

**DOI: 10.7596/taksad.v6i4.1140**

**Citation:** Barkoosaraei, M., & Moshiri, S. (2017). Designing of Genow Botanical Garden with Sustainable Architecture Approach. *Journal of History Culture and Art Research*, 6(4), 1211-1226. doi:<http://dx.doi.org/10.7596/taksad.v6i4.1140>

## Designing of Genow Botanical Garden with Sustainable Architecture Approach

Masoumeh Hassan Doost Asl Barkoosaraei<sup>1\*</sup>  
Shahriar Moshiri<sup>2</sup>

### Abstract

Now a day, botanical gardens are considered as the most important and influential public green spaces in most countries of the world. These complexes on one hand have scientific and research applications in the fields of botany, gardening, conservation and plant ecology, and on the other hand they play an important role in public education and tourism. So it can be said that botanical gardens have been converted from merely research environments to multi-functional green spaces. The purpose of this study is designing the Botanical Gardens in Genow ecotourism region, located in of north of Bandar Abbas as a research-tourism complex that has been welcomed by citizens and tourists and respond to the various of their users. Selecting Genow region was due to its vicinity to the Protected Area and Reserve Biosphere of Genow (in terms of life value of diverse plants of protected area). In the process of designing the relevance of botanical garden with Genow echo tourist area, in performance dimension have been considered by the use of Persian garden pattern, and in terms of relationship with nature, with the benefit of recreational spaces and enjoyment of sustainable architecture components (green roofs, living walls the biological filter in the interior parts), that due to having these features will be considered by non-researcher tourists in Genow ecotourism region.

**Keywords:** Botanical Garden, Genow ecotourism region, Sustainable architecture, Green roofs, Living walls, Biological filter.

<sup>1</sup> Corresponding Author, Department Architecture engineering, Bandar Abbas Branch, Islamic Azad University, Bandar Abbas, Iran.

<sup>2</sup> Department Architecture engineering, Bandar Abbas Branch, Islamic Azad University, Bandar Abbas, Iran.

## **1. Introduction**

By using technologies of building industry can be substantially prevented from wasting energy. Today, architects and engineers try to use "passive technology" (hidden) that comes from natural resources such as land, air, soil, sun and water instead of methods based on active technology that has high consumption of energy. This will have two results: The first meet the needs of human thermal in interior spaces of building and second, create identity for body of building. One glance at the state of construction in our country over the ages, we are witness to construction of buildings that were built according to climate and environmental conditions. In other words, water, wind, humidity, terrain and in general weather conditions have had direct impact on Iranian traditional architecture in different parts of the country. But with the arrival of modern architecture and the use of mechanical installations effect of climate have been gradually pale in buildings. Therefore, the issue that we are looking in this study is that whether it is possible to design buildings that meet the needs of users, according to available resources and also advantage of science and technology by minimizing the use of nonrenewable energy resources. Based on the above issue, the purpose of this research is to design Botanical Garden in the region of GNU ecotourism in the north of Bandar Abbas, which the principle of sustainable architecture has been considered in its design.

## **2. The importance and necessity of research**

Nowadays botanical gardens in many countries are the most important and influential public green spaces. These institutions in one hand have research and scientific applications in the fields of botany, horticulture, conservation and ecology and on the other hand have an important role in public education and tourism. With the development and expansion of activities in the field of botanical gardens, they have become merely research environments to multi-functional green spaces. Iran, due to the breadth and diversity of climate, is habitat of numerous species of plants and many of them are including the most important, rare and beautiful plants in the world.

Plants are a powerful tool in the hands of architects to create and enrich the quality of space. However, lack of attention to the practical use of plants, unknown their features, their environmental capabilities caused for our professional and non-professional community, to not benefit from these potential. On the other hand the increasing destruction of valuable sources of plant, animal habitat destruction, flattened forests, occurrence of increasing flood along with water resources and soil degradation, overcoming invasive alien species due to lack of the right choice in planting new varieties low productivity of water and increasing

desertification, all of them are direct or indirect result of lack of plant knowledge or lack of its expansion among professionals and the general public. Botanical gardens can create an opportunity for botanical research and practical experience of using plants in shaping and creating quality spaces and as well as training these experiences to professionals and in the next step to the general public. Cooperation botanical and architectural expertise in this issue is necessary and inevitable.

