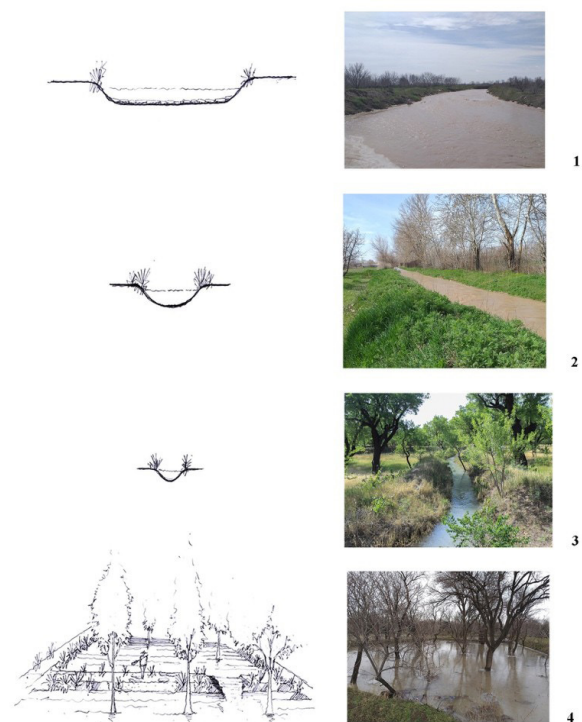


Fig. 3. Details of water transfer and storage substrates in the traditional Qazvin water system from the river to the orchard plots, including 1) River, 2) Main canal, 3) Tributary, 4) Orchard Kort. Source: Authors, 2019.

three layers: nature (geology, evolution, seasonal rotation, etc.), society (history of human activity), an individual (a human being who thinks about the landscape); (Berque, 2013, 7) and the perspective of the connection of these three layers is formed in a complex and reciprocal process. In this sense, landscape reading is not a simple present that can be achieved with atomistic approaches. Recognizing the relationship that has developed and evolved over the centuries between humans, society, nature, and natural forces and is influenced by the culture and socio-individual, historical, and ritual-mental relationships of residents is a complex process that requires reading the two-way relationship between components. They are intertwined and ultimately their ultimate connection in a macro system.

In this paper, these three layers are considered to read the landscape of Qazvin orchards, and in three scales, the role of hydraulic infrastructure in shaping the orchard landscape is analyzed in layers. On a territorial scale, Qazvin orchard landscape is the product of biological, geographical, and natural processes and interactions with society. In this scale, in terms of general features in the formation of territories, features and general characteristics that are understood by humans in the “initial look” (Merleau-Ponty, 2012, 50-51). It means the general and primary perception of the traditional orchard of Qazvin and what is its general identity and the place of its difference with other sets of orchards in the city of Qazvin. In the next step, human activities, specifically in the case of Qazvin orchards, agriculture and activities and related components are analyzed. In this scale, social and cultural relations related to these activities that shape the landscape are moreover considered. At the micro-scale, individual perception is constantly examined with physical, dynamic, and changeable components in the orchard. In line with the hypothesis of the article, this reading is clearly formed beyond the traditional water system of The orchards.

Hydraulic landscape of Qazvin orchards

Qazvin orchards can be studied as a dynamic landscape that has evolved over the centuries. The orchard is a symbol of the continuous civilization and culture of the people of Qazvin with the water capacities of the Qazvin plain, which has led to the creation of a stable system of social and cultural relations between the people on the one hand and the stable relations of society with nature and natural forces on the other.

Descriptions of the orchard help understand the common landscape of the orchard and beginning to understand it without going into the details or relationships that, on a smaller scale, shape the specific features of the orchard landscape. The most important features and components that are mentioned in the description of Qazvin in relation to Qazvin orchards can be generally divided into three parts. The second is the continuity of the orchards and the lack of

walls, which strengthens this green presence, and the third is the orchard products, especially pistachios, grapes, and sometimes almonds, and their form, which refers to the shortness of trees and how to plant grapes in the soil (Table 1).

On a large scale, the common landscape of Qazvin Orchards is formed by a series of wall-less orchards and fences that surround the city, pass through them when entering the city, the river flows in them and is dedicated to tangled planting. The area and location of the orchards next to each other are enclosed by soil boundaries that allow water retention in one or two annual irrigation periods, which is in the spring, and the possibility of planting and maintaining special plant species.

