Association for Saving the City's Life
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Islamic Republic of Iran
Ministry of Agriculture Jahad
Agricultural Planning, Economic and Rural Development Research Institute (APERDRI)
APERDRI

GIAHS Proposal

Globally Important Agricultural Heritage Systems

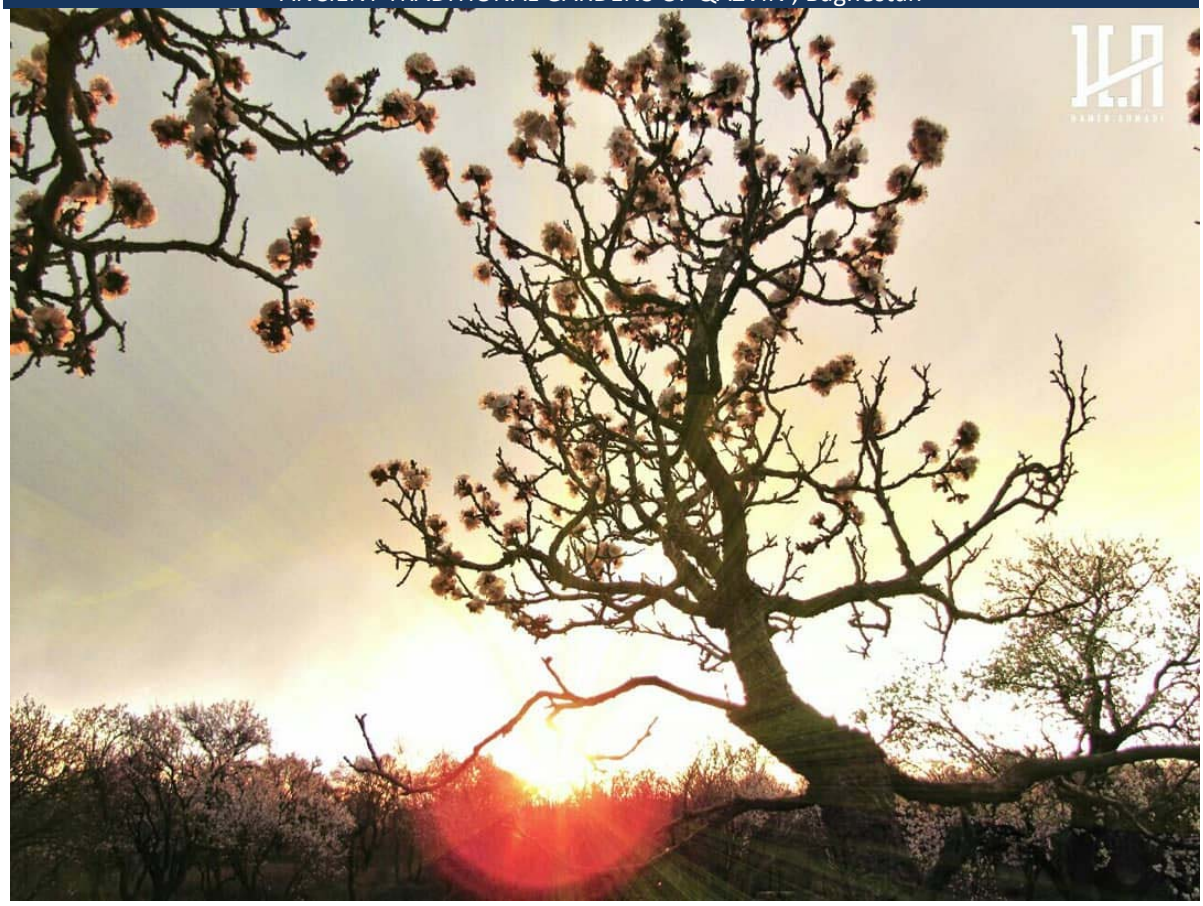
Ancient Traditional Gardens of Qazvin Bāghestān

Location: Qazvin, I.R. Iran

October 16, 2023


Photo by: Mahdi Moatamed


Photo by: Porya Kakvand

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Traditional Garden of Qazvin

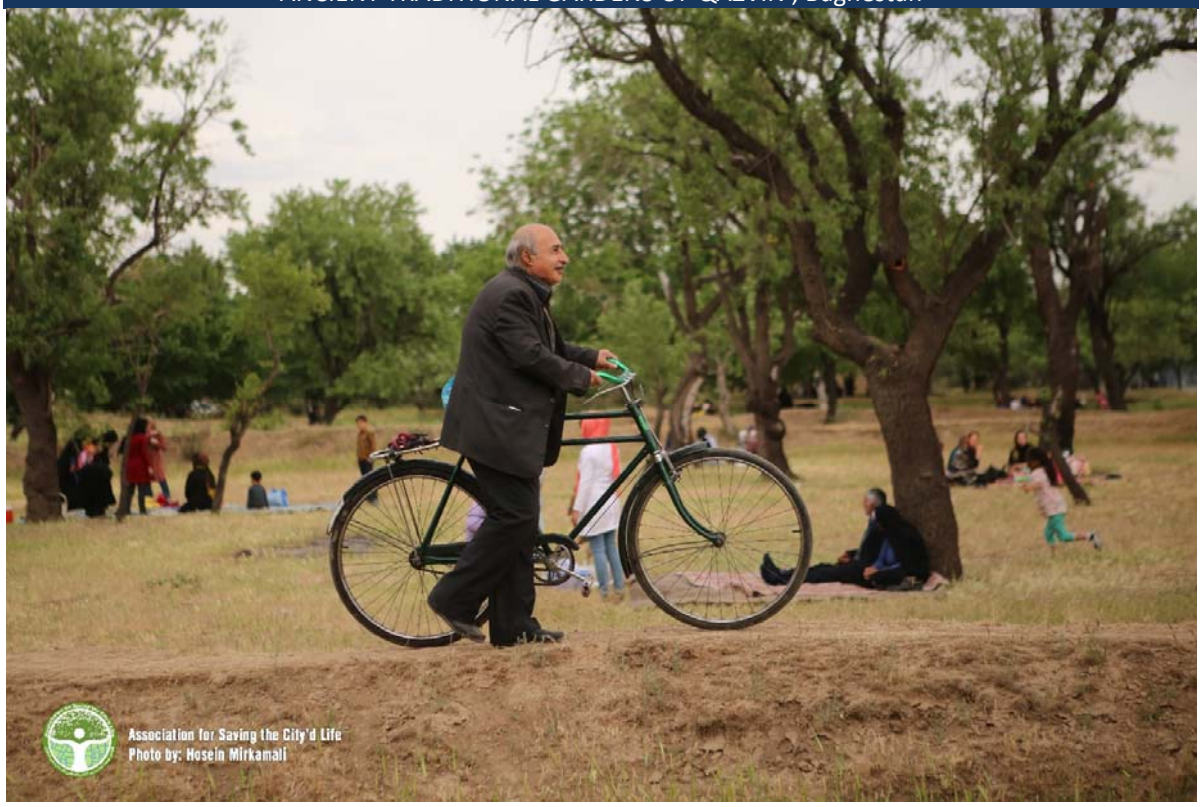
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Photo by: Hosein Mirkamali

To the garden owners and gardeners of Qazvin Traditional Gardens (Bāghestān) which have steadfastly preserved this important agricultural heritage system, and to the people of Qazvin and all stakeholders of Bāghestān, whose efforts and contributions made this proposal possible.

Association for Saving the City's Life

تقدیم به باغداران و باغبانان باغستان □نتی قزوین که این نظا□ میراثی ارزشمند کشاورزی را با ا□تواری حفظ کر□ه‌اند و تقدیم به مر□□ قزوین و به همه□□ت اندرکاران باغستان که با تلاش و مشارکتشان این مهم را امکان‌پذیر کر□ند.

انجمن مر□□نها□ تو□عه حیات شهر

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I. SUMMARY INFORMATION

Name of the Agricultural Heritage System: Traditional Garden of Qazvin (Bāghestān)
Requesting agency/ Organization: Ministry of Agriculture-Jahad, I.R. of Iran
Responsible ministry (for the government): Ministry of Agriculture-Jahad, I.R. of Iran
Location of the site: Qazvin traditional gardens districts, Qazvin city, I. R. Iran. The System lies within longitude 50° 0' E and latitude 36°15'N (Map1 and Map2, Annex1).
Accessibility of the site to capital city or major cities: The traditional gardens of Qazvin; Bāghestān surround the city from the east, west and the south. In some parts, it becomes very close (500m) to the downtown core. Intercity railway runs through the site. The city is approximately two-hour drive to the capital city, Tehran. Major road and rail arteries pass through the city connecting it to other major cities in neighbouring provinces.
Area of coverage: 2780 hectares
Agro-Ecological Zone: Hilly area of agroforestry eco-systems in South, east, west of Qazvin
Topographic Features: Plain and hilly areas cover most part of the site.
Climate Type: Semi-arid climate
Approximate Population: 968.000
Ethnicity/Indigenous population: Muslim people constitute over 99% of the total population and live at the core area. The rest are mainly Armenian ethnic
Main Source of Livelihoods: An estimated 30% to 100% of the overall household income are earned through Bāghestān by means of production and sales of fruits, nuts, vegetables, and other Bāghestān related occupations.

II. EXECUTIVE SUMMARY

Qazvin is situated at the southern foothills of the Alborz Range (at an altitude of 1,280 meters). Its climate is cold and dry; however, it is permanently threatened by seasonal floods. Flooding agriculture has traditional roots in practices dating back more than 1100 years ago. "Traditional Gardens of Qazvin," locally referred to as “Bāghestān-e Sonnatī” or simply "Bāghestān," is a flood spreading system that has been cleverly constructed as a green ring to protect the city against the floods.

During the wet season, according to the water scroll, gardens are flooded with water up to the tip of the dykes. This water then gradually penetrates into the ground. It is a useful method considering the economic, environmental, and social aspects. With a long history of producing organic fruits, foods, and sweets, made from Bāghestān products, the city's economy relies heavily on Bāghestān. Many jobs and industries in Qazvin are related to Bāghestān

The traditional gardens of Qazvin, Bāghestān, is a typical example of Iranian garden agriculture. It not only maintains the national heritage status but also provides outstanding advantages in enriching biological diversity, altering ecosystems, and ensuring food safety. This system serves as an example of adaptation to harsh climatic conditions and climate change.

Bāghestān features innovative elements that are anchored in its flood irrigation-based structure. Bāghestān includes localities and each locality consists of several gardens. Gardens have private owners who use common resources including seasonal rivers’ water. Sustainability has demanded effective governance to harmonize shared resources in line with stakeholders' interests. As a result, traditional management, oral culture, and established laws have emerged. A testament to civilization, Bāghestān thrives on agriculture that is intertwined with Qazvin's culture, beliefs, and economy. Over 50% of owners rely on Bāghestān as their primary income source, while the rest of the owners earn 30-70% of their income through it. Gardeners, along with garden owners, also earn a living from Bāghestān.

From riverhead to blooming flowers, ponds, and trees reflecting in water, Bāghestān's enchanting landscape is unique in spring. A gentle breeze carries petals onto the ponds. In summer, greenery, birdsong, and coolness provide a city escape. Autumn brings colorful leaves, while winter showcases snowy branches. Bāghestān's beauty spans all four seasons.

It can be concluded that Bāghestān provides all kinds of ecosystem services in four categories of productive, regulating, supporting and cultural services for the city.

III. DESCRIPTION OF THE AGRICULTURE HERITAGE SYSTEM

Part A. Values/ Specific Features of the Proposed Sites as Global Importance

In the summary of the ecological reflections which is raised from the regional identity and considering the land topography in Iran, it can be said that the most important ecological feature of Iran is the diversity in its ecosystems. This is derived from the environmental conditions, particularly the physical foundation of Iran in terms of climate and land configuration. In this context, the water basin divisions are considered foundational subjects. These divisions provide hydrological characteristics that play a significant role in the structure and processes of the land's ecological makeup. Vertical (from mountains to plains) and horizontal (inter-system relationships in equidistant layers of watersheds) ecological services are among the most prominent ecological functions which affect the landscape's features. Ecological services flow through the rivers, from the mountains to the plains, and the watershed areas overlooking the city and gardens of Qazvin serve as remarkable examples of this phenomenon.

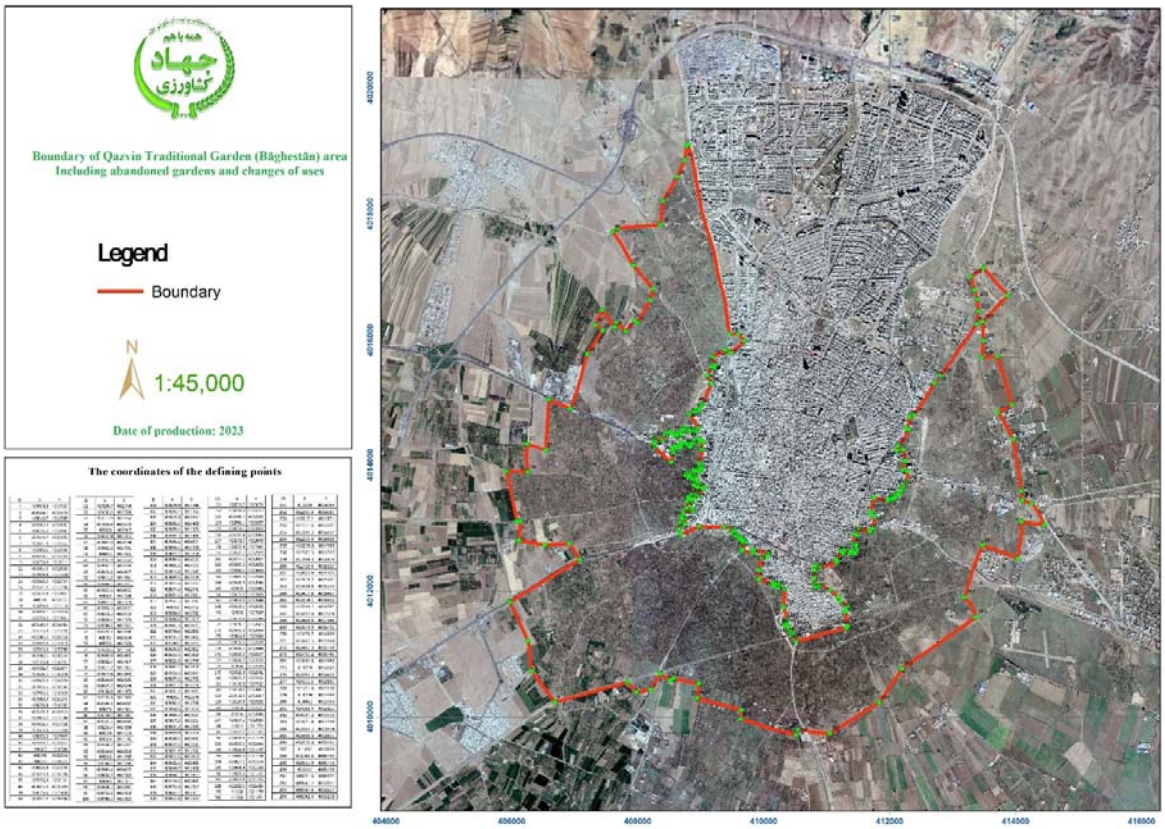


Figure 1: The geo-referential boundary of Bāghestān including abandoned gardens and changes of uses

In a comprehensive examination of the landscape of Iran, alongside the environmental potentials, one must also consider the environmental constraints. Therefore, in a holistic and integrated perspective on Iran's environmental conditions, the mountainous nature of the country and the confinement of water basins on one side, and the dominance of semi-arid to arid climates on the other side, can be counted as severe environmental limitations which restrict human biological activities. This is because the former provides the grounds for "soil desertification," and the latter establishes the foundation for "regional water scarcity" in Iran. Hence, in Iran's closed basins, a few limited permanent or seasonal rivers serve as biological corridors. These rivers, by possessing a degree of vitality in the deserts of Iran, have been regarded as the basis for Iranians to establish centres of civilization. Overcoming the challenging living conditions in the Iranian plateau has not been easily attainable, and what is recognized today as centres of civilization are the results of the continuous and persevering efforts of successive generations of its inhabitants. Achieving these ongoing and intelligent efforts are now acknowledged as indigenous knowledge, which are a part of human knowledge and human lived experience and has been able to quench the thirst of this land and secure its food security throughout its extensive history.

As a manifestation of the harmonization of human to the environment, the Iranian individual have used various methods in different parts of Iran due to the diverse and tense climatic conditions, of which qanats and windcatchers in the central and southern regions of Iran are an example. Another example of this adaptation is the proximity, interconnection and coexistence of city and garden, which in various geographical regions carries specific features that adapt to the local environment.

Qazvin, due to its geographical coordinates (latitude 25°36'N and longitude 50°E) and an elevation of 1300 meters, falls within the semi-arid cold climate. It serves as a transitional zone from the dry climates of inner Iran to the semi-humid to humid climates of Alborz. This city receives water from five seasonal rivers originating in the northern watersheds of Qazvin plain, with two rivers converging near the vicinity

of the city. As a result, benefiting from the relative wealth of groundwater resources and the potential of the alluvial soil, traditional gardens gradually settled around the city and the inhabitants of Qazvin elevated it to the status of a "city amid gardens,"

The main motivation for creating gardens has been the utilization of environmental conditions and the transformation of the threat of floods into an opportunity for food production (Figure 6 and Figure 7) . It has, achieved not by governments or engineers, but by farmers relying on their lived experience. The gardens of Bāghestān have been constructed in the form of basins to accommodate and absorb the seasonal river floods. Urban farmers of Qazvin's Bāghestān have coordinated their cultivation method with this form of flood irrigation. As a result, the trees and shrubs in the gardens, mostly grown from seeds, are highly adaptable to summer droughts and yield with one to two episodes of flood irrigation. Additionally, mixed planting in Bāghestān has provided the groundwork for resilience in conditions of drought or frost. Nowadays, the products of Bāghestān continue to be considered strategic products of Qazvin city and play a significant role in the city's economic cycle. Each year, a portion of Bāghestān's products are exported to foreign markets, with Qazvin pistachios in particular standing out as one of the most important garden products. Qazvin pistachios, with their captivating colour and first-rate taste, are a unique variety distinct from other types of pistachios in the country and the world.

Furthermore, the unique flood irrigation of the gardens leads to the consistent and continuous stabilization of fertile alluvial soils, as well as nourishing the underground water tables. The fertile Qazvin plain, situated to the south of Bāghestān which provides over one percent of the country's agricultural and horticultural products is dependent on Bāghestān. and the agricultural well water is supplied from the Bāghestān's aquifer. As a result, Qazvin's gardens have been responsible for various ecosystem services, including fruit production, biodiversity, soil and plant support, as well as water and flood regulation, and the creation of cultural traditions for over a thousand years.

One of the cases affected by the Bāghestān irrigation system is its landscape The difference in water utilization is the reason for the difference in the landscape of the city with the garden around it, which has been mentioned by various tourists such as Chardin and Tavernier. The traditional garden of Qazvin has created a green visual landscape around Qazvin. This green belt, which consists of city trees and rivers in between, covers Qazvin. The landscape of the garden is not only its visual and scenic qualities, but also includes its constituent processes and human activities

The gardens of Bāghestān are privately owned, and thus the most remarkable aspect of the traditional garden in Qazvin is that over more than a thousand years, the residents of Qazvin have been able to manage their shared, be it limited, and valuable resources for the sake of their common interests. This vast realm has been passed down as a unified entity from one generation to another.

Unlike many agricultural fields, actors in the gardens are not solely farmers (gardeners). In Bāghestān, both the gardener and the gardens owners (orchardist) are considered important and distinct characters. Despite the fact that gardeners are the workforce of the garden, they play a significant and influential role in its management and administration and they are primary guardians of indigenous knowledge of Bāghestān. People from all walks of life had the opportunity to become garden owners through various methods, such as working on the land. These rules have contributed to the expansion of the gardens over time.

The hierarchical structure of Bāghestān's physical divisions has been established for the sustainable management of this vast and complex system, and the social relations of Bāghestān are aligned with this hierarchical structure. Bāghestān is managed like a city, and the essential and central element of it is the "locality". A figure named "Dakhû" is responsible for managing One or more adjacent localities. In this system, social relationships between garden owners and gardeners have been meticulously and legally formulated, and these customary rights are considered a part of the native Bāghestān knowledge. One of the most significant and key elements of

customary rights in the gardens is its historical water division document, which is still adhered to in its entirety and accuracy. One could claim that the most important factor that has kept Bāghestān alive and cohesive until today is its highly intelligent, human-centered, and creative social and managerial system, which is intertwined with urban life and has defined the coordinates of civilization in this historic city. What reinforces such a theory is the multifaceted connection between the garden and urban life in Qazvin, which persists to this day. Many traditions, foods, and traditional sweets of Qazvin are derived from the products of Bāghestān, especially almonds and pistachios and grapes. Today, Bāghestān remains the most important, widest, and most accessible leisure spot for the people of Qazvin. The lack of a fence in Bāghestān has long led to a culture of generosity among gardeners. Gardeners share Bāghestān space, which is privately owned property, with the city's residents and passersby. Local customs in Qazvin are intertwined with Bāghestān, the most important of which is the "Outing on fifty" ceremony [outing on the 50th day of the New Year].

The traditional gardens of Qazvin, Bāghestān, which until four decades ago had enclosed the city in a circular shape, now encompasses the west, south, and east of Qazvin. These ancient traditional gardens dating back to more than 1100 years covering an area of 2,780 hectares (Figure 2). is registered in the list of national monuments. Figure 1 shows geo-referential boundary of Bāghestān including abounded gardens and land-use changes and Figure 3 shows its location.

In about six recent decades, Bāghestān has faced risks because of some external problems, including water shortage due to the manipulation of runoff, climate changes, and also due to the neglect of the principle of sustainability in urban development, and then it needs protective measures.

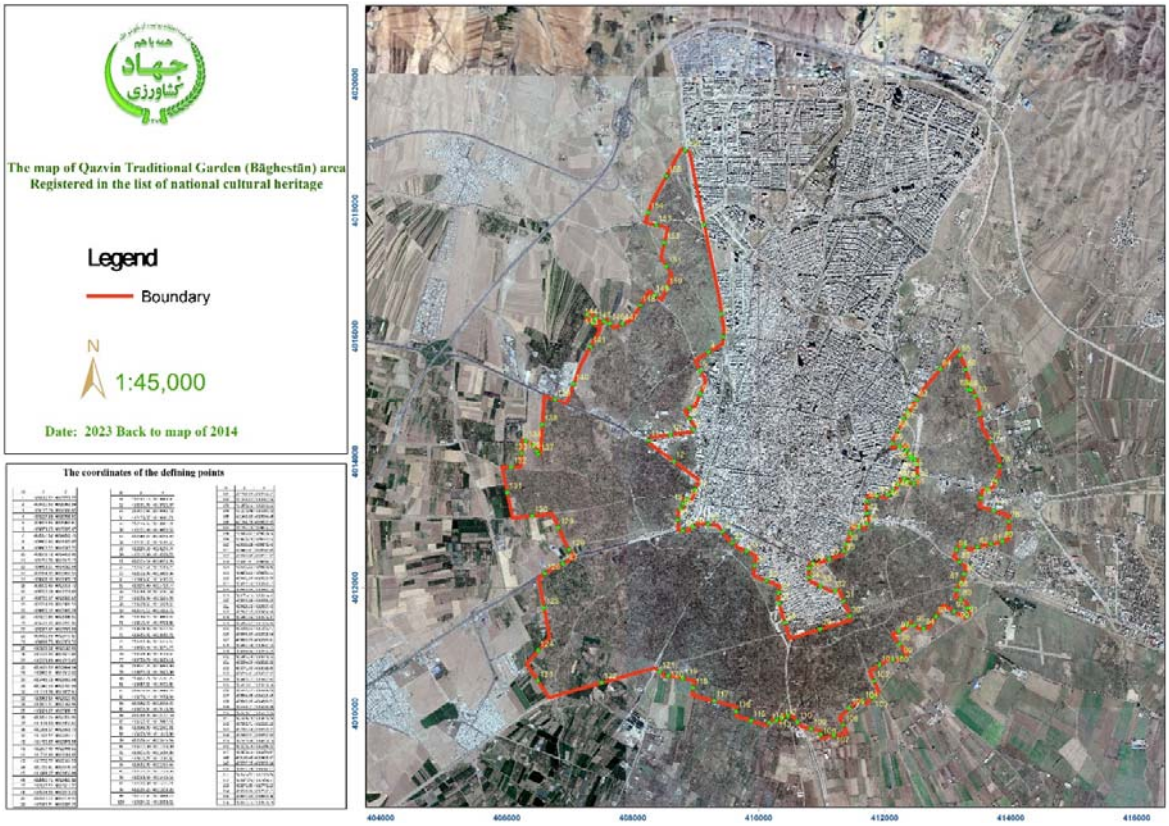


Figure 2: The georeferencical boundary of Bāghestān according to registration in Iran Cultural Heritage

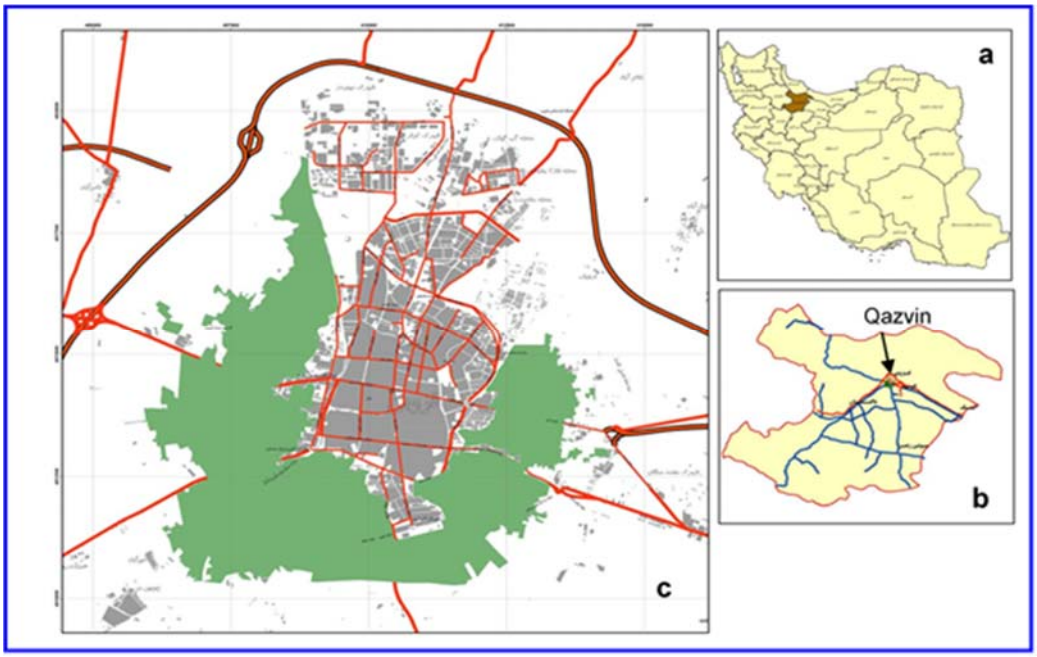


Figure 3: Location of Qazvin traditional garden, Qazvin province on the map of Iran (a), Qazvin city in Qazvin province (b) and Qazvin traditional garden in the south, east and west of Qazvin city as a green belt around the city (c). By Avers

A.1. Structure and physical characteristics of Bāghestān

The aim of this section is to describe the physical structure of the gardens, including their shape, location, the catchment system, and their physical demarcations.

Figure 4: Qazvin located at the foothill of Alborz

A.1.1. Bāghestān's catchment system as a watershed management system

Qazvin is located in semi-arid to arid regions. The most important water source of the city and Bāghestān is current floods in seasonal rivers, which, if not managed, would be destructive.

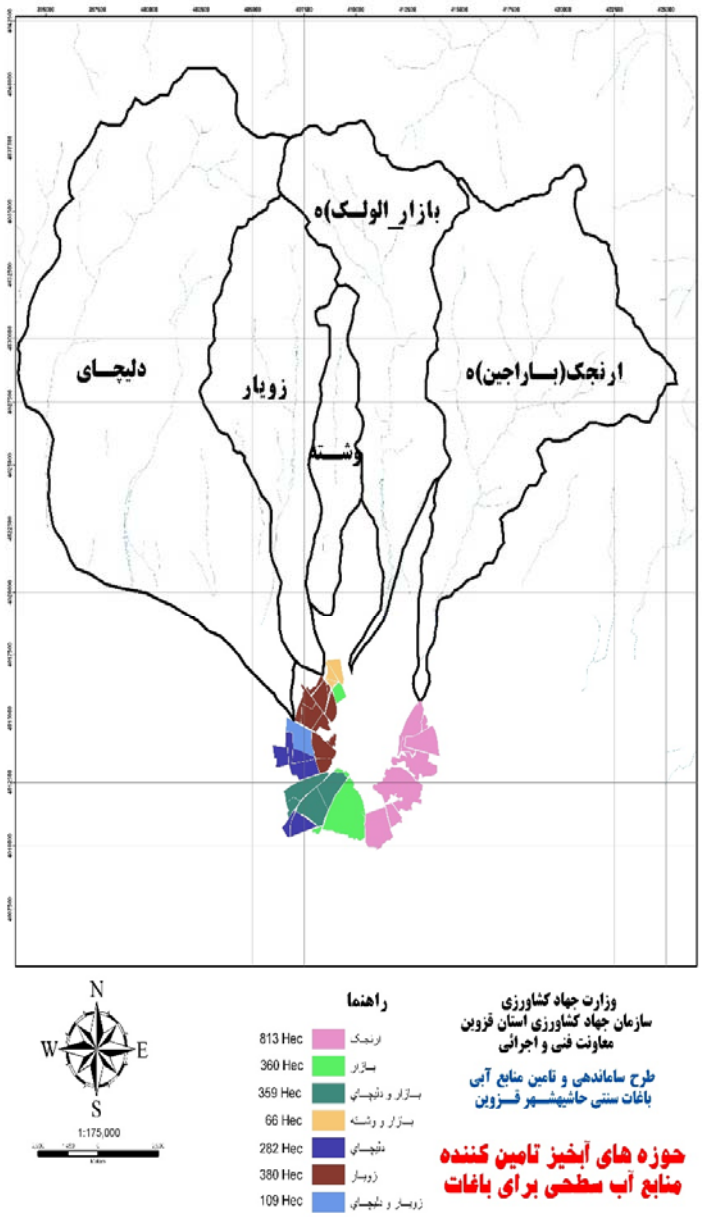


Figure 5: Basin of important routes overlooking the Qazvin region; By Avers

One other distinct feature of Bāghestān is its irrigation method. Since Qazvin is situated at the foothills of Alborz ranges (Figure 4), it is constantly being threatened by seasonal floods. Our ancestors have managed to devise a clever method to turn this natural threat into an advantage.

During the wet season, according to the water scroll, gardens are flooded with water up to the tip of the dykes (Figure 6 and Figure 8). This water then gradually penetrates into the ground. Interestingly, the grapevines thrive on this single shot of flooding and bear healthy fruits on annual basis. Moreover, the floodwater reaches the underground water basins causing the underground water resources to replenish. Since the source of this water is natural flood, nutrients are also carried onto the garden's soil, supplying the nourishment needed by the trees.

Figure 6: Flood irrigation according to the water scroll; photos by unknown artists.

Gardens are irrigated twice a year, once in winter and once in spring. Gardens do not need irrigation for the rest of the year, even in the summer heat. The only exceptions in this regard are new seedlings that are planted to regenerate damaged areas and must be irrigated manually in summer (Shahbazi, Kermanshahani, Ahmadi, et al., 2019).

