

TAIF BOTANIC CONSERVATION CENTER

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Abstract

Agriculture is very important to human beings because it forms the basis for food security. It helps human beings grow the most ideal food crops. It is the purpose of this project is to create a complex contains educational, economical, and recreational facilities to improve the agricultural sector. The project studied three different case studies in term of concept, program, architecture and interior design, site, construction, sustainability, and financing. Also, it studied the different buildings' standard requirements and the departmental zones to assume the project's program. This study proposed three different sites and the site selection is according to certain criteria. The resulted project included a complex of five buildings; research center, farmer service center, convention center and botanic exhibition and museum, on the other hand a botanic garden and greenhouses. The selected site is located in Al-Hada, which have several advantages of accessibility, landform, view, surrounding, infrastructure, location, climate, visibility, sustainability and topography. This project utilise the sustainability material and design concept.

Keywords--Botanic Conservation Center, Agricultural, Educational, Economical, Recreational

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INTRODUCTION

Agriculture was developed around 10,000 years ago [1]. It has undergone significant developments since the time of the earliest cultivation. Agriculture for humans is Investment in the land. It was the first investment the human could have. The Fertile Crescent of Western Asia, Egypt and India were sites of the earliest planned sowing and harvesting of plants that had previously been gathered in the wild [2]. Independent development of agriculture occurred in northern and southern China, Africa's Sahel, New Guinea, parts of India and several regions of the Americas [3]. Agricultural techniques such as irrigation, crop rotation, the application of fertilizers were developed soon after the Neolithic Revolution but have made significant strides in the past 200 years [3].

In Saudi Arabia the agriculture before the discovery of oil was one of the most important economic resources in the Kingdom [4]. During the 1970s and 1980s, the government has restructured the agricultural sector [5]. The main objectives were self-sufficiency, food security and improve the economic. Although successful in raising domestic output of some important a type of crops, the kingdom has not totally achieves these objectives. It produced a limited surplus, sufficient to export some quantities of food. Saudi Arabia produced in it farms it fields and it various types of agricultural yields. This project is a new vision to the future of the agriculture sector. It's brought new approach for the community toward the agriculture and opens their minds to this rich full sector. It is a place where the family can go and enjoy by learning, shopping and relaxing.

CASE STUDIES

This study considered three case studies related to agriculture center from Spain, Lebanon and Canada. The agriculture center used the green building techniques to provide a sustainable eco-friendly building. The selected cases studied are well designed and constructed for their unique propose. The cases studies are:

- Instituto Hispanoluso de-Investigaciones Agrarias, Salamanca, Spain
- Horticultural Research center, Beirut, Lebanon

c. Halifax seaport farmers market, Halifax, Nova Scotia, Canada

Instituto Hispanoluso de-Investigaciones Agrarias, Salamanca, Spain

Instituto Hispanoluso de-Investigaciones Agrarias is designed by Canvas Arquitectos with build area of 4800 sqm (Figure 1). It is a research laboratory which meant for research and experimentation in farming and plant maintenance. It has the infrastructure required to conduct research related to agricultural activities in the field of physiology, biochemistry and molecular biology of plants, fungus and microorganisms [6].

The site designed to be part of a bigger area of environmental interest close to the river Tormes, so the design of the building is not imposed. It's basically part of the territory. The building emerges in the landscape distancing itself from a housing environment without a clear order, with different shapes and indiscriminate occupation. The topographic redevelopment of the site lead to two levels: in the upper, with the entrance from the street, the building is hidden in the landscape, while the lower level opens onto the river, separating from the ground by piles that isolate the construction of possible floods [6].

The research program and support facilities occupy half-buried volume to gives access to different nuanced services through an interior corridor. The laboratories are situated in four cubes on piles, guiding their views to the river and being separated to allow a sequenced view to the river bank from the common area [6].

Horticultural Research center, Beirut, Lebanon

Horticultural Research center is designed by Hiba with build area of 3100 sqm. The Horticultural Research Center is a research facilities that help to improve the quality of fruits and vegetables that are of marketable value. This will be revealed on the horticultural production of the country. The center also has an educational goal will affects the society and recreates the region Location. The center of market gardens supplying Beirut is mainly damour. Damour has a direct access to the city Beirut and is also easily accessed from the mountains and coastal plane. In

addition to the accessibility, the land cost is cheap with respect to other lands, and the place needs centers of attraction to give back life to the place [7].

The project includes five main zones: the Research zone including research laboratories and other educational facilities, the administrative zone, the public zone including a conservatory to exhibit the plants subject to research, the service zone including the irrigation head house, and weather station, refrigeration room, storage area, and the parking zone [7].