At this scale, the landscape of Qazvin Orchards is based on its special irrigation system:

- The location and extent of the orchard are based on the water of floods around the city. Fig. 4 indicates the relationship between Qazvin Orchards and the control of the water in five seasonal rivers of Qazvin plain. The development rate of the orchard in the four corners of Qazvin city corresponds to the possibility of receiving water from the rivers.

- The general morphology of the orchards in the form of interconnected ponds without walls and fences between them is based on the method of submerged irrigation and the division and overflow of water between the orchards.

- The type of plants and how to plant them depends specifically on the time, type, and duration of irrigation of the orchard, which is submerged in water once or twice a year: species planted in the orchard, including pistachios, almonds, apricots, and grapes, and in some areas walnuts. Species are compatible with annual irrigation and deep rains in the soil. The planting method, which is sparse, mixed, and irregular, is an important feature in the common landscape of the orchard and has been formed for centuries, depending on the amount of irregular flooding based on floods.⁹

- High and low fertility and differences in the method and amount of planting in different areas of the orchard are furthermore affected by the special water system of the orchard and the amount of water in rivers, soil type, rules, and regulations governing water distribution. The distance and proximity of the orchards to the beginning of the river and the proximity of the plots to the streams play an important role in watering the orchards, especially in shortage conditions (Simiari, 2019). Another important point is that the water share of neighborhoods and blocks is different. Some blocks do not have a share of water and buy the water they need from other orchards; in periods of water scarcity, they go drier and thinner (ibid.).

- The access routes that provided Qazvin with the surrounding cities were through roads that passed through the orchards of Qazvin and were the passage of caravans. These roads followed the water distribution network and, in

Table 1. Historical narrations and descriptions written from the Qazvin Traditional Orchards. Source: Authors.

Traveller/Historian	Date	Narratives and Descriptions
Ibn Hawqal	4th century A.H.	... Qazvin, despite its water shortage, is a blessing and its area is one mile by one mile (Ibn Hawqal, 1987, 122-123). ... It has trees and vines and crops, all of which are made from rainwater and taken from other crops to other places (Ibn Hawqal, 1987, 113).
Naser Khosrow Ghobadiani	5th century A.H.	... There were many orchards, without walls and thorns, and there was no barrier to entering the orchards. I saw Qazvin as a good city ... unless there was little water in it and ... (Naser Khosrow, 1994, 5).
Zakariya al-Qazwini	7th century A.H.	... orchards and the trees are very much there, the areas and around them are all beautiful places. It is built on a pleasant side to which no city has been built with its acceptance and pleasantness, and ... and the groves and orchards are around the great city and the environment is beautiful ... (al-Qazwini, 1994, 216).
Abdul Karim ibn Muhammad Rafi Qazvini	7th century A.H.	... Qazvin rivers are three rivers from which the orchards of Qazvin are irrigated ... (Dabir Siaqi, 2002, 58).
Hamdallah Mustawfi	8th century A.H.	... The water is abundant from the aqueducts and the orchard reapers, and they water the watershed once a year, and many grapes, almonds, and pistachios are harvested. After the flood, they plant abundant melons and watermelons without any other water. ... (Mustawfi, 1983, 58) ... The orchard or <i>Fand</i> of the city are connected to each other around the city like a belt and the area has been carefully measured to be one thousand acres and Every acre of sixty steps in sixty steps and in the middle of the garden there is no vacant land (Mustawfi, 1985, 779).
Amīn Rāzī	11th century A.H.	... Of the strangers of the world, the vineyards are there that do not drink water more than once a year ... Grape fruit, melons and pistachios are good ... (Rāzī, 1999, 1932).
Jean-Baptiste-Siméon Chardin	17th century A.D.	Despite the scarcity of water, all kinds of food and drink are very abundant in this city because the lands around Qazvin, unlike the city itself, are completely irrigated and full of water channels. Therefore livestock, cattle, all kinds of fruits, and grains are grown in abundance. And it is obtained and flows like a flood towards the city (Chardin, 1956, 37-38).
Ernest Orsolle	19th century A.D.	The area around Qazvin was relatively good in terms of cultivation ... (Orsolle, 2003, 212).
Jean-Baptiste Tavernier	17th century A.D.	Qazvin ... has no walls and fortifications and is more than half of the city of orchards. In the lands of Qazvin, pistachio is grown. Its tree is not bigger than a walnut tree of ten or twelve years old and pistachios are clustered like grapes (Tavernier, 1958, 77).
Monsieur Bohler	13th century SH	And about half a farsang is around the city of orchards, most of whose trees are vines and pistachios ... (Bohler, 1978, 9).
Abu Ishaq Ibrahim Istakhri	4th century A.H.	Qazvin is a big city. It has a civilization and a siege; And they do not have running water. When to eat will be enough. But the orchards, gardens and the waterless farmer abounded. Almonds and raisins grow a lot there ...; And the cultivation was on rainwater; And it is a prosperous city with water shortage ... (Istakhri, 1961, 166-172).
Jane Dieulafoy	19th century A.D.	Orchards surround Qazvin like a very wide belt. ... It did not take long for us to enter the pistachio vineyards and orchards (Dieulafoy, 1992, 109).
N. P. Mamontov	19th century A.D.	The first fires of Qazvin can be seen from afar among the orchards ... If Qazvin had more than this water, it would be a better city. The fields around the city are fertile and many plants have grown along the shallow aqueducts that originate from the mountain snow. Orchards and vineyards around Qazvin have a lot of apricots, pistachios, peaches and grapes. (Mamontov, 1930, 25).
De Sercey	13th century SH 19th century A.D.	The closer we got to the city of Qazvin ... because the road was smooth and easy, we quickly passed through the fields and orchards that included fruit trees, especially hair and pistachios (De Sercey, 1983, 135).
George Curzon	19th century A.D.	After the village of Agha Baba, a plain is reached smoothly, and the traveler, approaching the vast vineyards and orchards that once surrounded the densely populated city of Qazvin, desires to ride on the saddle of his emeralds for a while (Curzon, 1988, 71).
Abdi Beig	10th century A.H.	Cities are literate on the wall; he is literate on orchards and flowers (Alami 2009,9).

