

## LANDSCAPE ARCHITECTURE AS A PERSPECTIVE OF ENERGY AND RECOURSES CONSERVATION

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**ABSTRACT:** The paper presents the effect of urban planted area in conserving the energy consumption and recourses conservation. An analytical study reviews the local urban landscape features prevailed during the ancient Egyptian, Greek and Roman culture, and flourished in Islamic civilization; also, the paper examines the key features of modern urban landscape design practices which are compatible with climate, social, economic and environmental issues, Case studies from hot desert regions such as Egypt, Arizona and Nakab that revives the Islamic theories for urban landscape, resources conservation and sustainability. Moreover, the paper also reviews the field studies to measure the effect of green areas in modifying the urban climate, in order to deduce the criteria of distribution of green areas through housing and public projects in respect of energy and recourse conservation.

Key words: landscape architecture, Energy conservation, Urban climate, Eco-villages.

### INTRODUCTION

Food and Agriculture Organization (FAO) announced that desertification threatens 20% of the world's population (1200 million) in 110 countries around the world especially in Asia, Africa and Latin America. and that about 50 million acres of productive green land turns annually to the land of non-economic return, and 14 million acres turns to desert render any production [MAB 1985], It is expected to climate changes that Delta Egypt sinking below sea level average during the coming centuries, and forest extinct in Lebanon during fifteen years, and another changes all over the world [Union of Arab youth 2001].

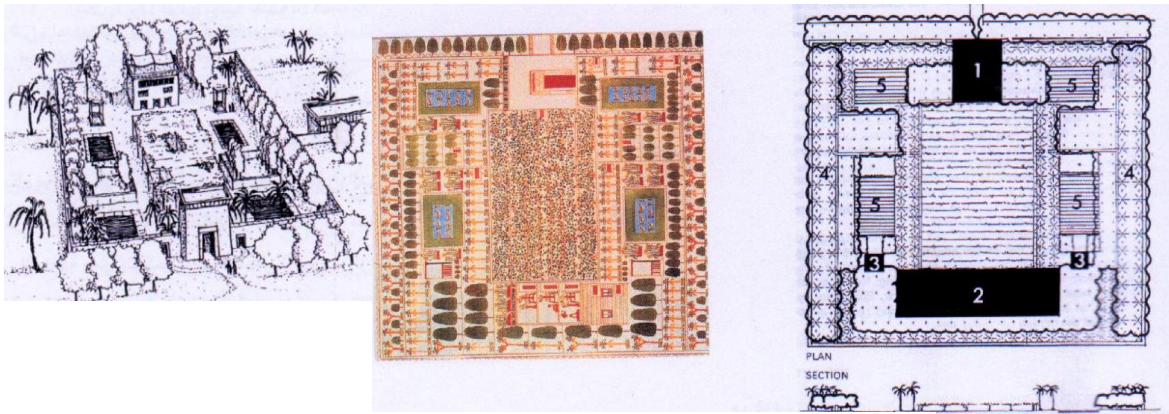
The President of the World Water Council warned of the lack of availability of fresh water with increasing population - more than the world's population to 8 billion people in 2025 - and the increasing consumption by more than twice the population increase during the fifteen last years, with the arrival of the global rate of desertification to 11 million acres annually as a result of ill - Water management, environment and logging, overgrazing and depletion of groundwater reservoirs, with the suffering of more than 200 million children worldwide are currently nutrition problems in our region in North Africa and Central and South-East Asia and North South and Central America [MAB 1985].

Although the Arab and Muslim regions are among the hot desert where water resources and natural vegetation are limited, beside Arab Gulf states depend on desalination of water, we will find most of the consuming behaviors at that areas, In spite they have a holy call for balance and rationalization at all aspects of the life (holy Quran-soura15/19-21), So, this paper addresses the comparative analysis of patterns and elements of landscape architecture within the public and semipublic spaces of housing projects, since ancient civilizations till modern civilization, and how to respond to the holy call in the vital importance of compatibility with the environment and resource conservation.

## 1. LANDSCAPE ARCHITECTURE IN ANCIENT EGYPT [Abdalhameed 1988]

The hot climate, even ground and the belief affected in the design of gardens and orchards. The public parks were limited in the river ponds and creeks during the time of the flood. and after the flood drawn the ponds turned to turf land, trees, parks and playgrounds.

