

GIS mapping and visualizing historical data of the Bagi Buldi, Bagi Dilkusho, Bagi Davlet Abad gardens of Amir Temur

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Abstract. The paper is devoted to the geoinformation analysis, processing and visualization of historical data on the gardens of Amir Timur - "Bagi Dilkusho" (translation "Garden that Captivates the Heart"), the garden "Bagi Buldi" ("Garden of Consciousness") and the garden "Bagi Davlet Abad" ("Garden - the Abode of Power"). These were luxurious country gardens with palaces, built in favourable natural and geographical locations of Samarkand along the military and strategic routes of Amir Timur's campaigns specially for the purpose of his recreation and restoration Using GIS tools, the location of 15 Temurid gardens of the 14th-16th centuries were found. At their historical site, measurements were taken with a Leica TS-02 Plus tacheometer. Thus, the use of GIS tools, the creation of an interactive map of the Timurid gardens of Samarkand, and the compilation of tacheometric and topographic surveys opened up a wide range of data for a more accurate reproduction of the design of these Timurid gardens. As a result, three-dimensional visualizations of the Bagi Dilkusho, Bagi Buldi, and Bagi Davlet-Abad gardens were performed in 3 DS Max programs, and three 3D films were created in the Lumion program.

1 Introduction

Research reflects a meticulous multi-vector scientific activity aimed at using GIS tools, methods of geoinformation analysis and mapping with the main goal of finding the historical location of the disappeared gardens of Amir Temur in the city of Samarkand and the Samarkand region. For this, the author studied the historical annals of the Temurid dynasty, notes of travellers and the diary of the ambassador to the court of Amir Temur, and a number of Waqf charters of the 16-17 centuries. According to the descriptions of the historian M.E. Masson [1], the Bagi Buldi garden was located to the east of Samarkand, on the shady boulevard "Kuchai-Khiaban" on the site of the current village of Kurgancha. The Bagi Buldi garden served as a venue for political negotiations and poetry evenings of scientists and poets of the 15th century, which were organized and patronized by Amir Temur. According to the academician of arts G.A. Pugachenkova, the Bagi Dilkusho

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garden “was located 6 km to the east of the Samarkand citadel, in the Khan-Charbag area near the village of Urta-Pulatchi” [2]. It is known that Amir Temur personally received the ambassador of the Castilian king - Ruy Gonzalez de Clavijo in the Bagi-Dilkusho garden [3]. Clavijo meticulously described the geographical and natural-landscape arrangement of the gardens and palaces of Amir Temur. Thanks to this diary of Ruy Gonzalez de Clavijo, today we have the opportunity to be fascinated by getting acquainted with the architectural and landscape design of the gardens and subsequently revive them architecturally. The Bagi Davlet Abad garden - located to the south of the Samarkand citadel and had the function of a nature reserve, a zoo, where a lot of various species of animals and birds lived freely, one can say that it was a prototype of today's contact zoo gardens back in the distant 15th century. It is very important to mention that the data on the gardening art of Amir Temur have increased thanks to the archaeological excavations of the eminent scientist and archaeologist Utkur Alimov, who in 1966-1967 discovered traces of the foundations of three park palaces: Bagi Dilkusho, Bagi Buldi, Bagi Davlet-Abad. U. Alimov reconstructed the plans of these garden palaces, describing their architectural appearance, size and design features, used building materials, decorative elements.

2 Purpose and objectives

The main purpose of this work is to identify the historical location of the disappeared gardens of Amir Timur, for the subsequent development of a project proposal for their architectural revival. Research reflects a meticulous multi-vector scientific activity purposed the objectives of using GIS tools, methods of geoinformation analysis and mapping with the main goal of finding the historical location of the disappeared gardens of Amir Temur in the city of Samarkand and the Samarkand region.

3 Methodology

Using Google maps and extensive capabilities of Arc GIS software from Esri, the author actively used the mapping and visualization method of the historical data she collected. By collecting and processing a wide range of ancient sources such as maps of Samarkand of the 17th-18th centuries, records of court chroniclers and waqf charters of the 14th-17th centuries, the author created an interactive storytelling map named "Samarkand Gardens of the Timurids of 14-15th centuries" with brief information about each of the 17 gardens in pop-up windows (Figure.1). The author filed an application for patenting the interactive story telling map and received a positive response and permission to patent this map.



Fig.1. Interactive storytelling map "Samarkand Gardens of the Timurids of 14-15th centuries" with brief information about each of the 17 gardens in pop-up windows. Author Sadikova S.N.

The author classified all the gardens of the Temurids according to their functional characteristics. Table 1. shows this classification with a brief description about the features of each garden and the year of its creation.