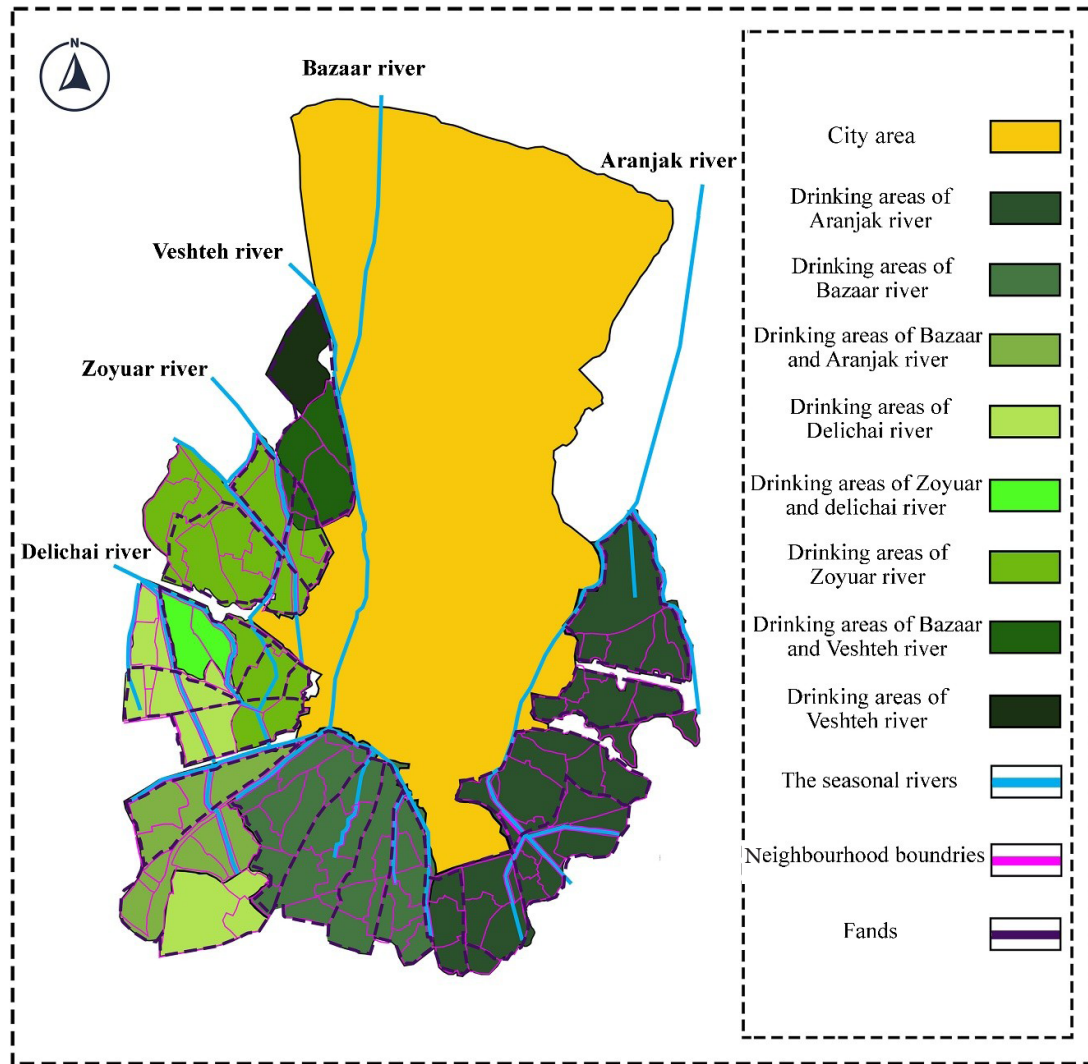


Fig. 4. Classification of Qazvin traditional orchard water intakes in relation to *Fand* divisions and orchards. Source: Authors, cited in Avers Consulting Architects and Urbanists, 2007; Haji Karimi, 2020.

fact, were the main irrigation canals (Akhavizadegan, 2002, 156); (Modern road networks and railways do not follow this logic).

On a medium scale in neighborhoods, the landscape of the orchard is affected by the relationship of the orchards with the water system. Our perception of the orchard is furthermore directly or indirectly affected by the water system by entering the neighborhoods and recognizing the relationships that govern them:

-The boundaries between neighborhoods and *Fands* are based on the division and, in fact, water sharing between orchards.¹⁰ Each river irrigates certain areas of the orchard, and the landscape of the orchards varies according to the river from which they are irrigated: Each river has a separate water distribution system and irrigating areas due to different amounts and factors such as management and ownership, location, Economic issues, etc. have different physical status (Rahmani, 2019).

-In neighborhoods, the location of wells, which is the most important architectural heritage in the orchard, is furthermore determined in connection with the water distribution network. Wells are public and common buildings built in neighborhoods to meet the daily needs and rest of orchardist, as well as to establish security in neighborhoods called "wells". Orchardists would go to their local wells to rest, and during the harvest season, they would settle in the wells to patrol the orchards at night. Each orchard site has at least one well that is shared by all orchardists. The location of wells in any place or block depends on the availability and security of the place and is formed next to the water stream; a group of them furthermore had reservoirs to hold water (Akhavizadegan, 2002, 112-109).

-The morphology of the orchards in the heart of the neighborhoods follows the network of water streams. Access routes at local and intermediate scales have moreover been formed in coordination with the water distribution