In Iran despite number of botanical gardens such as the National Botanical Garden, Botanical Garden agricultural faculty in Karaj, botanical gardens in Behshahr, Mosher, Dezful, Hamedan, Yazd and Kashan, botanical gardens have never been able completely play their role in the mentioned field. Many of these gardens currently do not have the ability to attract tourists and training public or even public visit and education of the people have no place in their program. This problem may be arising from policy makers in the gardens or type of their research or arising from weaknesses in the design of the gardens and the lack of consideration of capacity, or fear of people damage to their collections. The design of these gardens in Iran have been taken place by botany, horticulture experts and designers, while doing this all over the world by landscape architects and utilizing the advice botanists, environmental designers, is required to form planting plants and architecture for building design. Due to existence disagreements to transfer the design of the gardens to different specialties involved, differences of opinion that different views have created about the design of these spaces.

### **3. Questions and Research hypotheses**

- 1) Relationship of botanical gardens as a research center with GNU ecotourism region, in performance dimensions, how will it be?
- 2) Botanical Gardens in terms of architectural design how will interact with nature?

#### **Also Research hypotheses include:**

- 1) Botanical Gardens due to benefit from the recreational space and having design of green roofs and living walls, will be considered to non researchers ecotourism GNU tourists.
- 2) Sustainable architecture components will be used in the design of botanical garden such as green roofs and living walls in order to even more closely with nature.

#### **4) Theoretical Foundations**

##### **A) Review and analyze the concept of botanical gardens**

More than 30 years due to the severe environmental crisis, the relation between man and nature have been included among the specific topics. With the creation of serious environmental problems, such as the increase in global temperature, destruction of natural resources and polluting the environment, officials thinking of finding solutions to solve the issues. So that sometimes issues of sustainable development, using natural energies and tendencies to environmental issues have placed on the agenda of many governments. One of the solutions proposed is the botanical gardens issue. Botanical garden is a place where a collection of native and exotic plants are cultivated outdoors and in greenhouses and plays an important role in research fields such as plant science and horticulture. In addition, botanical gardens preserve plants under threat of extinction. Botanical gardens serve for educational purposes as well as entertainment. In addition, attracting audiences and provide services such as stores or places for spend leisure time, will also help to supply part of the cost of collection and also this provides economic sustainability for collection in the long term (Barati, 2005).

##### **B) Review and analyze the concept of sustainable development**

Sustainable development is a new concept of economic growth which leads to well-being and opportunities for all people of the world. However, it does not require to destroy limited number of natural resources of the world and the existing capacity for their personal interests. Sustainable development is a process in which economic policy, finance, trade, energy, agriculture, industry and other policies are designed in a way that succinct development that is economically, socially and ecologically sustainable and concept of it is enough investment in the field of education, health, population and energy without creating social debt for future generations (Soflaee, 2006). Principles derived from the definition of sustainable development has achieved based on worldview defined by each civilization. The principles which determining and dominating all community activities must be considered ranging from spiritual and material (qualitative and quantitative) qualities. In summary, it can be said that what is now known as sustainable development mainly pays to material and physical environment aspects (quantitative) and in order to maintain the status quo for future generations, in other words, environmental resource protection and sustainable economic development is considered as the main target (Naghizadeh, 2000). World Commission on Environment and Development in Beratlend report (1987) has defined "stability" as follows: "Meet the present needs without compromising the ability of future generations to meet their

own needs". According to this definition, sustainability will be causing to create a balance in meeting human needs, without compromising health and efficiency of natural systems (Mendler, 2005).