Table 1. Classification of Temurid gardens by functional purpose

№	Functional purpose	Name of a Garden	Year of creation
1.	Palace Gardens	1. Baghi Dilkusho 2. Baghi Nakshi Jahon 3. Baghi Baland	1396-1399 1370s Mid. 15th c.
2.	Recreational country side gardens	1.Kora Toba Garden and Jahonnomoi Palace 2.Takhti Karacha Garden	1398 1398
3.	Gardens for hunting	1.Kora Toba Garden and Jahonnomoi Palace 2.Baghi Behisht 3.Takhta Karacha	1398 1378 1398-1399
4.	An intimate garden for the royal family	1.Baghi Shamal 2.Baghi Behisht 3.Baghi Amirzade Shahrukh	1397 1378 1394
5.	Gardens for negotiations and poetic debates	1.Bugi Buldi	1st half of the 15th century
6.	Multifunctional gardens	1.Bagi Maidan with the Chil-Sutun Palace and the Picture gallery - Mirzo Ulugbek’s Chinni Khana 2.Bagcha - Mirzo Ulugbek’s Garden ; 3.Bagi Davlet -Abad	1435-1436 20s of the 15th century 1399
7.	Gardens for public festivities	1.Bagi Zagan; 2.Baghi Chinar;	- 1399-1404

		3.Bughi Nau;	1404
8.	Gardens inside the citadels	1. Bustan-Saray; 2.Garden at the Kuk-Saray Palace in the Citadel of Samarkand ; 3.Garden at the Ak-Saray Palace in Shakhrisabz	1370-71s 1370 1379
9.	Memorial Gardens	1.Darus-Saodat in Shakhrisabz; 2.Wakf garden at the mausoleum of Khoja Ahmed Yasavi in the city of Turkestan ; 3.Garden at the complex of mausoleums Shahi-Zinda in Samarkand ; 4.Garden of Baghi Firuza at Ishratkhana ; 5.Gur Emir Mausoleum Garden ;	1376 1402-1405 1397 XVI-XVII. 1463-1464. 1404-1405. 1st half of the 15th century

In order to implement the design proposal for the architectural revival of the gardens, it was necessary to study the parameters and architectural techniques for designing gardens and palaces of the Temurids of 14-15th centuries. The author systematized the parameters of the considered gardens of the Temurids according to the historians and chroniclers who described these gardens, as well as the data of modern scientists who conducted archaeological excavations and measurements at Bagi Dilkusho, Bagi Buldi, Bagi Davlet-Abad gardens.

A thorough search for the locations of the gardens and their application to the mentioned interactive map was done in accordance with the eloquent descriptions recorded by medieval chroniclers and the conclusions of authoritative scholars and historians of the 20th century. Then followed field work in the countryside, the author personally examined the approximate locations of the gardens of Amir Temur mentioned by Soviet scientists and historians, who described in their scientific works the geographical landmarks, the name of the villages, the proximity of the target gardens to the holy burials of spiritual religious figures of the Middle Ages, which served as landmarks. During the field work, topographic surveys of the gardens and remains of the palace platforms in the centre of the gardens of Bagi Dilkusho, Bagi Buldi and Bagi Davlet Abad were carried out using the Leica TS-02 Plus tacheometer.

4 Results and discussion

In addition to collecting and processing extensive historical data on the gardens of Bagi Dilkusho, Bagi Buldi and Bagi Davlet Abad, as well as cartographic studies using GIS tools, the following references in historical and scientific sources were also analyzed and taken into account:

- according to the book "Zafar-name" written by Sharafiddin Ali Yazdi, quote: "in 1398, before leaving Samarkand for the city of Kesh, Amir Temur ordered to build a garden and a beautiful palace in it at a distance of 15 km to the east of Samarkand"⁴];

- according to the academician of the Academy of Sciences of Arts G.A. Pugachenkova: "... Bagi Buldi was located to the east of Samarkand, on the Kucha-i-Khiaban boulevard"

[2]; During the study of waqf documents, historian V. Vyatkin found out that Bagi Buldi garden was located east of Samarkand, on the site of the current village of Kurgancha;

- archaeologist U. Alimov specified the location of the Bagi Buldi garden, he wrote that this garden was located, quote: “On the right side of the Samarkand-Penjacent Road, 1.5 km from the Dilkusho garden” [5].

Having studied satellite maps and the area during field work, author turned out that in the village of Kovchin in Taylak district of Samarkand region, among the rural fields in the centre of the local cemetery, an anthropogenic hill with trenches on its top has been preserved. Comparing with the drawings of the archaeological survey plans of U. Alimov, we can conclude that this hill served as a platform for the palace of the Bagi Buldi garden, and the trenches are traces of foundations - all that remains from the luxurious palace of Amir Temur, after prolonged barbaric marauding of nomads. Thus, the geolocation of the Bagi Buldi garden was found, its coordinates are 39.60452, 67.0641.