network. The accesses to the orchards, which provide the orchardist with access to their orchards within the neighborhoods, have in fact been formed within the water distribution streams, and the entrances to each orchard have been through the mouth of the orchard, which has been the custom of the orchard for many years. Social relations, communication hierarchies in neighborhoods, and participatory management of orchards in accordance with the divisions of *Fands*, valleys, and sites are directly derived from the divisions dictated by the water system. On the other hand, the formation and community of orchards together without a fence has led to the formation of complex social relationships at the orchard scale. The management system and social relations and hierarchy of *Fands* with each other and with river management are further based on the water system, and the network is interconnected and has a hierarchy including officials (*dakhôu* and *dakhôubâshi*), trustees, orchardmen, orchardist and worker (ibid., 59).

-The amount of water intake in the orchard, the value of the land¹¹ and the fertility and scarcity of orchards in each place are affected by the orchard water distribution system: distance and proximity to the stream dividing the water of the place and additionally the existence of rules such as the Water priority (*sadr-âb*)¹² on the fertility of some orchards. Other orchards that do not benefit from these criteria or are located in the neighborhoods at a distance from the beginning of the stream and may receive a small share of water in times of water shortage or may not even receive a share of water in a period of flooding.¹³ Thus, Qazvin orchards are formed with a varied landscape of sparse orchards along with fertile and green plots, and this feature of the landscape is directly resulting from the way the orchard is divided.

On a micro-scale, personal communication and individual perception are shaped by a deep understanding of the orchard landscape. This view is from the point of view of people related to the orchard, Qazvini visitors familiar with the orchard and in relation to plots or other small scales of the orchard.