### **C) Review and analyze the concept of sustainable architecture**

Sustainable architecture involves a combination of values such as aesthetics, environment, society, politics, and ethics. This architecture is practice of applying this values and knowledge and combines in a central aspect in harmony with the environment. The application of sustainability concepts in architecture has opened new debate in the name of sustainable architecture, ecological architecture, green architecture and environmental architecture which all have the same concept and implies eco-friendly architecture. Sustainable architecture in the city loop to fit the scale and function also is an integral part of the larger loop and urban row. In this architecture, materials and construction elements can be recycled and are frequently organized (Soflaee, 2006). Goals of sustainable architecture (environmental, social, and economic) can be summarized under the following points:

- 1) *Environmental goals*: to create superior environmental quality, the ability to reuse, garbage removal and survivor, transformative low material consumption, recycling water to sewage, remove emissions pollutants.
- 2) *Economic goals*: superior value creation reduces operating costs, reduce energy consumption, and provide perfect solutions with ease of production methods, prospective solutions.
- 3) *Social objectives*: security, compliance, recruiting quality, energetic eliminating poverty, creation of sound insulation, flexible schedules, healthy life, home care, continuing education, home delivery, ability to adapt (Ahmad, 2003).

### **D) Environmental Architecture**

Environmental building is designed to take advantage of beneficial landscapes and climate and reform those scenes that are unfavorable this design, in addition to creating comfortable internal spaces pay attention to the external design of buildings. Green spaces affect in urban design and around private buildings on the climatic conditions and reduce external temperature. Five principles of environmental architecture have been expressed by Thomas Fischer as follows: (Chen et al., 2011)

- 1) *Healthy internal environment*: all possible measures ensure that structural systems and materials do not emit pollution and gas pollutants into the interior and should kept clean and fresh internal air space with filters and plants.
- 2) *Energy efficiency*: All possible measures ensure that building energy consumption be minimum and heating and cooling and lighting systems, use methods and products that reduce this consumption.
- 3) *Ecological materials*: All possible measures should produce and use building materials that have the lowest environmental degradation.
- 4) *Environmental form*: All possible measures should provide a form to design and climate of the region to optimize the ecological site based on recycling and energy efficiency, provide harmonious relationship between people and nature.
- 5) *Good design*: All possible measures should consider performance, longevity and beauty of the buildings in relation to energy consumption (Fisher, 1992).

## **5) Research methodology**

In this project, the research method is descriptive and analytical. The survey instrument used to examine the theoretical basis for further research had been based on the library study and go straight to books and documents. Also in other sectors the study is based on viewing of documents, including reports, documents, numerical and visual documents. Field observations have been used in consolidation and verification of review of the documents and go directly to the target range in the studies, decisions, and policies. After collecting information from different sources and categorize and sort them, pulled major factors that have the greatest impact on process of design and designer can be used obtained properties.

## **6) Geographic features**

GNU is side of the north of Bandar Abbas. Under the mountain to its range is more than three milestones and from its range to Bandar Abbas is nearly three milestone. Its high air in the summer is like a Block Khafr and Fasa and has sweet waters from the Sar fountain, and in head of the mountain is cold trees such as apple, quince and apricot and in the bosom of this mountains is orange and tangerine and lemon and palm trees and in its range is lots of Mango and coconut and tamarind tree and so Deh abadi happened on this mountain such as Nark and Naband and so on. In 1970, this area was approved as a national park. The region is located in

geographical location "18 ° 27 to" 29 ° 27 north latitude and "18 ° 56 to" 56 ° 55 'east longitude in north of Bandar Abbas. This area is examples of mountain ecosystems, which show all functions and values of this type of large eco-system in their surrounding plains area to the most obvious aspect. The major presence implications of this eco-system in dealing with Plains isn't only cause of changes in weather conditions and creation of suitable conditions for life, fauna and flora of the region but also provide promotion of the level of livelihood activities and the formation of biological cells and population centers.