According to G.A. Pugachenkova, the Bagi Dilkusho garden “was located 6 km to the east of the Samarkand citadel, in the Khan-Chabag area near the village of Urta-Pulatchi” [2]; The medieval book “Samaria”, (written by Mir Abu Tohir Khoja Samarkandi and translated by V.A. Vyatkin in 1899) describes that the Dilkusho garden “was located 6 km to the east of Samarkand, in the village of Bidak, now Chumchukly, near the village of Hinduvan”[6].

Author found the grave of Khoja Safo (15th century) in the centre of the old cemetery, that was located (according to M.E. Masson) “to the north of the Bagi Dilkusho garden” [1]. Then author also took into account the note of M.E. Masson, that the bridge "Puli Magok" divided in half the distance from the Firuza citadel gate to the Bagi Dilkusho garden [1]. The gate of Firuza was identified and marked on the interactive map, the bridge still exists today, therefore, it was not difficult to determine the distance and location of the garden of Dilkusho.

Notable are the descriptions of Ruy Gonzalez de Clavijo about the campaigns of Amir Timur and the solemn celebrations of military victories in the gardens on the way back to the citadel of Samarkand [3]. Following the logical sequence, taking into account all the above-mentioned landmarks, it was concluded that the garden of Dilkusho was located directly on the route of the victorious return of Amir Timur from the campaign from India. Thus, the location of the garden of Baghi Dilkusho was found, its coordinates are: 39.62081, 67.04439.

The garden of Davlet Abad was studied by such eminent researchers as V.L. Vyatkin, M.E. Masson, I.A. Sukharev, G.A. Pugachenkova, A.Yu. Yakubovsky, U. Alimov. According to V.L. Vyatkin, quote: “the garden was located on the road to Shakhrisabz, between the gardens of Bagi-Dilkusho and the palace of Jahannomoi” [7].

According to the waqf documents, V.L. Vyatkin identified the location of the village of Davlat-Abad of the 15th century “between the Dargom and Shaudor irrigation ditches” and thus he assumed that the palace-garden of Bagi Davlet-Abad was located between the Takhti Karacha pass and another garden of Amir Temur – Baghi Dilkusho “as a transit point” [7].

In the diary of Ruy González de Clavijo (transl. by I. I. Sreznevsky) it is indicated that Davlet-Abad was located to the south of Ishrat-Khana, on the left bank of the Dargom canal [8].

Thus, according to U. Alimov: “The garden-palace of Amir Temur Davlat-Abad was located to the south of Samarkand, not far from the Dargom canal and south of Kafir Kala” [5] - an archaeological site, a royal palace of the pre-Islamic period. Thus, the location of the Bagi Davlet Abad Garden was found, its coordinates are 39.55773, 67.01318.

The author developed project proposals for the architectural revival of the gardens Bagi Dilkusho, Bagi Buldi, Bagi Davlet-Abad with their palaces in their historical places. This

was done in strict accordance with the measurements of the traces of the foundations made by U. Alimov and with his drawings on reconstruction of the palaces. Architectural projects of three gardens and their palaces (plans, the main and side facades, section of the buildings, as well as general plans of the gardens) in 2D and 3D graphics were developed by author as well as an animated 3D film about each of the above-mentioned gardens (Figures 2-4).

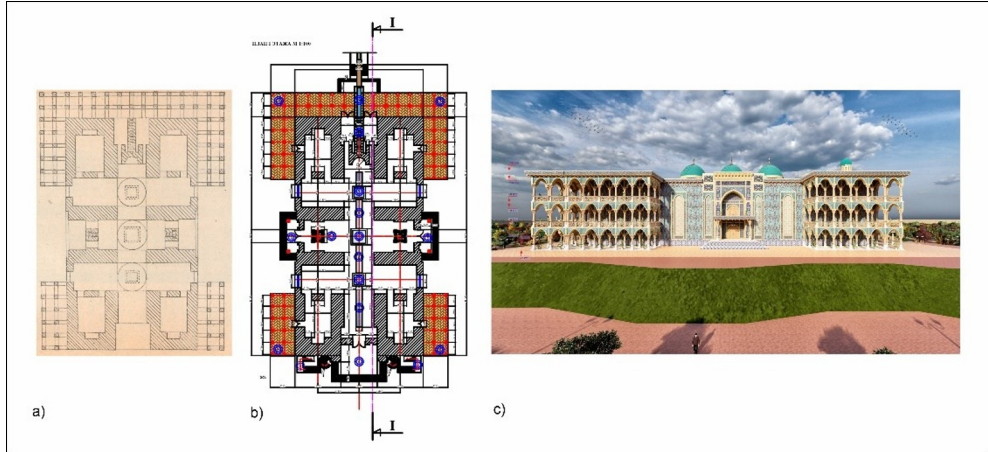


Fig. 2. Author's project proposal for the architectural revival of the Amir Temur's Garden Bagi Dilkusho. a) Reconstruction drawing by archaeologist U. Alimov, b) 1st floor plan, c) 3D visualization of the side facade of the Bagi Dilkusho palace.