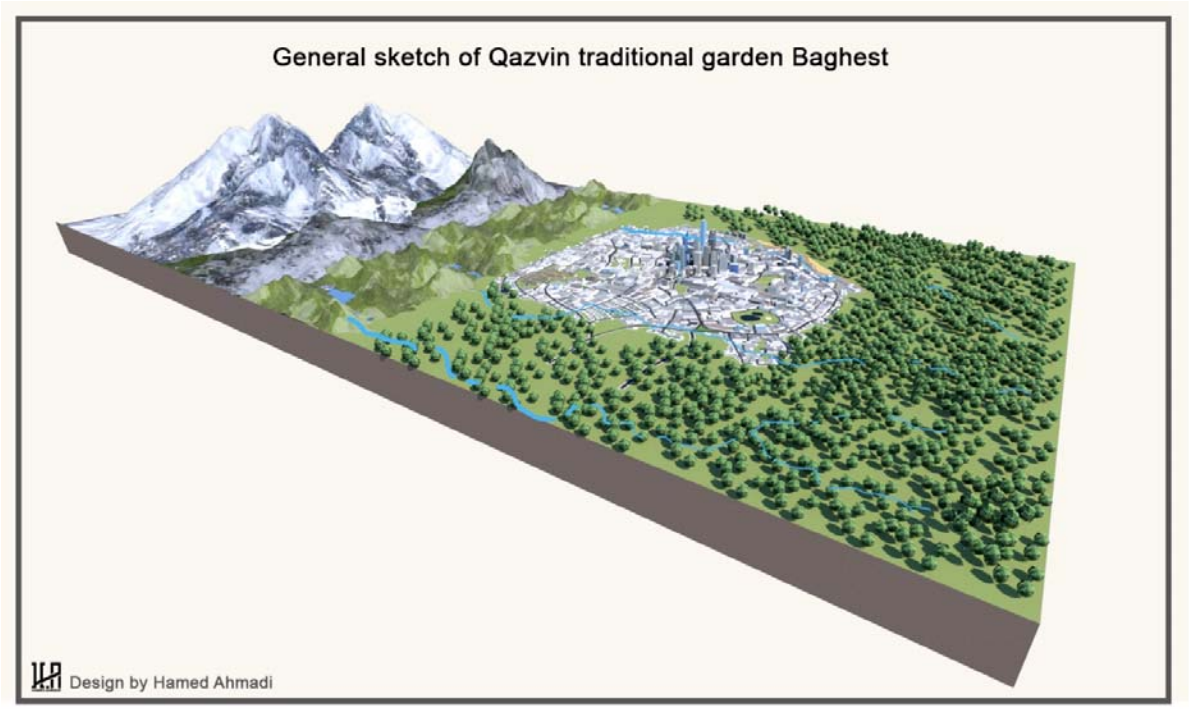


Figure 7: A general sketch of Bāghestān by Hamed Ahmadi

As we have mentioned in the previous section, Bāghestān is a rain catchment system and plays an important role as a flood barrier. In support of this claim, it should be said that according to some sources, the Gardens were created as a seal at the beginning of their formation and later became gardens. This issue has required that Bāghestān gardens do not have walls and fences. Figure 7 shows a general sketch of

Figure 8: Flood Irrigation; Photo by Hamed Koleje'i.

Bāghestān. The unbounded nature of the gardens has given rise to cultural and social

features that are now part of the cultural landscape of Bāghestān and are important elements of the national identity of Bāghestān.

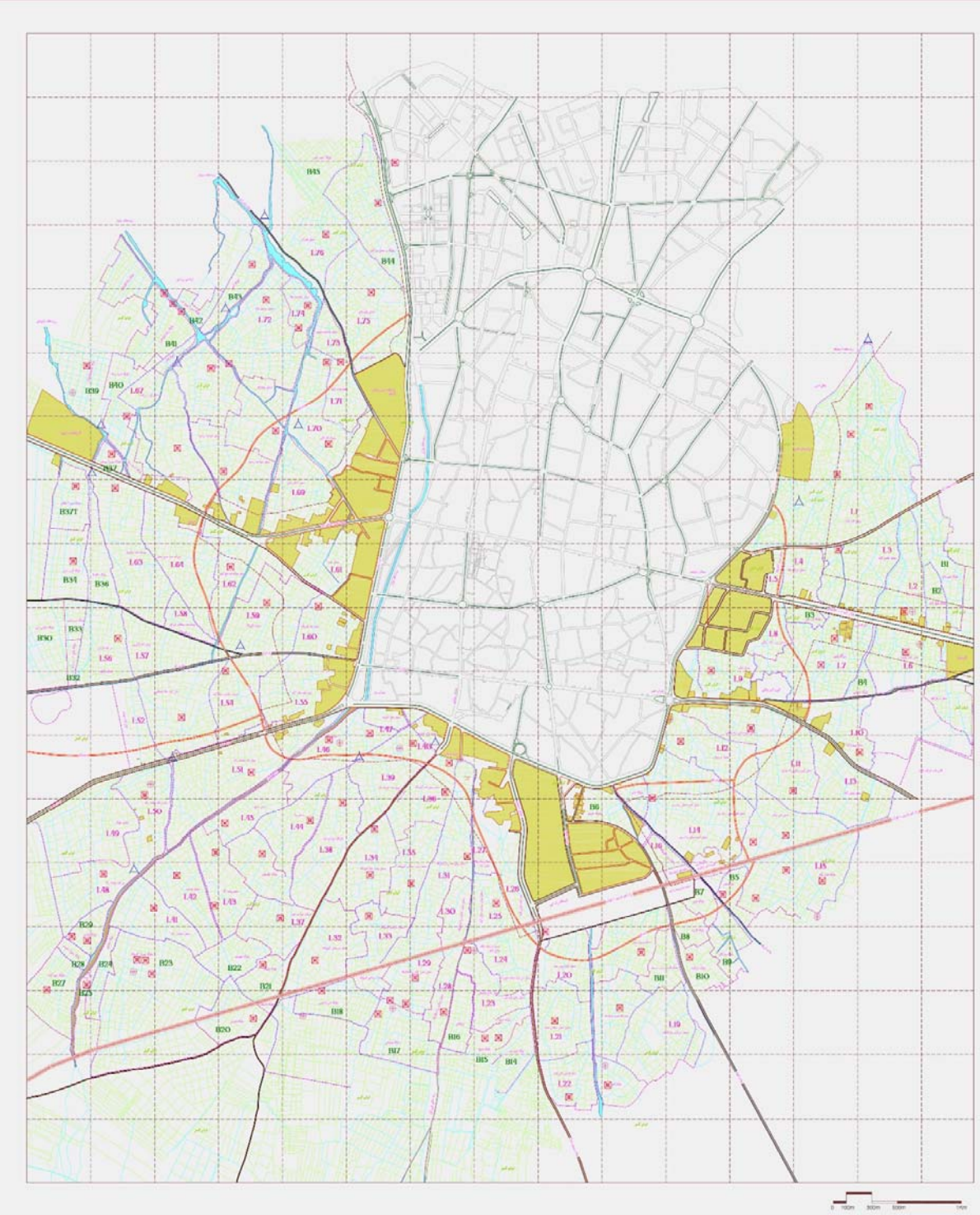


Figure 9: Physical structure of Bāghestān

A.1.2. Hierarchical physical structure

Bāghestān is fed by five seasonal rivers that flow from the southern foothills of Alborz in the north of Qazvin to the city. Each of the rivers irrigates a part of the garden. Seasonal river water enters the river network in Bāghestān and is distributed in the gardens. Therefore, the first and largest divisions of the gardens are based on the rivers which irrigate them. There are small parts of the garden that are drunk from two rivers and receive a portion of the water they need from each.

Table 1: Bāghestān Physical Structure

Bāghestān Physical Structure	
Title	**Description**
Garden	A plot of Bāghestān with dirt borders that usually has one owner
Locality	A number of gardens that form a garden complex due to having commonalities together
Bolûk Locality	It is the same as the Locality, but it has been added to Bāghestān after setting up the historical scroll of water. Most of the blocks do not have water rights registered in the water water scroll. They are irrigated from the excess water of the localities
Fand[1]	A collection of several Localities or Bolûks or a part of a big locality or a locality
River basin	A collection of several localities that are irrigated by one of the seasonal rivers.

The second largest division of Bāghestān is called "Fand" or "Saman". Each "Fand" consists of several continuous sites that are irrigated by close streams. Each Fand contains four, five or several localities forming localities. Each locality, which contains several gardens, is a set of interconnected plots (gardens) that are irrigated by specific streams and a group of gardeners take care of them. Table 1 shows the elements of physical structure of Bāghestān and Figure 9 shows the location of the localities. Table 28 in Appendix 1 provides a complete list of place names, their names, the area of each locality and the river by which the locality is irrigated (linked to their location on the map). Also in Appendix 2, the same table has been prepared for Bolûks, which are secondary places that join Bāghestān after the date of the historical water scroll (Table 29).

[1] In this case, there is no consensus among Bāghestān experts.

Larger localities need more gardeners for irrigation and other farming activities. There are at least 2 and at most 4 gardeners in each locality. Each locality also has its own name, for example, one of the Fands named "Chashnah Rah" consists of 4 localities: Pishfand, Paroek, Shania Bolûk, and Sarfand. The Table 2 provides some statistical information on the number, area and status of Bāghestān gardens.

Table 2: Some statistics of Bāghestān localities

Localities and plots No & area	
Total Number of Localities (localities and Blûk localities)	**135**
Total Number of localities	**79**
Number of destroyed or abandoned localities	**4 hectares**
Total Number of Blûk (according to the map of 2014)	**56 hectares**
Number of destroyed or abandoned or Blûk	**8 hectares**
Area of Localities	**16 – 126 hectares**
Average of area of small-size plots	**800 square meters**
Average of area of medium size plots	**2500 square meters**
Maximum Area of plots	**8000 square meters**
Area of abandoned land plots inside the Bāghestān	**68**
Area of abandoned of on the edge of the city and on the side of the roads	**182**

A.1.3. Buildings

1. Chāhkhāne

Figure 10: Chāhkhāne; shared building in Bāghestān; By Shokooh Kermanshahani

As mentioned above, each locality contains several gardens. With the exception of only one garden, individuals own all other gardens. This single garden houses a building named "Chāhkhāne" in local language, which is a resting place for the gardeners and a temporary storage for the harvest. These buildings are the most important architectural structures in the garden complex. These are public and common buildings built in the localities to meet the daily needs and rest of the

Figure 11: The foreign tourists visiting the "Chāhkhāne Hajfathali"; photo by Fateme Soltan Asiyabanha

gardeners, as well as to provide security in the locality. Each locality has at least one

Chāhkhāne, which was shared by all gardeners of the locality. Figure 10 and Figure 11 show one Chāhkhāne among all.

Normally, next to each of these structures, there is a drinking water well; hence, they are named “well station”. In some of the larger localities, there are two Chāhkhānes.

2. Aleh

In the middle of Bāghestān, some temporary structures are built to rest at harvest time. These structures, called "Aleh" in the local language (Figure 12), are made of pruned branches of trees in different dimensions as canopies by gardeners in their gardens.

Figure 12: “Aleh”; [Androodi, E., Sahrakaran, B, 2017. Vernacular Culturan Landscape of Qazvin,s Traditional Gardens]

A.1.4. Adaptation of Bāghestān trees to the dry climatic conditions of Qazvin

During the life of Bāghestān, the trees of the gardens are adapted to the dry climate and flood irrigation system and have become fertile by being irrigated just twice or even once a year. There are even gardens in Bāghestān that have been abandoned and not irrigated for years, yet their old trees have survived only on rainwater since their roots have penetrated deep in the moist soil. Bāghestān contains a large number of

100 to 1000-year-old trees. Figure 13 and Figure 14 show some the pistachio trees in Bāghestān, which their age is estimated between 800 and 1000 years according to the experiences of gardeners.

Figure 13: Ancient pistachio tree with an estimated age of 700 to 800 years; photo by Fateme Soltan siyabanha

Figure 14: Ancient pistachio trees in Bāghestān with an estimated age between 700 and 1000 years; photo by Shokooh Kermanshahani

A.1.5. Bāghestān genetic resources

In Bāghestān, there are plants and trees with great genetic diversity. Conservation of plant communities with genetic diversity is a necessity of environmental issues. The richness of Bāghestān in terms of biodiversity is so great that many experts believe that the Bāghestān should be recognized as a biosphere reserve.

A.1.6. Bāghestān soil

In the traditional gardens of Qazvin, Bāghestān, floods enter streams through seasonal rivers and are stored in Bāghestān gardens, which are shaped like pools, and are finally absorbed by the soil. This type of irrigation stabilizes the fertile and rich soils of the foothills continuously in Bāghestān (Figure 15).

Figure 15: Deep cutting of Bāghestān soil during the construction of a bridge; photo by ASCL NGO

This is while Bāghestān soil is rich and ideal for agriculture and is as important as garden trees. The destroyed parts of gardens can be regenerated as long as the soil of the gardens is not destroyed. It should be noted that it takes about 300 to 700 years for each centimetre of soil to be formed.

A.1.7. Proximity to the city

The gardens are adjacent to the city and there is no boundary between the gardens and it. Perhaps the role of Bāghestān as a barrier has primarily caused this neighbourhood, but this issue has also brought other positive effects and in practice has made Bāghestān the most important ecological capacity of the city. Among them, the followings can be mentioned:

- Bāghestān stands as a powerful barrier against dust particles of the dust centres located in the south of Qazvin (BuinZahra region). Moreover, Bāghestān act as the green belt of the city.
- According to a study based on satellite images, Bāghestān moderates air temperature of the city between 5 and 7 degrees.
- Bāghestān plays the role of the lungs of the city and is the most important source of softening the city's air.

Despite its private ownership, Bāghestān has historically served as a public promenade for the city. The large number of people present in the garden at Sizdah Bedar and Panjāh Bedar ceremonies are very significant examples (Figure 16).

Figure 16: "Panjāh Bedar": an Iranian festival held annually at 9th may; photo by: Hosein Mirkamali

Adjacency to the city has also had negative and destructive consequences over the past decades for the gardens of Bāghestān.

A.1.8. Roads in Bāghestān

Figure 17: Roads in Bāghestān; Photos by ASCL NGO

One of the requirements of Bāghestān and one inevitable element of any other field of production is road. In Bāghestān, the borders separating the plots have been used for pedestrians and donkeys for transportation. Also, over time, a number of dirt roads have been created for cars to pass (Figure 17).

Roads, however, are double-edged swords, and paved roads can pave the way for abandonment, villa construction, and the destruction of gardens. On the other hand, the roads endanger the security of gardeners, especially their products, with the risk of unauthorized entry and theft of crops (Figure 17).

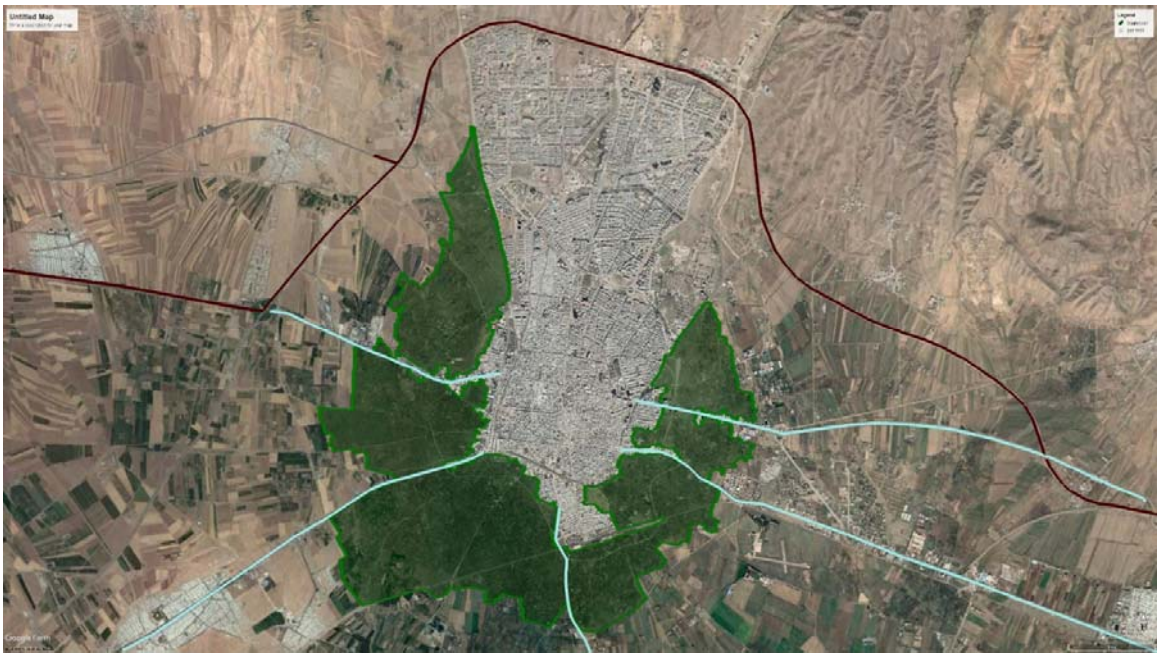


Figure 18: The main roads in Bāghestān; by Hamed Ahamadi

A.1.9. Products, interplanting

Grapes, pistachios, almonds and to some extent Gheysi (dried fruits of apricot) are the main products of Bāghestān gardens. There are also walnut trees as stable and profitable trees in some gardens. In addition to the mentioned products, products such as elm, apple, and berry are also harvested.

Most of Qazvin strategic products are produced in Bāghestān and have specific characteristics; especially almonds, pistachios, and garden grapes are superb. For example, the characteristic of Qazvin (Bāghestān) pistachio is its green kernel. For this reason, Qazvin pistachio is used in confectionery. Some traditional foods and special sweets of Qazvin, which are nationally famous, are also prepared using Bāghestān products. Also, an important part of Qazvin pistachios product is exported to foreign markets.

Interplanting and Resilience

One could claim that the most important function of Bāghestān is the production function. All the four ecological services of the garden, as well as the secondary incomes that can be obtained from it, depend on the production in the garden to be prosperous. For example, the added value of product processing or the income from tourism is available if the garden is productive and green.

Interplanting is one important traditional approach which increases or guarantees production income in Bāghestān or compensates part of the damages in very dry years is the various methods of interplanting or combined cultivation. We will explain this in more detail in Section IV.3-10.

A.2. Non-physical characteristics of Bāghestān

A.2.1. Private Ownership

The structure of Bāghestān, which we briefly introduced above, needs to be maintained. The gardens have high quality tree and shrub species, which can tolerate dry weather and are compatible with flood irrigation system. The central reason, explaining the sustainability of the gardens, is that these gardens are the arena of economic production. That is why people of the city own the gardens during centuries

and preserve this engineered system. In other words, one of the most important reasons for the sustainability of the gardens, along with its harmony with living conditions, has been its alignment with the interests of citizens and owners. One of the main differences between Bāghestān and public green spaces is its private ownership. According to a report by the Qazvin Traditional Gardeners' Cooperative, more than 50 percent of garden owners earn their living only through gardening. For the rest of the gardeners, the garden is an important part of their income.

A.2.2. Social relations and traditional management in Bāghestān

In addition to garden owners, there are other people in Bāghestān who their importance is not less than others: workers. Although, Dakhûs and gardeners are the active participants of Bāghestān who have worked for centuries in managerial and environmental duties to preserve and maintain the gardens, Bāghestān still relies on this population and their activities to survive. Table 3 introduces the main stakeholders of Bāghestān.

Bāghestān management system, as described in the previous section, is based on sharing resources and interests. On this basis, and over time, appropriate social relationships and a special lived experience have been formed. These include the relationship between garden owners and gardeners, the role of Dakhûs and local trustees, how gardens are managed and transferred, and how costs are shared. The sustainability of Bāghestān has been established based on these social relations for centuries. Another important issue that should be considered in these social relations is the customary rights in Bāghestān. Customary rights can be seen in maintaining abandoned gardens, in the way the gardens are developed, and in the various ways of owning and managing shared resources. The traditional management method of the gardens is based on the hierarchical structure, very delicate and perfect methods that need to remain central in managing the gardens despite the presence of government institutions.

Table 3: Bāghestān Stakeholders

Bāghestān Stakeholders	
Title	**Description**
Garden owner	The owner of one or a number of plots of Bāghestān
Gardener	Those who carry out horticultural operations in Bāghestān and are trained in this field in a traditional and experimental manner from more experienced gardeners. Bāghestān's management system has been formed from the beginning with gardeners as its center. The garden owners[2] leave all the garden affairs to the gardeners as garden managers.
Dakhû	In any two or more localities of Bāghestān that are located next to each other, a person who is more experienced and considered trustworthy is chosen as the manager of the locality. The Dakhû superintends the communal affairs of the localities, including irrigation, the affairs of the Chāhkhānes, co-operation at the time of harvest and other horticultural operations mentioned in Table 10. In the governance system of Bāghestān, Dakhû is considered as the manager and in case of a dispute between gardeners or garden owners of localities, he manages the matter and his final vote is respected by all. Dakhûs played a very active role in Bāghestān until a few decades ago. At present, in some localities of Bāghestān, the role of Dakhû has diminished and the matters related to them are performed by major garden owners or river deputies.
River Deputy	Those who are elected among the gardeners as river deputy. Each of the localities in Bāghestān receives water from one of the 4 seasonal rivers. Gardeners and garden owners of the localities of each river; once a year, in a democratic process and through elections, choose a person from among themselves as a river deputy (responsible for river affairs). The river deputy supervises the affairs related to irrigation, the condition of the river bed, the condition of creeks and compliance with the irrigation schedule according to the water scroll.

In addition to the above-mentioned points, also subtle cultural behaviours have a special place in Bāghestān. Leaving a portion of crops for poor people who come and look after remaining crops for themselves, allocating crops across the borders to pedestrians, and allocating their best grape plant to gardener are some examples of such tender behaviours.

[2] In some cases, the owners of gardens are also gardeners, but other gardeners also cooperate with them. In these cases, the management of gardens may be the responsibility of the owner of the garden or one of the expert gardeners.

A.2.3. The organic relationship between the historical city and Bāghestān

Figure 19: A view of Bāghestān from the historical city of Qazvin; photo by Mehdi Motamed

The proximity of the city and Bāghestān (Figure 19), due to its characteristics including the siege of the city by the gardens and the urbanization of the garden forces, has formed a special social identity in Bāghestān. The connection of the historical localities of the city with the localities of Bāghestān is one of the manifestations of this social identity. Bāghestān localities adjacent to the city are synonymous with historic localities, and Bāghestān forces live mainly in these localities. Another issue that has strengthened this connection over the centuries is the link between Bāghestān and the Bazaar. Furthermore, Bāghestān products are the most important products of the city, and in addition to direct supply in the market, several processed products are made of them. Various types of grape juice, almond and almond Bāklavā, pistachio and almond slices, various sweets such as Qorābieh and Thin Bread are examples of these products that are the most important souvenirs of the city. Qazvin's famous food, Gheymeh Nisār, is also made of Bāghestān products.

In general, it should be said that before the Industrial Revolution and forced migration to Qazvin, Bāghestān, economically and also because of its other

advantages, was at the centre of the ecosystem and consequently the social identity and urban civilization in Qazvin. He has formed and lived along the garden. Despite the carelessness during recent decades, Bāghestān still plays a pivotal role in the life of the city, and according to Bāghestān specialized non-governmental organization, Association for Saving the City's Life, the city's life depends on the existence of Bāghestān.

A.2.4. Historical elements

One of the first and most famous written references to Bāghestān is the travelogue of Naser Khosrow, who describes Qazvin as follows: "I arrived in Qazvin on the 10th of Muharram. The garden had no walls and thorns and there was no barrier to enter the gardens, too. And I saw Qazvin a good city." Nasser Khosrow's travelogue dates back to more than 1,100 years ago concluded that Bāghestān has existed since centuries ago. Referring to the lack of water in Qazvin in the presence of gardens is another important point which expresses the importance of the location of Bāghestān (Kermanshahani, 2016).

Also, other historical books, including 'Asar al-Bilad wa Akhbar al-Ibad' by Zakariya al-Qazvini, have recurrently made reference to Bāghestān. Several domestic and foreign tourists have also mentioned Qazvin Gardens. For example, Madame Diolafois, a French tourist, passing through Qazvin, described the gardens as very beautiful and charming plots.

The impact of Bāghestān on Qazvin city, as well as the surrounding cities, is undeniable. Therefore, neglecting and its subsequent destructions will have harmful and irreparable consequences for Bāghestān. Presenting the importance of this ecological zone to people is one way to prevent destructions. It draws public attentions to Bāghestān and as a result, more governmental attention and care would be drawn toward the gardens.

Part B. Contemporary Relevance

Bāghestān is not just an agricultural complex. The lives of the local population have formed an unbreakable bond with the cycle of produce, from growth to consumption. The ownership of a property, therefore, would have been a considerable advantage for the locals.

At their heart, traditional gardens of Qazvin have formed a socio-cultural as well as geographic structure, which largely has survived up to now.

Bāghestān now covers the west, south and east of the city and as the map of the city and the garden suggests, the city of Qazvin is rooted in Bāghestān; that means the city of Qazvin continues to live with the maternal support of Bāghestān. As in the past, it plays simultaneously the role of flood management and aquifer management for the city and the region. For this reason, survival in Qazvin depends on Bāghestān.

A significant number of Qazvin residents still own or work in Bāghestān gardens, earning between 30 and 100 percent of their income from Bāghestān. Bāghestān products are still considered strategic products of Qazvin and play an important role in the economic cycle of the city. Every year, part of the garden products is exported to foreign markets. Organic pistachio is the most dominant nuts in Bāghestān, and it is local to the area. This species is green in colour with a distinct flavour.

Bāghestān today, as in the past, is connected to the city without any obstacles or distances in addition to playing the role of the city green belt, this relationship has led to the continuation of social relations between Bāghestān and the city. In Qazvin, many traditional custom, foods and sweets are related to Bāghestān products, especially almond and pistachios. In addition, grape juice, various pickles and main nuts of Qazvin are obtained from garden products. The tradition of home baking for Nowruz, the biggest and most important Iranian celebration, is another manifestation of the connection between the city and Bāghestān. Most homemade sweets of Qazvin, including different kinds of Bāklavā, are made from almonds and pistachios of Bāghestān. For this reason, jobs such as “Koobandegi” are still thriving in Qazvin. Koobandegis receive almonds and pistachios and other items needed for sweets from

the families, grind them, and deliver them to the families. In recent decades, due to the popularity of Qazvin traditional sweets in other cities, the production of homemade sweets in small industrial workshops has flourished and has employed a significant number of people.

Today, Bāghestān is still the most important, largest and most accessible place of recreation for the people of Qazvin. The lack of uncircumcision of the gardens has led to a culture of generosity among garden owners. Owners share their privately owned garden space with locals and passers-by. In this way, there is still a coherent set of connections between the city and the garden.

B.1. Climate and Atmosphere conditioning, air purification

Nowadays, urban designers quantify the ecosystem services provided by urban green spaces; this may include recreation as well as the mitigation of noise and air pollution. Urbanisation has transformed rural and natural landscapes into urban and industrial estates in many parts of Iran. In this context, it is important to incorporate cultural heritage landscapes as one of the urban green spaces that provide important ecosystem services in our cities. Traditional gardens, Bāghestān, in Qazvin are evolved cultural landscapes resulted from an initial social and economic imperative, and has developed its present form by association with, and in response to its natural environment. It retains an active social role in our contemporary society, which is closely associated with the traditional way of life.

B.2. Special emotional and cultural connection

The locals have a special emotional connection to Bāghestān. The dry weather in the Qazvin Province makes the yield of other crops low. However, in such arid weather the trees grow well, and produce encouraging yield every year. Therefore, the species grown in the traditional gardens symbolize “life-saving nature”, and could be acknowledged the “surviving resources” to sustain life in the community. There is a strong emotional connection of the locals to the traditional gardens as they believe that as long as there is fruit on the trees, they won’t starve.

The system possesses relevant historic and cultural features. The gardens trees have lived with the locals for generations, witnessing their hard work and bearing their emotional connection. The system is also the essence of the Qazvin Province, demonstrating the Province's adaption to the tough environment, and preserving it against the odds brought about by the environment. Additionally, the stunning gardens of the city of Qazvin with their beautiful scenes on one side and the strong vitality, and resilient to drought and flood on the other demonstrate the profoundness of history.

While creating their culture and adapting to the nature, the locals created an ecology-culture complex system, which is inseparable from their lives. It is of prime importance to point out that customs, behaviour, history and other cultural factors relating to traditional gardens have deeply entered into the social and individual behaviours and practices concerning the environment and the universe. Examples of these are production, knowledge, festivities and rituals. One may conclude that the system is the treasure of the Province, of Iran, and of the whole world, as well.

The system has provided the source of livelihood and enriched the local culture. It deserves to be named as "a treasure of Qazvin Province". The remarkable landscape has been developed over a long time as a result of ingenious land and water resources management. The agricultural heritage system contains a wealth of diverse knowledge systems and management techniques which help to ensure food security and quality of life for the local people and cope with the global and economic challenges of today and tomorrow. Visualized as a green belt surrounding the city the historical trees are not only a source of livelihood, a favourite food of the locals, but also an important part of the local people's cultures and customs. They are components of the local landscape.

The region is a bustling scene of prosperity in autumn. The air is filled with the happiness as they celebrate the harvest in the gardens. Skilled tree climbers climb on the trees using basic tree climbing techniques learned from their masters. Once up on the trees, they use specially made rods to hook the branches, and shake them, letting the fruits fall. Under the trees, fruit pickers then gather the fallen fruits into their

baskets. They acquire knowledge of accomplishing the harvesting tasks with efficiency by cooperating and contributing effectively, which in turn brings joy and love to everyone.

B.3. Relative snack and foods

Ancient wisdom meets modern convenience. It can be extrapolated that organically cultivated fruit products offer healthy snack alternatives to processed and junk foods. The dried fruits containing vitamins, nutrients and minerals could help keep us moving throughout the day. Sundried apricot, peaches, grapes and nuts that are produced and hand processed with care in Qazvin traditional gardens have become more desirable, and are now regaining much more interest among young people. There has been a great promotion towards providing skilled human resources in Iran to create the back bone of a knowledge-based economy. It is thought that the idea of producing various homemade nutritious nibbles could be one of the most ingenious knowledge-oriented initiatives recently proposed throughout the country. These healthy snacks, when produced to a standard rate of product quality could be better introduced to the community as a viable alternative to the unhealthy sweets and snacks. The new survey conducted throughout the rain festival held in spring 2016 reveals that local young ladies are becoming more passionate about adapting with the healthy snack diets, which underline the significance of the new generation becoming much more interested in traditional snack food. The fruits and nuts are part of the main source of livelihood support in this region. The locals have developed the catering culture of pistachio and grapes to a great extent. Foods made of pistachios include Bāklavā, a traditional sweet, Gheymeh Nisār, an old rice recipe, chopped nuts pieces and pistachio powder for cake decoration, pistachio rice, pistachio jam, pistachio honey and roasted pistachio with different flavours.

B.4. Customs and Rituals

As spring approaches, the gardens and valleys are dotted with pink and white flowers manifesting astounding views in the environment. In the spring festival, local people from Qazvin and neighbouring towns come along to see the beautiful

blossoms on the trees. They enjoy gathering and eating their favourite foods that they especially enjoy.

One of the most desired cultural events and traditions is named: Panjāh Bedar. People spend one day out every year on the 9th May camping in the gardens. The custom follows another national day called Sizdah Bedar, which is a day out on the 1st of April when people spend time picnicking outdoors. It is postulated that this custom has survived while less significant festivals were eclipsed by their Islamic rivals and gradually became abandoned by Mongol and Turkish rulers.

The protection of Bāghestān means the protection of significant ecological and biological resources for the locals and for all residents of Iran. The traditional gardens are a clear symbol of remarkable ecological, social and cultural heritage. They progressively contribute to the global conservation of biological diversity by preserving the sustainable ecosystems. These gardens provide astonishing landscape view to the citizens of Qazvin while playing a great role in maintaining a sustainable nurturing and healthy living environments for thousands of local people involved.

Part C. Historical Relevance

Qazvin plain has been the cradle of agricultural civilizations since about the seventh millennium BC (archaeological excavations). The foundation of Qazvin city is attributed to the second Sassanid Shāpur. In the Islamic period, the city of Qazvin was considered as the cradle of Islamic civilization and culture, and in the 15th century AD, it was the capital of the Safavid dynasty for 57 years (before the capital was moved to Isfahan).

Although according to the names in Bāghestān localities and in the beliefs, the history of this collection of gardens is attributed to the Sassanid era, Muslim historians and geographers and later tourists who have visited Qazvin are those who have written the oldest documents about these gardens. They have mentioned green gardens with various trees and unique vines without walls and fencing. "Qazvin is originally Kezvin, derived from "Kez" meaning pistachio and "Yen" meaning city, so Kezvin means the city of pistachios which was later converted to Qazvin."

C.1. Historical References

The first historical record about Bāghestān dates back 1100 years ago, to the 10th centrury in “Soorat’ol-Arz” of Muḥammad Abū’l-Qāsim Ibn Ḥawqal (1).

Nasir Khusraw, a renowned 11th century Iranian poet, also known for his famous journeys and travel memoirs, has also recorded his observations in his travel logs. He wrote: "… I arrived in Qazvin on the 10th of Muharram. It [Qazvin] has great many gardens with no walls, no thistle fences, and no obstructions preventing entry into the gardens. I found Qazvin to be a city of beauty with fortifying walls which have corrugated edges on top. Water was scarce on the surface. Presence of water was limited to the springs and irrigation channels."