-The morphology of the orchards is influenced by the water system as single cells: the smallest cell forming the orchard complex is called a *Kort* (the rectangular field of the orchard). The size of these pieces varies from 250 to 6000 square meters in an approximate number between 12 to 13 thousand pieces with irregular and continuous shapes. These parts are generally irregularly quadrangular, surrounded by border ridge to hold water in the form of flooding. In addition, Depending on the flow rate of the rivers, the height of the soil border around the orchards varies. In neighborhoods and blocks, based on the proximity and distance to the beginning of the *Nahr* (watercourse), the width of the land borders is also different (Simiari, 2019).

-The mixed planting method in orchards is affected by the water system and compliance with the method and amount

of water intake throughout the year. In addition, in order to strengthen the soil boundaries of the orchards against erosion and fall caused by proximity to water, plants such as yellow flowers, dahlias, sumac, and purple trees are planted on the border between the orchards. On a micro-scale when visiting the orchard, these formed boundaries specifically affect our perception of the orchard.

- Individual perception of the orchard is strongly influenced by the time of visiting the orchard, and the traditional one-time irrigation system plays an important role in shaping this difference in perspective.

-The traditional water system is associated with certain traditions in Qazvin society. For example, the *50-Be-Dar* ceremony (the day of the end of the orchards water intake)¹⁴ was held among Qazvin people as a picnic. Even today, this custom is preserved among the people in the form of a wreath in the orchard, and in fact, it is considered a celebration of thanksgiving for the year full of water or a prayer for asking for rain in the years of low water.

Discussion and summary

This article aims to prove the fundamental nature of hydraulic infrastructure in the formation of Qazvin Orchards landscape, relying on the concept of landscape and dividing the three layers of landscape reading into the landscape reading of Qazvin orchards beyond shaping the hydraulic infrastructure. The results demonstrate that the landscape of the orchards is affected by traditional hydraulic infrastructure at different levels.

On a territorial scale and initial perception:

- Boundary and location of the orchard around the city, the common landscape of the orchard in the form of sparse orchards without walls and borders, as well as the common landscape is affected by the species of trees in accordance with the climate, and the special irrigation method is affected by the water distribution system.

Intermediate scale and semi-deep perception:

- The range of quarters and *Fands* is formed based on the share of water share from rivers.

-The common landscape of the orchard as a low and sometimes high orchard in different parts is formed based on the relationship and position of the parts to the water distribution system, and a varied landscape dominates the orchard.

- Social relations and the hierarchy of managerial relations are formed in accordance with the divisions of quarters and *Fands*.

-The location of access and transit routes between the orchards, which also affects the way we perceive and visit the orchard, is in line with the water-carrying streams.

At the scale of reason and rational and individualistic perception:

- Morphology of plots and orchard plots depends on the

share of orchard water and their type of proximity to the water system. Type of borders and planting on the borders to protect the soil borders of the plots against water inside the plots the mental and collective relationship of the people of Qazvin that is intertwined with the orchard is a clear example of the *50-Be-Dar* ceremony which is held in accordance with the orchard irrigation calendar and as a public celebration.

- The relationship of orchardist in the form of neighborhood relationship or collective management of orchards in each place is moreover affected by the water distribution system in the orchard.

Fig. 5 illustrates the hydraulic infrastructure in three scales in relation to orchards, *Fands* and quarters and neighborhoods and *Korts*.

Conclusion

The results of this study represented that the Qazvin orchards landscape in its morphology, general structure and physical components, as well as its social relations, horticultural and agricultural landscape has been strongly influenced by the traditional hydraulic infrastructure. The hydraulic system which has been responsible for irrigating these orchards for centuries. This impact was bold from the beginning of the formation of these orchards until today (considering the protection of the traditional irrigation

system in significant parts of the orchard, despite changes in planting order in some parts or the addition of diverse but limited water resources to the orchard in recent decades). This relationship between the landscape of the orchard in its ultimate sense (in the sense of human connection with the environment in objective and mental dimensions before separation) is such that it can be referred to as the water-axis landscape of Qazvin orchards and hydraulic infrastructure is a fundamental component in He considered the formation of the landscape of Qazvin orchards. Considering the fact that the landscape protection and revival is the preservation and revival of the components and the processes that shape the landscape, and not the conservation of the landscape as a fixed museum to visit, the protection and rehabilitation of Qazvin orchards landscape is specifically dependent on the protection and rehabilitation of its traditional water system. The system which is a fundamental component and a direct or indirect basis of other components and processes that shape the landscape. Otherwise, preserving the appearance, regardless of the shaping foundations, will freeze it and eventually destroy the landscape of Qazvin orchards. The results of this research can be a way forward in the protection and rehabilitation of the Qazvin orchards landscape where the continuity of this landscape throughout history can be achieved by preserving and strengthening its fundamental components.