1. 1 **Design pattern of gardens** was geometric, symmetric and axial - it followed human creation- with straight lines, perpendicular angles and emphasizing the entrances.
1. 2 **Elements of the landscape** were local trees and shrubs for shade and food (palm trees, cypress, acacia, doum, buckthorn, olive,..), vine trellis and shading trees covered the corridors. Medicine herbs, aromatic flowers, Louts and Bardy flower boxes -symbol of the North and south province of Egypt. Holy pond was at the Temples same as in Karnack temple, beside the water irrigation channels. Flooring was sand and stones. There were statues of the gods and places to sit inside the gardens of King and priests. Mud-brick fence surrounded houses and burned brick surrounded temples for privacy and protection from wind and stray animal.



*Fig.1 Domestic ancient Egyptian gardens[Rogers2001].*

## 2. BABYLONIAN LANDSCAPE ARCHITECTURE [Abdalhameed 1988]

The climate and mountainous nature imposed the construction of the stepped terraces with trees growing at different distances equal.

- 2.1 **Design pattern of gardens** was geometric, symmetric and axial in spite the uneven ground.
- 2.2 **Elements of the landscape** were local trees (fruits, aromatic and medicinal). Stairs and slopes joined the levels. Flooring was sand and stones. There were water ponds at the bottom of terraces where water flow in the form of Falls

[Abdallah1981].(fig.2) [Rogers2001]

### 3. PERSIAN LANDSCAPE ARCHITECTURE [Jon Ady 1990]

Concerned with the art of landscaping, the Persians opened the gardens of paradise, as well as devised water parks, walls gardens, and submersible gardens.

**3.1 Design pattern of gardens** was geometric, symmetric and axial. Gardens had taken the form box or rectangle and divided in four equal parts through two perpendicular paths, fountain or pond was often placed at the cross.

**3.2 Elements of the landscape** were local trees and shrubs (cypress, nuts, pomegranate, mint, jasmine, tulips, basil, carnation), magnificent flowers boxes which became painted murals on the boards. Flooring was sand and stones. water irrigation channels and water-filled moat was surrounding the garden and city for the protection.

### 4. ROMANIAN LANDSCAPE ARCHITECTURE [Abdalhameed 1988]

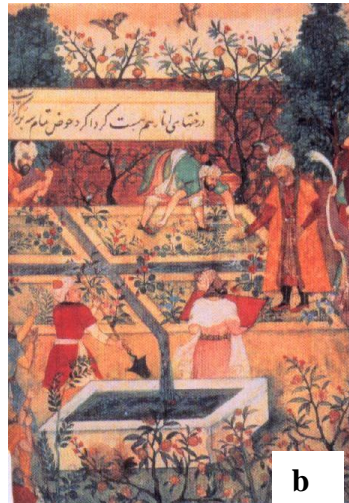
While the extended park at the Greek, design of the Roman gardens followed Pharaonic garden pattern design, focused on the garden houses and palaces were focal center of daily activities.

**4.1 Design pattern of gardens** was geometric, symmetric and axial though the uneven ground.

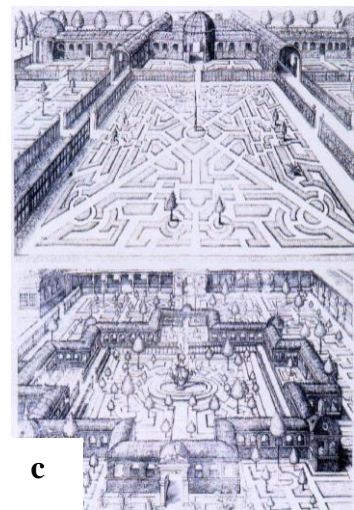
**4.2 Elements of the landscape** were local trees, shrubs and diverse crops because of the rainy climate, Pieces of pottery for the flowers. Roofed arcade surrounded the gardens, and the towers were in the middle of the garden as a security. Burned brick was for paving paths, fences and water wells -wells had been in the map of the gardens. Multiple fountains. Statues, decorated walls and sculpture works were depicting people and ravenous animals.



a



b



c

Fig.2 a- Babylonian stepped gardens, b- Persian gardens, c- Renaissance garden.

### 5. ISLAMIC LANDSCAPE ARCHITECTURE

The Arabs had no civilization to impose it on the cities that they entered for the deployment the last call for unification. They integrated and confirmed local positive customs at that city while negative customs disappeared due to the Islamic rules.



There were many functional Gardens (recreational, cultural, scientific and curative), and there were the roof gardens, and gardens for the poor followed alwakf<sup>1</sup> system [Alfeqi 1414 hegri]. Moreover, prophet Mohammad peace be upon him forbid cutting the trees even in the territory of the infidels God, and maximized the preservation of resources and balance in consumption . The wealthy Moslems coordinated their garden's design with heaven in the holy book (holy Quran - verse 13/35). Andalusia gardens in Spain are still marvelous example for built gardens and green courtyards, so far, garden in Kashmir valley in India which had high trees at 40 m and multi-level water channels [Jon Ady 1990].