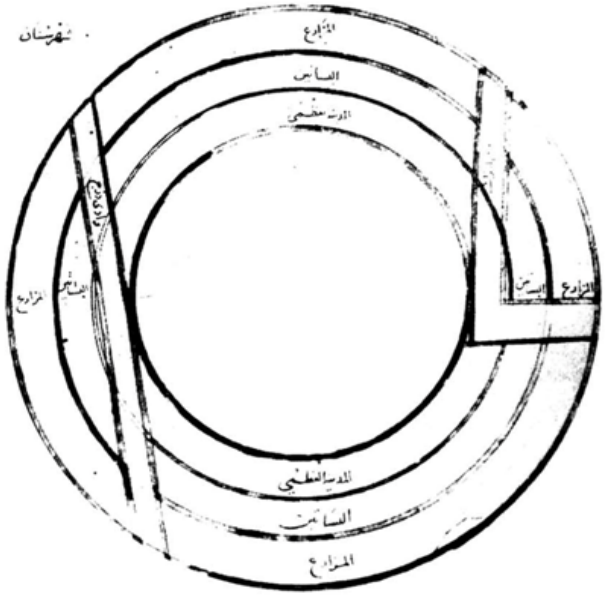


Figure 20: Sketch of the city of Qazvin and surrounding gardens; drawn by Zakariya al-Qazvini in his book "Athar al-bilad; 13th century AD

Among other references to traditional gardens of Qazvin one could notably refer to 'Athar al-bilad wa al-Akhbar al-Ibad' by Zakariya al-Qazvini at the beginning of the 13th century and 'A Selective History' by Hamdullah Mustawfi dating back to the 14th century C.E. Both of these works describe Qazvin as a grand city with vast gardens and distinctive varieties of plants that are not found in other cities.

Zakariya al-Qazvini has described Qazvin in his book, as a ‘big and populated city located in a vast and flat plain with a brilliant plan’. He has included a sketch of the traditional gardens and farms around Qazvin (Figure 20).

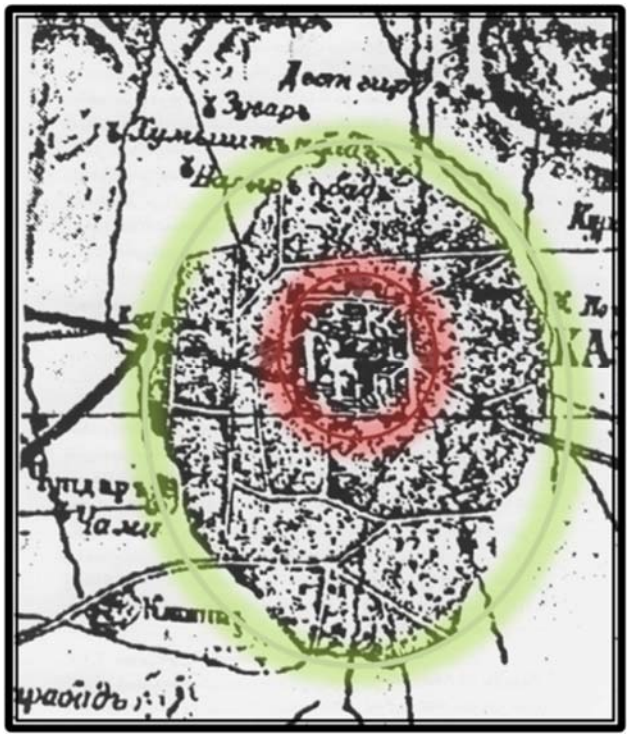


Figure 21: Qazvin, 1915; red line shows the city and green line shows Bāghestān

Bāghestān originated in the plain and hilly areas of Qazvin and were established during the Safavid Dynasty of Persia, when Qazvin served as the capital of Iran (1555-1598). Also, Figure 21 shows a view of the city and the garden around the city in 1915.

Figure 22 depicts an aerial photograph of Qazvin taken by the Army Geographical Organization in 1955, revealing a large expanse of gardens surrounding the city. This photograph was taken ten years after World War II, and depicts the railway and its station as the first modern development to intervene in the garden landscape.

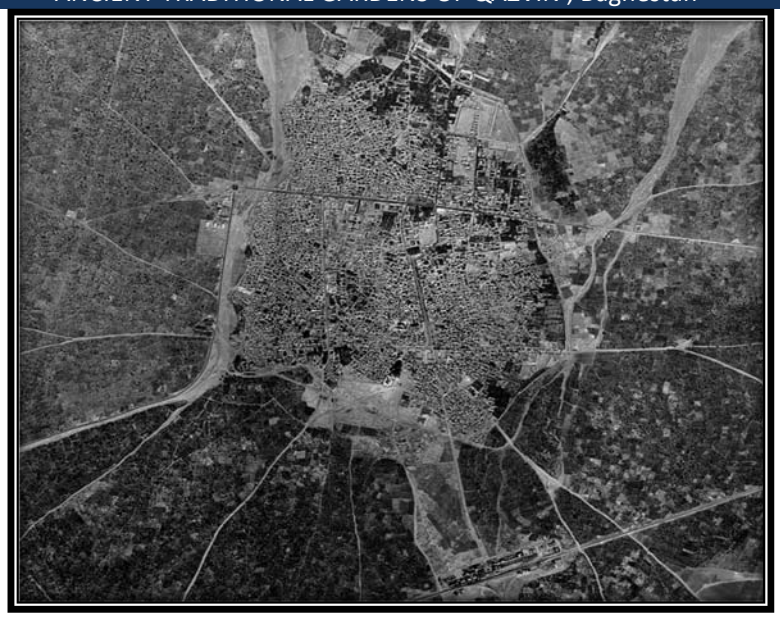


Figure 22: An aerial photograph of Qazvin taken by the Army Geographical Organization in 1955

C.2. Water Scroll; Indigenous Water Distribution System;

As described above, Bāghestān is irrigated by floods from seasonal rivers in winter and spring. Therefore, the most important source of life in Bāghestān is water, which is completely communal. The management mechanism for this water subscription involves determining and formulating the method of scheduling and protecting the water.

In order to properly utilize the seasonal rivers of Qazvin and prevent disputes amon gardeners and owners, they wrote a petition to divide the water of the gardens.

The water scroll that is currently observed in Bāghestān belongs to the 14th century “Ilkhanian” period and was signed and sealed by "Hamdaleh Mostofi", the famous historian of that period. Figure 23 a copy of two pieces of water scroll.

Figure 23: Two pieces of Bāghestān historical water scroll

The water scroll reflects the hierarchical structure of the garden, including the allocation each river, below each river, the allocation of localities. This document specifies the exact start and end dates of irrigation, and for each day of this period, it specifies which garden is first irrigated first and which ones are subsequently flooded. The traditional water distribution system of the Qazvin gardens, including Bāghestān, is registered as Intangible National Heritage in the national list since 2017.

Table 4 is a rewrite of a part of the Bāghestān water scroll, which shows the irrigation schedule of the “Fand”s of a river. Next, in the water scroll, there is a schedule for the localities irrigation of each Fand and then the gardens of each locality. Table 5 lists the parity of the first five signs of the year as mentioned in the scroll based on the "Old Faras" or constellation.

Table 4: The Sample of Water Scroll Schedule

Schedule	day

1. From the morning of the 13th of July to the morning of the 14th, the right of “Mr. Naser-din…”	**[1]**
2. From the morning of the 14th of July to the morning of the 18th, the right of “Saz-Abad Fand"	**[5]**
3. From the morning of the 18th of July to the morning of 20th, the right of “Hamolian” and “Meysaran”	**[2]**
4. From the morning of the 20th of July to the morning of 22th, the right of “Tarike” Fand	**[2]**
5. From midnight of the 22th of July to the midday of the 23th, the right of “Hamolian” and from the midday to sunset, the right of “Kangalestan” and from the sunset to the morning of 24th, the right of “Sazabad”	**[1]**
6. From the morning of the 24th of July to the morning of 25th, the right of “Jodrah” Fand	**[1]**
7. From the morning of the 25th of July to evening song, the right of “Jodrah” and from evening song of the 25th to the morning of 28th, the right of “Kashkan”	**[3]**
8. From the morning of 28th to the morning of 30th, the right of “Kangalestan”	**[2]**
9. From the morning of 30th to the morning of 30th, the right of “Kangalestan” and “Dalv”	**[1]**
10. From the morning of 30th to the morning of the 1st of August, the right of “baravad”	**[1]**
11. From the morning of the 1st of August to the morning of the 3th, the right of “Meydan” Fand	**[2]**
12. From the morning of the 3th to the morning of the 5th, the right of “Khoramabad” Fand	**[2]**
13. From the morning of the 5th to the morning of the 6th, the right of “Joladoha”	**[1]**
14. From the morning of the 6th to the morning of the 8th, the right of “Ghorazabad”	**[2]**
Sum of Days	**[26]**

Table 5: Parity of the first five signs of the year as mentioned in the scroll based on the "Old Faras" or constellation

	Solar Calendar	Gregorian calendar	Number of Days	Constellation
1	1st Farvardin	21th March	30	16th Capricorn
2	1st Ordibehesht	21th April	30	16th Aquarius
3	1st Khordad	22th May	30	15th Pisces
4	1st Tir	22th June	30	16th Aries
5	1st Mordad	23th July	30	16th Taurus
6	1st Shahrivar	23th Auqest	30	Gemini
7	1st Mehr	23th September	30	Cancer
8	1st Aban	23th October	30 + 5	Leo
9	1st Azar	22th November	30	Virgo
10	1st Dey	22th Desember	30	Libra
11	1st Bahman	21th January	30	Scorpius
12	1st Esfand	20th February	30	Sagittarius
Sum	12 Month of Year	12 Month of Year	365	twelve zodiac signs

The adherence of the gardeners to the water scroll is such that, according to customary rules, even if the owner of the garden does not come to receive water and even if he has abandoned the garden, the other gardeners of the place will water his garden and do not waste his turn. This will preserve the aquifer. In the past decades, gardeners kept a small number of animals (mostly sheep). Garden grasses were used to feed livestock. Therefore, until half a century ago, grass had an added value in the garden. Today, the number of sheep in the garden is very limited. Today, the number of sheep in the garden is very limited. Mainly because there is no suitable storage place for livestock and the structure of gardeners' houses in the city is not suitable for keeping livestock. In such a situation, garden grass is considered a challenge due to

the possibility of fire in summer. A study is needed to turn this challenge into an opportunity.

Another important point that is affected by this water distribution system is that, despite the passage of time and frequent change of ownership, the rivers, streams localities, and gardens in Bāghestān retain their historical names.

The Garden also contains elements that are several hundred years old and are of great importance. For example, we can name the hundreds of years old trees in the garden as well as architectural structures such as Chāhkhāne and Aleh; (Akhvizadegan, 2005).

Part D. Comparative Analysis

D.1. Special Features of gardens that distinguishes them from other gardens in the world

Gardens play a vital role in sustaining a healthy lifestyle. Qazvin traditional gardens, developed over centuries of hard work by laborious people, have become a natural ecosystem that provides a habitat for plants and animals that have adapted to the arid climate. The evolution of gardens has created an urban agriculture landscape that benefits the citizens and those in need. Urban agriculture not only creates green spaces but also helps people who lack secure access to food. The number of commercial urban farmers is growing worldwide to provide aid to those who in need (Feeding America; "Urban Agriculture: Practices to Improve Cities,"). However, traditional agricultural practices need to be updated through sustainable long-term management strategies, alternative marketing, and branding to ensure economic feasibility and a balance between amenity and productivity. In Qazvin, the mature fruits and nuts gardens are important components of greening and provide fresh perishable foodstuffs to urban consumers. Their significance lies in their cultural heritage, as they reflect the history of the city.

Lack of water resources is a common issue in many countries, especially in the Middle East. Flood management has been a common way of supplying water to farmers and gardeners in arid and semi-arid regions of the world, including Iran. Iranians have long employed traditional methods of soil and water conservation and desertification control, as well as the simultaneous development of agriculture in accordance with climate, soil and land restrictions in the country. Such traditional methods and indigenous watershed management knowledge are compatible with the environment and high climatic conditions of the country and on the other hand have been adapted to the needs of watershed residents. In fact, by catching rainwater and exploiting the wastewater flowing in small canals, flood irrigation has been used in agriculture and horticulture.

Additionally, the construction of embankment in the wide valleys (khadin), row of soil dams on alignment lines (flood bounding), flood agriculture, collection of wastewater from steep slopes for tree planting (Meskate), and exploitation of floods

from streams and canals by directing them onto level platforms (flood irrigation) are examples of rainwater and flood management methods in Egypt, India, Tunisia and Yemen (Majdoub et al., 2014).

Flood spreading and management can reduce negative environmental effects such as soil erosion and water pressure, as well as direct stream flow abstractions during the dry seasons (Al-Qudah, 2009). Various ancient Iranian technologies for water harvesting and use remain relevant today for coexisting with the desert, while ensuring sustainable long-term development. These methods respond to the growing needs of communities, while making sustainable use of the limited natural resources. The most important features of this indigenous knowledge are its simplicity, low cost, and its ability to ensure ecological balance and stakeholder's participation.

Flood irrigation has been practiced in Khorasan for seven thousand years in Iran. Additionally, palm cultivation using floods has been common in the Fars province at the southern regions of Iran. In this method, a catchment is constructed to direct part of the flood of the main waterways to marginal lands to irrigate the palm trees and to control about 70% of the floods. In the south of Khorasan, ponds are created with embankment construction on level lines along the dry river channel called "Bandsar" (Arabkhodri, 1374). In Sistan and Baluchestan, embankment or stone walls called "Khoshab" and "Degar" and "Hotak" are examples of the traditional flood exploitation systems in Iran (Hosseini Marandi et al., 1397). The "Khoshbab" system is located on the margin of rivers, plains, and hills. Its components are: embankment or stone wall, flood gate, overflow, drainage and farmland, all of which are built with the indigenous knowledge and knowledge of the people (Khoobfekrbarabadi et al., 2020).

D.2. Gardens bear witness to the cultural heritage spanning from the past to the future

Traditional gardens in Qazvin were established during the 11th century during Siljuk dynasty, according to local residents and scholars (Dabir Siaghi, 1997). It is believed that the first gardens were constructed in the East of Qazvin near a location called Shapoor, and gradually expanded to the west and south. The antiquity of the

site is evident in the Persian words “Boostan” meaning garden found in an old document from around 700 years ago. Theses gardens hold great cultural significance as they have been withstood the harsh environment and have coexisted with the locals for generations, witnessing their hard work. The garden system is an innovative use of urban green space and represents an adaptive response to environmental conditions, which may contribute to system resilience.

D.3. The Importance of organic product

Traditional gardens of Qazvin have remained stable for a significant period, making them an ideal site for researchers to study sustainable agriculture and stable habitat systems. These gardens have provided immense ecosystem services. Unlike modern agricultural practices, the amount of fertilizers and pesticides has been minimal, resulting in lower amounts of nutrients and toxins in groundwater and surface waters. The use of chemical agents in the gardens would have led to soil degradation, a catastrophic consequence. Therefore, it can be inferred that the ecosystem here in Qazvin has been sustainable providing goods and services to the society for an extended period.

Overtime the farmers have selected patterns suitable for the site, and have developed knowledge about not using fertilizers based on experience. This knowledge has been adapted to the local culture and environment and embedded in community practices. It is built on the perceptions of people who believed that the soil is enriched by minerals brought by rivers flowing from the mountains. A similar scenario would be true for pesticides with respect to the winter flooding irrigation system. Farmers have measures and realized that one of the advantages of watering in winter was that the freezing water would kill the pest in the soil, thereby eliminating the need for pesticides.

Nuts such as almond and walnut were traditionally kept for winter recipe, and any surplus would be sent to the market for sale. The temperature, moisture content, and organic status of the products is carefully controlled and monitored at each stage. For nuts, it is important to maintain their freshness to maximize market potential.

Grapes, on the other hand, can be used to produce more than twenty different products that have special place in Persian cuisine. For example, when mixed with nuts, raisins provide a perfect and healthy flavour. Vinegars of various types are also essential ingredients of homemade pickles made with different kinds of grapes. Grape syrup is another product that is used in winter dishes.

D.4. Crucial ecological services

In the sparsely vegetated land, trees function as windbreakers, the gardens in the southeast of the city convert hot wind to cool and humid, reducing haze. The gardens in the northwest of the city reduce cold wind and protect the city from its effects. They also provide comprehensive soil and water conservation services. By the way, the irrigation methods in Bāghestān are consistent with the water resource limitations of Qazvin. The planted species in Bāghestān are completely compatible with the climate of the city; for example, almond trees have strong roots that can penetrate up to 7 meters vertically in the soil, making them able to meet water needs from deep down in the soil in case of drought and dehydration. Gardens provide a specific method of reducing air pollution, promoting clean air, and prevent flooding. Irrigation canals divide floodwater, which can be used to irrigate gardens and protect the city from flood. The old landscape looked like a city surrounded by a green belt like chain of trees. Although this green scene has changed due to city expansion, its liveable but ecological development pattern remains one of the most important and crucial issues. However, for Qazvin city with such an inherited landscape, the related ecological services would be of great importance and even more crucial. Planting 1000 trees in the northwest of Qazvin resulted in saving $1 million in managing surface sewage, decreasing pollution and costs of energy in the area. This points out the importance and value of the gardens in the northern margin of the city that once existed and are now removed. The amount of oxygen produced by a 50-year-old tree equals $31250, as well as a value of $37500 for air purification (Eghbali et al., 19.)

IV. CHARACTERISTICS OF THE SITE: GIAHS SELECTION CRITERIA

1. **Food and Livelihood Security**

Traditional gardens cover 2,780 hectares of the city land of Qazvin and possesses an unparalleled topography with rivers and vegetation, creating a diverse landscape with various species. Despite prolonged drought season and decreasing precipitation, which is being aggravated by global warming, farmers have managed to cultivate a variety of fruits, including juicy grapes and apricot, as well as three types of dry nuts: pistachio, almonds, and walnut. It is impressive how, over centuries, farmers have developed such a complex, diverse, and locally adapted agricultural system. This system is recognized as one of the most efficient that optimize water use while providing high quality water and fruit diversity. This system has been managed using time-tested, ingenious combinations of techniques and practices, which not only ensure food and livelihood security but also conserve natural resources.

Yield estimation

In order to provide accurate and precise information about the performance of Bāghestān, it is necessary to have statistical data on the yield of Bāghestān over a period of 3 to 5 years. This is because Bāghestān's yield varies in dry and wet years. Furthermore, in some years, early warmth in the late winter and subsequent cold snaps in spring can result in partial frost damage to the almond crop. It should also be noted that a portion of the pistachio trees in Bāghestān yield fruits every other year, while another portion yields annually.

Another point that should be considered in yield estimation of Bāghestān is that it is not uniform in terms of its function. Some areas are lush and productive, while others are less dense, and certain locations are abandoned and considered unproductive. In this basis, in the documents of Qazvin Agriculture Organization and in the maps prepared by the municipal consultants, three colours green, yellow and red have been used to express this matter. Bāghestān’s localities are placed in one of these categories based on their conditions. Out of 2,780 hectares of traditional garden land in Qazvin, Around 900 hectares, that is, about 30% of traditional garden land in Qazvin, have been evaluated as yellow or red. Due to unsustainable urban development and secondary factors, such as fragmentation of ownership or lack of

water-share in the water scroll, these gardens are not in a suitable production condition. Most of the red gardens are located on the side of the roads. Some of them have been abandoned due to the high revenue/gain of/from repurpose (land use change); as market says, the value of a garden located near the city can be increased more than 50 times by converting it into an urban plot. This is due to the wrong fiscal policies in the urban economy which provides a great opportunity for garden owners to abandon their productive activity in the hope of achieving such a profit from economic rent. Fortunately, with some legal restrictions, such repurposing has been limited. But it is crucial to keep in mind that in the long run, this high gain of repurposing can lead to many problems such as abandonment of lush gardens and destruction of more areas of Bāghestān. What we can do to counter this abandonment, is to emphasize on economic and profitability aspects of gardening and show that the opportunity-cost of abandonment is high compared to gardens maintenance.

Another part is stuck between the road and the edges of the city. In most cases, the hydrological network of these gardens has been disturbed and the connection of these pieces with the garden ecosystem has been cut off. Recreation plans should be implemented for these parts.

The estimated statistics of the Table 6 have been extracted based on the annual statistics of crop production in Qazvin Agriculture Organization. a complete statistics of the number of species in the municipal garden organization, by collecting questionnaires from expert gardeners. This statistic is subject to sufficient water supply and the absence of natural disasters such as frost and hail. Pistachio is currently the most profitable product of Bāghestān. This is due to the price of pistachios in the market and because, unlike almonds, pistachios rarely suffer from natural disasters in Bāghestān. In the past years, grapes were considered a profitable crop in Bāghestān. But in recent years, due to the high price of pistachios and lack of water, many gardeners have replaced grape bushes with pistachio seedlings. Insufficient water causes grapes to not have an appropriate economic yield and as a result, approximately there is no grapes in the red area.

Table 6: Average Annual Production of Bāghestān

Average Annual Production			
Trees(In profitability order)	Total (tons)	Green Area (percentage of total product)	Yellow Area (percentage of total product)
Pistachio	800	%70	%25
Almond	2400	%60	%35
Grape	700	%80	%20

Unfortunately, there is no sufficient data to estimate the efficiency and productivity in Bāghestān. But according to garden owners, in some gardens of Pistachio, there is an annual average of 4-5 tons production per hectare that is a high degree of efficiency and shows the profitability and productivity of Bāghestān.

Economy of gardens

Accurate statistical data regarding the income of garden owners (orchardist) has not been collected. However, an acceptable estimate can be reached relying on other available data. The following data is used to estimate the income and living conditions of garden owners and gardeners:

1. Estimated production statistics of the main products

2. Gathering the opinions of Bāghestān experts through interviews and questionnaires; In this case, we carried out a research method based on experts' opinions using 10 garden experts who included large, medium and small garden owners.

3. Income statistics of urban households (Qazvin city) published by Iran Statistics Center, 2022.

Table 7: Classification of Garden owners according to the ownership

Classification of Garden owners according to the ownership	
Class	Owned Area
Major owner	Garden owner who owns more than 15000 square meters of the area of Bāghestān
Medium owner	Garden owner who owns 3000 square meters to 15000 square meters of the area of Bāghestān
Small owner	Garden owner who owns 500 square meters to 3000 square meters of the area of Bāghestān

To obtain the result, we must note that the economic conditions of garden owners have a functional dependence on two main parameters: The amount of ownership; The condition of their plots. We explained the classification of gardens (plots) conditions above. To include the ownership area parameter, we define gardeners in three categories based on the knowledge and tradition of Bāghestān and the needs of this study. Table 7 shows this classification. The results of the estimation of the income of garden owners are given in the Table 8 and Table 9.

Table 8: Garden owner income compared to the middle class of the city

Garden owner income compared to The middle class of the city			
Yield class / Ownership class	Green Area	Yellow Area	Red Area
Major Owners	Much higher	Similar	Lower
Medium Owners	Higher	Similar / Lower	Lower
Small Owners	Similar / Lower	Lower	Lower

It should be mentioned that the owners, who have gardens in red area, as well as the small owners, normally have also another job. Income from Bāghestān is a complementary for them. In addition, non-gardeners have bought some gardens on the edge of the city in order to change their use.

Table 9: Income decile of garden owners

Income decile of garden owners			
Yield class / Ownership class	Green Area	Yellow Area	Red Area
Major Owners	7-9	5-7	--
Medium Owners	6-8	4-6	--
Small Owners	4-5	--	--

One strength point of Bāghestān, which has led to its preservation, is that about 90% of the area of the garden is owned by major or medium garden owners. About 55% of this figure belongs to the major garden owners, for whom the garden is often profitable. Table 10 provides an estimate of the number of garden owners in green, yellow and red areas. It also shows the area owned according to the classification of area and ownership according to the report of municipally Garden Organization. Furthermore, Table 11 shows that there is a significant relationship between major ownership and productivity of gardens.

Farming households can also earn two types of income from value-added activities. The first type of income is derived from processing activities that have traditionally existed in gardens, in the form of family gardening. The second type of income, which has started in recent years, is derived from experiential tourism activities. This type of activity, which has attracted the attention of Bāghestān's youths, not only generates income but also creates motivation and credibility among them. An illustrative example of this is introduced in the appendix 3. Based on conducted interviews, tourism income can have a significant impact on increasing the

income of farming households. However, it should be noted that sustainable tourism in Bāghestān can only be profitable when there is a thriving production.

Table 10: Number of gardeners and owned area

Number of gardener owners (orchardists) and owned area		
Major Owners	Number of Garden owners	450
	Total Area under ownership	55%
Medium Owners	Number of Garden owners	1050
	Total Area under ownership	35%
Small Owners	Number of Garden owners	1500
	Total Area under ownership	10%

Table 11: Ownership Percentage According to the Classification of Area and Owners

Ownership Percentage According to the Classification of Area and Owners (%)			
Area Class / Ownership Class	Green Area	Yellow Area	Red Area
Major Owner	70	50	-
Middle Owner	25	30	-
Small Owner	5	20	-

Gardeners

In addition to the fees for gardening duties, gardeners have another income from Bāghestān based on customary rights, amounting to one-tenth of the produce of the gardens they work on. Partial incomes, including a portion of the good yield of grapevines, belong to the gardeners. If a gardener possesses a green area, their income constitutes one-tenth of the local produce, which is considered an average household

income in urban areas. The Number and Income of gardeners is provided in Table 12.

Table 12: Number and Income of gardeners

Number and Income of gardeners		
Yield class	**Number of gardeners**	**Income compared with medium class of the city**
Green Area	120	Higher
Yellow Area	60	Similar/Lower
Red Area	20	Lower

2. Agro-Biodiversity

Biodiversity plays a crucial role regulating agro-ecosystem functions, meeting the diverse needs of the farmer and society. It is not just limited to biological impact on production, but encompasses the valuable ecological processes resulting from the interactions between species and the environment. There have been various conventions aimed at protecting ecosystem structures and functions to provide goods and services for humankind. The ecological services of the system include maintenance of biodiversity, with a particular emphasis on the soil and water conservation and flood prevention.

2.1. Abundant biodiversity, local species:

In Bāghestān, there are approximately 100 local varieties of pistachio, almond, grape, apricot, walnut, and plum trees. Some of these species are currently endangered. These trees are typically planted in various locations with regular irrigation, but in Qazvin traditional gardens, the trees are watered twice a year. Some of the genotypes are the clones and varieties that can only be found in the Bāghestān (Table 14).

Some of these species, such as pistachio and almond, have been living there for centuries. They not only boast rich biodiversity but also hold a rich culture and heritage. The highest area covered by fertile gardens in Bāghestān is pistachio, followed by grape, walnut, and almond trees, respectively. Table 13 shows the area

covered by fertile trees and seedlings planted in the gardens (Annual report of Qazvin Municipality Garden Organization, 2016).

Table 13: Land use area of gardens in terms of main trees in the traditional garden of Qazvin

Land use area of gardens in terms of main trees in Bāghestān				
Tree Species	**Fertile tree (ha)**	**Seedlings (ha)**	**Sum (ha)**	**Percentage of coverage**
Pistachio	593	97	690	28
Grape	494	439	933	37
Walnut	365	0	365	15
Almond	264	8	260	10
Other trees (Apricot, plumes, …)	195	65	252	10
Sum	1891	609	2500	100

2.2. Special species and rich germplasm resources:

Common or local name of varieties for different trees of Bāghestān are presented in Table 14. The Asian pistachio pronounced as "Pesté" (Figure 24) along with the almond pronounced as "Bādām" are the most important nuts that produce in Qazvin.

The Qazvin plain, with its long, arid, and relatively hot summers with low humidity could be classified as one of the semi-arid regions in Iran. Pistachio is a

Figure 24: Pistachio trees; photos by unknown artist

drought-tolerant tree UPOV that flourishes in the hot summer temperatures of around 100 degrees Fahrenheit, producing large quantities of the best nuts during the growing season. Interestingly, once the pistachio saplings are established, they hardly need any supplementary irrigation. The relatively high elevation of Qazvin plain and its location in higher geographic latitude cause the rain to fall in the form of snow in the winter and in the form of torrential showers in the spring (Ghorbani, 2013). Pistachio trees can merely survive in winters, as they do not need to stand for prolonged cold winters. There are more than 120,000 pistachio trees in Qazvin traditional gardens, almost 10% of which are older than 700 years, and 40% are more than 100 years old.

There are at least six local cultivar of pistachio with numerous local clones (Table 14). Iranian pistachios have been exported to other countries for over 100 years and have established a strong position in the global market[3]. They are considered the king of nuts with certain varieties, including one called kernel pistachio, being highly

[3](http://www.ft.com/cms/s/0/a676d320-c439-11e5-808f-8231cd71622e.html#axzz49lacgoUD)

prized. Additionally, the pistachio trees, along with other trees in the gardens, provide ecological niches for many other species.

Almond gardens in Bāghestān are often seeded (not by grafting trees) and have

Figure 25: Almond genotypes in Bāghestān; photo by unknown artist

a long history of cultivation (Figure 25). Some farmers cultivate almond tree from the best seeds, and sometimes, the almonds fruits fall on the ground during picking that new seedlings emerge from them. Recently, in a study on the genetic diversity of almond drought tolerant plants in Bāghestān, more than 50 genotypes (almond clones of Bāghestān) which are seed-based, have been recorded (which are specified by the code) through study of morphology and molecular indices. The morphological characteristics of each genotype of almonds and other fruits (both in the field and in the laboratory) have been examined based on the guidelines of UPOV (Union for the Protection of New Varieties of Plants). Each tree was graded or measured and included traits related to leaves, branches, flowers and fruits (Hajivand et al., 2018).

Table 14: List of plant species and common or local names of varieties in Bāghestān

List of plant species and common or local names of varieties in Bāghestān				
Scientific name	**English name**	**Common and local names**	**Usage**	**Endemic variety/ local breed or**
***Pistacia vera* L.**	Pistachio	peste	Nuts, garnish, baking, pesto or nut butter, sliced special dish (Gheymeh Nisār), special dessert (Sholezard), adding a beautiful green colour to various desserts (Bāklavā)	**Local breed:** Kaleh Bozi (90%) Sefid Pesteh Ghermez Pesteh Badami (seed-based) (1-2%) Baghali **Foreign or imported varieties:** Kalkhandan
***Prunus amygdalus* (Mill.) D. A. Webb**	Almond	baadaam	Raw or toasted seed as nut and snack, dessert (Bāklavā), sliced (for dessert, Sholezard), flaked, and slivered, as flour, oil, butter, or almond milk.	**Indigenous and seed-based genotypes:** Sangi Sweet (Shirin) Bitter (Talkh) Thin-skinned almond **Foreign or imported varieties:** Shahroud 12 Shahroud 21 Shokofeh Tuno Supernova Rabie Mamaei Francis Azar
***Juglans regia* L.**	Walnut	gerdoo	Green walnuts and nuts	Local breed
***Prunus armeniaca* L.**	Apricot	zardAlu	Fruit trees	Local breed: Mohammad Rezaei (90%) Haj Kazemi Raei (Quisi) Shamad
***Malus communis* L.**	Apple	sib	Fruit trees	Local breed
Prune spp.	Plumes	Alu	Fruit trees	Local breed
***Morus alba* L. / *Morus nigra* L.**	Berries	tut sefid/ tut siah	Fruit trees	Local breed
Elaeagnus angustifolia	Oleaster	senjed	Nut and Medicinal	Indigenous
***Vitis vinifera* L.**	Grape	~Angur	Raw and sec (raisins) fruits, other products, Abghoureh, Gardeghoureh, vinegar, concentrated grape juice (Shireh),	**Local breed:** Chafteh Asgari Shahani peykani Yaghoti Yazandaei Ologhi Ologhi Siah Shahani Siah Mish Pestan Mollaei Mollaei Siah

ANCIENT TRADITIONAL GARDENS OF QAZVIN ; Bāghestān				
List of plant species and common or local names of varieties in Bāghestān				
Scientific name	**English name**	**Common and local names**	**Usage**	**Endemic variety/ local breed or**
				Tokhmi Gouri Bidaneh Sefid Shahani Nafti Mesghali Gharib Shelak Khalili **Foreign or imported varieties:** Shekar Shirazi Bidaneh Ghermez Kondouri Turkamenstan 4 Black seedless Flame seedless
Ulmus glabra	Elm tree	nArvan	Shade trees	Indigenous
***Cercis siliquastrum* L.**	Judas tree	~arqavAn	Shade trees/ Basket weaving from soft branches	Indigenous
Rosa foetida Herrm.	Persian yellow rose	gol(e)zard	Hedge trees/ Basket weaving from soft branches	Indigenous
***Rhus coliolia* L.**	Sumac	somAq	Hedge trees/ powder of dry fruits as red and tartness spices	Indigenous
***Rosa × damascene* Mill.**	Damask rose	golmohammadi	Medicinal/ Hedge trees	Indigenous
***Achillea millefolium* L.**	Yarrow	bumAdarAn	Medicinal	Indigenous
***Mentha pulegium* L.**	spearmint	na~nA~	Medicinal	Indigenous
Tragopogon dubius Scop.	yellow salsify	sheng	Medicinal	Indigenous
***Glycyrrhiza glabra* L.**	Liquorice	shirinbayAn	Medicinal	Indigenous
Matricaria chamomilla	Chamomile	bAbune	Medicinal	Indigenous
***Alcea sp.* L.**	Hollyhock	Gole xatmi	Medicinal	Indigenous
***Fumaria officinalis* L.**	Common fumitory	shaahtare	Medicinal	Indigenous
Datura stramonium	Datura	taatoore	Medicinal	Indigenous
Sisymbrium officinale	hedge mustard	khaak(e)shir	Medicinal	Indigenous
***Cucumis melo* var. flexious**	Armenian Cucumber	Khiyaar chambar	Vegetables	Indigenous
Citrullus lanatus	Water melon	hendevaane	Vegetables	Indigenous
Cicer arietinum	Chickpea	nokhod	Legumes (stew and potages)	Local variety (Rainfed)
Lens culinaris	Lentil	~adas	Legumes	Local variety (Rainfed)

It is very important to reserve the almond trees in Bāghestān because of their proper adaptation in this region. These genotypes can be used as a very rich genetic resource in almond breeding programs.