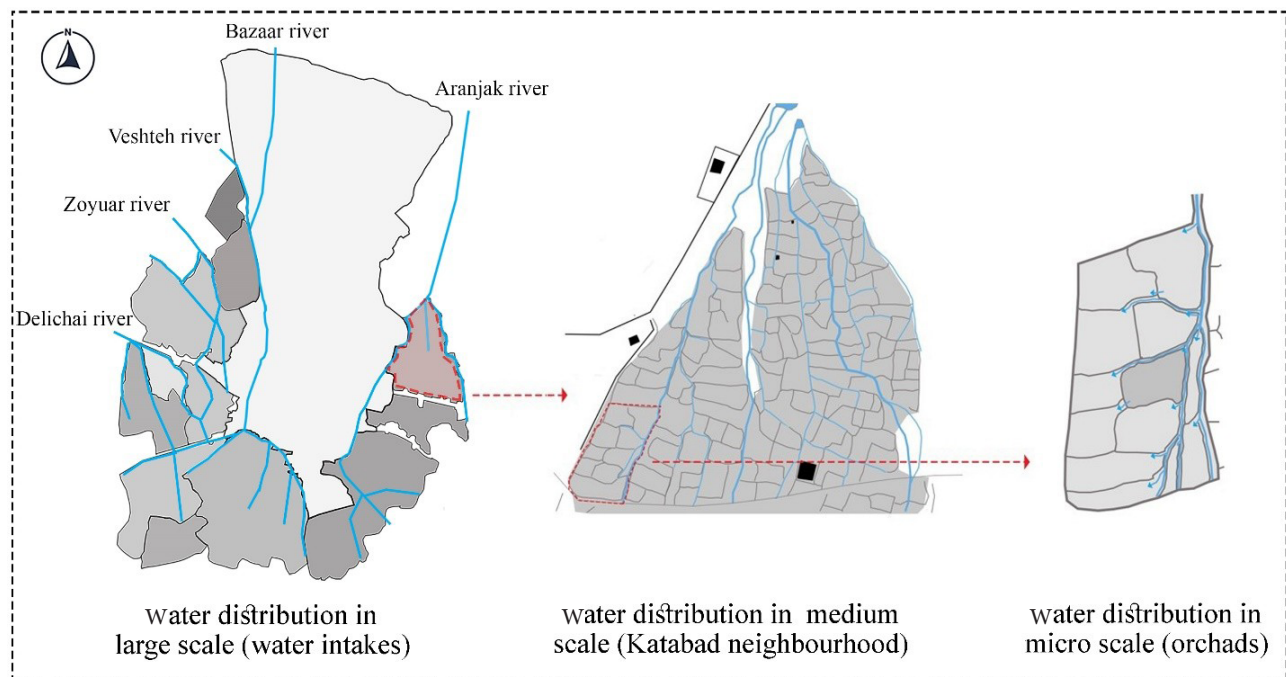


Fig. 5. The intertwined relationship between the orchard and the water system in three scales: macro (total orchard), medium (location), and micro (neighborhood and plot). Source: Authors.