**5.1 Design pattern of gardens** was geometric, symmetric and axial. Gardens formed in square or rectangular of several central courtyards and backyards that integrated with building blocks through the taghtaboush<sup>2</sup> and arcades. Columns of arcades ornate with palm leaves, grapes and figs.[Alfeqi 1414 hegri]

**5.2 Elements of the landscape** were local trees, shrubs and aromatic and medicinal plants, climbing plants and vine trellis. Flower pots that are easy to transport to interior spaces and above the rooftops. Fountains connected with water channels and ponds. Floors were colored marble, ornate glassed tills, basalt and carved stones. Mosaics was coating for walls, floors and shelves of books and umbrellas. There were domesticated animals and towers for birds [Alfeqi 1414 hegri]. Embodiment has forbidden and the meditation should be in the nature and the miracle of creation- as in the holy book (holy Quran- soura 29/20 & 41/53).



*Fig. 3 a- Ganet-alareef courts for fruits cultivation and water ponds  
b- Cordoba palace and Hara (narrow street)*

## **6. RENAISSANCE LANDSCAPE ARCHITECTURE** [Abdalhameed 1988]

Europe's civil wars controlled the pattern of cultivation in the temples and forts that were cultivation of food and medical, while political stability has expanded to include spaces

<sup>1</sup> Alwakf system is an economic system that taking the profit of a trading project to expense on services and worship projects.

<sup>2</sup> Taghtaboush is a covered outdoor sitting area at ground level located between courtyard and back garden

for entertainment. Parks existed by the rise of the West and separation between church and science and continued the geometric pattern of garden design in Europe until the eighteenth century. The colonization of civilized Cities quoted design patterns and crops with science and civilization of the colonies. Natural pattern of landscape emerged in England parks and they quoted trees from India, Africa and America. The Industrial revolution and building materials manufacturing techniques caused the spread of high buildings and separated between the building and spaces surrounded, consequently the increasing of crime which was called the Americans socialists and architects in the early twentieth century to the design of residential spaces for reasons of social development. Then the design of green areas developed and have multiple trends and functions, and they considered form than Beneficial in the design of green areas, whether public or private green spaces. (fig.2) [Rogers2001]

## **7. CONTEMPORARY URBAN GREEN AREAS**

French and English colonial culture transferred to there colonies including Egypt. At the beginning of the cultural movement in Egypt there was a distinction between what is local and what is foreigner, So the official and the academic institutions transferred Western cultures other than the reality of local environmental planning and design of construction and landscape architecture and more. After Arab petrol forbidding in 1973 and recognize the climate changes due to the industrial concentration, the presence test of the Western and American desert compounds that compatible with the desert environment to rationalize energy and resource conservation, a call of Islam to reconstruction of the ground which applied by the Western now.

So, Paper analyzes several models for the landscape of residential and public spaces in warm dry and humid deserts in order to assess their compatibility with the local environment in terms of selected elements of landscape, irrigation systems, and pattern design approach and the purpose of the landscape.

### **7-1 Landscape at spaces of housing staff in Kafralgona- Egyptian arid desert**

KafrElGouna on the Red Sea coast north of Hurghada distance of 20 kilometers. It is at an altitude of about 3 meters above sea level, Latitude 27 degrees of suspicion hot semi-humid climate, the average daily temperature in summer is 33-25 degrees Celsius and humidity of 60%,and winter temperatures 20-10 degrees Celsius and humidity 45%, rain less than 200 mm a year, active winds up to 7m/s North and northwest. Housing project constructed for employees of hotels the touristy, and extended to have services, coffee shops, hotel chalets, several international hotels, health club, museum, cinema and a multiple restaurants. The residential area of 200 staff units and set up brick walls and vaulted roofs and domes (updated traditional pattern), the attached housing units are surrounded vista that connected with narrow corridors for pedestrians.

#### **7.1.1 Pattern and landscape elements of residential spaces**

Organic patterns are followed in the scattered spaces around the buildings. Spaces reserved for pedestrians which helped in spreading the palm, shading trees (acacia)and shrubs (aromatic, lantana, Yucca, and basil) all over the spaces and concentrated at the entrances of buildings. Desert grass (aurantiacus, spectabilis) with a rock formations and colored gravel. Paths paved with stone, brick and mosaic tiles. floor pottery lamps lit the village in addition to the traditional lighting poles.