All almond clones of Bāghestān are named Sangi. There are also bitter almonds, which are mostly used in medicine and are very important for diabetic patients. Shahroud 12, Shokofeh, Tono, Supernova, and other imported cultivars (often late-flowering cultivars) are cultivated in Qazvin gardens (Table 14) The oil extracted from the bitter almond has been used by gardeners for more than 700 hundred years.

A total of 25 varieties of grapes grow in the traditional gardens, which trace their history back to the 16 century. Grapes that are planted in gardens are adapted to the shortage of water and warm climate during summer.There are some grapes cultivars, among them “Shani” (Nafti, Peykani and Gerd) is found to be local to the area (Figure 26). This grape is black and sweet with thick skin (Figure 26). The healthy winter

Figure 26: Different grape cultivars in the Traditional garden of Qazvin; photo by unknown artist

snack made of raisins and walnuts improve taste and physical quality (Rasouli, 2018).

Figure 27: Apricot tree; photo by unknown artist

Apricot trees (Figure 27) grown in Bāghestān have adapted to the dry climate and water shortage. Dried apricot (Gheysi) has a long tradition of use in the province dating back to the 13 century.

Figure 28: Walnut tree; photo by unknown artist

Walnut trees (Figure 28) are grown in some part of the gardens where water is more accessible. Water is distributed in the gardens via a creek irrigation system, so some gardens that are nearer to the creeks are irrigated quickly and easily.

Apple trees are also found in the traditional gardens, with one species being native to the region. This species is small and sweet, has a lifetime of 50 years, and

the ability to regenerate itself from root without needing grafting. It has been Qazvin's favourite apple for more than three centuries (Figure 29).

Figure 30: Oleaster tree in traditional garden; photo by unknown artist

Figure 29: Apple tree in Bāghestān; photo by: Porya Kakvand

Oleaster[4] trees that grows in Bāghestān, are wild plants, and gardeners collect some of their fruits, which have medicinal properties such as anti-diarrhea and astringent effects, as well as their fruit powder for treatment of osteoarthritis (Figure 30). The remaining fruits are left for animals in the gardens.

Berry [5] trees also have a long history of being cultivated near the Chāhkhānes, traditionally constructed rooms near the wells. Every two or three gardens have one small building that is traditionally made for gardeners to rest and stay for sentry duty during the day and night especially in spring and summer. Berry fruits come in two types, black and white, and they are not for sale; they are grown for labour use and visitors.

There are also interplanting under trees with grape bushes which have a high variety. The farmers also cultivate potato, cucumber, green bean and vegetable providing the farmers with food for their daily lives, next to the gardens.

Border plants including rose flowers are commonly grown. Borders are about one meter wide and 80 centimetres height Damask rose bushes[6] are planted near to the borders; gardeners pick the flowers for making rose water and some for sale.

Persian yellow rose7 (Figure 31) are grown in the traditional gardens near to the borders. Some people know this flower as herbal medicine. Stems and branches of this plant were used for basket weaving in the past; gardeners would use these baskets for carrying fruits home or to market.

[4] (*Elaeagnus angustifolia* L)
[5] (*Morus alba* L. and *Morus nigra* L.)
[6](*Rosa × damascene* Mill.)
[7](*Rosa foetida* Herrm.)

Figure 31: Persian yellow rose; photo by unknown artist

Another border plant is sumac[8] (Figure 32) The dried fruits of sumac trees are ground to produce a tangy, crimson spice popular in Qazvin and these trees are just for home use of gardeners.

Figure 32: Sumac trees; photo by unknown artist

2.3. Domestic animals and wildlife in Bāghestān:

8. (*Rhus coliolia* l)

Domestic animals in Bāghestān include horses and donkeys (used to transport gardens products) and dogs. The gardeners themselves maintain the limited number of livestock in the gardens, which was higher in the past. Most herds of sheep from surrounding livestock husbandry come to Bāghestān for grazing from the grasses and litter of trees and shrubs.

The main wild animals that are recognized in the region include carnivores like common Fox and marten, are spread throughout the region. With regard to the proper flora, nuts, fruits and adequate water resources, in addition to the mentioned animals, the rodents such as squirrel, mouse, mole, rabbit, and reptiles such as snake, lizard and turtle. Hedgehog as insectivore is the other animal species in the region. Furthermore, amphibians like frogs and toad have been found in the gardens.

It is also important mention that the wild squirrels in the garden are not native species. The main habitat of these squirrels is the forests of Zagros; but they were caught alive, and then were sold in other provinces such as Qazvin. The attack of the squirrels left by the people in Bāghestān, has made serious problems for gardeners. These animals have no natural enemies in Bāghestān, and actually, feed by the garden products and have reproduced and become invasive species in Bāghestān.

There are also a large number of local and seasonal birds in Bāghestān. The most frequent birds which are found in Bāghestān include Passerine and Raptors. Starling, sparrow, roller, pigeon, cuckoo, hoopoe, woodpecker, crow, rook, magpie, buzzard, owl, falcon, sparrow hawk, nightingale, lark, wagtail etc. are the most important birds in the region. Some of the Arthropod which are observed in Bāghestān includes mantis, bee, honey bee, black beetle, scorpion, tarantula, spider, ladybug, lacewing, aphid, sun pest and psyllid. There are also some of earthworms and millipedes in Bāghestān.

2.4. Safeguarding biodiversity:

Iran’s pistachio industry has a long history of over 100 years, and has successfully secured a significant share in the global market, making it the most sought-after nut. This popularity is due, in part, to the selection of certain varieties,

including one type of species known as the green kernel pistachio. Additionally, the pistachio trees along, with other trees in the gardens, create many ecological niches for other species, leading to the formation of a rich biodiversity.

3. Local and Traditional Knowledge System

In Qazvin, complex, diverse, and locally adapted agricultural systems have been adapted and nurtured for centuries. There systems are rich in indigenous knowledge and serve as invaluable source of social, cultural, ecological and economic services for the local community. The ingenious combination of techniques used in managing this agricultural heritage system ensures community food security, the conservation of natural resources and biodiversity and the promotion of sustainable development.

The traditional garden systems in Qazvin demonstrate the innovative potential of its residents in management of finite resources, floodwater spreading and management, biodiversity conservation, ecosystem dynamics, and strategic use of the landscape. The cultural, ecological and agricultural diversity of these systems is not only evident in their traditional form but is also reflected in the evolving knowledge, practices and technologies employed by the community.

3.1. Aquifer and indigenous knowledge of floodwater irrigation in Qazvin traditional garden:

In arid and semi-arid regions of the world, including Iran, harnessing floodwaters is a common method of supplying irrigation water. Floodwater distribution also plays a significant role in replenishing groundwater, stabilizing the alluvial soil, and rejuvenating vegetation. Bāghestān is a prime example of such floodwater distribution mechanism, dating back over a thousand years, according to historical sources. Our ancestors in this historical city, which is situated in a semi-arid region, ingeniously transformed natural threats into opportunities.

The city of Qazvin is situated at the foothills of the Alborz ranges and has always been struck by seasonal flooding in winter and spring. Bāghestānwas built as a protective green belt around the city against floods. These unfenced gardens act as the main dyke and the largest aquifer in the region. They cover a vast area of around 2500 ha on three sides of the city. The floodwater irrigation practice in Bāghestān stabilizes the alluvial soil and recharges water underground reservoirs.

Traditional gardens consist of small plot of 500 to 5000 m^2, with an average size of 2000 m2. These gardens are arranged in a manner that protects the city from floods. The plots are positioned adjacent to each other and are separated by borders, typically 1-2 meters high (refer to Figure 33). The height of the borders matches the level of the plots, allowing the water to gradually infiltrate the soil. As such, the gardens act as local dam and a potential reservoir for collecting flood waters. Rivers running across the town direct water into irrigation channels, which in turn, divert the flood water towards the traditional gardens. During the rainy season, the gardens are filled with water, rising to the height of the plots, which gradually permeates into the soil, irrigating the trees and shrubs are irrigated.

Figure 33: The gardens are pitched together and separated by borders up to 1-2 meter-high, which acted as a local dam and a potential reservoir for collecting flood waters

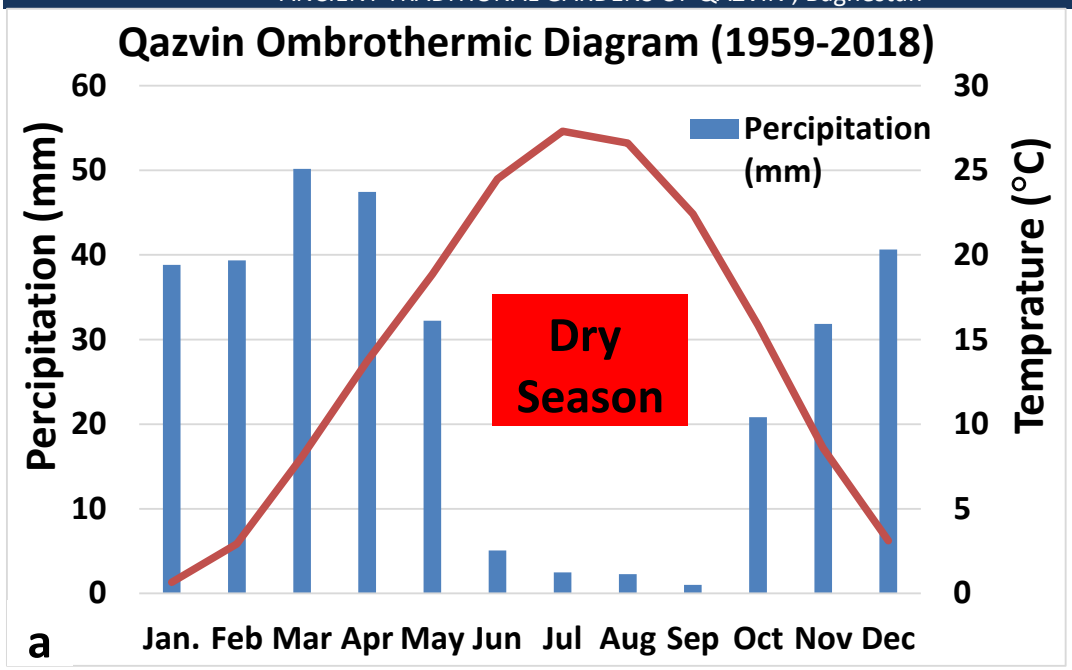
Furthermore, it has been reported that approximately two-thirds of the incoming water can gradually infiltrate the ground and replenish the groundwater aquifers (Aowerth, 2009). This irrigation method is only utilized once or twice in the winter and early spring, when evaporation is at its minimum, to ensure optimal water conservation. It is important to note that the garden is not irrigated during the summer months. The success of this irrigation technique ensures the survival of the garden's trees and their economic viability.

An excellent example of farming culture present in Bāghestān the maintenance of a water scrolls. This scroll serves as an agreement between farmers at the beginning of the irrigation season, which typically runs from early January to mid-April. Each scroll specifies the frequency and the duration of irrigation for each garden in the vicinity. Figure 45 displays an image of such scroll document bearing the seal of Hamdullah Mustawfi (Persian official geographer and historian) from the 14th century. For centuries, farmers have upheld these schedules, and the indigenous water distribution system of Qazvin Bāghestān has been recognized as an Intangible National Historical Relic (Safinejad, 2003). Bāghestān serves as pivotal points for the development of complex set of social, cultural, and environmental codes, which have now been officially registered as a national heritage.

3.2. The Role of Meteorological Data in Flood Irrigation Practices in Qazvin Traditional Garden

Based on the meteorological data from a long-term statistical period, the average long-term rainfall of Qazvin is approximately 312 mm, and the average evaporation is 1470 mm, as illustrated in Figure 33. These figures highlight the aridity of the region and emphasize the importance of implementing effective water management strategies to maximize the productivity of seasonal rivers.

Data on average monthly temperature and rainfall, as well as the Omro-thermic diagram of long-term period from 1959 to 2018 (Figure 34 a), indicate that the dry season in Qazvin lasts approximately six months, from late May to October. In the traditional garden of Qazvin, irrigation typically occurs once in winter and once in early spring (April), when evaporation is at its minimum (Figure 34 a, Figure 34 b). However, during other periods, particularly in the summer, irrigation is not carried out in the garden (Shahbazi et al., 2020).



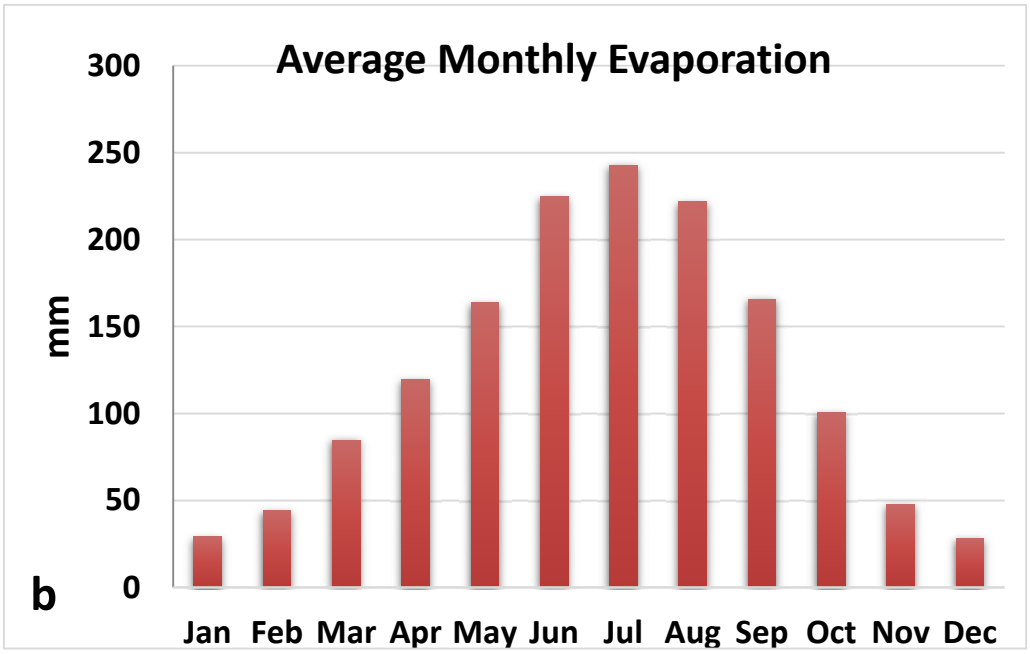


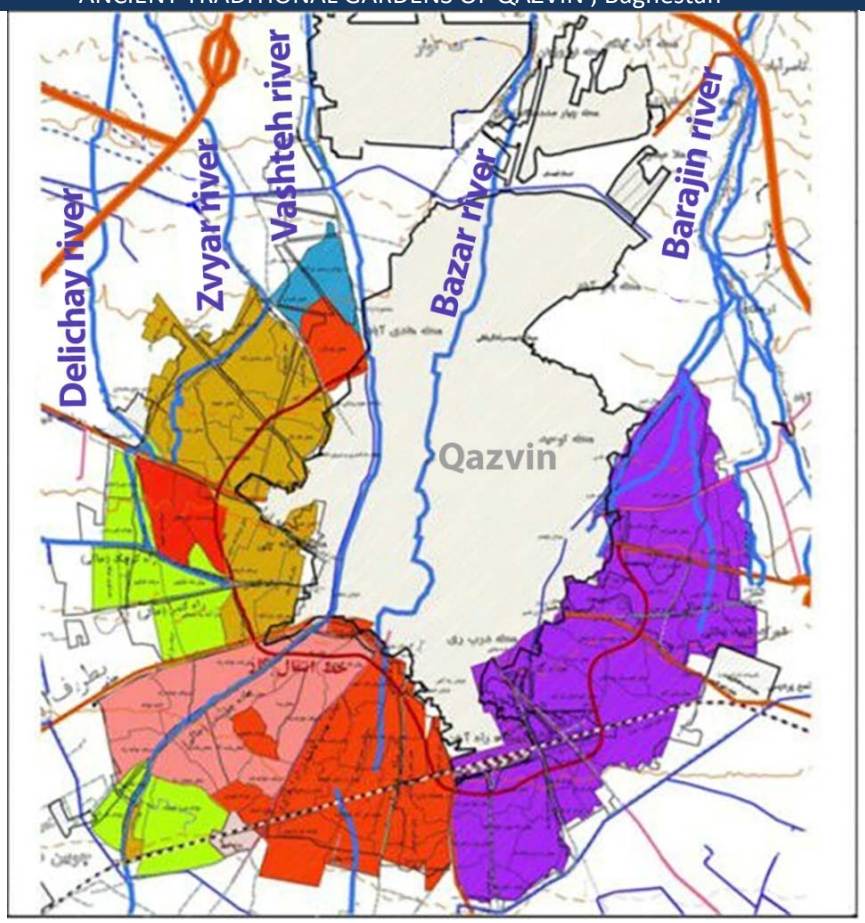
Figure 34: Ombrothermic diagram (a) and average monthly evaporation (b) based on long-term (sixty years) meteorological data of Qazvin synoptic station.

3.3. Hydrological Network in Qazvin and Water Conservation Measures in Qazvin Traditional Garden:

There are five seasonal rivers located within Qazvin traditional gardens, as depicted in Figure 35. Furthermore, due to its proximity to the Alamut and Alborz mountains, the Aranjak River flows into the city from east, passing through

downtown gardens. The traditional gardens effectively control the river overflow by channelling it into the ground and transferring it to underground water. Bāzār River flows from the northwest and enters the traditional gardens in the same direction, ultimately flowing southward. Similarly, Zaviar River flows from west toward southern part of gardens, serving as a crucial source of irrigation. The Dalichây River flows from north and waters the northern parts of the gardens. It is noteworthy that in normal years, the amount of water intake for two irrigation cycles in traditional gardens can reach up to 30 million cubic meters, whereas in rainy years, it can increase to 50 million cubic meters due to floods (Aowerth, 2009).

The Bāghestān's strategic geographic and topographical location, ingeniously designed and developed by our predecessors, allows for the collection of runoffs during the winter and spring seasons. The remaining water is then used to irrigate the trees and transferred to underground water storage. Urban designers currently suggest that “green infrastructure” could be utilized to manage storm water runoff instead of, or in conjunction with, hard infrastructure such as pipes, pumps, and storage chambers (https://cwp.org/). The ancient traditional gardens, with almost one-thousand-years of history, can be regarded as a type of “green infrastructure”, encompassing the city of Qazvin and forming a salient ecosystem. The ecosystems have the ability to effectively regulate surface runoff, naturally storing the rainfall for summer drought season. Consequently, traditional gardens play a vital role in water conservation in a semi aired area (Shahbazi et al., 2020).



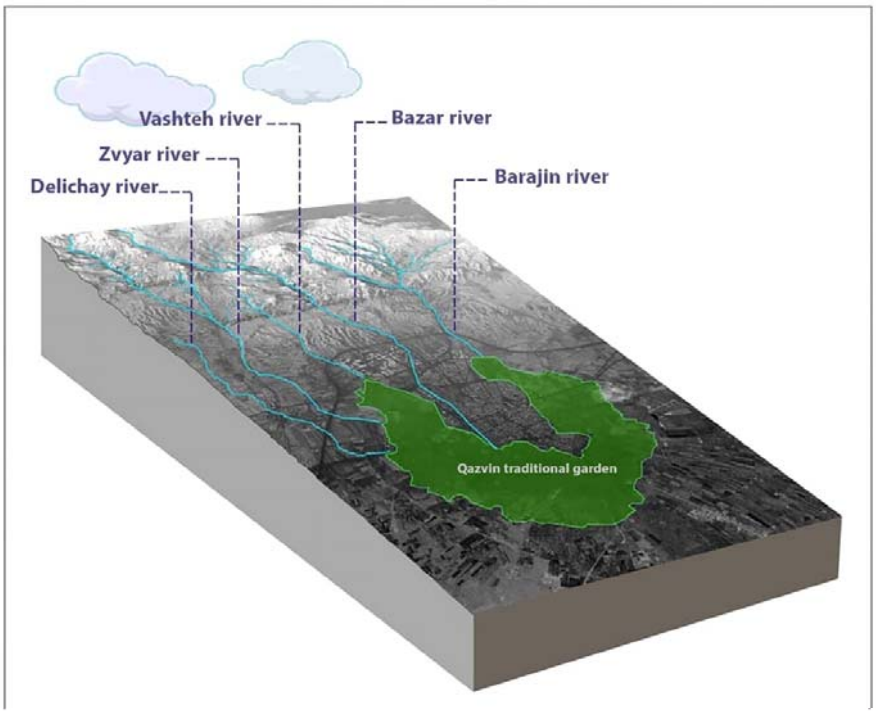


Figure 35: Map of seasonal rivers supplying water resources required by the traditional garden of Qazvin, Aranjak or Bārājin, Bāzār, Veshteh, Zooyār, and Dalichây (a), Qazvin Traditional garden is the largest aquifer in the region where fresh water is flowing(b; by Hamed Ahmadi)

Owing to the extended dry season and the considerable distance from the creek, some gardens rely on aqueduct (Qanat) and wells for irrigation. Unfortunately, there are only 15 wells available within the 2780-hectare area of traditional gardens (Figure 36). Regrettably, the wells next to the Chāhkhāne have all dried up over the last 30 to 40 years due to declining groundwater levels. Nonetheless, all 15 wells are utilized to irrigate the gardens. The water of some of these wells, such as Babagilak, Haj Fatali, and Mafi, is not exclusively for Bāghestān, but also for irrigating lands outside the garden (Table 15).

Due to the persistent water shortage in Qazvin, the transportation of water from nearby regions, such as Taleghan, via lengthy canals, has been arranged. However, the excessive exploitation of groundwater to meet the increasing water demand for the rising population and make up for the shortfall in the surface water for irrigation has caused a significant decline in the water tables in recent decades. Nevertheless, the traditional gardens remain self-sufficient using their seasonal irrigation system. Furthermore, gaining access to the Taleghan-Qazvin canal is extensive and uneconomical for traditional garden farmers. Despite having to purchase this water, there are considerable losses involved before the gardeners can collect and utilize it in their gardens due to the water having to pass through one garden to another, and through the creek, causing substantial losses.

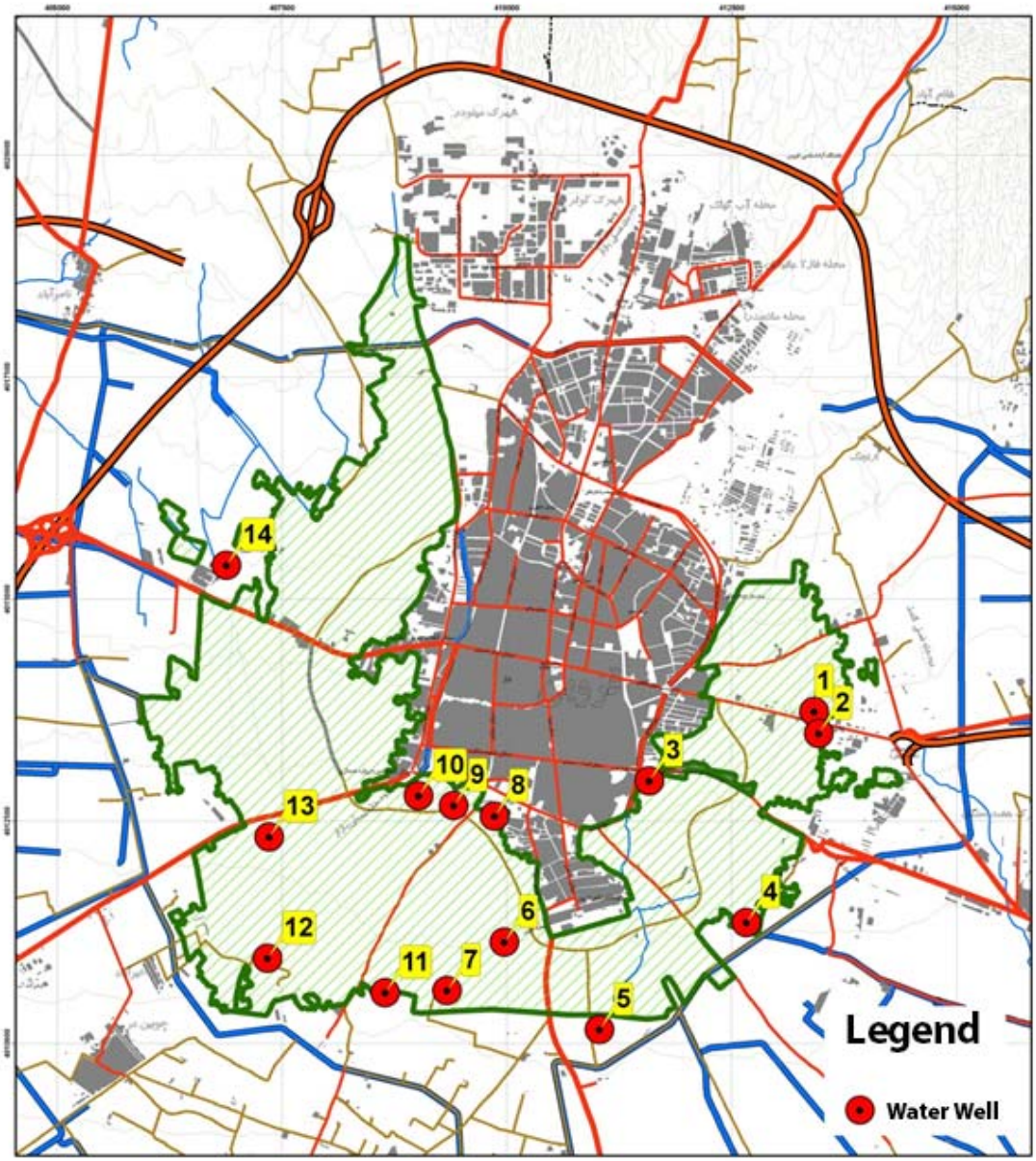


Figure 36: Map of the location of wells in the traditional garden of Qazvin

Due to irrigation of a vast tracts of lands surrounding BuinZahra with salinized (salty) water, this region has emerged as a focal point for sandstorms. The gravity of this situation is intensifying day by day. A report issued by the department of agriculture at Imam Khomeini International University states that the underground water sources in Qazvin will completely succumb to salinization within the next 15 years. Consequently, the threat of desertification will gain alarming momentum.

Table 15: The list, ownership and location of wells in Traditional Garden.

	The name of well	Ownership	Location
1	Mokrian	General	at the place of Beryan kola
2	Tadayon	Private	at the place of Poshtakabad
3	Mafi	Private	Gardeners have no share in this well, but sometimes they buy water from its owner
4	Hajibabaei	Private	at the place of Darzban
5	BabaGuilak	General	Below Poshtakabad, Mirzanaghi block
6	Hajifathali	General	Bazar River
7	Rezaei	General	Kibik place
8	Salimi	General	Bazar River
9	Shahrdari (Municipality)	General	Behind Molakhalila
10	Haj Ibrahim (Shaneieh block)	General	at the place of Shaneieh block
11	Shevidi	General	Sharif block
12	Haj Ahmad Bolaghi	General	Bazar River
13	-	Private	
14	-	Private	
15	-	Private	

Given this grim background, the preservation of gardens and trees that have thrived for centuries due to effective natural resource management becomes exceptionally crucial. If the destruction of the green belt around Qazvin become a reality, the entire region is inevitably poised to transform into a desert. One significant indicator of the value of preserving traditional gardens in Qazvin is the tangible cost associated with producing an equivalent volume of greenery as opposed to the cost of conserving it.

3.4. Soil conservation

Iran is located on the dry and semi-arid belt of the earth. The city of Qazvin is one of the semi-arid regions of Iran, which is formed on the Qazvin plain and is surrounded by the traditional garden of Qazvin. Qazvin plain is geologically connected to the geological structure of the Alborz mountain range from the north and to the central Iranian plate from the south. The geological structure of these two plates and tectonic activities along with compressive forces have caused the formation of Qazvin Plain (Figure 37).

The soil composition of Qazvin plain and Bāghestān, which is a part of this plain, is a combination of rock units of the northern Qazvin formations. The diverse sediments of the northern heights of Qazvin have been brought to the lower areas by the water erosion of seasonal rivers and floods over the course of hundreds of thousands of years. The soil of Qazvin plain is the result of this process.

Figure 37: Geological map of Qazvin

The soil of Qazvin geologically belongs to the Quaternary period and is considered one of the young sediments. The continuous combination of flood sediments caused by the erosion of the northern heights of Qazvin and plants and trees has resulted in the formation of rich and high-quality soil, which is classified as very mature soil in terms of soil quality and consequently, the agricultural productivity of Bāghestān soil is very high.

The traditional irrigation system of Qazvin Garden is based on feeding from winter and spring floods. This irrigation system has created temporary ponds by dividing the area of Bāghestān into smaller parts by earthen walls. Water remaining in ponds (gardens) for a period of several days, causes minerals to precipitate and enrich the soil of Bāghestān. This process is repeated every year.

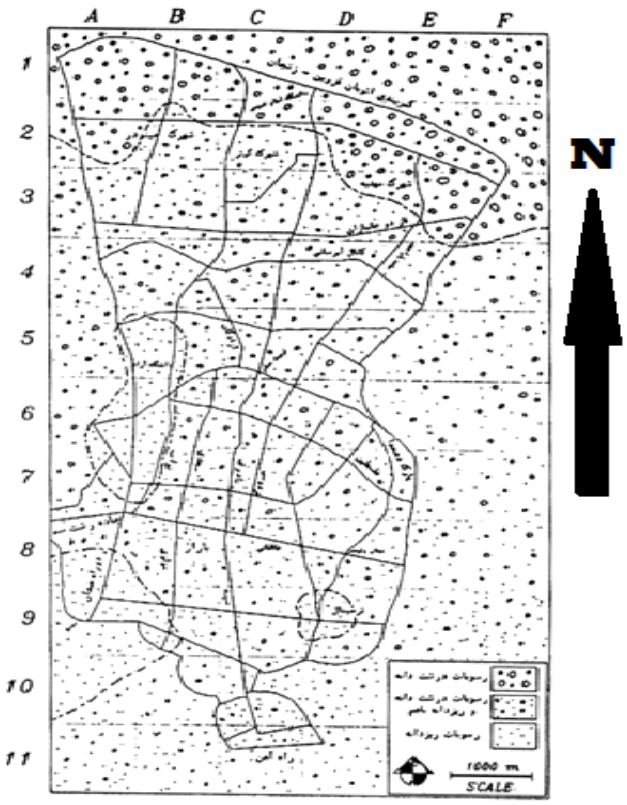


Figure 38 :Garden soil texture

As can be seen in Figure 38, the size of the particles becomes smaller from the highlands to the south and moves toward siltization. The dominant composition in Bāghestān soil is the combination of clay with some sand, which has caused proper drainage of the soil and its permeability. Garden soil has a good amount of organic carbon along with the balance of nutrients. Due to the remaining leaves of the garden trees and sometimes the hard residue of the remaining products such as the shell of pistachios, almonds and walnuts, it has caused the creation of fertilizer in the soil of Bāghestān, which, in combination with the minerals of the floods, has led to the regulation of soil nitrogen. In general, it should be said that gardeners have nourished

the soil and balanced the acidity and increased the quality of the soil with smart traditional methods and using indigenous knowledge.

The chemical analysis of Bāghestān soil shows the richness of this soil in all kinds of mineral and organic substances. The mineralogical composition indicates the predominant composition of silty sand, which has increased the permeability of the soil, and this factor, along with factors such as the amount of organic carbon, the amount of soil acidity and soil moisture, has improved the soil quality of Bāghestān and increased the productivity of the soil in this area. Examining particle size distribution, saturated moisture content, apparent specific gravity, organic carbon, equivalent calcium carbonate and weighted average diameter of soil grains indicate relatively suitable porosity and good permeability in Bāghestān soil. An example of soil analysis from one of the localities of green area of Bāghestān is given in Appendix 5.