Fig. 3. Author's project proposal for the architectural revival of the Amir Temur's Garden Bagi Buldi. a) Reconstruction drawing by archaeologist U. Alimov; b) 1st floor plan; c) Executive tacheometric and topographic survey of Bagi Buldi; d) 3D perspective view of the Bagi Buldi garden and its palace; e) A platform on the top of which trenches from the foundations of the former Bagi Buldi palace were found.

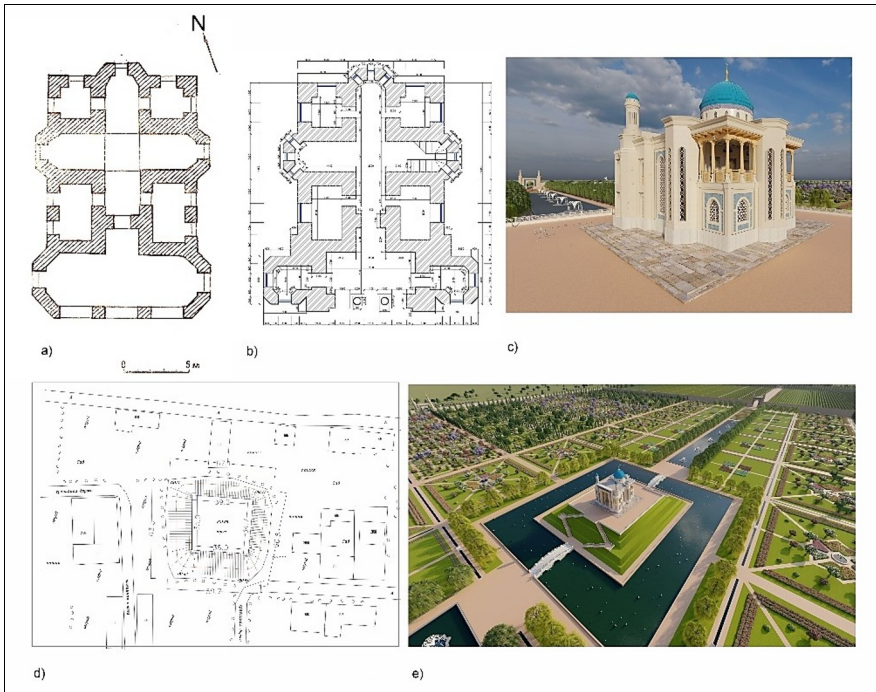


Fig. 4. Author's project proposal for the architectural revival of the Amir Temur's Garden Bagi Davlet Abad. a) Reconstruction drawing by archaeologist U. Alimov, b) 1st floor plan, c) executive tacheometric and topographic survey of Davlet Abad, d) 3D perspective view of the Davlet Abad garden and the palace.

5 Conclusion

“It is well known that architecture and gardening art of Central Asia and the Middle East reached culmination development in the period of government of Amir Temur and his descendants (the 14-15th centuries) in Transoxiana”[8]. Deep study of the theme of garden and park art of the Temurid dynasty, processing of data on the gardens of Amir Temur, identification of the historical location of these disappeared gardens, creation of an interactive map of the "Samarkand Gardens of the Temurids" using the wide capabilities of GIS - all this complex and expedient work is aimed at developing an ecotourism capacity in the Samarkand region, improving an ecology. In case of revival of the gardens of Amir Temur Bagi Dilkusho, Bagi Buldi, Bagi Davlet-Abad according to the author's project proposals, hundreds of hectares of trees and other green spaces will be planted, new ecosystems will be created for the development of biodiversity. In addition, new tourist attractions will be created in the suburban part of the Samarkand region, so the tourist load on the historical environment of old Samarkand and its infrastructure will be naturally reduced. The flow of tourists to the region will become uniform and normalized. As part of the “tourist mahallas”, the revived gardens of the Temurids can become new attractions to meet the needs of recreation and new jobs for the local population, and will fully contribute to the accelerated development of sustainable domestic and foreign tourism in the Samarkand region.

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