### 7.1.2 Environmental compatibility of the landscape process

The purpose of the forestation of housing area is to improve the visual of housing blocks. The shaded paths through the compacted buildings enhance walking. Desert landscape elements tolerate both high temperature and salinity. The source of irrigation water is groundwater which cured from the excess of salinity; drip irrigation system is a guide to water conservation. There has not been a fruitful trees, although the project was an opportunity to join the blank scattered spaces in orchards that facilitate cultivation of fruit, medical and aromatic plants which increase the value of the investment.

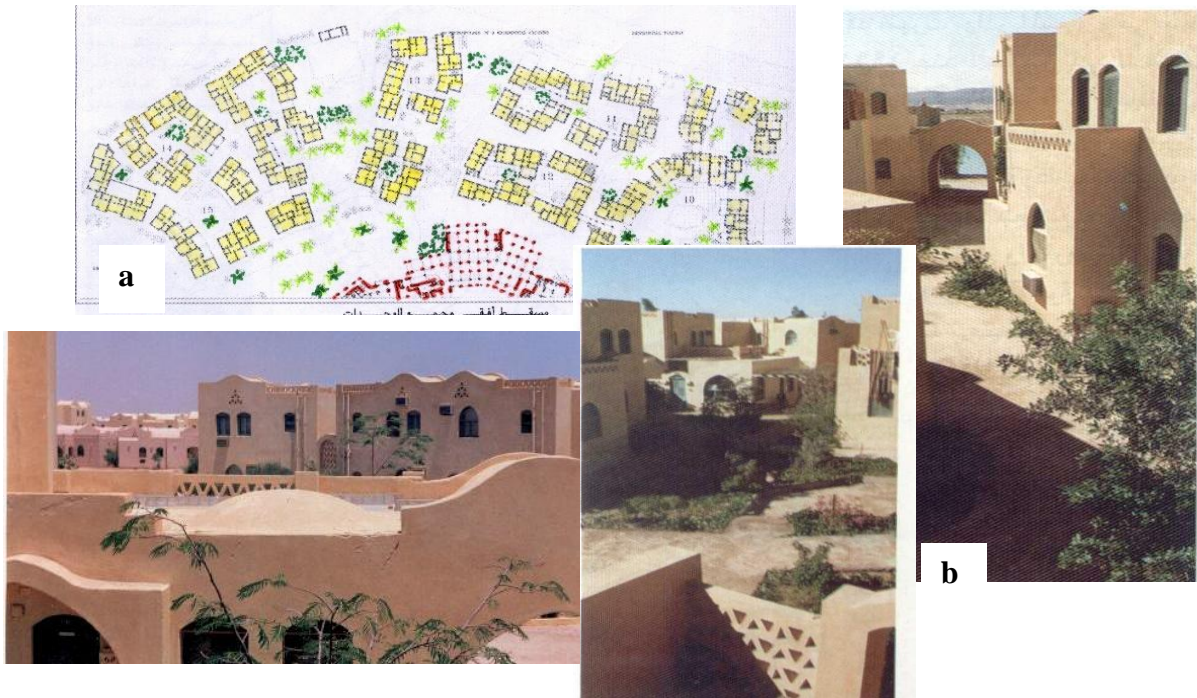


Fig.4 a- Plan of staff housing in KafraGouna b- the landscape

### 7.2 Landscape at spaces of housing areas in SHARJAH- UAE

The city of Sharjah is one of the cities the United Arab Emirates, located on the Arabian Gulf, which is at latitude of 25 degrees north latitude, climate is hot and humid in summer, warm and comfort in winter, area of Sharjah is 2600 square kilometers, and population is about seven thousand people representing indigenous peoples about 20%. The heritage neighborhoods are compacted and pointed stone houses with green courtyards. Its narrow pedestrian streets are shaded by buildings no reforestation to enhance air flow through urban fabric. After petrol discovered and the Union of Arab Emirates in the seventies, which widened the area development projects, including landscape architecture of the public spaces. Currently, Sharjah indigenous people live in separate houses with courtyards and wide street surrounded-to accommodate the movement of the cars that left in the courtyard of the house, while most of the foreigners are living in residential towers. Tourism has become now the region's economic infrastructure so that development projects linked foreigners and that began to abandon some of their traditions and the holy Arabic language.