It should be mentioned that traditional gardening methods including shoveling and traditional (submerged-flood) irrigation by clay walls in the garden have had a significant impact on increasing the physical and chemical quality of the soil in Bāghestān.

The presence of Bāghestān and the strong roots of his plants, along with the soil which has proper permeability and porosity, will control the subsidence of the land around Qazvin city. The soil of Bāghestān is not only an ecosystem for the living of millions of microscopic species and creating a biological balance in this area, but also by creating a balance between surface and underground fluids, it plays a more important role in maintaining the lands under its cover and as a result maintaining the planet.

The soil of Bāghestān Qazvin is the product of tectonic, geological, hydraulic, plant and human interaction, which has caused one of the highest quality agricultural soils in Iran. Each gram of this soil has an economic value and if it is lost, it will be impossible to recover it due to the loss of environmental conditions.

According to the farmers, when the soil is deeply overturned, distinct layers of soil with varying colours become visible, indicating the soil's nutritional content. These layers can be categorized as follow:

The uppermost layer, approximately 20cm thick, consists of sandy clay containing circular granules, promoting high permeability.

Beneath that lies a layer, around 60cm deep, comprised of sandy clay with intermittent lime patches and exhibiting medium permeability.

Further down, between depths of 60cm and 1.5m, there is a uniform sandy and loam soil layer with low permeability. The presence of sandy part within the soil layer significantly influences its permeability.

The preservation of traditional gardens has been partially attributed to seasonal rivers, which transport minerals and nutrients, enriching the soil.

The creek irrigation system facilitates the distribution of water to the gardens. Geographically, gardens located in the proximity to the creek can benefit from faster and easier irrigation, whereas those situated away may encounter challenges, particularly during the dry season.

3.5. Ecosystem function:

The traditional garden are not only sources of livelihood for the people living nearby, but also provides ecological values. It is especially so for the area with water deficiency, where the other tree species could barely survive. Qazvin Province is surrounded by the trees, which mostly grow in south, east, and west. Therefore, they play an important role in maintaining biodiversity, water and soil conservation, and breaking wind and filtering the air for the populated city. Wind erosion has become a serious environmental problem throughout the country (Akhavizadegan, 2003). It often appears in the S-W and gradually extends to the central Iran and reaches Tehran and Qazvin. Wind erosion damages land and natural vegetation by removing soil from one place and depositing it in another. Wind erosion control practices reduce soil erosion by slowing wind speed, which prevents soil particles from detaching and becoming airborne. Trees in the traditional gardens were found to be a superior

practice to protect the nearby cropland from wind erosion Traditional gardens have also acted as a natural barrier against strong winds. There are two wind systems known as “Raz” and” Mah” that bring with them dust particulates and cause major damage. These gardens protect the city against the corrosive powers of sand storms (Heshmati, 2013).

Another significant feature of ecological functions is that of watering periods between Januarys to March each year. There are a number of advantages involved when doing winter flooding. It is interesting to envisage how this irrigation method is now becoming increasingly adopted by modern agriculture. For instance, winter flooding is being thought to do better than damage to nut and fruit trees in California's Central Valley during the El Niño condition (30F). The Central Valley farmers’ idea to deliberately flood gardens to ensure the trees have enough water, and to help recharge the groundwater basin in winter when more water is available, is more likely similar to that of our farmers’; bearing in mind that with the frozen water, it is the timing that no other plants and crops in the region require irrigation. The indigenous knowledge adapted and experienced by the local farmers has been successfully passed to the next generations.

Climate and Atmosphere conditioning, air purification:

Nowadays, urban designers quantify the ecosystem services provided by urban green spaces; this may include recreation to the mitigation of noise and air pollution. Urbanisation has transformed rural and natural landscapes into urban and industrial states in many parts of Iran. In this context, it is important to take in cultural heritage landscapes as one of the urban green spaces that provide important ecosystem services in our cities. Traditional gardens in Qazvin is an evolved cultural landscapes resulted from an initial social and economic imperative, and has developed its present form by association with, and in response to its natural environment. It retains an active social role in our contemporary society, which is closely associated with the traditional way of life. There can also be found explicit material evidence of its

evolution over time. There is little doubt that this evolutionary process has been managed by local knowledge system.

However, as in many places in world, changes driven by processes of urbanisation and globalization are almost inevitable, which outrun their evolutionary adaptive capacity. Pressures are constraining farmers' innovation and if led to the adoption of unsustainable practices it would result in biodiversity loss, ecosystem degradation, poverty and loss of people's livelihoods. The trees in the traditional gardens are planted contiguously, hence enhancing transpiration and forming stable microclimates, and conditioning local surroundings. The air is more favourable in the garden's plantations than in the areas in the vicinity. Simultaneously, the trees absorb excess carbon dioxide in our city atmosphere and contributing to climate change. Recent study on climate change in Iran foresees an overall temperature rise of 4.25˚ C for period: 2071-2100 relative to that for 1961-1990. Trees cool the city by up to 5°C, by shading our homes and streets, breaking up urban "heat islands" and releasing water vapour into the air through their leaves. This is crucial for the carbon cycle, and the carbon balance. It also increases the concentration of oxygen. Research points out that the carbon sequestration and oxygen production functions of trees are valuable. In addition, being in the vicinity of industrial states the city will be exposed to more airborne pollution, thus the role of the strand of trees in absorbing smoke and dust and purifying the air is significant. Furthermore, the wind-blown from Alborz mountains to the city frequently bring dust and particulate matters with it, for which traditional gardens act as filtration barriers against the wind.

The trees are suitable for preventing and reducing dust, and are resilient to sulphur dioxide, as well as to chlorine and hydrogen chloride. As to carbon sequestration, oxygen generation, noise reduction and micro-environment regulation, the trees are second to one when compared to other species. In fact, trees provide a wide range of environmental, social and economic benefits such as:

- A mature tree absorbs 12 Kg CO_2 (36$) yearly.
- A mature tree absorbs particles and polluted gases of air (185-370$) yearly.

- A mature tree decreases air temperature 5-10 F yearly and is known as a "temperature island" in urban areas (almost equal 62000$)
- Each 1000 trees planted in northwest of Qazvin resulted in saving 1 million$ in managing surface sewage, decreasing pollution and costs of energy in the area. This points out the importance and value of the gardens in the northern margin of the city that once existed and are removed (land of volunteers.com., 2014)
- The amount of oxygen produced by a 50-year-old tree equals to 31250 $, as well as a value of 37500 $ for air purification (keptics. stack exchange.com., 2014) (12)

3.6. Knowledge on fruit trees cultivation

People have learned relevant knowledge and skills for cultivating pistachio and growing vines. It is more likely that the indigenous knowledge has been developed to progressively answer a number of questions: How would pistachio cope with water scarcity? How would the plant uptake the required mineral nutrients from the growing media? It is now proven that pistachio can be successfully cultivated in gardens as it has shown great resistance against dry climate and water shortage for so many years. It can also be envisaged that the minerals brought down by rivers adequately maintain the nutrients that plants needed. The vines interpolated with pistachio trees have shown to grow well together with almond and apricot trees. Compared with other plants, pistachio trees have stronger performance in water conservation. They hold water by the porosities of soil in the depth of the soil. Mature pistachio trees hardly need irrigation, merely in spring when the rivers are flowing and conveying nutrition materials down from the mountains. Operating and managing the irrigation system once a year has been a common practice for cultivating pistachio. The other advantage of pistachio is their late blooming, that prevents frostbite.

Physical measures are taken to prevent and treat common diseases and insect pests of pistachio such as leaf roller. Gardeners prune the trees by different method in different season for easy harvesting. Since the lack of lateral branching causes the

fruit-bearing wood to become increasingly distant from the central axis of the tree, farmer keep pruning in February.

3.7. Management of the traditional gardens

Traditional management system of Bāghestān is the basis of Bāghestān traditional good-governance. It is the most or on of the most important foundations of Bāghestān sustainability. Any intervention of external organizations in this system must be made with sufficient analysis and care – we have discussed this subject in section A.2.2.

Figure 39: Irrigation system as canals and steams in Bāghestān; photos by unknown artist

3.8. Gardening practices and activities

Contrary to many people's beliefs, gardening is not a seasonal activity and gardeners work all year round except on snowy and rainy days. Irrigation time does not stop even if it snows and rains (according to gardeners, "even if stone fall from the sky").

Gardening is taught to young people by nature and labour experts and provides employment and skills for them. The types of activities are presented briefly in chronological order as follows. Some of gardening tools and implements are presented in Figure 40.

Figure 40: Some of gardening tools and implements in Bāghestān; photo by unknown artist

Irrigation: After the flow of water in the rivers, depending on the weather conditions, irrigation usually start in December and, as the case may be, continue until early June. Irrigation of traditional gardens is a specialized and very difficult activity. Each gardener is done on set dates based on the amount of water with the help of your family and as needed with the help of friends and neighbours by paying wages. In the past, due to heavy snowfall in the Alborz Mountains, the rivers were full of water and a lot of workers were needed for irrigation operations (Figure 39).

Strengthen soil borders or "Afshān": The abundance and volume of water required to strengthen the soil boundaries of the gardens every year. In this way, the water ***intake*** capacity of the gardens be maintained. Therefore, from autumn to before shovelling (early May) when the soil has good moisture, one or two shovels of soil are poured from the garden floor on the borders. As a result, the soil boundaries are strengthened and the shovelling operation becomes easier.

Pouring soil into the main stream or "Rabez": Repairing the streams where soil is removed, dumped on the border, and dams closed, i.e. opening the entrance of the garden stream (where the water enters the garden) and block the water inside the main stream (to prevent the water from entering the garden by pouring soil into the main stream). Today, valves are installed instead, but the valves do not work well during floods and prevent water from passing through.

Bringing the plant out from under the soil: In the spring, depending on the weather and the date of irrigation, from April 4 to April 15, the grape bushes that have buried in the fall remove from the soil.

Shovelling the gardens: The most important and most useful activity in gardens is shovelling the soil, which is done according to the weather conditions, irrigation date, and proper soil moisture and at the same time with the flowering of weeds on the garden floor and before they seeding from 10 May to 10 June. Shovelling is done by gardeners, their families, other gardeners, migrant workers and labourers from rural and other provinces. Although shovelling may seem like a simple practice, it is actually a very technical activity. The expert gardeners dig up perennial grass roots

Figure 41: Shoveling the gardens in Bāghestān; photo by Porya Kakvand

and keep the garden surface smooth, while unskilled workers only turn the soil upside down (Figure 41).

Special shoveling the gardens or "Yek bile": Some gardens are "Kala", meaning they have not been worked on for several years because the soil is hard in the spring.

***Weeding the soil borders in the garden*:** At the same time as shovelling or shortly after the grasses on the borders enter the grain formation stage, all the wild grasses are picked on the soil borders and collected and collected. This fodder was then collected and shovelled and ready for consumption and transported to homes and used by livestock in winter.

Harvesting the fruits of the gardens: From the beginning of June, the harvest began with the arrival of Qaisi (early ripening of apricot) cultivar and ended alternately until the end of October with the grape harvest of Gori cultivar. The process of harvesting almonds, grapes, grapes, pistachios (Figure 42), walnuts, cucumbers, peas, watermelons, squash and transporting them to homes and markets requires hard work and the cooperation of family members, especially adolescent children. Many teens and young adults helped fathers on summer vacations. Fruits were transported by donkeys. People with taste carried some high-quality and delicate fruits by skilled people in large baskets called baskets to sell at a higher price. These people put wooden baskets full of high-quality apricot or grape fruit weighing approximately 30 kilos on their heads and brought these fruits to the market by

Figure 42: Harvesting the pistachio fruits of the gardens in Bāghestān; photos by unknown artist

crossing borders, hills and streams and streams. Carrying fruit in a basket on the head is a hard and tedious task that is fortunately obsolete today.

Pruning of grape bushes: From the 10th September, pruning started from ruby, Shahani and Asgari bushes when the bushes had leaves and continued until the end of November. All pruning foliage are collected in a special way that was ready to be carried by the donkey. Pruning before the leaves fall is a costly and labour-intensive task. However, it was done in the past, because of the use of green leaves of plants as forage.

Pruning the trees: Almond trees are pruned and rejuvenated every two or three years, but pruning of almond and pistachio trees is lighter and mostly involves cutting out ectopic and dry branches (Figure 43).

Figure 43: Pruning the trees; photos by unknown artist

Weed control on the garden floor: Usually, due to inaccuracy in shovelling, some thin-leaved and broad-leaved permanent weeds that have deep roots remain. In the past, gardeners used to remove permanent thin-leaved grasses one by one with the help of tall shovels in summer and early autumn (autumn heat). This process is

Figure 44: Weed control on the garden floor; photos by unknown artist

repeated two or three times to clear the garden of these weeds. But the control of broad-leaved annual weeds is done by manual digging (Figure 44).

Shovel with long shovels in the summer "Bil Ordeh": Gardens that had good shrubs and trees but were declining due to low yields were delayed for a year, and in the summer, they dug up the shovel to a shovel depth (30-35 cm) with long shovels. As a result of this activity, the yield of the garden increased. In early autumn, when the soil is dry, which usually throws two shovels or half shovels, that is, a shovel is thrown and the soil is dumped, then it is cleaned or so-called swept, then the second shovel is beaten and thrown forward (about one meter forward).

Removal and eradication of unproductive plants (Bilashebaran): Gardens whose shrubs and trees are old and worn out, or do not produce fruit due to ages of neglect, normally regenerate by gardeners. In summer, the garden area is dug into by shovels and the soil turns upside down. In addition, with the opinion of experts, trees and shrubs without interest and surplus are uprooted, and well-kept trees and shrubs are maintained. If the land is empty and the garden needs to be filled, in the fall of the same year, holes with a rectangular cross-section measuring 100 by 40 cm and a depth of 75 to 100 cm will be dug. In March, two tall cuttings of new grapes are planted at rain season. Sometimes, in the same year, a number of almonds and pistachios are planted around the garden.

To increase the fertility of gardens, the skilled gardeners (with financial and physical strength), remove infertile plants and shovelling (Bil Ardeh) in one or two parts of their gardens at summers. Once every 20 years, the gardens normally renew their gardens.

In the years when gardens were damaged by natural disasters, philanthropists renovated a number of their gardens with the intention of creating jobs to support those working in the gardens and creating jobs. The result of these efforts and expenses incurred is overproduction and revenue of their gardens in later years.

The operation of shovelling and removal of unproductive plants the garden is done exclusively by expert gardeners (to level the garden and make the most appropriate decisions about shrubs and trees and replanting).

"Warshow": Grape cuttings are planted in the traditional garden of Qazvin at a depth of 75 to 100 cm to withstand the annual drought period from June to next year's water turn for about 9 months of the year. To continue this situation, every few years in the fall, the legs of the grape bushes are cut to a depth of half a meter and the misplaced green roots are removed to the main root called the chicken so that the plant always uses the stored moisture by the deep roots.

Peeling dry leaves "Kotak giri": The remains of the dry branches in the middle of the bushes are cut with a saw and ax every few years to increase the strength of the grape bushes.

Uprooting plants: In the past, in order to protect the grape plants from the damage of severe winter cold, depending on the weather conditions, from November to early December, all the branches of the grape plant were buried. The start of the operation depended on the fall rains, because the soil that was poured on the bushes had to be moist.

***Dropping a tree*:** At the end of the harvest and the beginning of the autumn season, the dry, sparse, substandard and misplaced trees are uprooted. They cut around the trees and after finding the sub-roots with an ax, they cut the roots and used the rope to put the tree to sleep on the side that would not damage other trees. Thin branches are cut with a saw and thick branches and the main trunk with a "Mashar" (long and double-sided saw) are cut and used for baking in ovens and ovens. The activity of planting trees is economical and causes the selection of trees and creates enough space for the growth of newly sprouted seedlings.

With this activity, no dry, old, worn and useless trees are removed. In the past, all border operations, digging, and grape cultivation were carried out by workers using shovels. The distance between the plants on each side is about 3.5-3.5 meters. The holes are dug with a shovel in the shape of a rectangle of 40-40 cm and a depth of 100 cm and in autumn or spring, depending on the possibility of irrigating two pieces of grape cuttings from local cultivars. Ruby grapes produce earlier, but royal grapes take 7 years to bear fruit and reach their maximum yield in the 15th year.

The irrigation is done twice in the spring. The garden floor is turned upside down with a deep shovel. This operation is carried out by the owners, their families and the worker in terms of manpower, and if the owner is not a gardener, the garden land will be given to other applicants.

Gardening practices included irrigation, "Afshān" (strengthening borders), shovelling, border weeding, pruning shrubs and trees, weeding, pruning gardens, "Warshow", peeling dry leaves, uprooting low-yielding and dry trees, collecting branches and burning them is useful for pests and diseases control.

In Bāghestān, the juicy fruits (grapes and apricot) used to harvest at the right time and after cleaning, they were transported by wooden baskets for sale to the market or for drying at home. Harvesting of dried fruits such as almonds, pistachios, and walnuts does not have such a time limit, and in case of delay, the waste will leave to the wild animals.

In terms of planting density, there is a local saying: "it is not dense and there is space for sunshine to get through". Most of the trees in gardens are seed trees that root can grow vertically down to the deep part of land; this would help for shortage of water. To increase fruit sets, the ancestors created the grafting technology for pistachio and other trees. The doctrine behind it is the same with the girdling technology presently used (http://www.technology-x.net/A01G/). The old trees are used as stock to graft other species on it. It demonstrates the innovation and advanced technologies of our ancestors. Physical measures are taken to prevent and treat common diseases and insect pests of trees, such as leaf roller. Farmers trim the trees by different method in different season for preventing insect pests effectively. Before April, they trim trees to maintain row spacing. They trim the branches of the trees in different ridges to different lengths to avoid overlapping picking seasons. The plantation density is different in each garden and varies generally 20.000 to 60.000 trees per hectare.

Leaf thinning, trimming, weeding and fertilizing are all conducted at the proper time. Every spring, before the growth appears, farmers remove all the branches and leaves at the height of 10 to 15 cm. During the growth season, trimmings are

conducted in a timely fashion to remove excessive or weak branches. Synthetic fertilizers are not used in gardens, instead compost made from plant residues, vegetables (in some cases), green manure and river bottom sediment are used as alternative fertilizer. This ecologically sound and profitable alternative fertilizer reduces environmental pollution, and recycles many substances. The dead infected stems are noticeably identified and removed and burned to stop the disease from spreading.

Table 16 presents the whole practices and production processes for each main crop/tree in Traditional Garden.

Table 16: The gardening practices and activities for each main tree in Traditional Garden.

Months	Activities performed during the year		
	Pistachio	**Grape**	**Almond**
January	If there is no snow and there is no freezing, streams and canals are organized and borders and soil ridges are strengthened ("Rabez"). Irrigation will start from January 6, according to the Water scroll.	If there is no snow and there is no freezing, streams and canals are organized and borders and soil ridges are strengthened ("Rabez"). Irrigation will start from January 6, according to the Water scroll.	If there is no snow and there is no freezing, streams and canals are organized and borders and soil ridges are strengthened ("Rabez"). Irrigation will start from January 6, according to the Water scroll.
January - February	"Afshan" and irrigation according to water scroll.	"Afshan" and irrigation according to water scroll.	"Afshan" and irrigation according to water scroll.
February - March	Irrigation according to the irrigation scroll, cutting down trees to prepare for grafting, pruning remaining trees if the buds are swollen. Pest control (spraying) and fertilizer and seedling planting.	Irrigation according to water scroll and planting the grape plants.	Irrigation according to the irrigation scroll, cutting down trees to prepare for grafting, pruning remaining trees if the buds are swollen. Pest control (spraying) and fertilizer and seedling planting.
March – April	Irrigation according to the irrigation scroll, Pruning trees	Removing uprooted grape bushes from the ground, especially royal grapes, and emptying ungrounded bushes.	Irrigation according to the irrigation scroll, Pruning trees
April – May	Irrigation, start shoveling, if there is little rain, picking grass	Irrigation, start shoveling, if there is little rain, picking grass	Irrigation, start shoveling, if there is little rain, picking grass
May – June	Shoveling, weeding, first spraying to control pests, grafting	Shoveling, weeding, first spraying to control pests, grafting	Shoveling, weeding, first spraying to control pests, grafting
June – July	Grassing of borders and streams, sawing of cuttings, continuing grafting, opening and removal of grown grafts and cutting their cuttings	Grassing borders and streams, picking unripe fruits "Ghoreh" of grapes for use as pickles	Grassing of borders and streams, sawing of cuttings, continuing grafting, opening and removal of grown grafts and cutting their cuttings

July - August	spraying to control pests (psyllid)	Beginning of grape harvest, first ruby or measles, royal, yezandai and ...	Picking almonds
August - September	Picking Pistachio	grape harvest (Fruit ripening in order)	Picking almonds
September - October	Picking Pistachio, pruning	grape harvest Gouri and Chafteh cultivars	Almond pruning
October – November	Pistachio pruning	Pruning the grape plant (cutting the plant)	Almond pruning
November - December	Pruning, pruning the trunks of trees, digging holes under the shade of trees for fertilization, pruning (pruning cleaning) and preparing for irrigation	Pruning, pruning the trunks of trees, digging holes under the shade of trees for fertilization, pruning (pruning cleaning) and preparing for irrigation	Pruning, pruning the trunks of trees, digging holes under the shade of trees for fertilization, pruning (pruning cleaning) and preparing for irrigation

3.9. Fruit storage and processing

Transplanted apricots, which have a good product, are sent to Qazvin and Rasht markets for fresh consumption. However, other apricots are transported to home workshops and turned into qaisi, and then exported to other cities and foreign countries. Gheysi and peeled almonds and pistachios and transported to the rooftops for drying by family members and working women at home. The family members and working women were also responsible for cooking the pumpkin juice from the stuffed grapes at home. In the attics that are built in most of the old houses, Chafteh, Molaei and Gouri cultivars of grapes are kept pendulum for winter consumption. The management and planning for product processing are normally done by the grandmother and the mother of the family.

The women in the gardeners' house are responsible for cooking food and bread for the family and permanent and temporary workers.

One common product derived from grape juice is concentrated grape juice or syrup, named: Shireh. It has been continuously made in traditional ways as it was made in ancient times by smearing grape juice and making syrup (Shireh), which is a tasty dessert, and is used in many dishes too. Another way of processing grape is to make it pickled. This processing method, being assigned to the ancient times of Silk Road, was invented over 1500 years ago, and is widely used in Iran. Unripe sour grapes (Ghoreh) are also used to extract verjuice (Ab'e Ghoreh), which is a popular

seasoning for dishes; it may be pickled, too. When dried out, Ghoreh will be ground into powder and used as seasoning powder. Dried grapes as raisin and other type also used in dishes.

3.10. The Interplanting of Trees and Crops

Pistachio trees bud late in July and mid-August; thus, they have different demand schedule for nutrition and water than other trees and vegetation. This makes it reasonable to plant them with other bushes and fruits such as grapes and apricots. The interplanting changes the two-dimensional layout planting only one species, to three-dimensional agriculture composed of trees and crops. This combination of trees and grapes not only improves production and economic gains, but also produces a series of eco-benefits (9). Planting cucumbers, watermelons and rarely peas and lentils in a rainfed manner is another action of interplanting. These crops, after the irrigation season, are often planted in regenerating gardens where seedlings have been planted. Considering that pistachio seedlings need 5 years to reach productivity, this is a method for productivity and economic resilience. Gardens that use well water have the advantage of planting some vegetables such as eggplant, squash and even tomatoes along with seeds or seedlings that are grown in the first years and need watering.

First, it can boost wind erosion protection, regulate the temperature and humidity, and replenish carbon dioxide and create a favourable environment for the city of Qazvin and the neighbouring towns. Second, the lower monthly average temperature and higher humidity resulting from interplanting is very conducive for increasing the grapes weight and yield. Third, it lowers the evaporation potential, and thus reduces evaporation, which helps maintain soil moisture and thus increases yield. Fourth, this is a practice that makes full use of the space, resulting in higher efficiency of natural resource utilization. Fifth, it reduces surface runoff, lowering the loss of water, soil and nutrition caused by rains during spring thus protects the field.

4. Cultures, Value Systems and Social Organisations

The traditional gardens, Bāghestān, as a cultural heritage is a collection of intertwined and fence-free gardens formed by the activism of citizens in all social classes and based on the division of labour, participation and social trust. This has led to the emergence of high social capital in this field, social capital that has shown a kind of commitment and a sense of interaction and presence. Social capital is a set of potential interests that are interacted with in social networks by a set of actors. Activists who diligently try to have a meaningful presence in social structures and use their community-oriented skills, abilities and attitudes. They strive to carry out responsible action and improve the quantity and quality of social interactions in the context of society and make the presence radius more meaningful. Therefore, it can be boldly said that Bāghestān complex is a manifestation of the valuable lived experiences of social activists at various levels in the face of all the ups and downs and difficulties; Based on trust, it depicts an area of cooperation and coexistence, an area that is devoid of atomization and individual profiteering.

This unique collection that has created because of the need to protect the city from seasonal floods is based on the following principles

- Participation
- The trust
- The authority of the trustees
- Formation of a hierarchy of land, water and trees
- Ownership and exploitation systems of different classes of society
- The division of labour defined in the families of the city
- Local economy turnover based on direct use of products or processing and conversion and use in various food industries or home consumption of them
- Resilience mechanisms such as keeping part of the products for possible crises in the coming year
- Generous support of the city and its people, such as providing a share for the needy and accepting people in the garden for recreation

These interconnected gardens are irrigated in accordance with the water scroll, which is set separately for each of the five rivers. The proven date of the scroll is at least 700 years old and signed by the historian of the "Ilkhanian" period, Hamdollah Mostofi. The participatory management in Bāghestān is based on the agency and authority of elders and trustees. Such a phenomen as a living, fertile and prolific creature has caused all actors in this field, in addition to having independent and specific identities, to form a common "We".

In fact, Bāghestān as a cultural landscape is a platform for interaction and deep and intertwined connections of human and nature around him, which includes a range of time from the past to the present and to the future. In this way, Bāghestān, as a dynamic and life-giving element, is a manifestation of cultural and natural elements together, which combine the way of life and civilization of different strata in the city. Bāghestān, based on cultural and social processes, has provided the conditions for the survival of the city. Bāghestān, based on cultural and social processes, has provided the conditions for the survival of the city. If we want to briefly describe the characteristics of the traditional garden of Qazvin, Bāghestān, we can refer to preserving the city's life, the field of responsible action, a unique context of participatory management, rationality based on ethics, the field of arrest, and coexistence and interaction of honourable and democratic people. Living in the city and working in Bāghestān is a way of life that follows the patterns of diligence, respect the elders and trustees, participation, trust, economics-oriented thinking while contentment and retention, maintaining the dignity of the poor active in Bāghestān. These sublime lived experiences have been passed down from generation to generation as indigenous and cultural knowledge. The sum of these valuable human habits and components has made Bāghestān a sustainable area and system for more than a thousand years.

4.1. The antiquity of Bāghestān and the narrations of tourists and other ancients

Some people, especially the old gardeners, believe that the garden of the city dates back to the time of Shapur, the Sassanid king. However, what is now available

and provable are the allusions of historians and tourists. In the section III we mentioned a number of cases. In addition to the above, travelogues belonging to the Safavid period (such as Del Lavaleh and Tavernier) and Qajar (Diolafova) should also be mentioned. In fact, what tourists and historians have pointed out is the existence of a lush and productive garden with limited irrigation, in a semi-arid climate and without permanent water.

4.2. Division of labor and different jobs formed from Bāghestān

The social hierarchy that governs Bāghestān is not based on power, magnitude, and the amount and type of work; But it is a mixture of all these. Sometimes, as we see in the agent named "Dakhûs", even the power and influence of a person who does not owner, but is trusted by the majority of gardeners, is ranked high in the social hierarchy in Bāghestān.

Here we introduce the main stakeholders of Bāghestān and also job groups related to it.

4.2.1. Stakeholders

Owners: Those who own some gardens of Bāghestān.

Dakhûs (Dekhoha): until about three decade ago, In the social structure of Bāghestān, one or more consecutive localities that has certain commonalities, had an agent named "Dakhûs or Dehkhoda" who was responsible for overseeing the proper performance of the duties of gardeners, taking care of general affairs and dismissing and installing gardeners. The Dakhûs also, based on their experience and expertise, were involved in estimating crop yields, pricing trees and gardens, dividing them between heirs, taking water and purchased water, dividing and collecting water, and also were diligent in resolving local disputes. The Dakhûs that covers localities of 5 different rivers, worked together to prevent the upstream intrusion and theft of water flowing in the river. In fact, they were more skilled at irrigating and directing floods than gardeners. Interestingly, Dekho's occupation was not inherited and they were selected based on their abilities, while horticultural occupation was almost inherited.

This personage of Bāghestān and his role has influenced from some changes in the social relations in Bāghestān from about 3 decades ago.

Gardeners: The gardeners are in charge of guarding the gardens, including the boundaries, trees, products and tools of the garden owners all year round. They make irrigation of gardens according to the water scroll.

Trustees of the localities: In each locality, one to three well-known garden owners who have more gardens and are aware of Bāghestān system due to constant travel and contact with others known as trustees. The trustees supervised the work of the gardeners. The trustees have resolved the challenges between the garden owners or between garden owners and the gardeners. Gardeners have sought the opinion of trustees to make public expenses, buy water when need or sell that when there are more than need, and at all work at their discretion. Owners that own small part of localities often follow the decisions of trustees and share their problems with locality trustees.

4.2.2. Jobs related to Bāghestān

Seasonal workers: Some of these workers come from Qazvin or other near provinces in different seasons. In many cases, these people, although they worked in this field for a season, have been the mainstay of certain gardens.

Grafters: Usually people with experience and good hand in grafting and people with taste in choosing fruits do this job and somehow believe in the sanctity of this work.

Basket weavers: Some families in Qazvin have been known by this name and this family name still exists in the city. They picked rose bushes and gathered the Qaraqach branch, and in the house, they wove a wooden basket to carry fruit and even more from the same stems.

Palan Dozan: Until about 50 years ago, donkeys were used to transport fruits and processing products, and the Palan Dozan class was responsible for sewing Palan.

Na'lbandan (Shoemakers): Due to the high use of mules and donkeys in horticultural affairs, the shoemakers' class has also flourished in order to exchange horseshoes.

Mashsharkesh: There were people who were invited to cut thick branches.

Arresazha *(Sawmakers):* Saws are one of the most basic tools used in gardens and their constant construction and sharpening has been one of the most important needs of gardeners.

With the change of social and economic conditions and the change of relations between Bāghestān and the city, some of these jobs, such as "Dakhûs", "basket weaver", and "Na'lband", become rare or have disappeared.

4.3. Indigenous knowledge of water division

Because the city of Qazvin is located in a semi-arid region, the predecessors have tried with their experimental knowledge to turn the threat of floodwater to some great opportunities. Bāghestān is irrigated from five seasonal rivers. "Bāzār", "Aranjak" (also named "Bārājin"), Zoyār, Vashteh and Dalichây are their historical names that are still called by them today. One of the cultural elements derived from this irrigation system is the water distribution petition. In this water distribution loom system, a "water scroll" is set for Bāghestān where each locality has an internal scroll (Figure 45). The scroll, which is now respected and observed in Bāghestān, was signed by "Hamdollah Mostofi" a famous fourteenth-century historian. Irrigation of more than 3,000 hectares of gardens from seasonal rivers in a period of approximately 150 days in the form of flooding is complex and precise and continues to exist after ten centuries. A system in which to prevent wastage of time and water, the gardens are irrigated in a row and on a rotating basis, and after the garden is filled, water is spilled into the adjacent garden and irrigated in the same way until the end of the fund. In this method, water does not return to the atmosphere to be transferred to the next garden. This is done to avoid wasting time and water. This engineering method is one of the wonders of the native Bāghestān irrigation system. Indigenous

knowledge of Bāghestān water distribution has been registered in the list of national cultural heritage.

Before the turn of irrigation, every gardener is obliged to prepare for water and irrigation. Preparation includes creating an earthen dam in front of the opening of

Figure 45: A piece from historical water scroll of Bāghestān

each garden and blocking the openings of other gardens and streams so that water can enter the desired stream without passing through a certain path. This Irrigation method and related customs have been accepted and observes by all garden owners and is supervised by trustees.

4.4. Formation of different kinds of participation:

4.4.1. Chāhkhāne

As we have explained in section III, the Chāhkhāne (Figure 46) are the most important buildings in the garden that are shared between gardeners of a locality. The interesting point about the Chāhkhāne is that due to the trust that people had in each other, the Chāhkhānes did not have a frame and a door. The land of the Chāhkhāne was usually allocated by the builder as a good deed for this purpose. In many cases, the ownership of the Chāhkhāne belongs jointly to the locality gardens owners. In

many cases, one or more mulberry and elm trees were planted around Chāhkhāne for public use. Old mulberry trees can now be seen next to the Chāhkhānes.