Genow protected area has been completed of main mountain ranges in the name GNU mountain which has mastery impressive on Persian Gulf desert. Most low-slope and plain lands are around this mountain in the east side and south and low-lying hilly lands are in northern and western parts. GNU mountain ranges and sub-mountain are often in east - west direction. Mountains, has a long and very steep slopes. The height of the mountains started from the periphery toward center from a height of 500 meters above sea level and gradually increases. Mountains, less likely to have mild slopes and often have cuts gradient fill, vertical walls, cliffs, and deep valleys. This kind of highs and lows extended to allows the creation of local microclimate in regional level and are effective in the formation of some special growing and growing diversity of plant.



*Figure 1: Aerial photo from the GNU spa area and the target site*

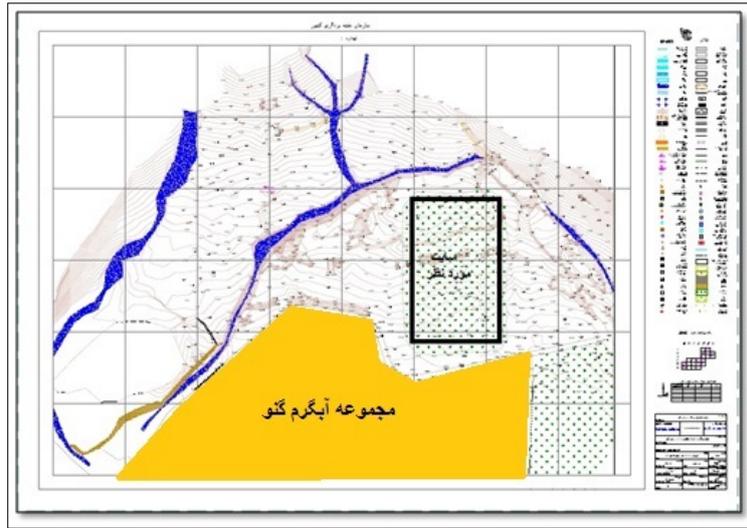


Figure 2: The range of target project and proximity

## 7) Design

According to the study area, design of different parts of the project is as follows:

Table 1: different parts of the project to design

Features of Range	Title of Range	Row
It is paved space with mosaics walls covered of plants (green retaining wall). With retreat, as concave which has inviting state, has way from right to public parking and parking staff, from the center of the field of public service and welfare from the left to garden set.	Botanical garden entrance space	1
Consists of two perpendicular axes inspired by Persian gardens and separator curved lines of gardens of traffic routes inspired by blossom bloom.	Overall geometry	2
At the intersection of two main axis of the garden, there is pool with an emphasis on value and it's holy.	Display - research units	3
Consists of educational materials, kindergarten parts, planting space, maintenance and harvesting, garden Maz, amphitheater, to	Kindergarten	4

make children and teenagers familiarity with various trees and plants.		
Consists of free land for the design, planting and growing plants by students and scholars.	Adult education series	5
Various types of rose as one of the permanent flowers which diversity in color and its species is high can be used as one of the most beautiful performance spaces, make beautiful scenery. An outdoor amphitheater decorated with ornamental paving and carpports made of logs has been designed in effective part of this complex.	Rose Garden	6
One of the four main garden make around the pool (toward north-eastern part). At the center of this complex pause space designed with decorative paving.	Onion and chrysanthemums herb garden	7
This garden is located on the southeastern side pool and consists of a pond in its middle which is located on part of the coffee shop pond. Building tiles are in the far east of the garden.	Seasonal herb garden	8
Collection of plants, trees and shrubs adapted to the climatic conditions of Bandar Abbas. Plants must be consistent in this part in terms of homogeneity of color, plant height, etc. This collection is specialized. The North East of complex is after fruit garden.	Arboretum	9
Include fragments of various native, rare and non-native fruit trees. This section is component of expertise and research spaces but has dramatic aspect.	Fruit gardens	10
Constructed with the aim of planting plants regularly and based on phylogenetic relationships plant families. This complex is one of the places where its professional aspect is more than Theatrical and is in the North West of complex.	Systematic Garden	11
The administrative department consists of sections such as public relations, management and research assistant, waiting space, meeting rooms, computer courses, archives and the secretariat.	Administrative section	12