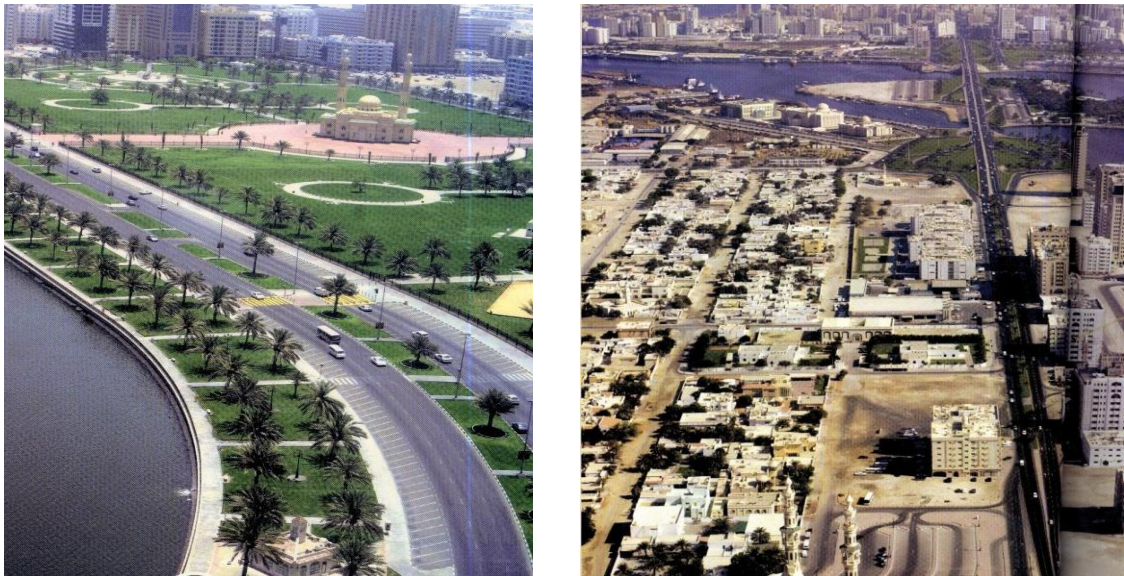


### 7.2.1 Pattern and Landscape elements of residential spaces

The pattern of landscape of public and semi-public spaces of housing projects is geometric and symmetric, while landscape elements identified in green grass punctuated by palm trees and colorful flower beds. Few trees are in the internal residential streets. No network for pedestrian roads only the shoulders of asphalt roads, sidewalks are paved in mosaic and concrete tiles. Pedestrians are rare due to difficult climate with the long-distances and exposed urban spaces and the absence of the shadow of either buildings or a forestation

### 7.2.2 Over the environmental compatibility of the landscape process

We can say that the desert of Emirates Turned to the green carpet of imported grass that consume more water, knowing that the water source is groundwater which is treated excess salt, that is economically costly. Although the pattern of a forestation approach helps to penetrate air through urban spaces, but the prevailing pattern of the residential towers result in stagnating wind behind those towers and air speed becomes less than 20-40% of the free wind, and had a negative impact on the failure of passive architecture that compatible with the natural environment Those passive treatments which still have present in sustainable and traditional district of old Sharjah and Bestkia in Dubai - criticized the restoration of the old traditional houses that built from marine stones and replaced to another materials, that stones reduce air moisture in the housing areas. Now, most of us depend on mechanical air conditioners. More over the recent trend of UAE is the establishment of recreational areas adapted mechanically fully with the internal landscape of imported plants - although the imminent consuming of fossil energy, which invited the West to exploit the direction of natural energy Particularly in heating homes, and scientific research have continued to find substitute energy.



*Fig.5 Layout of modern residential houses with courtyard for native Sharjahian, and towers for foreigners, geometric pattern of the landscape.*