Figure 46: Chāhkhāne photo by Reida Mirhoseini

In fact, Chāhkhāne was the residence of gardeners and other people who worked together in this field, i.e. a place based on participation and empathy and a place to rest, warm up on cold nights and drink tea and prepare for irrigation operations. Joint operations such as maintaining the security of large gardens, various gardening operations, converting or drying some products and helping each other; It would not have been possible without Chāhkhāne, and then Chāhkhāne operated as a partnership house.

4.4.2. Establish security and deal with natural and human hazards

Since Bāghestān gardens do not have fenced, they have always been attacked by some people. It has been possible to eliminate the problems created by them only with the participation of all the residents of Bāghestān neighbourhoods. Natural hazards such as floods and inundations and the opening of ditches and waterways to prevent water flooding or freezing of trees by lighting fires in all neighbourhoods are other manifestations of participation in the garden. All activists in this field have believed and continue to believe that helping, cooperating with each other is the basis of sustainability, and that no garden can be built alone without the help of others.

4.4.2. Garden, collective work, family and division of labour (traditional gardens in celebration)

During maintenance and harvesting, gardeners who have followed the participatory system come to the rescue. Collective work is one of the factors for the stability of

Bāghestān. The families involved in Bāghestān activists, especially the owners, have been working as a family, and the children and women have been working on peeling almonds and pistachios, drying alfalfa, raisins and other products, making Abghoureh, Gardeghoureh, vinegar. They participated in the preparation of pickles and other products. In many cases, the women of the neighbourhood and the family helped each other in various ways and prevented the wastage of products and their spoilage.

4.4.3. Resolving problems and lawsuits

Challenges and disputes are possible in any shared environment. In Bāghestān, when disputes arise, elders and trustees act as judges. They solve problems and disputes based on their lived experiences and indigenous knowledge and prevent the loss of individual rights in the best way. In fact, the unwritten customary laws that have been passed down from hand to hand and the trust in the elders have been a comprehensive and reliable refuge to bring peace to Bāghestān.

4.4.4. Presence of non-governmental organizations in education, promotion and participation

In recent decades, due to the development of the city on the one hand, and the change in lifestyle (following the Industrial Revolution) on the other hand, Bāghestān of Qazvin has suffered some damages. In recent years, NGOs have been working to support the garden. Launched in 2014, Bāghestān specialized association of "ASCL (Association for Saving the City's Life)" is the first NGO to support Bāghestān. The "Green Garden Movement" is another association that has focused its specialized activities on supporting Bāghestān for the past three years.

Non-governmental organizations operate in three main areas:

- Understanding Bāghestān
- Introducing Bāghestān
- Prevent the destruction of Bāghestān

Here are some examples of activities carried out by NGOs:

- Introducing Bāghestān and its irreplaceable values, to the people of the city, especially the youth and teenagers (Figure 47).

Figure 47: Promotional programs by grassroots organizations; photos by ASCL NGO

- Trying to create a sense of belonging in the people of the city, especially children and adolescents (Figure 48).

Figure 48: The presence of children in Bāghestān and creating a sense of belonging; ASCL NGO

- Knowledge of Bāghestān through scientific and field studies.
- Publish articles and tips for a number of senior theses related to Bāghestān.

- Holding local, national and international conferences (Figure 49 and Figure 50).

Figure 49: Workshop on relationship between agriculture and the environment; in cooperation with IKIU Qazvin University and the Land Affairs Organization of Iran; ASCL NGO

Figure 50: "Bāghestān and Water Management" workshop; in collaboration with IKIU university and in the program of the International Conference "Water,the Source of Life"; ASCL.IR ASCL NGO

- Serious and continuous demand from the city and national managers, and also cooperate with them, to preserve the garden, support gardeners and gardens owners, and prevent the destruction of Bāghestān.

Figure 51: Human chain to support Bāghestān; ASCL NGO

Figure 52: Introducing of Bāghestān in the celebration of World Soil Day 2017 in the presence of Minister of Agriculture and the head of the Environment Organization; ASCL NGO

Figure 53: Family programs for deep familiarity of citizens with Bāghestān; ASCL.IR

- In 2017, the "Association for Saving the City's Life" (ASCL) received the

national award for the best soil servants from the Minister of Agriculture (Figure 52).

- One other important and prominent examples of the activities of non-governmental organizations has been the presence and submitting an oral report to the Supreme Council of Urban Planning and Architecture in 2018 by ASCL association.

  The development plan of Qazvin city was changed in favour of Bāghestān due to the demand of the non-governmental association ASCL, and with the support of other associations such as " Bāghestān Green Movement" and with the general support of the people of Qazvin.

4.5. The legend of Siākolā

Social trust has been one of the most fundamental factors that has contributed to the sustainability of Bāghestān. The compassion of the trustees of Bāghestān and their justice-oriented view, as well as the trust of gardeners and garden owners in them, has led to cohesion and empathy among garden activists throughout history. One of the people that gardeners still remember well and has become a legend is Siākolā. Siākolā was one of the trustees and elders of Bāghestān, who is said to have been the center of justice and to follow the problems and challenges that occurred in Bāghestān. There is a story among gardeners: "Siākolā severely punishes his son because of injustice about a gardener. In order to serve his teacher, Siākolā's son tramples the water of one of the gardens and directs the water to his teacher's garden. When Siākolā becomes aware of this, he puts her to sleep in a stream of water instead of a dam, and changes the course of the water to irrigate the garden of the oppressed person." Social trust and respect for each other's rights are so ingrained among the gardeners that even today, if it is the garden's water turn and the garden owner is not present, his right will not be lost and his garden will be irrigated.

4.6. The relationship between citizens and customs and traditions related to the garden

Undoubtedly, cultural studies have shown that numbers in different cultures have symbolic values that are rooted in people's beliefs. The importance of this issue becomes more apparent when we know that some of these numbers are chosen based on tact and logic that are rooted in social capital. As a result, these symbolic numbers become the source of the formation of customs that keep alive the social cohesion, participation and social trust. One of these ceremonies in Qazvin is the "Panjāh Bedar" ceremony, which is held on the fiftieth day of the year (Figure 54 to Figure 56). The Iranian year begins with the beginning of spring: Nowruz. The Panjāh Bedar ritual is held fifty days after Nowruz and on a long-standing official basis every year. But what has

been going on in these 50 days? The response is the “irrigation”. This day is the end of the irrigation period in the water scroll.

The permanence of communities always shows that social life requires memories and intersubjective sharing in order to achieve cohesion and unity, and at the same time to create a platform for participation, companionship and collective empathy. Panjāh Bedar is one of these cases, which, while providing a meeting place for families, relatives and citizens in general, provides the basis for expressing the problems, dangers and suggestions of garden activists. On the day of Panjāh Bedar, common rituals such as praying for rain in dry years and prayers for thanksgiving in rainy years are performed collectively. In In this

Figure 54: Panjāh Bedar, Bāghestān; photo by Hosein Mirkamali

ceremony, foods and sweets are used that are prepared from Bāghestān products. The lost well-known are “Doimāj” and “Gheymeh Nisār” and also Bāklavā as a sweet.

4.7. Distinction between Bāghestān and other Iranian gardens

Unlike other types of Iranian gardens that have always belonged to wealthy families or rulers, Bāghestān have owners of different strata and are not limited to the wealthy of the city. Also, in Bāghestān some garden owners are women. In the past, the gardens of Bāghestān was so valuable and prestigious that it could be a gift from the groom's family to the bride. Therefore, among the owners of the gardens of Bāghestān, some women who either bought or

Figure 55: Panjāh Bedar; Bāghestān; photo by Hosein Mirkamali

received some gardens as a gift or inherited. Another notable difference between Bāghestān and Iranian garden is its area. Bāghestān covers an area about 3000 hectares while famous gardens such as Finn Garden, Prince Garden and other Iranian gardens are much smaller. Qazvin Garden is exactly the garden of the people, that is, it was not created by rulers, princes and special people from the rich and powerful classes, but these ordinary people are the owners of the components of this integrated complex.

Another point is that Bāghestān was not created for the purpose of entertainment, fun or purely economic or political purposes. In addition to the role of aquifer management and flood management, Bāghestān has been providing livelihoods of all classes of society. Bāghestān with mixed and non-row cultivation and high-yielding fruit trees, lacks luxurious buildings such as Kashan Fin Garden or Eram Shiraz, etc. On the contrary, with the least and simplest possible form, it has some common places called Chāhkhāne which we introduced in the section III. Bāghestān irrigation method is unique and wonderful so that its trees do not need irrigation in summer.

Figure 56: Baking traditional food in Panjāh Bedar; photo by Hosein Miskamali

This irrigation system is described in previous sections. In term of physical structure, Bāghestān does not have a regular shape and it is not designed for straight streets and corridors. Rather, we are witnessing a kind of turbulent and diverse disorder in accordance with the flow of water and the continuation of streams. Another noteworthy point is that workers and garden owners do not live in Bāghestān. Due to the close relationship between the city and Bāghestān, the place of residence and accommodation of the owners and

workers of the garden has been in different neighbourhoods of the city. “Chāhkhānes”, as the only Bāghestān buildings, were common places for gardeners to stay when needed, such as irrigation, harvesting, and so on. In the Iranian garden, we see different water features or fountains or decorative ponds, but such elements are not observed in the traditional Qazvin garden, Bāghestān. Soil type, plant species, function and purpose of establishment, has made Bāghestān needless to have such elements. It is very interesting that with the historical changes and change of governments, the main structure of the traditional garden of Qazvin has remained the same. Only in the last century has it been exposed to some interventions and changes in the sub-aspects and not the main text and appearance.

4.8. Traditional foods and sweets, processed products and snacks derived from garden products

The fruits and nuts are part of the main source of livelihood support in this region. The locals have developed the catering culture of pistachio and grapes to the great extent. Foods made of pistachios include Bāklavā, a traditional sweet (Figure 57, Figure 58), Gheymeh Nisār, an old rice recipe (Figure 59), chopped nuts pieces and pistachio powder for cake decoration, pistachio rice, pistachio jam, pistachio honey and roasted pistachio with different flavours.

Figure 57: procedure of making Bāklavā

Figure 58: Bāklavā Pich; ingredients: almond, pistachio, sugar, cardamom; photos by unknown artists

Multiple valuable products may be obtained from grapes each containing important and valuable nutrients. Various products may be produced by grapes such as grape juice, varieties of raisins, concentrated grape juice (Shireh), pickled grape, varieties of vinegar and varieties of pudding such as Halvā, which are usually served, in combination with walnut and pistachio for breakfast. Raisin and walnut, when served together in small bags constitute healthy snacks.

Figure 59: Gheymeh Nisār: Qazvin traditional food; photo by unknown artist

Dolme is similar to Greek dishes made with vine leaves, stuffed with a delicious herby rice mix, shaped into little rolls and boiled until wonderfully tender (Figure 61).

Figure 60: Homemade Bāklavā; photo by unknown artist

In the old time, farmers used to keep the concentrated grape juice (Shireh), Figure 62, in a jug in cool place, normally in the basements in their houses for the whole year and included it in their food; they believed that this grape juice is full of energy, and has similar benefits to that of mother milk. There are substantial evidences that people's food preferences and practices – what might be called food cultural beliefs – could affect their cuisine (Logue, 2013). Farmers in Qazvin believed that this soft concentrated grape juice could keep them spiritually refreshed, and improved their physical performance and work efficiency.

Figure 61: Dolme; photo by unknown artist

Figure 62: Shire (concentrated grape juice; photo by unknown artist

5. Landscapes and Seascapes Features

5.1. The role of gardens in shaping the landscape

The agricultural landscape in the Qazvin garden is the result of complex systems and interrelated activities that have been formed in the ground over time. The result of this entanglement has been the creation of an interconnected zone called the traditional garden of Qazvin: Bāghestān. Farmers in these areas have continued to work and live to this day with the proper use of local resources and institutions within the ecological constraints of their region. In such systems, ecological, social and agricultural sustainability are strongly interdependent. These elements in Bāghestān include plots, small lands with a variety of crops and non-geometric and organic planting system, irrigation system, structures and methods of water transfer, interactions, etc.

5.2. The evolution time line of Bāghestān and the city

According to the available documents, the exact time for the formation of these gardens is not clear. The reason is that these areas are constantly evolving like an ecosystem and have been expanding both internally and horizontally over time as the city progresses. However, according to the documents and observations mentioned in historical texts and travelogues, the closest estimated time for the formation of Bāghestān is 1100 years ago. Figure 63 shows these documents in the form of a garden evolution timeline (Ahmadi, 2019).

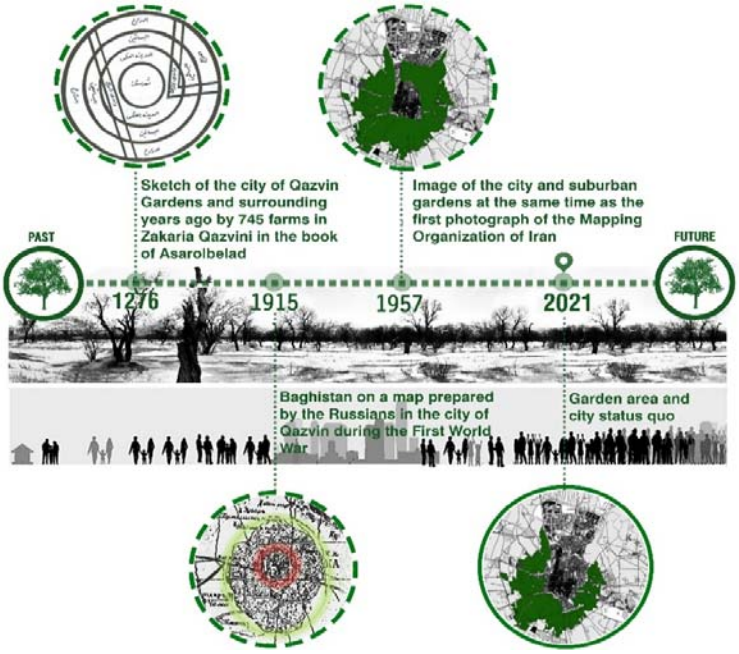


Figure 63: The time line of Bāghestān and the city; by Hamed Ahmadi

5.3. Bāghestān as a cohesive whole from upstream to downstream

Qazvin gardens, Bāghestān, as a cohesive whole and influenced by an ecosystem, operates on a larger scale than its physical dimensions. When we study the garden of Qazvin from upstream to downstream, in the large-scale longitudinal profile, we see the following sections, which are shown in Figure 64.

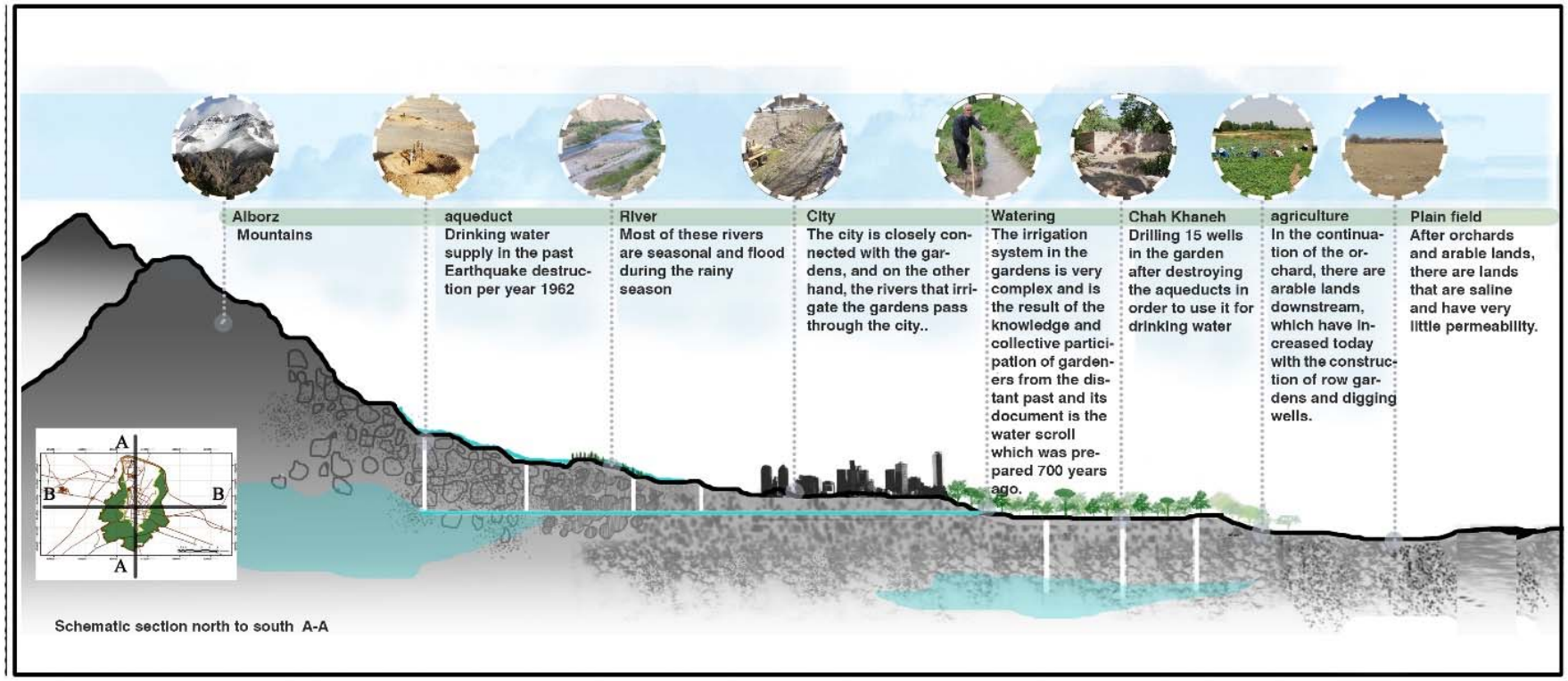


Figure 64: Bāghestān as a cohesive whole from upstream to downstream; by Hamed Ahmadi

Heights's → city → garden → plain

These sections are connected to each other through living and dynamic factors such as river, aqueduct, trees, wind, human factors, agriculture, etc. and they make this cohesive whole: Bāghestān.

5.4. Canopy layers of the dominant garden trees

Vegetation in Bāghestān, in addition to species diversity, has a very high genetic diversity. Figure 65 shows the canopy layers of the dominant species in the garden and the height of their mature trees.

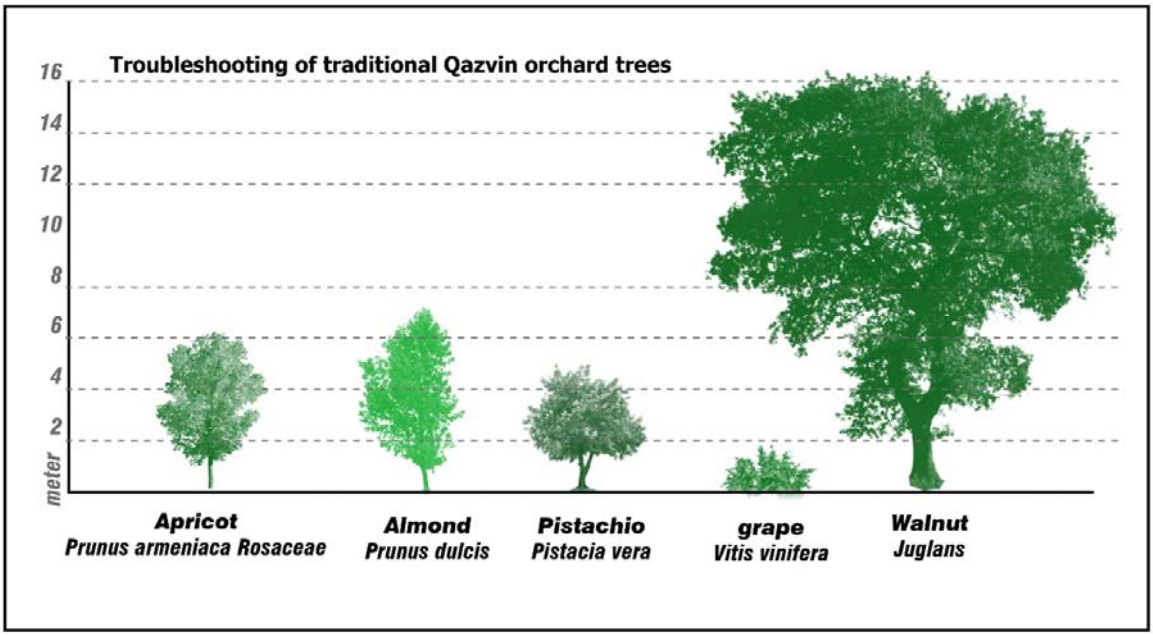


Figure 65: Canopy layers of the dominant garden trees; By Hamed Ahmadi

5.5. Water cycle in the garden

Figure 66 shows the water cycle system in the garden schematically. As it is known, according to Bāghestān irrigation system, which is based on flood irrigation, the incoming water is supplied by seasonal rivers. After entering Bāghestān, water covers the plots of each garden and fills the ponds, and then penetrates to the depths of the earth due to the permeability rate of each garden. Then, the roots go to the depths of the earth to find water, and in this way, even in low rainy seasons, the trees show more resilience than the trees in industrial gardens. In principle, this system can

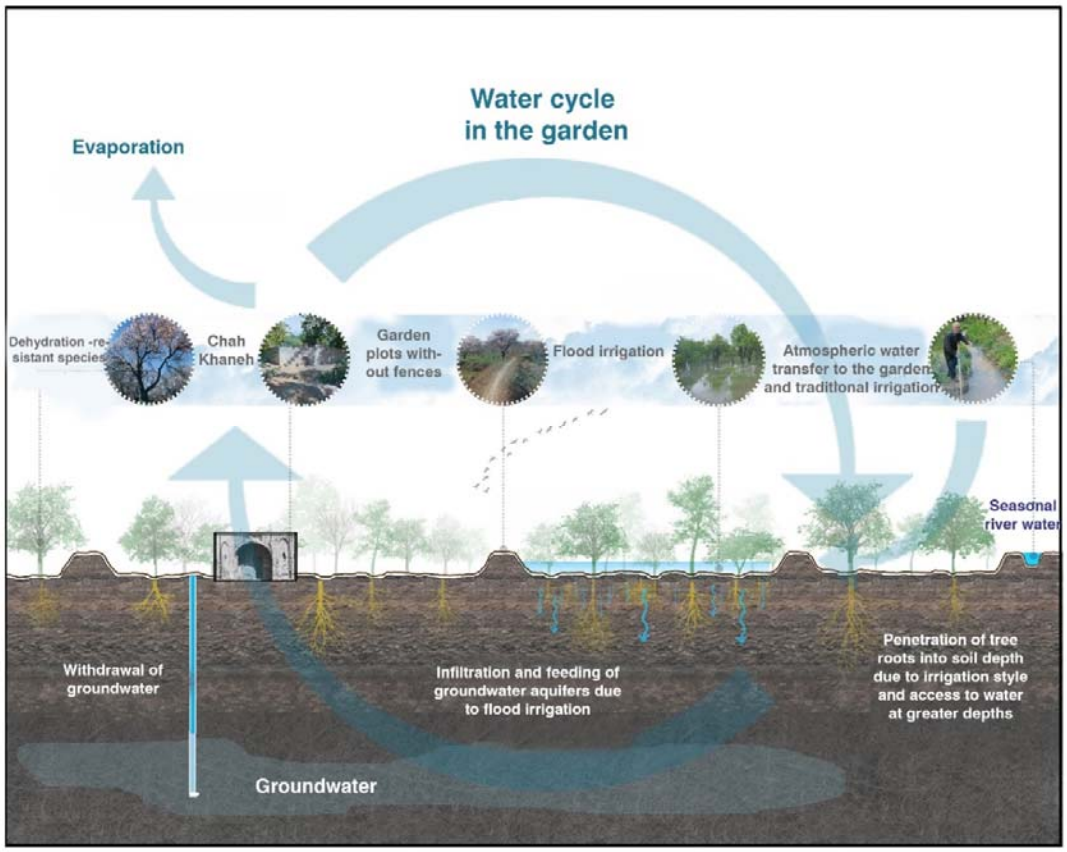


Figure 66: Water cycle in Bāghestān; by Hamed Ahmadi

be mentioned in such a way that due to the climate of this region, water in this irrigation system is stored in deeper layers of soil to evaporate less. This system was not formed all at once and has been the result of the knowledge and experience of gardeners for many times.

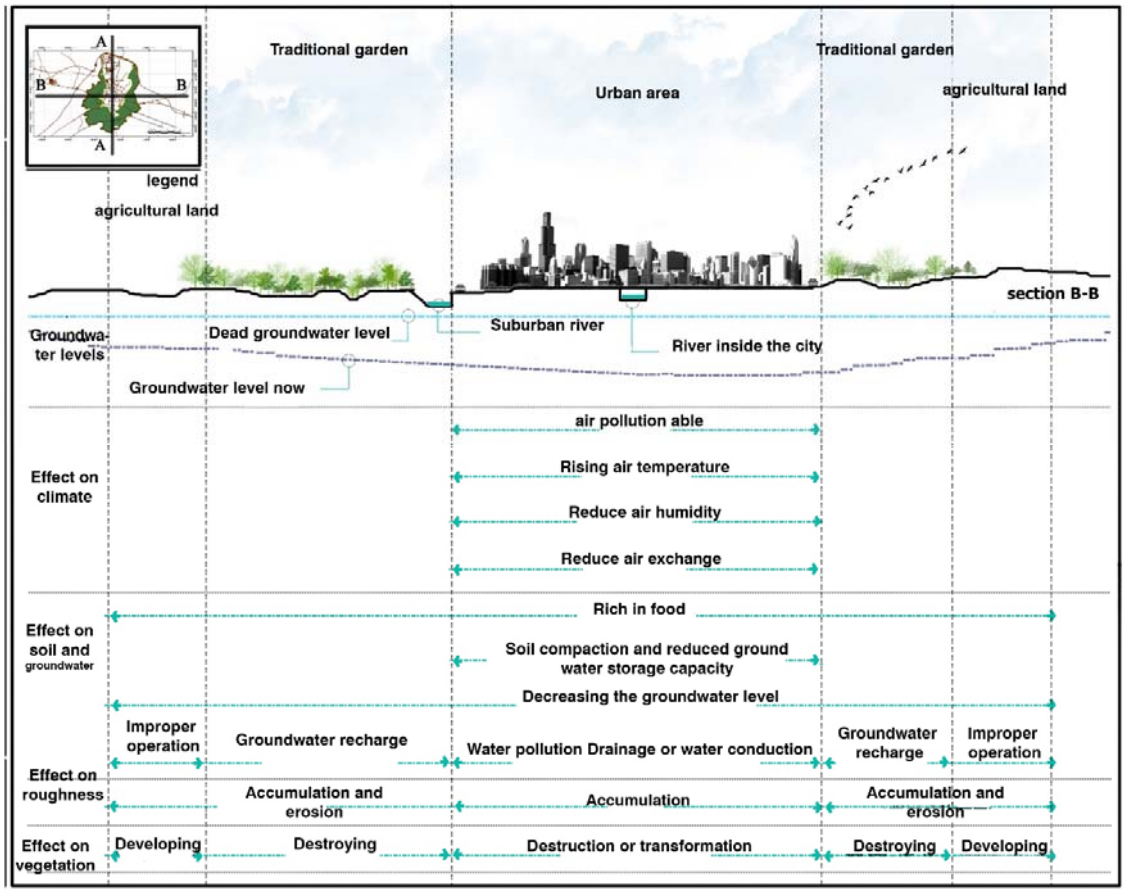


Figure 67: The ecosystem services of Bāghestān to the city and the interactions between them; by Hamed Ahmadi

5.6. Ecosystem services of Bāghestān to the city and the interactions between them

The ecosystem services provided by Bāghestān for the city of Qazvin can be measured with different metrics and these services can be found in different layers of the earth. Figure 67 shows these services from the ground layers to the ground level and above. In the lowest layer, underground, Bāghestān increases the groundwater level. Bāghestān on the ground provide food and transfer energy to the city. In the upper layer, the garden improves the air temperature and softens the air of the city and it also prevents the transfer of dust from outside the city to inside.

V. ACTION PLAN FOR THE PROPOSED GIAHS SITE

1. Goals

Main goals the action plan could be included as identify indigenous knowledge of flood spreading (flood irrigation) as well as trying to update this ancient skill and experience, increasing the employment rate and income of the farmers, maintaining the biodiversity and ecosystem services, developing Agro-tourism, and promoting the development of eco-civilization, socialist new tourism industry, and sustainable agriculture.

1.1. Increasing employment and income

The traditional gardens are potential backbone industry of the organic dried fruits and nuts in the Province, and are influential for the poverty alleviation of the town. At present, the tree cultivation area has been reduced to 2870 hectares. Once surrounding the north and west part of the city the traditional gardens have endured some severe degradations since over 25 years ago.

People have set up businesses to sell their fresh and dried fruit products on a wider scale market including springing up stalls along the main roads, sending them for further processing and wholesaling and retail sale. The products include organic dried apricot, different types of raisins, grape drink, different types of vinegar, grape paste, pickled grape, dried nuts, pistachio-skin jam, and Bāklavā. The internal market for these traditional products has become more demanding.

The presence of a lively green belt surrounding the city of Qazvin has made it of high interest to those coming from neighbourhood cities. They will have the pleasure of visiting green gardens while trading high quality products. The city centre of Qazvin is in vicinity to Bāghestān, which make it a less polluted downtown.

1.2. Research priorities for Bāghestān

Indigenous knowledge of flood spreading in the traditional garden of Qazvin, by reducing flood damage by storing water and feeding groundwater aquifers, on the other hand, guarantees the life of the downstream lands and plains of the fertile plain of Qazvin.

1.3. Developing Agro-tourism

Agro-tourism presents various functions of agricultural production, environmental protection and leisure tourism. It has promoted the development of local agricultural economy as well as the increase of farmers' income, which has gained wide attention of the citizens of Qazvin. The trees' economic benefits lie not only on harvesting and selling of fruits in a market, but also in opening the space to tourists. Their unique landscape feature and aesthetic values are important components of multi-functional agriculture. The trees are in different size and age, from very old to the very young ones standing next to each other. Their circular crowns, trunks, flowers, fruits and leaves present high ornamental value. They are always an astonishing view, whether planted alone or in groups. The gardens take on different looks, as their colour, fragrance, and shape change with seasons.

In spring, flowers of apricot and almond trees fill the gardens with fragrance, and colourful butterflies can be seen everywhere (Figure 68). In the summer, the plants provide shading for people working or visiting the gardens. In the autumn, a superior scene can be seen where fruits hang on the trees which are coloured with leaves of different shades. Moreover, the sound of cricket and birds attracts everyone's attention thought the gardens. Meanwhile, the interpolating of trees with crops also presents a wonderful view. In this scenario, one can appreciate the beauty of the trees and the simple lifestyle of the tree dominant green areas inside or in vicinity of the city. This is a wonderful service for urban residents, who suffer from polluted environment and trapped in the concrete buildings in the town centre.