And in the basement consists of the central engine room. Modular living wall and modular green roofs has been used in this building.		
Herbarium or repertory for the plant where the samples are as dry and special way, identify, classify and kept. In fact this complex is dry plant museum.	Research Center	13
Laboratory is equipped place with physical and chemical conditions that can control plants, which are grown in it. In this space rare species genetically are studied and tested.	Laboratory	14
It is in the eastern end of the transverse axis of the garden. This complex has modular green roof and modular living wall.	Library	15
These places are strictly specific and consist of different parts as follow: Plant pieces, chassis, and parts of transplanting. This complex is located in the southwestern part of site.	Greenhouse and nursery production	16

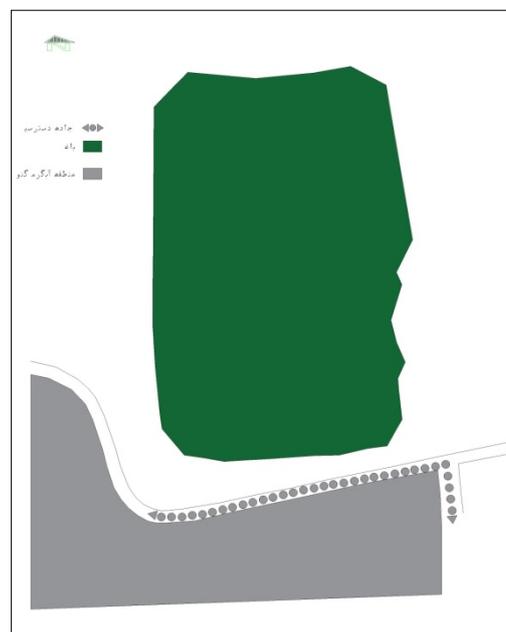


Figure 3: Select target ground based on a detailed Geno plan

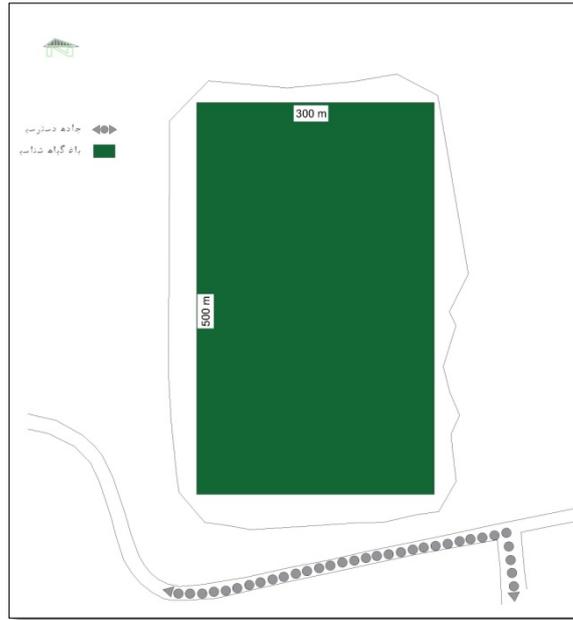


Figure 4: Selection the range of site

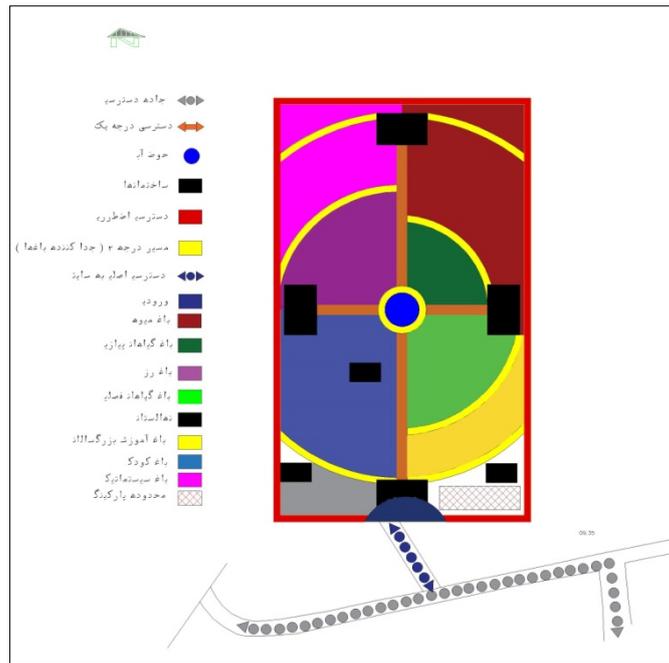


Figure 5: Locating buildings and parking





*Figure 8: Map of site plan*



*Figure 9: Perspective No. 1 from complex*



*Figure 10: Perspective No. 2 from complex*



*Figure 11: Perspective No. 3 from complex*

## **8) Conclusion and Recommendations**

Given that Hormozgan province is poor in terms of vegetation cover and due to diversity of plants in the protected area Biosphere Reserve GNU, creation of a botanical garden is necessary for study and research about plants, especially plants in the region and their protection and maintenance from extinction and creation of growth fields and develop a variety of native and non-native plants. Botanical garden design in addition to prevent extinction of plants, leads to increase educational level of people in the field of botany and the necessity of maintenance and preservation of it. In addition, by creating gardens and circulation spaces, the complex comes a recreational facility for the public. Along with all these advantages, building design of complex in the style of stable architecture is an architectural landmark in Hormozgan province which has attracted attention of the public and architects in this issue and led to the development sustainable architecture and sustainable development, along with it, will have impact in hot air adjustment in region.