### 7.3 Landscape architecture at spaces of Civano compound in Arizona desert

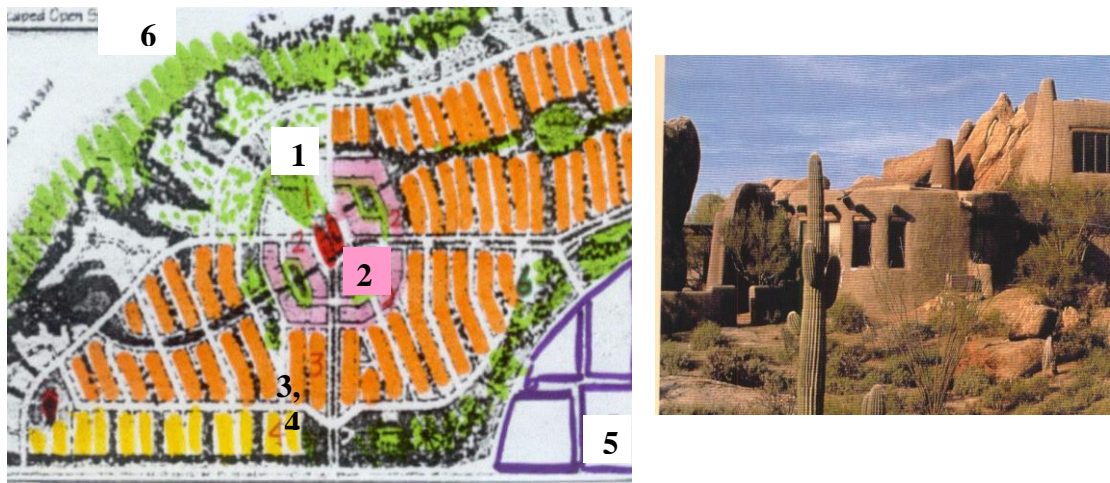
Tucson is located in south-central Arizona, it is situated in a high desert valley surrounded by 4 mountains, and elevation is 800m above sea level. Temperature is 38-24°C in July and 18-5°C in January, yearly rainfall is about 27 cm and humidity is low [Tucson web site]. Civano is located within the city of Tucson, the master plan proposes an 820 acre mixed-use community of 2600 dwelling units for native Americans - the trend is now changed to how to develop the Indians' lives as a part of the society!-(5000 people) organized around three neighborhood centers. Commercial and industrial space area are 75 acre. Straw-bale is a building material and construction system well known in Arizona where Tucson was the first city to adopt straw-bale building code [Mervat2000].

#### 7.3.1 Pattern and Landscape elements of residential spaces

Housing units are attached and have front and back yard which will cultivate with vegetable and fruit trees. Natural desert open spaces with proposed area about 400 acres at the north direction which considered as recreational facilities [Mervat2000]. Design desert landscape in order to attract wildlife.

#### 7.3.2 Over the environmental compatibility of the landscape process

The desert landscape should be integrated with all other component of desert development. Also water harvesting is the capture, diversion and storage of rainwater for plant irrigation and other uses. The House Energy Doctor Program (HED) provides a comprehensive analysis of home energy use – passive improvement strategies are: increased roof and wall insulation, double glazing with reduced area, vented roof, shade trees, overhangs and high efficiency mechanical system [Mervat2000].



*Fig.6 layout of Civano neighborhoods with the nature desert as recreational facilities(6)  
1- park, 2-civic center, 3,4- housing, 5- energy production zone, 6- wild plants.*

### 7.4 Landscape architecture at spaces of Zionist youth settlement in Nakb desert

Desert development in Israel aims to achieve certain political economic and most of all ideological goals which has basically called for the return to the Holy Land, and the



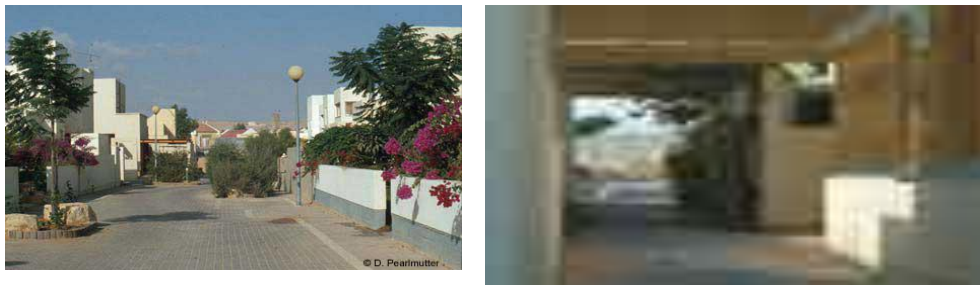
establishment of new settlements particularly the rural-agriculture settlements in new region. Patio house neighborhoods built in Dimona (elevation 600m) in the arid Negev Highlands which have wide daily and seasonal thermal fluctuations, temperature in summer is 32-20°C with low relative humidity and strong afternoon winds. In winter it is freezing (20-3) with abundant solar radiation [David 2003].

#### **7.4.1 Pattern and Landscape elements of residential spaces**

Neighborhood consists of 80 private building lots. Housing units have back yard which will cultivate with vegetable and fruit trees. Narrow brick-paved streets interlaced with landscape elements, and only 2.5 meters wide. The shading effect is increased by overhead trellises supporting deciduous vines. Open space at the center of each cluster allows ventilation and private gardening, using shade trees, largely deciduous and drought-resistant and including a number of fruit, ground cover of local crushed stone interspersed with succulent flowering desert plants [David 2003].