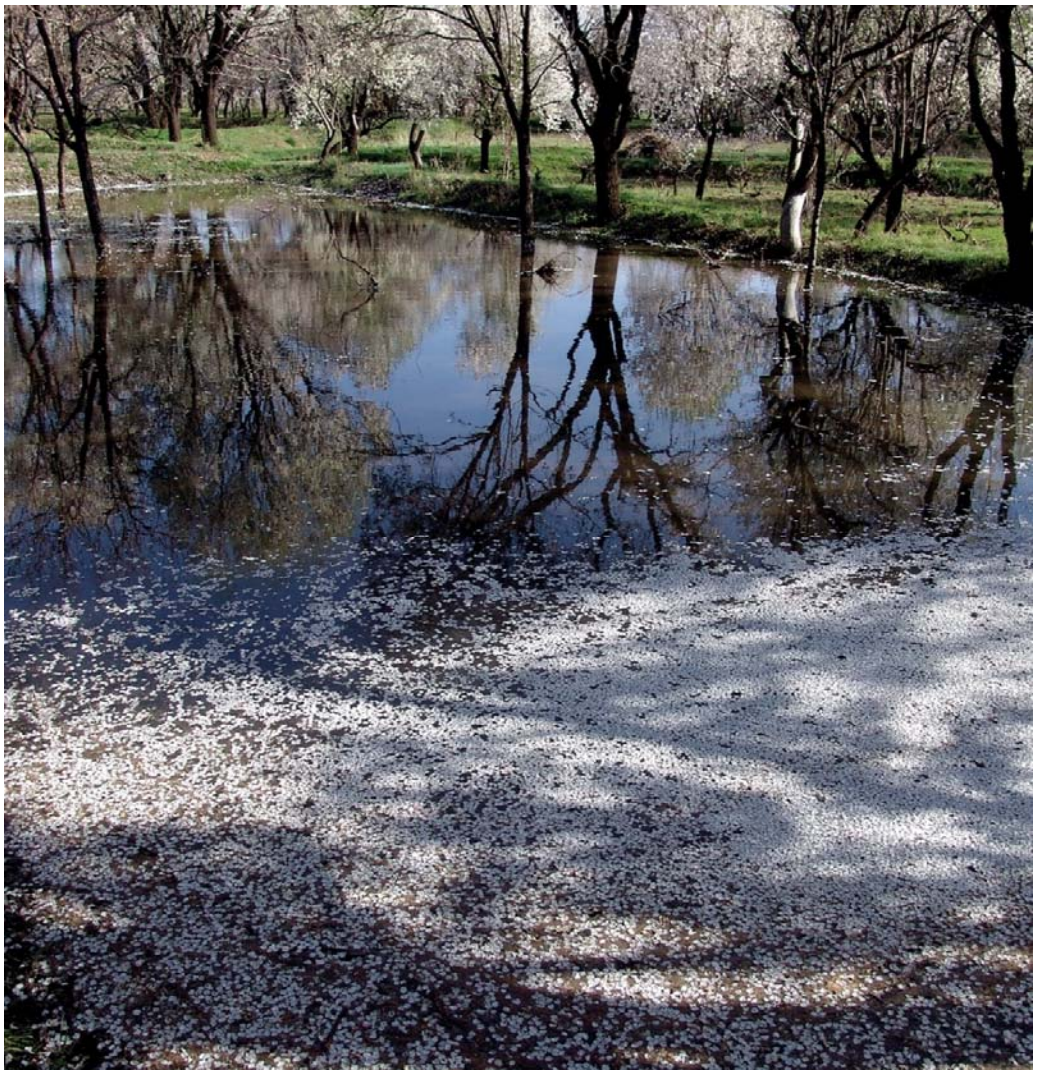


Figure 68: Bāghestān in spring is full of these wonderful views; photo by MohammadAli Hazrati

Therefore, people's desire to be close to the nature provides an opportunity for the gardens to develop into tourist sites. The fruit gardens, with its grand ancient trees, and rich culture background, can promote leisure tourism and enhance economic development.

1.4. Promoting sustainable regional development

The city is a human dominated ecosystem, in which people interact with other humans and with other species as well as their built and natural environment. The ecosystem services we receive from nature are many including resource services, regulatory services, support services and cultural services. There have been a number of projects attempting to enhance the ecosystem services to modern cities. However, this could be achieved more effectively in the case of traditional cities, particularly when they demonstrate substantial potential for it.

1.5. Establishing Qazvin as the prime organic dried fruit producer and nuts

Iran is the leading the pistachio producer and exporter in the world. The production volume of in-shell basis pistachios in Iran amounted to approximately 551,307 metric tons in 2018 (https://www.statista.com/statistics/968417/production-of-pistachios-in-iran/). As the Table 17 shows Iran was leader for exporting pistachio in 2018.

Table 17: The largest pistachio producers in the world. Source: UN Food and Agriculture Organization, Corporate Statistical Database (FAOSTAT). .

Pistachio production, 2018	
Country	**Production** (tonnes)
Iran	551,307
United States	447,700
Turkey	240,000
China	74,828
Syria	43,299
World	**1,390,269**

In 2017 and 2018 the global production of pistachios worldwide amounted to 586.2 thousand metric tons. Although pistachios originate from Central Asia, the United States produced 47 percent of the world's pistachios, more than any other country. However, the country with the largest harvested area of pistachios worldwide in 2017 was Iran, with over 429 thousand hectares of pistachio trees. The gross production value of pistachios worldwide amounted to about 5.5 billion U.S. dollars in 2016. Qazvin, with its pistachio with completely green kernels is one of the most prominent organic pistachio producers in the world (Figure 69).

Figure 69: Pistachio with completely green kernels of Bāghestān; photo by unknown artist

1.6. Increasing the income of farmers by making brand for their products

Iran's pistachio has been exported over 100 years and has secured a foothold in the world market. It is the king of nuts. Iran, which has been a pistachio producer since the fifth century, managed to regain the position of top producer in 2013 for the first time since 2008.

The income of the traditional gardeners will increase when nuts and grapes organic products are branded.

The fact that people are hardly informed about the quality of dried fruits and nuts because there has been no advisory centre to associating on to, which in turn causes variations in the product quality. Some merchants often sell inferior goods as superior ones, thus impeding consumer confidence. Fourthly, there is no large-scale, high-profile festival or trade fair of gardens production, especially for pistachio products. In addition, backward infrastructure in the production area for transportation hampered the production and sales, thus restraining the development of traditional gardens. These factors have restrained the benefits of Qazvin traditional gardens from being realized. They are all parts of planning, organization, and deliberate actions for building a brand. Once having a world-class brand, which is of great potential benefit, farmers would be able to build trust and can make it easier to sell their product to the potential clients. Having intimate contact with Iran Organic Association and IFOAM-IRAN the traditional gardens system, by the time it becomes a GIAHS will be able to be one of the most important *brands for organic products* in Iran.

1.7. Maintaining the biodiversity and eco functions of the system

Bāghestān not only represents the major part of livelihood provisions for local farmers, but also enhances the environmental protection, biodiversity and ecological balance in the area. For example, trees can conserve soil and water and bring about protection against erosion. They also outline a characteristic ecosystem, providing natural habitats for many plant species and animals. The System is, therefore essential

to have a sustainable environment by maintaining ecological balance and biodiversity.

2. SWOT Analysis for the Proposed GIAHS Site

This section has organized in two subsections. First, in 2-1, we explain the important features, which affect the garden as strengths, weaknesses, opportunities and threats. Then in 2-2, we introduce a brief and comprehensive analysis of these features, classified in five headings.

2.1. Important features

2.1.1. Land use changing in Bāghestān

With the advancement of urbanization and industrialization, urban land uses replaced agricultural activities and hence some large areas of traditional gardens have been occupied and decreased from the late 1950s to the early 21st century. In 1951, the materials used for the construction of intercity roads and railways (Rasht, Hamedan and Tehran) were supplied from some areas located in the gardens. Other industrial estate infrastructures such as those of oil company's storages, the flour producing factory site development, and the grain crop storages were the first whose activities led to the destruction of the garden. After 1951, more land uses and urban services were demanded as a result of urbanization, and resulted in further destruction of the gardens.

Figure 70: Unsustainable urban city development threatens traditional gardens in the age of the city

In case of destruction and change of use of gardens, due to the decrease of groundwater level, unfortunately, the landslides in Qazvin plain, as neighbouring provinces such as Hamedan and Tehran will be predictable.

Economical changes began in 1951, when the country's industrial development plan was on the move in the 1950s, and Qazvin was named as holding one of the industrial estate sites in the country. Therefore, much of the government fund was allocated to the construction industry and the commerce and trade industry. The truth is that urban agriculture has experienced a revival in recent years. At the same time, the Province fundraising activities for the management of the garden was stopped. The authorities' lack of concern, from one hand and the sabotage of a group of garden owners, from another gave rise to the alliance failure between enthusiastic gardeners and the garden owners. The removal of trees has resulted in damage to habitat, biodiversity loss and aridity. It has adverse impacts on bio sequestration of atmospheric carbon dioxide. In recent years, new policies and regulations have been

established to encourage the central government to preserve biodiversity conservation and sustainable use of traditional gardens.

2.1.2. Lacking in-depth research and development of unique species of trees

Despite the significance of in-depth research on the unique species of trees in Bāghestān some initiative projects have emerged only recently. Apricot, almond, pistachio, walnut and grape trees are local in the gardens, some of which are currently on the verge of extinction. The fact that trees are watered twice a year, making them unique species to the habitat of gardens, demands an extensive research, particularly on the specific cultivar groups of grapes and the associated local varieties. Except vines, the rest of the trees are growing by themselves in a mixed pattern. In-depth research on the development of unique species of trees that are habituated to the shortage of water in warm summer climate are needed to move toward achieving best practices in the protection of the eco-environment.

2.1.3. Lacking adequate supervision to establish quality organic products brand

Gardens' production has been used to take up sizable market shares with its low price. But the enterprise had hit a bottleneck, and saw its market share shrink. There might be several causes involved; firstly, people have become more concerned about the quality of dried fruits and nuts and the associated brands. The fact that gardens' organic production was labelled as low-end product works against the industry. Secondly, traditional methods of fruit processing are relatively costly and less efficient. Thirdly, lack of a supervising industrial association, which in turn causes variations in the product quality. Some merchants often sell inferior goods as superior ones, thus impeding consumer confidence. Fourthly, there is no large-scale, high-profile festival or trade fair of gardens production, especially for pistachio products. In addition, backward infrastructure in the production area for transportation hampered the production and sales, thus restraining the development of traditional gardens. These factors have restrained the benefits of Qazvin traditional gardens from being realized. They are all parts of planning, organization, and deliberate actions for building a brand. Once having a world-class brand, which is of great potential benefit,

farmers would be able to build trust and can make it easier to sell their product to the potential clients. There may be a need for a framework to be used for developing synergies between organic production and marketing.

2.1.4. Economic gain Threats

Modern agriculture, driven by economic gain, has continuously impacted traditional agricultural practices. An example of this is the short-term economic gains brought about by replacing old trees with new varieties. Nevertheless it would destroy the precious germplasm resources, which is thought to exist in the Qazvin traditional gardens. Of course, when the short-term economic benefits are undermined, the ecological, historic and cultural values of the ancient gardens will be damaged.

The Qazvin Province has been serious about promoting the development of eco-agriculture and organic fruit production base. However, the organic development is mired in difficulties. The production quality of organic fruits and nuts, for which no chemical fertilizer or pesticide are allowed has dropped by a large margin, which has brought down the economic return significantly. Thus, there has been a decline in the interest of farmers in growing organic fruit and nuts. However, organic fertilizers with less environmental impact could alternatively compensate for this, if used with care and control measures.

2.1.5. Increasing demand for gardens organic fruits and nuts

At present, organic green fruits and nuts are the best-selling variety of their kinds in Iran. This particularly suits Qazvin homemakers, who are keen to use it as a rich taste for making Bāklavā. With increasing public awareness about the dangers of genetically modified crops and chemical fertilizers and pesticides, organic products, including fruits and nuts, have gained a better place in the consumer basket. However, local producers need marketing assistance to continue producing organic products.

National and international assistance to introduce healthy and organic products of Bāghestān on the one hand, and the addition of local knowledge and new

technologies of organic production, including organic fertilizers and organic pesticides, on the other hand, will encourage gardeners to continue producing organic products.

2.1.6. Rich germplasm resources in Bāghestān

There are many pistachio, grape and almond genotypes in Bāghestān which are local in the region. These varieties constitute an important germplasm resources bank for future breeding programs of these plants.

2.1.7. Agricultural, ecological and social impacts

Once joining the GIAHS family, traditional gardens and the landscape ecology will receive more attention to stay green. They will be offered more opportunities for cultural heritage tourism development. It is expected to develop and expand urban agriculture reflecting varying levels of economic and social development and exert multiple social and ecological impacts. Therefore, becoming a GIAHS will encourage the people to value, protect and pass on the agricultural heritage.

The traditional gardens are the agricultural heritage of the Qazvin Province and provide advance philosophy for modern agriculture, because it includes rich production experience, traditional technology, and thoughts of harmonious development between mankind and the nature. Joining GIAHS farmers will have better understanding on indigenous knowledge and management, and will use them in handling challenges nowadays organic agriculture in Iran is confronting. In this way, traditional culture inheritance and innovation are combined to make the urban agriculture system in Qazvin Province more comprehensive, coordinated and sustainable.

2.1.8. Bāghestān, acting as the school of nature for urban kids

The traditional gardens are located in a very short distance from the city of Qazvin. If a safe pedestrian path is constructed to access some gardens, it will be a good opportunity for local kids to visit them as a nature school. There are a number of non-profit organizations who are dedicated to inspiring life-long connections to

land. They will be able to use traditional gardens and run several nature education programs for all age. It is also a potential site for nature tourists. These prospects would help the economy of farmers encouraging them to keep it green.

2.1.9. Potentials and Opportunities for Sustainability and Management of GIAHS

Green pistachio combines the natural colour of pistachio, and the rich refreshing taste of the nut. It is popular in Iran, especially in Qazvin, where people use it in different dishes and sweets, especially Bāklavā. It not only has great market potential in Iran, but is also gaining reputation in foreign markets.

2.2. SWOT analysis

A brief and comprehensive analysis of strength, weakness, opportunities and threat points of Qazvin traditional gardens, Bāghestān, are classified in five headings, including flood irrigation system, ownership and management, production and economy, agro-biodiversity, landscape and tourism which are presented in Table 18 to Table 22.

2.2.1. Flooding irrigation system

Table 18: SWOT table for Flooding irrigation system

Strengths	Weaknesses
1.1. The existing irrigation system, based on pond structure of gardens and feeding aquifers has been able to support the productive gardens of QB and the fertile plain of Qazvin, as well as ecological services of QB[9] 1.2. The flow of seasonal rivers despite the arid and semi-arid climate of the region 1.3. Very accurate irrigation scrolls and strict adherence [10] of gardeners to the water scroll in many parts of the garden 1.4. Necessity of the plots in gardens for flood irrigation system 1.5. Only once or twice winter and spring irrigation through flood irrigation	**1.1.** Lack of sufficient knowledge about the infiltration rate of flood waters in groundwater aquifers **1.2.** Insufficient knowledge of river water supply and the effect of climate change and rainfall pattern change on irrigation system efficiency **1.3.** For the parts that later joined the garden, most of the blocks are not considered in water scroll **1.4.** Difficult and expensive of gardening operations due to the impossibility of using mechanized tools **1.5.** Need to irrigate in dry years and also need to irrigate young seedlings in summer
Opportunities	**Threats**
1.1. National legislations and laws to prevent the development of roads in QB **1.2.** High efficiency in water use **1.3.** The social structure of the garden can manage the allocation of water from the destroyed parts to the blocks in need of water **1.4.** Water absorption and artificial feeding of underground water tables **1.5.** Crop production with little water	**1.1. Development of urban and transit roads and changing the use of gardens[11] destroyed the water supply network** **1.2. Upstream water exploitation due to rural development and tourism development by encroaching on QB water right and destroying riverbeds** **1.3. Some canals were more and less overflew because of some improper valves of water distribution dams and the blockage of canals, especially in flood conditions** **1.4. Gardeners tend to plant in rows and densely for the use of modern gardening tools and machines** **1.5. The gardeners had to dig the deep wells in the garden to supply the water needs for young seedlings and the water of some of garden wells are used for urban and industrial purposes**

[9] Such as flood control, dust suppression, carbon sequestration and reduced temperature

[10] The latest version of which is seven hundred years old

[11] *i.e.* urban green space, greenhouses and abandonment of gardens due to urban development

2.2.2. Ownership and management

Table 19: SWOT table for ownership and management

Strengths	Weaknesses
2.1. The alignment of private property with the social, economic and environmental interests of the city **2.2.** The existence of various traditional methods of ownership based on precise customary rights **2.3.** Ownership of a large part of the QB by major owners **2.4.** The traditional, precise and stable system of QB participatory management according to its physical structure	2.1. Lack of sufficient mutual services from the city 2.2. Orality of customary rights 2.3. Less motivation of small plots' owners to maintain QB, due to less influence in management decisions 2.4. Absence of established mechanisms for the required interactions with new urban organizations
Opportunities	**Threats**
2.1. Protection and development of QB over many centuries by private owners (citizens of Qazvin) 2.2. The possibility of using some customary rights to revive the abandoned parts of QB 2.3. The possibility of survival of governance system in QB 2.4. Continuation and consolidation of "good urban governance" over "urban governance" based on the QB-city relationship	**2.1. Government ownership of affected sectors, which harms the principle of citizen participation** **2.2. Some of the traditional methods of ownership have lost their function because the physical development of the gardens almost stopped actually.** **2.3. Increased of small ownership of gardens due to the issue of inheritance** **2.4. The unplanned interference of new governmental urban organizations in the management system of QB**

2.2.3. Production and economy

Table 20: SWOT table for production and economy

Strengths	Weaknesses
3.1. Production of major strategic agricultural products in Qazvin QB: pistachios, almonds, various and varieties of grapes and other unique species including Gheysi **3.2.** **a.** Healthy or organic garden products due to very limited consumption of pesticides and chemical fertilizers **b.** Extensive use of qualified garden products in traditional and industrial confectionery and cooking in Qazvin, other cities and abroad. **c.** Local processed products such as grape juice, juice, vinegar, pickles **3.3.** Being located next to the city **3.4.** Indigenous knowledge of organic production in QB **3.5.** Flood irrigation from the rich water of seasonal rivers **3.6.** profitability and productivity	**3.1.** a. Loss of crop due to colds and loss of pests due to the presence of early flowering almond species, which usually suffer from frost in April b. Outbreak of pistachio psyllid in some years with drought stress or introducing some new varieties. **3.2.** a. Improper supply of QB products b. Limited use of natural- processed products in food industries **3.3.** Lack of balance between the urban land economy and production efficiency **3.4.** Cost and time-consumed of the production **3.5.** The fact that some Bolûk do not have a permanent share of water in the water scroll, (especially in dry years) **3.6.** Lack of sufficient data to reliably estimate the efficiency and productivity
Opportunities	**Threats**
3.1. Economic productivity 3.2. a. Value-added of organic garden products in markets b. Export and value-added of Qazvin pistachio and almond products. c. The possibility of use of local products by small or home industries 3.3. QB public benefits 3.4. Growing interest of people to organic products 3.5. The possibility of using the water of Taleghan dam and the possibility of using the water share of the localities that have been completely destroyed 3.6. Increasing the motivation of young people to work in Bāghestān	**3.1.** **a. Replacement of native species with non-compatible species and varieties and its consequences.** **b. Demand for more use of pesticides and chemical fertilizers** **3.2.** **c. Use of inexpensive, chemical and non-organic products in confectionary** **d. Competition with grand industries** **3.3. The potential of changing the use of gardens especially in the urban edges** **3.4. lack of transfer of knowledge and experiences to the next generations of gardeners** **3.5. Tampering with river water due to urban development**

2.2.4. Agrobiodiversity

Table 21: SWOT table for agrobiodiversity

Strengths	Weaknesses
4.1. Rich in biodiversity of almonds, grapes, pistachios, apricots and they have been partially identified 4.2. Adaptation of trees and shrubs to drought and the irrigation system over several centuries 4.3. A large number of animal species (domestic and wild)	4.1. The early flowering of some varieties in QB 4.2. Lack of comprehensive study of native clones and imported cultivars in gardens and lack of breeding programs for the specific clones (genetic resources) of QB
Opportunities	**Threats**
4.1. Appropriate genetic diversity for the breeding programs 4.2. An agricultural research center to continue of researches and to start breeding programs for the genetic resources of QB 4.3. A good factor for ecosystem stability	**4.1. Loss of genetic diversity (clones of garden trees) due to low production and change of use of gardens** **4.2. Replacement of new and incompatible species** **4.3. The invasive squirrels feed the garden products of QB**

2.2.5. Landscape and tourism

Table 22: SWOT table for landscape and tourism.

Strengths	Weaknesses
5.1. Organic connection between the QB and the city.[12] 5.2. The fencelessness of the gardens because of flood irrigation system 5.3. Very charming views of QB in the four seasons of the year 5.4. View of seasonal rivers in autumn, winter and spring	5.1. - 5.2. Weak security of gardens, products and gardeners
Opportunities	**Threats**
5.1. The possibility of defining interrelated tourist plans from historical city to QB and vice versa 5.2. The historical role of Bāghestān as a suburban promenade 5.3. Tourist attraction and suburban promenade 5.4. Leisure and tourism of citizens and passers-by	**5.1. The effect of lifestyle changes in the city on the quality of garden functions.** **5.2. The desire of some garden owners to build a fence for security and sometimes for the motivation of building villas** **5.3. Landscape damage due to the urbanization and abandonment at the edge of the city; Side effects of non-eco-friendly tourism** **5.4. Construction of roads or recreational lakes with the installation of rubber dams; The risk of flooding**

[12] The special social and cultural identity and advantage of Qazvin, which is based on QB

3. Ongoing Efforts to Conserve Bāghestān

3.1. Ongoing Efforts

The Ongoing efforts may be outlined as:

1. Holding the National Conference on "Traditional Gardens" at Qazvin University in cooperation with the Qazvin Agricultural Organization, Qazvin province and Qazvin Municipality 2003
2. Comprehensive study of water resources of gardens around Qazvin in Qazvin Agricultural Organization, 2007
3. Establishment of Qazvin Traditional Garden (Bāghestān) Owners Cooperative Company by Bāghestān trustees in 2009 that is temporary inactive due to some challenges
4. Establishment of a traditional garden organization in Qazvin province and establishing the executive office of that organization in Qazvin Municipality in 2011
5. Carrying out two studies on the Qazvin traditional garden (Bāghestān) and its challenges commissioned by Qazvin Municipality
6. Registration of Qazvin traditional garden in the list of national cultural heritage in 2014
7. Forming the specialized non-governmental organizations in support of Bāghestān (ASCL: Association for Saving the City's Life) in 2014 and also "Bāghestān Green Movement"
8. Bāghestān International Workshop organized by ASCL NGO in cooperation with Qazvin IKIU University International Conference: "Water, the source of life" And by inviting representatives of all stakeholders and related organizations, 2015 (Figure 50). In this scientific event, Scholars of research institutions Gottingen University of Germany visited traditional gardens and expressed their interests to do research on germplasm resources of traditional gardens.

9. Implementation of various promotional programs in Bāghestān by non-governmental organizations from 2015 until now.
10. Holding a workshop on the impact of agricultural areas on the environment with a focus on the garden by the ASCL NGO

In Qazvin University and in cooperation with the Land Affairs Organization of Iran, in 2018.

11. Some academic research (of course, insufficient) in the form of a master's thesis and papers, in the faculties of urban planning and architecture, agriculture and technology in the universities of Qazvin and Tehran (some are mentioned in the list of the references)
12. Number of studies in the Agricultural Research Center of the Agricultural Organization (mentioned in the text and the references)
13. Installation of shutters at the water inlet to the gardens to facilitate the work of gardeners, by the municipal garden organization
14. Some efforts to compensate for water shortages in dry years by allocating water from the Taleghan water supply network. This is done with the participation of garden owners and with the help of the Agricultural Organization, the Regional Water Company and the Qazvin Municipality
15. Recently, a committee has been formed in the Agricultural Organization of Qazvin Province by the order of the Deputy Minister of Agriculture. This committee has the duty to deal with the affairs of the garden and the problems of garden owners and gardeners and to provide the ground for solving the problems.
16. Considering that Bāghestān Gardeners' Cooperative Company has been deactivated in the last two years, Garden owners are consulting to form a garden owners union, in line with the traditional garden management structure.
17. Holding more social gathering in gardens: Since the social awareness has been increased by NGOs, a regular outdoor activity to walk through the

gardens as well as assembly programs have been launched over the weekends to let people become more familiar with the agro-eco-system and enjoy the natural landscape.

3.2. Government implementing privilege policies for Qazvin traditional gardens development

1. A series of supporting policies have been implemented: Firstly, the policy of preserving urban agriculture and taking control of all urban development.

2. Law on Conservation of Agricultural Land Use.

According to this law, the Land Affairs Organization of the country, which is under the supervision of the Ministry of Agriculture, can prevent the change of use in the gardens.

3. Preservation of the historical status of gardens is explicitly stated in the Law on Conservation of Agricultural Land Use.

4. According to the country's development plan law, municipalities are required to maintain the green belt of cities. Qazvin Garden in the three sides of the city is known as the green belt.

5. National Registered Heritage Criteria

Considering that Bāghestān was registered in the National Heritage List in 2014, there are strong protection criteria for its area and privacy. Qazvin Cultural Heritage Organization is responsible for monitoring the observance of these criteria.**4.4.**

4. Influence of the GIAHS

Despite the intelligence of Iranians in harmonizing with nature for social and economic life, which has been the foundation of Iranian civilization; in about the last six decades, the lack of attention to indigenous knowledge and the increasing interest in replacing them with incompatible technologies, as well as the lack of attention to the principles of sustainability in urban development, endangered civilization achievements. Consequently, the disruption and manipulation of drainage systems (as a result of road development and land use change) as well as the hydrological effects caused by climate change, have become the basis for increasing the dry period of seasonal rivers. Therefore, the biological corridors that rely on runoff are disrupted in their ecosystem services, and the green areas dependent on these streams in and around the cities are under threat.

The traditional garden of Qazvin, as an example of civilization-building agricultural systems, is also in such a situation and is threatened by these conditions. As the maps show, the garden has shrunk in recent decades and parts of its current area are also subject to damage.

Registering the traditional garden of Qazvin in the GIAHS, by introducing and valuing it at the local, national and international levels, can stop threats and help the production and economic growth and finally the stability of this valuable system. The potential created by registering Qazvin traditional garden (Bāghestān) as a “Globally Important Agricultural Heritage System” can strengthen protection and restoration plans, strengthen the mutual compatibility of Bāghestān and environmental changes, and strengthen the economic value of its products in the market. It can also help to introduce new economic productivity such as agro-tourism in Bāghestān.

Since GIAHS initiative was established, an increasing number of countries have participated in the scheme. This signifies an increasing recognition of the values of agro-heritages and the GIAHS. In Iran, the GIAHS has also attracted much attention and support from the government. The advantages of GIAHS include a larger international market, and more foreign investment. As a result, their market

value will greatly improve. This is bound to bring about positive and far-reaching influence on trees cultivation, the protection of old trees and organic fruits and nuts production and processing technologies, and the tourism industry.

When becoming a GIAHS, Bāghestān and those of related farmers and enterprises will enjoy higher popularity and market value. More companies will contribute to the industry, extending the industrial and traditional food chains. As a result, more jobs will be generated. The supportive funds and the price increase of pistachio and fruits will boost the farmers' income.

5. The Dynamic Conservation Action Plan for GIAHS Site

The SWOT table, i.e. the most important strengths, weaknesses, threats, and challenges in the Bāghestān was provided in part 2 of section V (Table 18 to Table 22). Linked to that analysis, the summary of a 5-year action plan which outlines key steps toward protecting the Bāghestān production system, executive and funding organisations, and also cost estimations (Table 23 to Table 27) is presented in this part.

Abbreviation signs for executive and funding organizations:

DOE = Department of Environment
ICHHTO = Iran Cultural Heritage, Handicrafts and Tourism Organization
IRIB = Islamic Republic of Iran Broadcasting
MOA = Ministry of Agriculture- Jahad
MOH = Ministry of Health
MOIMT = Ministry of Industry, Mines and Trade
MOP = Ministry of Power
MORUD = Ministry of Road and Urban Development
MSRT = Ministry of Science, Researches and Technology (universities and affiliated research institutes)
MUN = Municipality

NGO = Non-Governmental Organization

PBO = Plan and Budget Organization

PG = Provincial Government

QB = Qazvin Bāghestān

RIO = Related International Organization

SFIDA = Supportive Fund of Investment Development in Agriculture

TGO = Traditional Garden Organization (municipality)

Planned Activities

QB reserve is located mainly in the south, west and east of city of Qazvin. It's within 48° 45′, 50° 50′ E in the east and 35° 37′, 36° 45′ in the north. The object of protection is QB with a history of approximately one thousand years. It surrounds the city of Qazvin taking up an area of 2612 hectares. Following what came in the SWOT analysis, the action plan for preserving of GIAHS, site presents in this section, in 5 headers. Also, Table 23 to Table 27 show the details of the action plan. Each item of these tables corresponds to a quadruple item of the SWOT tables (Table 18 to Table 22)

5.1. Flooding irrigation system

5.1.1. Protection Planning of Flooding Irrigation System in QB.

Goal

The existing irrigation system, based on pond structure of gardens and feeding aquifers has been able to support the productive gardens of QB and the fertile plain of Qazvin, as well as ecological services of QB (flood control, dust suppression, carbon sequestration and reduced temperature). There is a lack of sufficient knowledge about the infiltration rate of floodwaters in groundwater aquifers. The water supply network has been destroyed due to the development of urban and transit roads and aquifer system has been damaged by converting the garden areas to urban green space or other agricultural alternatives such as greenhouses.

The goal for conserving the QB's floodwater harvesting system is to preserve agricultural and ecosystem services of GIAHS site and preservation of experiences and traditional agricultural techniques examining how to work, as well as to get to an undergrowth vegetation coverage of 70% or above in the conservation district.

Action

a. A measurement system of hydrological balance components at the basin scale as a basis for hydrologic modelling, in order to simulate the interaction between surface water and groundwater.
b. Application of a pre-calibrated and evaluated hydrological model to improve the efficiency of the floodwater spreading system of QB.

5.1.2. Maintaining the Hydrology Balance of the Region.

Goal

The Impact of the flow of seasonal rivers despite the arid and semi-arid climate of the region is very significant. Nevertheless, the upstream water exploitation due to rural development and tourism development has caused encroaching on Bāghestān water right and destruction of riverbeds. Unfortunately, the knowledge on river water supply and the effect of climate change and rainfall pattern change on irrigation system efficiency is insufficient.

The goal for conserving the hydrology balance of the region is maintaining the rights of gardens in the Bāghestān and allowing them to continue their ecosystem services.

Action

1. To recover the riverbeds (5 rivers feed QB)
2. To supply water required for the village and upstream tourism sites from other sources such as wastewater treatment
3. To study the climate change scenarios and their impacts on hydrology of the region

5.1.3. Preservation of Indigenous Knowledge of Floodwater Irrigation and Maintaining the Water Supply Network in QB.

Goal

There have been flood irrigation canals and streams in many parts of the gardens in QB since one thousand years ago, and there have been a strict adherence of gardeners to the water scroll, a very accurate irrigation schedule –the latest version of which is seven hundred years old. However, for the parts that later joined QB, most of the Bolûks are not considered in the water scroll. In addition, some parts of the river network were damaged due to urban development. Some canals were more or less overflew because of some improper valves of water distribution dams and blockage of canals, especially in flood conditions. In general, the social structure of the garden can effectively manage the allocation of water, ranging from the destroyed parts to the Bolûks in need of water. Any intervention and change in the water scroll can disrupt the stability of the indigenous water distribution system.

Therefore, the goal for preserving the indigenous knowledge of floodwater irrigation is to enhance cooperation and contribution to sustainable management in QB, as well as water management over hundreds of years.

Action

1. To strength the horticultural cooperative company in accordance with the traditional structure of QB
2. To repair the water supply network and to install suitable valves
3. To conduct some field researches into the improvement of the physical environment of QB.
   - 3.1. Researches into a comprehensive computing: using pervasive computing for water dividing management in QB.
   - 3.2. Researches into the historical assessment (age) of QB in terms of anthropogenic influence on the water supply system.

5.1.4. Lack of Special Mechanisations for Small Plots in QB.

Goal

In QB, the gardens are pitched together and separated by borders which are about 1-2 meters high, which then turn up to the height of the plots allowing the water to penetrate gradually into the soil (acted as a local dam and a potential reservoir for collecting flood-waters). These plots in gardens are necessary elements for flood irrigation system. Therefore, the gardening practices are difficult and expensive due to the impossibility of using mechanized tools, so todays gardeners tend to plant densely in rows so that they can use modern gardening tools and machines.

The goal for providing the suitable machinery for QB is that it is required for economic development of GIAHS site.

Action

1. To design the proper gardening machines for QB plots

5.1.5. Water Scarcity and Demand of the other Water Sources in QB.

Goal

The climate change is a global threat, for which this proposal has demonstrated technical and managerial action plans to be taken. As well, Qazvin has been suffering from unprecedented and widespread drought for the recent decades. The trees and shrub species of QB are relatively drought- tolerant and they are normally irrigated only once or twice in winter and spring through flood irrigation. However, more water and irrigation are necessary in dry years, specifically for young seedlings in summer. Therefore, the gardeners had to dig deep wells in the garden to supply the water needs for young seedlings. Nevertheless, the water of some garden wells is unfortunately used for urban and industrial purposes.

The goal for water supply from more sources for gardens is to protect the GIAHS site and increase production. The technical and managerial action plans should be undertaken within the proposed time scale to combat global threat. The impacts of

international financial threats can be lowered by becoming a GIAHS and by allying with other GIAHSs to learn from them. The strategies are as following:

Action

1. To pipe and allocate water from Mahmudabad water treatment plant to QB for the required supply
2. To equip Qazvin water treatment plant and to allocate a part of its water to QB in drought conditions

5.2. Ownership and Management

5.2.1. Protecting the alignment between private and public interests in QB.

Goal

The alignment of QB's private ownership with the city's social, economic and environmental interests has been one of the most important factors of QB's survival and sustainability throughout history. Some changes in the urban system and organizations, economic characteristics and lifestyle, require that the city also provide mutual services to the gardeners. As an example, QB security is now affected by urban and road development. Therefore, the city should provide services to the gardeners in securing gardens TDR plans is another example. Currently, Qazvin Municipality and the Agricultural Jihad Organization provide limited and few services to QB, which are very inadequate.