Halifax seaport farmers market, Halifax, Nova Scotia, Canada
 Halifax seaport farmers market is designed by Lydon Lynch Architects with build area of 5200 sqm. The Seaport Farmers' Market is an award winning Platinum designed ecological showcase on the Halifax Waterfront. The Seaport Farmers' Market uses 75% less power and 75% less water a typical market building. Harvesting free natural resources and responding to the seasons, it's one of the most sustainably designed, low energy building in North America [8]. The building functions as a gateway to the Seaport warehouse district, with the projections on the front elevation responding to the varied character of the adjacent facades. The existing ocean terminal is peeled back to create a seawall public plaza which transitions into the covered exterior public market area beneath the projecting roof. The northern edge of this facade peels back further to reveal and express its original structure [8]. The project content many sustainable features which are integrated into the building architecture. From the roof deck, one can see the solar panels, wind micro turbines and the extensive green roof.



Figure 2. Horticultural Research center [7]



Figure 3. Halifax seaport farmers market [9]



Figure 1. Instituto Hispanoluso de Investigaciones Agrarias [6]

SPACE PROGRAM

This project consists of five primary zones for the botanic conservation center namely green market, farmer service center, research center, plant exhibition and museum as well as convention center. The functional diagram of the space program is shown in Figure 4. The capacity of the visitors is assumed to be 2500 people. The project assumption and zone distribution are tabulated in Table 1 and Table 2 respectively. The green market zone occupied the largest area about 50% of the total area. The gross floor area of the project is about 70086.6 sqm.

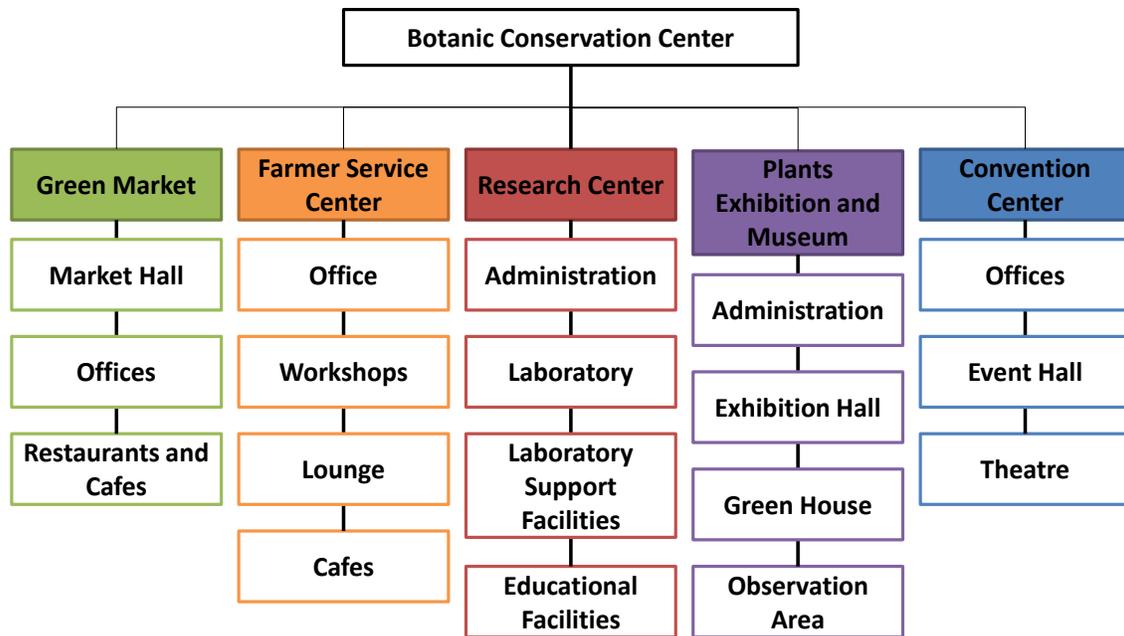


Figure 4. Functional diagram

Table 1. Project assumption

| | |
|-----------------------------|------------------------|
| GFA (Gross Floor Area) | 70086.6 m ² |
| Net Area | 54349.2 m ² |
| Footprint Area 26% | 28393.4 m ² |
| Un-Built Area 74% | 82540 m ² |
| Site Area Assumption | 110933 m ² |
| Expected Number Of Visitors | 2500 |

Table 2. Zone Distribution

| Descripti on | Percenta ge of GFA (%) | GFA (m ²) | Numb er of Floors | Footpri nt (m ²) | Net Area (m ²) |
|---------------------------------|------------------------|-----------------------|-------------------|------------------------------|----------------------------|
| Farmer Service Center | 5 | 3884 | 2 | 1942 | 2988 |
| Conventio n Center | 9 | 6418 | 2 | 3209 | 4937 |
| Green Market | 50 | 35084 | 4 | 8771 | 26988 |
| Amenities Zone | 10 | 6794.4 | 1 | 6794.4 | 5662 |
| Research Center | 11 | 7661 | 3 | 2554 | 5893 |
| Botanic Exhibition s and museum | 15 | 10245.2 | 2 | 5123 | 7881.2 |