### **8.1) Response to hypotheses**

First hypothesis: Botanical Gardens due to benefit from the recreational space and having design of green roofs and living walls, will be considered to non researchers ecotourism GNU tourists.

In response to the first hypothesis, It can be said that the design of complex buildings with a green roof and living wall will be interest to people and while people become familiar with this style, and can be share with modeling of it in other places, even in their own homes, both in order to increase the per capita green space and in order to maintain and develop the plants and prevent their extinction.

Second hypothesis: sustainable architecture components will be used in the design of botanical garden such as green roofs and living walls in order to even more closely with nature.

In response to second hypothesis, which is in relation to the first hypothesis, it can be said that the use of green roofs and living walls and biological filters in designed target cause relationship of the buildings with the environment and nature and will be a good model for use in buildings. That will be designed in this climate and hereby have a huge impact on regional air adjustment, and connect with nature and preservation, this culture will be developed in the region.

## References

- Ahmadi, S. (2003). Sustainable Development in Architecture. Civil Engineering Conference, Architecture and the city of Kerman.
- Barati, S. (2005). Botanical Garden. Architecture MA thesis, Tehran University, Faculty of Fine Arts.
- Chen, F.; Kusaka, H.; Bornstein, R.; Ching, J.; Grimmond, C. S. B.; Grossman-Clarke, S. & Sailor, D. (2011). The integrated WRF/urban modeling system: development, evaluation, and applications to urban environmental problems. *International Journal of Climatology*, 31(2), 273-288.
- Mendler, S. & Odell, W. (2005). *The HOK Guidebook to Sustainable design*, (2<sup>nd</sup> ed.). NJ: Wiley.
- Naghizade, M. (2000). Iranian architecture relations, with principles of sustainable development. *Art magazine*, No. 44, Tehran.
- Soflaee, F. (2006). Sustainability climatic elements, in traditional Iranian architecture (hot and dry climate). Set of articles of Third Conference of optimize fuel consumption in the building, Organization, management and optimization of energy consumption in the country, Volume 1, Tehran.