Endnote

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1. Comparison of aerial photos demonstrates that during the last half-century, more than 700 hectares of the orchard area of Qazvin (about 1.4 of the total area of the orchard in 1971) has been destroyed, which is due to various reasons from the development and urban expansion to drought and abandonment of orchards. Affected by the weather, economic and cultural conditions of the society are considered effective in this destruction.
2. Each *Fand* or *Nâr* consists of 4-5 quarters and a number of blocks that are adjacent to each other and use common streams. The local term *Fand* is common in the western and southwestern regions of the orchards, and in the eastern and southeastern regions of the orchards the term *Nâr* is used.
3. Taking into account the three quarters named Yalian, Ver-teppeh and Dizaj, which are outside the main area of Qazvin traditional orchards but have the same shape and management as other traditional orchards and are also available in old documents, the area of traditional orchards is about 3100.
4. According to historical writings, until the 4th century AH, the people of the city used well water, and from the Ghaznavid period onwards, the technique of aqueduct has been used for water exploitation in neighborhoods and buildings of the city (Dabir Siaqi, 2002, 498).
5. Since 2019, eight million cubic meters of water were allocated by the Jihad Agricultural Organization to irrigate traditional orchards in Qazvin under the title of cultivation plan. The volume of water required and consumed from these 8 million cubic meters varies in different years and depends on water supply and water shortage, due to precipitation in that year. In addition, there are about 14 deep water wells in the area of orchards (Simiari, 2019) of which 8 of these wells are contracted inside the orchards (Avers Consulting Architects and Urbanists, 2007, 255, Vol. II). Depending on the type of orchard irrigation system that is flooded. Water wells are not able to irrigate orchards, but for years of water shortage, orchard regeneration and planting of seedlings are used to create narrow streams in about 5% of neighborhoods (Haji Karimi, 2019).
6. Most river discharges are from January to May. Irrigation of all traditional orchards in Qazvin starts once or twice in mid-December and depending on the rivers from which water is taken, it will be done up to 50 days after spring or until the beginning of summer (Simiari, 2019).
7. The width of the drawers of the main streams is 1.30 meters and the side streams are between 0.7 to 1 meter, and the streams have different widths from 1 to 5 meters according to the water needs (Haji Karimi, 2019).
8. The method of indirect water intake the overflow of orchard water to another orchard from the rock mouth between the soil border of the two orchards, which is called Sharp in the local language, is that first the first orchard is filled with water and then water enters from this orchard to the next orchard (Akhavizadegan, 2002, 133).
9. The planting pattern in the traditional orchards of Qazvin is mixed and irregular, the trees are planted in each plot without any special order. Also, grape bushes are grown on the floor of the orchards (Avers Consulting Architects and Urbanists, 2007, 183). One of the reasons for not planting more trees in most of Qazvin orchards is the limited amount of water available (Haji Karimi, 2019).
10. In general, the divisions in Qazvin orchard arise from the commonalities in the water division system and are as follows:
Kort: the smallest part of the orchard, surrounded by embankments with a height of 1 to 1.5 meters.
Quarters: A collection of plots with an area of about 10-30 hectares that are irrigated from common streams and maintained by a group of orchardists.
Blocks: A collection of plots with an area of about 5 to 10 hectares that are drunk from common rivers, and usually the blocks have no water rights and were created after the water petition was written.
Fand and *Nâr*: Each *Fand* and *Nâr* consists of 4-5 places and a number of blocks that are adjacent to each other and use common streams. In the past, *Dakhôu* was in charge of managing the fund. The term *Fand* is common in the western and southwestern regions of orchard and in the eastern and southeastern regions of orchard (Haji Karimi, 2009).
11. Today, in valuing Qazvin orchards, factors such as management and ownership, access, population and quality of vegetation, sufficient water, etc. are all influential factors.
12. *Sadr Ab* - is water that belongs to an orchard with the right of precedence and this orchard is irrigated first and earlier than the rest. An orchard that uses chest water, in turn, uses the right to water (Akhavizadegan, 2002, 120). As a result, the orchard has more fruit and more trees than the neighboring orchards in one place. On the scale of neighborhoods between plots in neighborhoods, as well how water is received from the creek and the location of the plots relative to the streams affects the amount of water intake and consequently the fertility of the neighborhood plots: Orchards adjacent to the creeks are irrigated directly. These orchards do not have a problem during the second water or the purchase of water in the dry years, and irrigation in addition to one water right depends on the decision of the orcharder (ibid., 132).
13. The rule of water intake in the neighborhoods is that the orchards are filled with water in the order of placement relative to the beginning of the stream and after each orchard is filled, it is the turn of the next orchard. The division of river water between the quarters, fands and streams according to the old scroll and then the division of water between the orchards is entirely the responsibility of the orcharders of each place and the orcharders have no duties. The water is divided between the orchards in such a way that the day before with the days before the turn, each orcharder is obliged to prepare for water and irrigation. Preparation includes creating an earthen dam in front of the opening of each orchard and blocking the decade of other orchards and streams so that water can enter the desired stream without loss by passing through a certain path (ibid., 129).
14. The watering time of the neighborhoods starts from mid-January and depending on the river, it usually ends up to 50 days after April.

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