SITE SELECTION AND ANALYSIS

Figure 5 demonstrate the proposed site locations. Figure 6 shows that Site 1 is located in Al-Hada between Al-Hada Road and Al-Hada Ring Road. Figure 7 shows that Site 2 is located in Taif in Alkhaldia District between Al-Hada Road and Al-Mutamar Road. Figure 8 shows that Site 3 is located in Al-Shafa on Al-shafa Road. This project considered several site criteria for site emulation in order to select the most appropriate site location. The considered site criteria are accessibility, landform, view, surrounding, infrastructure, location, climate, visibility, sustainability and topography. The site evaluation result of each site is tabulated in Table 3.

It is necessary to select a site that can be accessible by people, automobile and loading trucks. The land form of the selected site should be a good fertile soil suitable for farming. The placing facilities should be depending on the site surrounding view praetors. It is important to understand where to place the facility in order for it to benefit from the surrounding. The project should be place in an active area surrounded with commercial areas and near to farms. Besides that, it must be available on-site water resources and infrastructure. The location has to be in agriculture area in order to success the project, also the climate must be suitable for plantation. The site should be visible site along a major street with easy accessibility is ideal. The site should be sustainable and suitable for plantation with less pollution. It prefers to have a variation contours to grade the building facilities by it needs.



Figure 5. Location of sites (Site 1) Al-Hada, (Site 2) Taif, (Site 3) Al-Shafa



Figure 6. Site 1 [10]



Figure 7. Site 2 [11]



Figure 8. Site 3 [12]

Table 3. Site Evaluation

| Criteria | Weightage (%) | Site 1 (Al-Hada) | Site 2 (Taif) | Site 3 (Al-shafa) |
|--------------------|---------------|------------------|---------------|-------------------|
| Accessibility(15) | 15 | 1.35 | 1.5 | 0.9 |
| Landform(12) | 12 | 1.08 | 0.84 | 1.2 |
| Surroundings(8) | 8 | 0.8 | 0.64 | 0.48 |
| View(5) | 5 | 0.4 | 0.3 | 0.3 |
| Infrastructure(10) | 10 | 0.8 | 0.6 | 0.4 |
| Location(10) | 10 | 1 | 0.95 | 1 |
| Climate(20) | 20 | 2 | 1.6 | 2 |
| Visibility(8) | 8 | 0.64 | 0.64 | 0.64 |
| Sustainability(7) | 7 | 0.56 | 0.42 | 0.56 |
| Topography(5) | 5 | 0.45 | 0.3 | 0.4 |
| Total | 100 | 9.08 | 7.79 | 7.88 |

After evaluating all the options and calculating the result as shown in Table 3, the first site option had the highest score. The site area is 60000 m². The selected site has different accesses which are Al-Hada Road, Al-Hada Ring Road and Al-Hada Telefreack. Figure 9 and Figure 10 show the site surrounding and site climate analysis respectively. The topography of the site enhances the exterior view as well as encourages the natural ventilation, and lighting. The average temperature in Al Hada is 14.6 °C in a year, also the average rainfall is 276 mm. July is the hottest month of the year. November has the lowest average temperature of the year, about 10.8 °C.

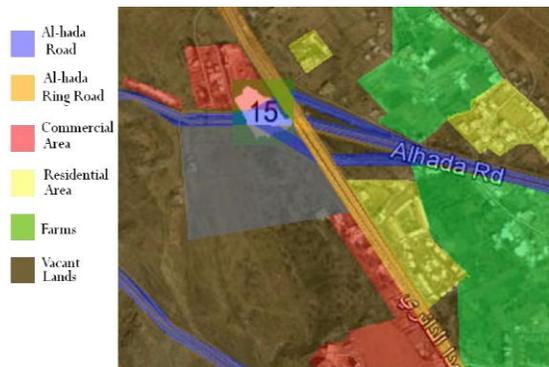


Figure 9. Site surrounding

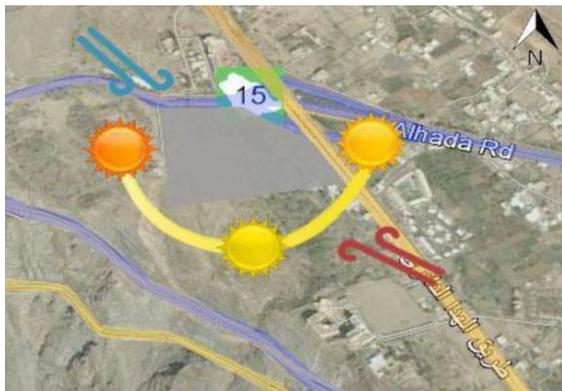


Figure 10. Site climate

ZONING AND PROJECT DESIGN

Figure 11 demonstrates the final site zoning of the project. This project placed the hotel on the west side on the highest part of the area to provide a good view and to enhance the natural ventilation. The research center with it owns entrance for

privacy and the farmer market onthe main road to be focal point of the project. The amenities are designed on the middle to be accusable from all parts.