Action

1. Development of a scheme for granting concessions and providing services to garden owners from the government and municipality
2. Issuing a registration document for all garden owners

5.2.2. Protecting and benefiting from the rich customary laws of ownership in QB

Goal

Contrary to what we see in the Iranian garden, in Bāghestān all classes of society can own a garden. This possibility is done through very precise customary rules. Part of these rules were related to the development (growth) of QB, which has been stopped in recent decades. Compilation of these laws, in addition to registering them, can be used to revive abandoned lands.

Action

1. Accurate writing of customary laws
2. Development of guidelines for revitalizing abandoned gardens

5.2.3. Enjoying the advantage of major ownership while protecting the rights of small owner in QB.

Goal

The fact that major owners own the majority of QB area plays an important role in the survival and sustainability of QB. On the one hand, majority ownership leads to higher economic productivity, and on the other hand, it leads to the strength of the traditional garden management system against the challenges that affect the QB. Of course, this point should not cause the interests of small gardeners to be ignored. The lack of motivation of small gardeners causes gardens to be abandoned among places that are in good condition. It is necessary to mention that the QB management system has protection rules for abandoned gardens, but increasing the process of abandonment is definitely harmful.

Action

1. Implementation of incentive schemes in order to consolidate the ownership of small gardens
2. Strengthening and activating the cooperative systems.
3. Socio-economic studies in order to strengthen the motivation and protect the interests of the garden owners of small gardens (plots).

5.2.4. Reinforcing the power of the traditional governance of QB despite the required interference of new urban organizations

Goal

The governance and the traditional management system of Bāghestān is the result of human experience and has been stable over many centuries. Today, some of the duties of the new government agencies, which have been formed in recent decades, interfere with the affairs of Bāghestān and it is inevitable. If this intervention is done without a plan, it is harmful for the QB. The interaction of

government organizations with QB should be done through a single institution. Also, the role of such an organization should be limited to a facilitator.

Action

1. The definition of a management-executive upstream complex in Qazvin Governorate
2. The complete return of garden management to the network of the traditional management system. Fulfilling the role of facilitator by the mentioned government institution
3. A complete and accurate record of Bāghestān's governance system

5.3. Production and economy

5.3.1. Improving the planting pattern and methods in QB.

Goal

Major strategic agricultural products in Qazvin QB are pistachios, almonds, apricot, various varieties of grapes; and the interplanting of trees with some crops has provided diversified agricultural produces. However, the improving the planting pattern and methods could increase the productivity of QB gardens. The frost in early spring and the pests reduced the productions of trees. Therefore, Study of planting pattern and new cultivars, as well as modern horticultural methods are necessary.

Action

Research:

a. Study of planting pattern and new cultivars

b. Using horticultural improvement methods for grafting

5.3.2. Branding and marketing of QB products.

Goal

The consumption of pesticides and chemical fertilizers in QB gardens is very limited. The qualified organic products (almond and pistachio) of QB use extensively

in traditional and industrial confectionery and cooking in Qazvin, other cities and abroad. These organic products are economically value-added. As well, there are many types of local processed products of QB such as grape juice, vinegar, pickles, which could be produced by small or home industries. However, due to improper supply of QB products and limited use of natural- processed products in food industries, the branding and marketing of products should be improved. In this regard, the role of local communities, NGOs and startups will be very important and decisive.

Action:

1. Farmers' association campaign to increase their products' standards.
2. Branding of processed and Organic products (Farmers and NGOs try to develop their logo)
3. Development of local businesses and workshops and online and direct supply start-ups
4. R&D to develop the logo inside and outside the country

5.3.3. Applying economic justice using TDR plans

Goal

Increasing the motivation of garden and garden owners by granting economic points.

Action:

Implementation of TDR plans.

5.3.4. Preserving the indigenous horticultural knowledge in QB.

Goal

The interest of people to organic products are increasing nowadays. Hence, the Indigenous knowledge of organic production in QB have to preserve. On the other

hand, transfer of these knowledge and experiences to the next generations of gardeners are not guaranteed because of the difficulty of work and the lack of interest of young people in gardening. Therefore, it is important and inevitable to register nationally or internationally the local knowledge of gardening in QB.

Action:

1. Registration of indigenous horticultural knowledge in Bāghestān
2. Creating suitable tools for horticultural operations and product processing
3. Promoting experiential tourism at the same time as developing the necessary rules and guidelines (to prevent the destruction of gardens)
4. Giving prestige to the indigenous knowledge and horticulture profession of through the introduction of Bāghestān at the national and global level
5. Encouraging young people to continue their education in fields related to work in Bāghestān.

5.3.5. Permanent water share for Bolûk localities in QB.

Goal

Preservation of Bolûks of Bāghestān using the water share of places that have been completely destroyed and have a permanent share of water in the water scroll

Action

1. Allocation of water share from Taleghan River
2. Permanent allotment of the water share of localitiess that are completely destroyed because of urban development, and that have a permanent water share in the water scroll, to Bolûks that do not have a water share

5.4. Agrobiodiversity

5.4.1. Protection Planning for Biodiversity in QB.

Goal

As mentioned in the proposal, the gardens of QB are rich in fauna and flora, as well as in garden trees, particularly in almonds, grapes and pistachios genotypes. These trees and shrubs are well-adapted to the floodwater irrigation system and are drought-tolerant. The grape, pistachio, and almond genotypes have been partially identified. but a comprehensive study of native clones and imported cultivars in gardens and the breeding programs for the specific clones (genetic resources) of QB is necessary. However, due to global warming, the late-flowering almond genotypes of main trees are necessary to be introduced in QB. Somehow, some new incompatible species were cultivated.

The goal for biodiversity protection is to develop a sustainable agriculture and preserve the ecosystem services of GIAHS site. Therefore, the strategy is:

Action

1. To conduct the field researches
   a- A comprehensive study of native clones and imported cultivars in gardens
   b- Using horticultural improvement methods for grafting that have been tested by some gardeners and have been successful in some cases.
   c- Long-term and yearly trend of carbon sequestration in the forms of soil organic matter and the plants tissues in floodwater harvesting of QB.
   d- Assessment of floodwater harvesting in QB on the physical, chemical and biological (fauna and flora) properties of the soils.

2. To conduct the breeding programs for improving the genetic resources of QB

3. To control the invasive squirrels in gardens as a pest in an integrated strategy by introducing some birds of prey (like eagles) to control the population of squirrels, as well as capturing or hunting as other strategies of a 5-year action plan

5.5. Landscape and tourism

5.5.1. Re-enrichment of QB-city organic relationship.

Goal

Although there is still a strong connection between the city and the garden, some changes in lifestyle have affected this connection. Since this connection is one of the important components of the QB protection, there is a need for action in this regard.

Action

1. Developing the city-Bāghestān tourism programs in accordance with the principles of Agro-tourism
2. Strengthening rituals and jobs and cultural components related to QB
3. Culture-based recreating of forgotten traditional rituals and jobs which are related to QB
4. Teaching urban agriculture and redefining traditional Qazvin agriculture and transferring native knowledge to future generations

5.5.2. Managing the side effects of fencelessness of QB gardens

Goal

Although QB's fencelessness is an inevitable feature that has prominent outstanding ecological and cultural effects, it also has unintended side effects. It also has some unwanted side effects, among that the most important is security.

Action

Pilot the use of intangible technology to strengthen the security of gardens

5.5.3. Promotional and tourism activities

Goal

Increasing public awareness and improvement of cultural activities

Action

1. Holding photo and film festivals
2. Planning of Ago-tourism programs
3. Implementation of promotional programs, especially for children and teenagers, in order to introduce the QB and create a sense of belonging

5.5.4. Seasonal rivers as tourist attraction

Goal

Planning for leisure and tourism in side of seasonal rivers in autumn, winter and spring respecting environmental features.

Action

1- Environmental assessment studies for tourism projects.
2- Planning of tourism and leisure routes (Agro-tourism)

5.5.5. planning a buffer zone

Goal

Profit of the ecological link between the garden and the city is firstly an opportunity. However, it is necessary to think of a plan to avoid damaging the edges of the garden.

Action

1. Strengthening the connection between the city and Bāghestān through redesigning Bāghestān as a buffer zone, without a doubt from the area of urban land.
2. Preventing the development of hard urban zone and change of land use.
3. Establishing walk-bicycle connection in the parts where this connection has been cut off.
4. Conversion of "Nasim Shomal" road to cycling and tourism route according to the resolution of the Supreme Council of Urban Development.

Table 23: Action plan for protection and improving the Flooding irrigation system

Strategy	Item	Activity	Executive Organizations	Funding Organizations	Time period	Cost estimate (Billion IRR)
1. Protection and Improving the Flooding irrigation system	1.1.	1. Construction of a southern ring road outside the QB 2. Field Researches: 2-a. Measurement system of hydrological balance components at the basin scale as a basis for hydrologic modelling in order to simulate the interaction between surface water and groundwater. 2-b. Application of a pre-calibrated and evaluated hydrological model to improve the efficiency of the floodwater spreading system of QB.	MUN MORUD MOA MSRT	PG PBO SFIDA	2023-2027	3300
	1.2.	1. Improving river beds 2. Supplying water required for the village and upstream tourism sites from other sources such as wastewater treatment 3. Study of climate change scenarios and their impacts on hydrology of the region	MOP MUN MSRT		2023-2026	
	1.3.	1. Strengthening the horticultural cooperative company in accordance with the hierarchical structure of irrigation based on rivers in QB 2. Repairing the water supply network and installing suitable valves 3. Research: a. Improving the physical environment of QB. b. Using of Pervasive Computing for water dividing management in QB c. Historical assessment of the QB in terms of anthropogenic influence on the water supply system	MOA MSRT ICHHTO		2024-2026	
	1.4	Designing of the proper gardening machines for QB plots	MOP MSRT MORUD		2024-2026	
	1.5.	1. Piping and allocating water from Mahmudabad water treatment plant to QB for the required supply 2. Equipping Qazvin water treatment plant and allocating a part of its water to QB in drought conditions	MOA MSRT		2024-2026	

Table 24: Action plan for ownership and management

Strategy	Item	Activity	Executive Organizations	Funding Organizations	Time period	Cost estimate (Billion IRR)
2. Ownership and management	2.1.	1. Development of a scheme for granting concessions and providing services to garden owners from the government and municipality 2. Issuing a registration document for all garden owners	MOA MUN	PG PBO	2023-2028	3800
	2.2.	1. Accurate writing of customary laws Strengthening and activating the cooperative systems 2. Using them in the development of guidelines for revitalizing abandoned gardens	MUN MOA MSRT NGO	PG PBO	2023-2026	
	2.3.	1. Implementation of incentive schemes in order to consolidate the ownership of small gardens 2. Strengthening and activating the cooperative systems 3. Socio-economic studies in order to strengthen the motivation and protect the interests of the garden owners of small gardens (plots)	MOP MUN DOE	PG PBO MUN MOA	2023-2026	
	2.4.	1. The definition of a management-executive upstream complex in Qazvin Governorate 2. The complete return of garden management to the network of the traditional management system. Fulfilling the role of facilitator by the mentioned government institution. 3. A complete and accurate record of Bāghestān's governance system	MUN MOA MSRT NGO	PG PBO MUN MOA	2023-2025	

Table 25: Action plan for production and economy

Strategy	Item	Activity	Executive Organizations	Funding Organizations	Time period	Cost estimate (Billion IRR)
3. Production and economy	3.1.	Research: 1. Study of planting pattern 2. Using horticultural improvement methods for grafting Branding of these processed products 3. Development of local businesses and workshops and online and direct supply start-ups	MOP MUN NGO	PG PBO SFIDA	2023-2026	5200
	3.2.	1. Registration of indigenous horticultural knowledge in Bāghestān 2. Creating suitable tools for horticultural operations and product processing 3. Promoting Experiential tourism at the same time as developing the necessary rules and guidelines (to prevent the destruction of gardens) 4. Giving prestige to the indigenous knowledge and horticulture profession of through the introduction of Bāghestān at the national and global level 5. Encouraging young people to continue their education in fields related to	MSRT MOA MOH ICHHTO	PG PBO SFIDA	2023-2026	
	3.3.	Implementation of TDR plans	Local communities, NGOs MOIMT, MOA, ICHHTO	PG PBO SFIDA	2023-2026	
	3.4.	5. Farmers' association campaign to increase their products' standards. 6. Branding of processed and Organic products (Farmers and NGOs try to develop their logo) 7. Development of local businesses and workshops and online and direct supply start-ups 8. R&D to develop the logo inside and outside the country 9. Using the opportunity of beekeeping 10. Using the opportunity to grow native medicinal plants	PG MUN MORUD MOA ICHHTO	PG PBO SFIDA	2023-2026	
	3.5	sing the water share of completely destroyed localities for Bolûks, permanently	TGO, MOA, MOP	PG, PBO, SFIDA	2023-2024	
	3-6	A 3 to 5 year of economic comprehensive study including the items listed in Appendix 4.	MOA, QB, TGO	MOA, PBO, TGO, PG	2024-2027	

Table 26: Action plan for protection and improving the agrobiodiversity

Strategy	Item	Activity	Executive Organizations	Funding Organizations	Time period	Cost estimate (Billion IRR)
4.Protection and improving the agrobiodiversity	4.1.	Field researches: a. A comprehensive identification and description of native clones and imported cultivars in gardens b. Long-term and yearly trend of carbon sequestration in the forms of soil organic matter and the plants tissues in floodwater harvesting of QB. c. Assessment of floodwater harvesting in QB on the soil physical, chemical and biological (fauna and flora) properties of the soils.	MOA MSRT	PG PBO SFIDA	2023-2027	2100
	4.2	Breeding programs for improving the genetic resources of QB (for late flowering and fruit production)	MOA MSRT			
	4.3	Control and management of the invasive squirrels in QB as a pest in an integrated strategy: to introduce the birds of prey (eagle) for good controlling the population of squirrels, as well as capture and hunt	MOA DOE Local communities			

Table 27: Action plan for Landscape and tourism

Strategy	Item	Activity	Executive Organizations	Funding Organizations	Time period	Cost estimate (Billion IRR)
5. Landscape and tourism	5.1.	1. Developing the city- Bāghestān tourism programs in accordance with the principles of Agro-tourism 2. Strengthening rituals and jobs and cultural components related to QB 3. Culture-based recreating of forgotten traditional rituals and jobs which are related to QB	ICHHTO MU MORUD NGO	PG PBO SFIDA	2023-2027	4000
	5.2.	Pilot the use of intangible technology to strengthen the security of gardens	MSRT MOIMT		2023-2026	
	5.3.	1. Holding photo and film festivals 2. Agricultural tourism 3. Implementation of promotional programs, especially for children and teenagers, in order to introduce the QB and create a sense of belonging	ICHHTO MU NGO MOA		2023-2025	
	5.4.	1. Environmental assessment studies for tourism projects and construction of tourism and leisure routes 2. Planning of tourism and leisure routes (Agro-tourism)	ICHHTO MSRT MOA		2023-2027	
	5.5	1. Stop constructing operations that cut off the connection between the city and Bāghestān. 2. Creating an intermediate space between the city and QB, without a doubt from the area of urban land, with suitable functions, including the supply of QB products, walking and cycling. 3. Establishing walk-bicycle connection in the parts where this connection has been cut off. 4. Conversion of "Nasim Shomal" road to cycling and tourism route according to the resolution of the Supreme Council of Urban Development.	ICHHTO MU BO MORUD NGO	PG PBO MUN	2023-2026	


Sadra nejati


Association for Saving the City's Life
Photo by: somayye zarei


Association for Saving the City's Life
Photo by: somayye zarei


Photo by: Mehdi Motamed

VI. ADDITIONAL INFORMATION

Appendix 1. Table of specifications of Bāghestān localities, link to their location on the map

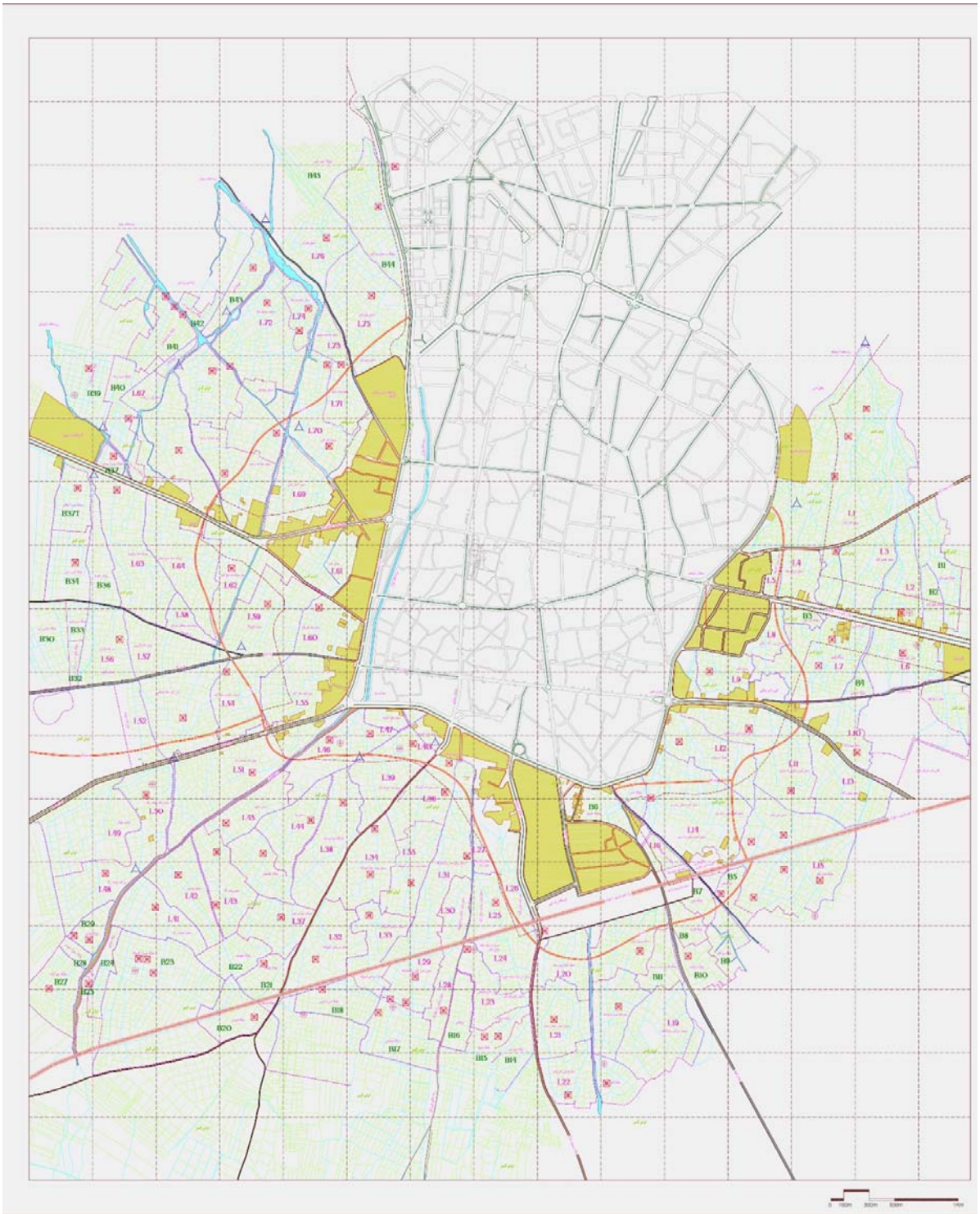


Figure 71: localities and Bolûk of Bāghestān

Table 28: Table of specifications of Bāghestān localities

Bāghestān Localities				Bāghestān Localities			
Locality	**Name of Locality**	**Area of Locality (Hectares)**	**Feeding River(s)**	**Locality**	**Name of Locality**	**Area of Locality (Hectares)**	**Feeding River(s)**
L1	Katâbâd	126.86	Arenjak	**L21**	Miân-Sâmân é lotté	24.4	Arenjak
L2	Bolbol-Âbâd é Bâlâ	20.43	Arenjak	**L22**	Ghûshchi-Bâshî é lotté	17.61	Arenjak
L3	Assem-Âbâd	30.12	Arenjak	**L23**	Hâj Fathali	18.38	Bâzâr & Dalichây
L4	Darrâk é Bâlâ	13.46	Arenjak	**L24**	Dar châhkhâné é Mâžel-Âbâd	19.47	Bâzâr & Dalichây
L5	Rûh-Âbâd é Bâlâ	5.9	Arenjak	**L25**	Miân-Sâmân é Mâžel-Âbâd	11.58	Bâzâr & Dalichây
L6	Bolbol-Âbâd é Pâyin	28.51	Arenjak	**L26**	Kheyr- Âbâd é Mâžel-Âbâd	11.26	Bâzâr & Dalichây
L7	Darrâk é Pâyin	41.48	Arenjak	**L27**	Pîsh-fand é Mâžel-Âbâd	15.54	Bâzâr & Dalichây
L8	Rûh-Âbâd é Pâyin	11.56	Arenjak	**L28**	Rîga raz é Râstalîak	10.58	Bâzâr & Dalichây
L9	Shâbû	12.48	Arenjak	**L39**	kheyr-Âbâd é Râstalîak	26.74	Bâzâr & Dalichây
L10	Boryân Kalâ	65.8	Arenjak	**L30**	Miân-Sâmân é Râstalîak	11.4	Bâzâr & Dalichây
L11	Kabûdestan é rah chamân	47.52	Arenjak	**L31**	Pîsh-fand é Râstalîak	27.35	Bâzâr & Dalichây
L12	DarZabân	27.49	Arenjak	**L32**	Sarastan é kîvîak	27.77	Bâzâr & Dalichây
L13	Poshti-Âbâd	28.96	Arenjak	**L33**	Darbaghî é kîvîak	19.64	Bâzâr & Dalichây
L14	Kabûdestan é rah-rey	50.37	Arenjak	**L34**	Posht-é-Châh é kîvîak	25.61	Bâzâr & Dalichây
L15	Ghomb yek	65.67	Arenjak	**L35**	Miân-Sâmân é kîvîak	21.1	Bâzâr & Dalichây
L16	Zûr kûchak	6.6	Arenjak	**L36**	Pîsh-fand é kîvîak	20.64	Bâzâr & Dalichây
L17	Zûrpîl	25.69	Arenjak	**L37**	Sar-fand é Khojé -fand	18.65	Bâzâr & Dalichây
L18	Kalé chûb é Mâzla-fand	19.81	Arenjak	**L38**	Ghadamgâh é Khojé -fand	31.6	Bâzâr & Dalichây
L19	Sarazîr é Mâzla-fand	35.17	Arenjak	**L39**	Pîsh-fand é Khojé -fand	27.66	Bâzâr & Dalichây

L20	Pish-Fand é lotté	19.26	Arenjak	**L40**	Bâgh é Énayat	5.63	Bâzâr & Dalichây
L41	Salmân Râh	21.65	Bâzâr & Dalichây	**L61**	Jûra & Kashkân	14.61	ZûYar
L42	Pashandî	23.43	Bâzâr & Dalichây	**L62**	Meydâna-fand é Hâj-karim	26.82	ZûYar
L43	Posht Âlâ	21.93	Bâzâr & Dalichây	**L63**	Meydâna-fand é Khâlûhâ	40.4	Dalichây
L44	Pasâ	21.38	Bâzâr & Dalichây	**L64**	Meydâna-fand é Haj-Jaøfar	33.33 + 3.44	Dalichây
L45	Sâbogh	16.31	Bâzâr & Dalichây	**L65**	Zîr Derakht é Kharâm-Âbâd		ZûYar
L46	Miâna râh	25.33	Bâzâr & Dalichây	**L66**	Khâjé Rashid é Kharâm-Âbâd	43.12	ZûYar
L47	Bâgh Âkhûnd	6	Bâzâr & Dalichây	**L67**	Baghdâyak é Kharâm-Âbâd	24.21	ZûYar
L48	Sar-Fand é Chashna râh	21.38	Bâzâr & Dalichây	**L68**	Jolomé Kharâm-Âbâd	24.54	ZûYar
L49	Shania-bolûk é Chashna râh	39.47	Bâzâr & Dalichây	**L69**	Kangaréstân	23.56	ZûYar
L50	Parûak é Chashna râh	24.14	Bâzâr & Dalichây	**L70**	Télla-kash	17.39	Bâzâr & Dalichây
L51	Pish-fand é Chashna râh	46.61	Bâzâr & Dalichây	**L71**	Ghorâd-Âbâd	23.05	ZûYar
L52	Sar-fand é Sâz- Âbâd	14.12	Dalichây	**L72**	Saødibak	40.09	ZûYar
L53	Sâz- Âbâd é Âghâ Mostafâ	36.09	ZûYar	**L73**	Châshnamah Pâyin	8.35	ZûYar
L54	Ûrt é Saman é Sâz- Âbâd	24.97	ZûYar	**L74**	Châshnamah Bâlâ	9.4	ZûYar
L55	Pîsh -fand é Sâz- Âbâd	20.93	ZûYar	**L75**	Valiestan	46.99	Bâzâr & Dalichây
L56	Sar-fand é Ghazâvey	21.42	Dalichây	**L76**	Ghasrân	22.98	Bâzâr & Dalichây
L57	Pîsh-fand é Ghazâvey	20.81	Dalichây		Kharak-Âbâd	--	Arenjak
L58	Meydâna-fand é	6.64	ZûYar		Mâriân	--	Arenjak

	Seyyed Kâzem Hasangir						
L59	Sar-fand é Tarîk	33.23	ZûYar		Khânlogh	--	Bâzâr & Dalichây
L60	Pîsh-fand é Tarîk	9.74	ZûYar				

Appendix 2. Table of name, area and feeding river of bolûks locality of Bāghestān

Table 29: Bolûk localities specifications

Bāghestān Bolûk localities				Bāghestān Bolûk localities			
Bolûk	**Name of Locality**	**Area of Bolûk (Hectares)**	**River(s)**	**Bolûk**	**Name of Locality**	**Area of Bolûk (Hectares)**	**River(s)**
B1	Jirbagh	29.35	Arenjak	**B23**	Mirza-Kûchak	80.5	Bâzâr
B2	Bolbol-Âbâd	7.12	Arenjak	**B24**	Dâshâgh	-----	-----
B3	Kord-ali	4.62	Arenjak	**B25**	Valî	8.53	Dalichây
B4	Halvaei	3.67	Arenjak	**B26**	Gholâm-ali	16.79	Bâzâr
B5	Khân	16.19	Arenjak	**B27**	Kheyr- Âbâd	20.7	Dalichây
B6	Hoseyn Siâhkolâ	25.26	Arenjak	**B28**	Mirzâ-Sharif	3.3	Dalichây
B7	Azîz	5.78	Arenjak	**B29**	Ghannâdî	9.38	Dalichây
B8	Ghâzimé	7.27	Arenjak	**B30**	Khodâverdî	20.48	Dalichây
B9	Markân	13.35	Arenjak	**B31**			
B10	Kharak-Âbâd	11	-----	**B32**	Hâj-Allâh-verdî	3.24	Dalichây
B11	Ghâzimé Zûrpîl	11	Arenjak	**B33**	Dûst-ali	4.93	Dalichây
B12	Hâtam-bak	11.1	Arenjak	**B34**	Nâyeb-Sadr	29.94	Dalichây
B13	Ghûshchi-bâshi é lotté	17.61	-----	**B35**			
B14	Khoja -fand	10.42	-----	**B36**	Khâlûha	11.14	Dalichây
B15	Sheykh	10.48	Bâzâr	**B37**	Mirzâ-Hâshem	18.76	Dalichây
B16	Now	11.35	Bâzâr	**B38**		6.64	
B17	Pahlavâni	23.27	Bâzâr	**B39**	Hâj-Mollâ Sâleh		Dalichây
B18	Tamar	16.27	Bâzâr	**B40**	Âseyyed Rezâ	40.91	Zûyâr
B19		36.86	-----	**B41**	Rezâ gholi khân	28.95	Zûyâr
B20	Naeini	17.06	Bâzâr	**B42**	Mollâ Feyzollâh	4.78	Zûyâr

B21	Sharif	9.55	Bâzâr	**B43**	Âhani	15.25	Zûyâr
B22	Shahidi	12.26	Dalichây	**B44**	Sar Âtash		

Appendix 3. Case Study of Experiential Tourism or Agro-tourism in Bāghestān

One of the capacities present in Bāghestān and which can serve multiple functions simultaneously is tourism. The first function of tourism is generating income for Bāghestān. Nonetheless, its most significant roles lie in the social and cultural outcomes that can have a long-term impact on the sustainability of Bāghestān. One of the obstacles that hinders the continuation of this knowledge-based sustainable system is the lack of recognition and a sense of belonging among urban residents, especially the youth and children. Healthy tourism serves as a means for creating awareness, connectivity, valuation, and a sense of belonging. This endeavor can be achieved by implementing projects such as cycling around Bāghestān to generate public revenue for consumption within Bāghestān. However, the approach and experience that we introduce and emphasize in this section revolve around agricultural tourism led by farming families. "A Day of Farming Experience in Bāghestān" is a title of a project carried out by Atefeh Shatarha, a young girl from a

Figure 72: case study of Agro-tourism in Bāghestān; Child tour, 2023

farming family. Atefeh has undergone the course of experiential tourism. She hosts groups of 10 to 12 tourists in her garden, allowing them to experience a typical day in Bāghestān. She has also designed several guided tours for children (see Figure 72 and Figure 73).

Atefeh states, "Those who participate in these tours are interested in purchasing processed garden products directly from me, including pickles, fruit leather, grape syrup, sherbet, and jams." Thus, this form of tourism activity not only generates income for farming families but also instils motivation and credibility in the youth of farming families. It facilitates the continuation of family farming in a manner compatible with the taste of the young generation. We asked Atefeh a question: "Can tourism contribute to the economy of Bāghestān?" She responded, "Definitely."

Figure 73: Agro-tourism in Bāghestān; case study

Considering Atefeh's familiarity with the principles of agricultural tourism and the fact that the garden belongs to her family, her activities pose no harm to Bāghestān.

In recent years, other tourist guides have conducted tours in the traditional garden in accordance with the principles of agricultural tourism. Among them, the names of Alireza Khamsa and Razia Rahmani should be mentioned.

Figure 74: Agro-tourism in Bāghestān; By Alireza Khamse

Figure 75: Create a sense of belonging Bāghestān; By ASCL

Appendix 4. Economic Study

The issue of economy in Bāghestān is the most important factor in maintaining garden or abandoning it by the owners (orchrdist). The economy of Bāghestān depends on many factors that are mentioned in different parts of the proposal.

What is necessary in this field, before any conclusion and action, and which has not been properly done so far, is a detailed and comprehensive study. Our suggestion for No. 3-6 of the Action Plan is a study that will be conducted over a period of 3 to 5 years and includes the following:

• Extracting and presenting the quantitative criteria of the three ranges (green, yellow and red) including the average number of trees (by species) per hectare

• Detailed statistics of the annual production of garden products by species and three ranges (green, yellow, red)

• Studying the fruiting of trees in three ranges in significant age ranges

• Estimating the costs for each hectare, each ton of product and each tree, separately for the three areas with the priority of the green area

• Estimating costs for each hectare, each ton of product and each tree sample, separated by three areas with the priority of the green area

• Reliable numerical data of the amount of product supply in domestic and foreign markets in order to estimate the income of the beneficiaries

• Calculating the efficiency of the tree sample based on previous data

• Study of soil and water tension

• Determining the optimal planting density according to economic efficiency and ecological capacity

• Studying the secondary income of the garden, including income from product processing and tourism

• Calculation of garden profitability with cost-opportunity logic for short, medium and long term periods

The garden cultivation pattern can be extracted from the results of the above study and considering other local and national studies.

Appendix 5. Sample of chemical analysis of Bāghestān soil composition in vertical profile

Laboratory number	Description	Depth	Saturation percentage	saltiness	Total saturated acidity	Lime Percentage	Plaster	Organic carbon Percentage	Nitrogen percentage	Clay percentage	Lay percentage	Sand percentage	Texture	Phosphorus	Potassium
87878	Profile adjacent to the pistachio tree	0-15	38	0.46	7.94	11	-	74%	7%	15	23	62	S.L	8	480
87879	Profile adjacent to the pistachio tree	15-45	36	0.4	8.06	11	-	43%	4%	17	21	62	S.L	11	552
87880	Profile adjacent to the pistachio tree	45-75	32	0.33	8.06	11	-	31%	3%	13	17	70	S.L	3	312
87881	Profile adjacent to the pistachio tree	75-105	45	0.36	7.89	12	-	27%	3%	19	25	56	S.L-S.C.L	2.2	248
87882	Profile adjacent to the pistachio tree	105-140	44	0.34	8.11	10.5	-	23%	2%	21	27	52	S.C.L-I	2.4	240
87883	Profile adjacent to the pistachio tree	140-180	44	0.35	8.05	10.5	-	2%	2%	23	23	54	S.C.L	2	248

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