#### **7.4.2 Over the environmental compatibility of the landscape process**

the desert plants and respect the value of land was as an aim. Israeli agriculture is highly intensive based on irrigation, water recycling, hothouses, scientific crop management and marketing [Mervat 2000]. More over, the self dependence of cultivate food in housing areas.



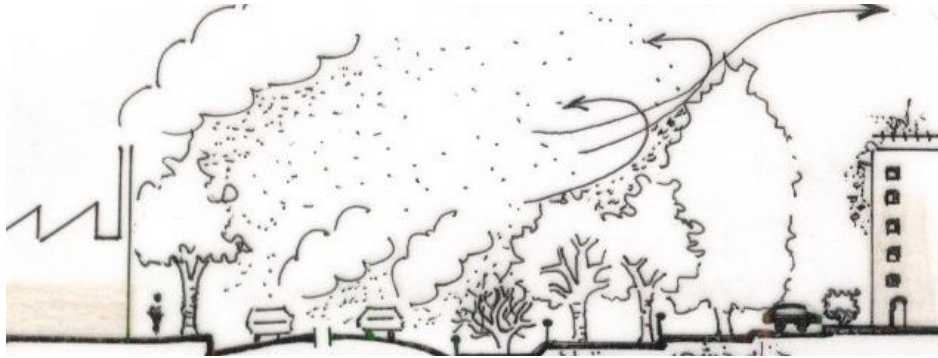
*Fig. 7 Cultivated streets of youth settlement in Nakab*

## **8 THE IMPACT OF URBAN GREEN AREAS IN IMPROVING THE URBAN CLIMATE**

The design details of planted areas to improve indoor and outdoor thermal performance are width of the planted area around the building, type of plants, size and shape of trees and shrubs, location of plants of different types with respect to the building. The following review of the field studies and measurements of affecting of green areas in improving the indoor and outdoor climate.

8.1 Green areas improve the urban climate and natural ventilation, reduce glare and moisturizing the air, control the movement and direction of wind, protection from rain water, and control floods and raise the level of humidity in dry climate, and absorb excess moisture through the huge wood stem of trees

8.2 Agricultural land and green belt surrounding urban areas act as a lung penetrates air to the urban core, and protect urban from cooling at night where emits long-wave radiation.(wind shadow distance is 11.5 time of the belt height)[ Michele1982] and filtrates the sand in front of the green built

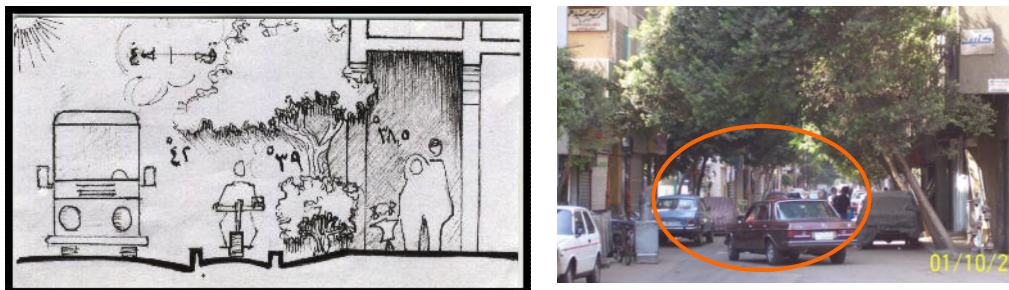


*Fig. 8 triangle shape of the green belt increases the protected area from polluted air*

8.3 Orchards reduce urban air temperature 5-4 degrees Celsius, (Orchard size 300\*150m and canopy covered 30%of land area and empty fields surround it) while the open fields nearby reduce the temperature 1.5 °c (surround air temp.29 °c), and less daily thermal contrast, despite the slow velocity of the air for more than 50% through orchard. Orchards increase humidity, salinity resistant, the surface shading vegetation compared with open spaces, in addition to being a useful economic and recreation. spread greens through private and semi-private spaces of urban mass contribute to modify the urban environment - direct vital benefits. Orchards can be a separator between the neighborhoods and the various uses of land. While residential gardens cultivated grass that consumes water and it has limited impact on the climate in place, and the fading impact of long distance of 150 meters [Givony 1998].

8.4 Grassy areas provide better ventilation while accumulate of dust and sand that are difficult to swept away, other than excessive consumption of water, and heat gain when grass is dry [Givony 1998].