The design concept of this project came from the nature environment of Taif area. Taif is a mountain which includes many levels of topography. The concept of the design is to provide a form with many levels connected together with a connection and attached to its environment. The development process flow of the project is shown in Figure 12.

Regarding the sustainability in design, the material used foe the sustainability of the building is Zinc panels and PTFE. Zinc is very abundant can be found in rocks, air, soil, water and in all living organisms. It is used in fertilizer as well as in construction. It is a safe element because it has the Zinc is non-ferrous metal, more resistant to corrosion and rusting requires very little maintenance over time. PTFE coated glass is a light material, low in maintenance due to the cleaning action of rain on the Teflon outer layer. Typically, cleaning is recommended every 2-5 years. It is also completely immune to UV radiation. It is a non-flammable material.

Also using Water Collector and distributed around the site to collect the rain water and store it. Install a living machine in different parts of the building to recycle the water and use it in irrigation. On the other hand double glazed Glass is energy efficient. The close gap between the two sheet of glass act like insulation layer. This will add thermal resistance and reduce the amount of heat gain at the summer time and reduce the heat loss on the winter time to make the space at comfortable temperature. Figure 13, Figure 14 and Figure 15 demonstrate the view of entrance of farm market and club area, outdoor area and main perspective of the project respectively.

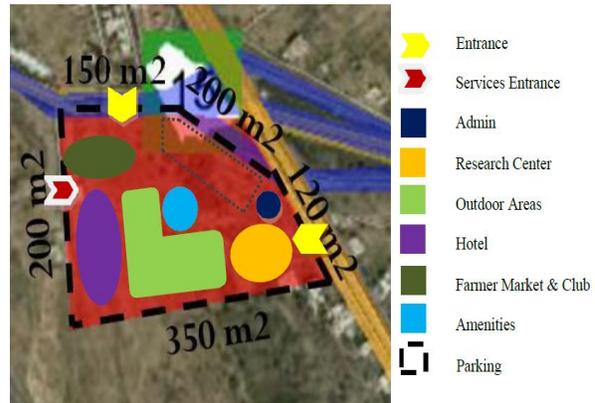


Figure 11. Site final zoning

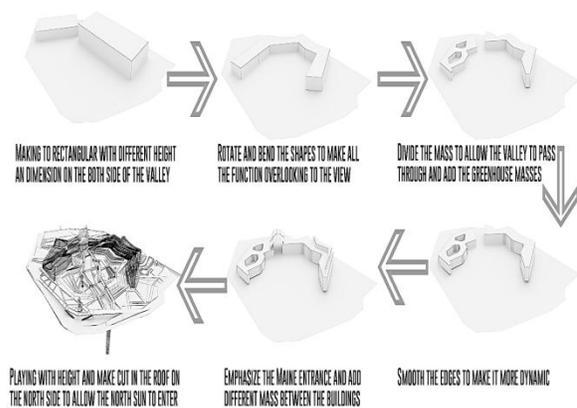


Figure 12. Project form development



Figure 13. Entrance of farm market and club area

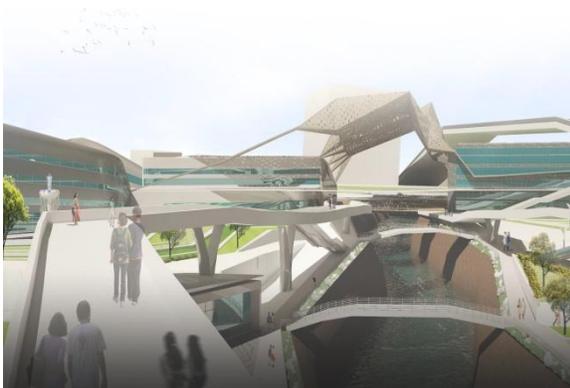


Figure 14. Outdoor area



Figure 15. Project Main View

CONCLUSION

Taif Botanic Conservation Center provides a new place where all ages can learn and understand the important of agriculture and to let them practice it by their own hands. On the other hand visitors can enjoy their time with the nature of the environment with grate atmosphere. Also make a research for the benefits for humans and agriculture. The proposed center has five main zones namely green market, farmer service center, research center, plan exhibition and museum, and convention center. The selected site is located in Al-Hada based on the evaluation criteria of accessibility, landform, view, surrounding, infrastructure, location, climate, visibility, sustainability and topography. The project design also emphasizes the use of sustainability material and concept.

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