8.5 Providing shade along pedestrian streets in hot regions decreases air temperatures 0.5-3°c - depends on orientation and density of plants. However, trees are located on the shoulders of the traffic roads causes the concentration of the pollution at the pedestrian level [Amal 2005].



*Fig.9 a- shrubs with trees to avoid pollution and reduce temperature  
b- trees at traffic roads concentrate pollution at pedestrians level*

8.6 Trees, shrubs and climbing plants that shade buildings at western and eastern reduce 50% of the incident radiation on the surfaces and ground, and reduce 60% of cooling energy consuming by building without shading, and increase the evaporation and moisturizing the air, and reduce the air temperature below 2 - 10 ° c depending on the intensity of shading, color and orientation of building. Square with massive a

forestation receives less than 40% of the energy of radiation received by the field without trees [Ian 1979] ]

8.7 Surface temperature of concrete wall at the west direction (dark) increases 10 °c more than the ambient air temperature, surface temperature decreases 1 ° C by adding a curtain Ivy screen - which illustrates the importance of shaded plants in the western wall and thus reduce the temperature of the Interior Spaces [Givoni 1998].

8.8 Roof garden of shrubs, climbing plants and service spaces reduce 90% of the convection on the roof building, increase the green areas. Roof gardens enhance air velocity, circulation and filtration, and forced air flow to penetrate under buildings roofs level. It is a living area in summer nights and winter days, and to mind the areas of economic and social development and entertainment.

8.9 Landscape affects cooling energy consuming at light-isolated building surrounded by trees and shrubs, the average daily consumption of hot summer days, Florida, in the absence of shaded plants of the building is 5.5 k. watts/day, after the addition of trees and shrubs of the building shaded consumption decreased to 2.2 k. w /day, the cold period heating consumption dropped from 8.6 to 3.6 k. .watt [Givoni 1998]

8.9 Mechanical cooling Energy consumption increases 20-30% for building surrounded by a rocky track than the building is surrounded by grass and shrubs to shade walls.

## 9. CONCLUSION

Clear from the analysis of landscape architecture throughout history that the principle of maximizing the value of land and resources has continued through the ancient civilizations, even philosophical trends began to take into more functional and utilitarian trend. Beside the manufacturing concentration affected depletion of resources, and space communications concentrated pollutants at the atmosphere till the renewal of nature component become difficult. Maybe the compatible models of green communities can be an invite reconciliation with the environment, so, we recommend the following:

- rooted the Islamic religious values in cooperating to revive the desert land, a forestation and fruitful economic integration, that principles improve the atmosphere of the ground, ensure shelter and food for successive generations, and maintain the environment efficiency of the existing communities.
- The planning and designing process of the desert built environment should be integrated, and should respond to the natural environment –that the first adapted environment on the ground- the landscape design should be designed to respond the harsh hot desert environment, retain public open spaces that are convenient to the desert climate and scarcely resources.
- Regional Agriculture that is informed of agricultural plots and tree belt around cities (with triangle shape) to increase the physical benefits, reduction of air pollution and temperature through the built areas. Maintenance of the arteries roads that parallel to the prevailing winds- or oriented at an oblique angle to the prevailing winds- within the compacted urban fabric to facilitate the drainage of urban energy.
- Maintaining the porous soil are essential to maintain the easy evaporation of the built up areas' energy which has been focused on the horizontal surfaces, that is through the separation between the traffic roads and pedestrian paths –the pedestrian



neighborhood- and using porous finishing materials for pedestrian walkways and buildings envelopes.

- Instead of the mechanical planning procedure of determining green land area according to the size of the population, it is desirable to establish a method which enable the evaluation of the need for open spaces, aimed at fulfilling specific functions within the urban network, while striving for intensive usage of the area by the local residents. That was in the Midvale era Cities (Fatimid Cairo, Esfahan, Aleppo etc- fig. ), Compacted residential compounds with central open space (saha of Masged), central courtyard houses and private orchards in the outskirts of the compounds are more effective than the public parks in the adapting with desert climate, scarcely resources, human development by adjacent to the plants, and the limited resources available to the municipalities at the developing desert countries.
- Rationalization of water consumption and the selection of plant species compatible with the local desert environment. The fountains and ponds that are located in the traffic streets without any human benefits, otherwise, locate it in the parks and private spaces to maximize the vital, social benefits and resource conservation.
- Energy conscious landscape which cited in that paper of the previous studies enhances the resources conservation and the rationalization of energy consumption air conditioning. Plant is energy-producing as well as trees such as jatropha, castor, sugar cane and beets, jobjoba, sunflower and soy.

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