Urban Greenery to Redefine Cityscape For More Sustainability

MASTER THESIS

Written by Danah Alkahef
Matrikel-Nr: 4061873
Born on the 20th of September 1989
Anhalt University of Applied Sciences, Bernburg
Course of Studies "Master of Landscape Architecture"

First Reviewer: Prof. Dr. Alexander Kader
Second Reviewer: Dr. Torsten Lipp

Handover Date - 29 January 2018

Cover Figure- Zürich, Switzerland.
Source: Author

Bibliographic Description

Alkahef, Danah

Urban Greenery to Redefine Cityscape for More Sustainability

2018/ 111 Pages/ 102 images / 04 Charts / 02 Diagrams / 01 Tables

Anhalt University of Applied Sciences, Bernburg
Faculty Landscape Architecture

Author's Abstract

The purpose of this Master thesis is to investigate the effects of greenery on the cityscape in general with linking this research to the growing countries such as the Middle East region, where the heat is more than the European region and they need more solution to decrease the Urban heat and live in a more sustainable way. The case study part was taking a place in Singapore because Singapore started their way in the sustainability and urban greenery and there is such a good examples of urban greenery in Singapore, and the design part site chosen in Damascus, Syria in the Middle East because of the urbanisation and random housing that impact on the city of Damascus specially in this time where a lot of destruction occurred due to the country unstable situation which Damascus need the focus in the Middle East. The work in hand is divided into six chapters:

00: Abstract
01: Introduction
02: Greenery in the urban fabric
03: Features of sustainable cities
04: Breathing and Living Architecture (Case study)
05: Design (Bio-culture Bus Shelter)
06: Conclusion

Statement of Authorship

I hereby declare that I am the sole author of this master thesis and that I have not used any sources other than those listed in the bibliography and identified as references. I further declare that I have not submitted this thesis at any other institution in order to obtain a degree.

Bernburg, January 2018

_____

Signature of the Author

Acknowledgement

I would like to express my gratitude to my supervisors Prof. Dr. Alexander Kader and Dr. Torsten Lipp for the useful comments, remarks and engagement through the learning process of this master thesis. Furthermore I would like to thank my loved ones, who have supported me throughout entire process, both by keeping me harmonious and helping me putting pieces together. I will be grateful forever for your love.

Table of Contents

Table of Contents

Abstract

Increase in urban population is resulting in increased population densities in the cities which also lead to increasing in pollution. Urban greenery have a lot of unique aspects. The purpose of the study reported in this master thesis is to assess the role of urban greenery in the cities and the big role of sustainability in the cities.
Urban greenery is to soften up the cityscape and make it a much more liveable place to be in. Providing greenery into the cityscape development is an important rule, with policies that integrate greenery into the built environment, and encourage greenery to be integrated back into the environment.

The dream of achieving a city and aspiring to, where all wrapped up in an amazing nature environment and make sure that the greenery that we create in the urban areas on the existing environment are more functional for an active use.
The living in an urban areas where there is no boundaries whereby the community have access to the green areas, and where the green areas have access to the architecture, this integration should build a harmony between the urban areas and the green areas for more breathable cities and architecture.

The solution for the polluted cities we live in at this very moment is green architecture in all sense, not just a sustainable architecture but a green architecture full of plants and greenery. Greenery in the cityscape also has an assignment role in protecting and conserving biodiversity and creating a shelter.
The urban greenery is the ventilation function to the city, which also an important for making the cityscape looks attractive and rich environment for its inhabitants. Greenery as well as other natural elements help to develop planning composition of cities, increasing expression and identity of the city.

In order to understand and express these green resources in the urban landscape, it so beneficial to see the city as a complex environment, the network of the built urban structure and the network green urban structure should be inseparable, these networks create the meaning of sustainability and describe the urban concentrations in a physical interaction.

Urban greenery has a value sense in spatial, ecological, social and cultural dimensions. In relation to a sustainable urban development. Nowadays, Many cities around the world are developing toward a sustainable living environments, the important of greenery becoming of a function in the urban development such as Europe, east Asia like Singapore, Korea and Japan and many cities still need more strategies to create and shape the existing environment, such as the middle east region.

The green areas in the middle east doesn't cover enough space and almost locate in the abandoned areas, while the urban composition lack of greenery in most of the middle east.
A lot of issues need to be resolved and prevent in order to improve and plan a sustainable urban development.

This approach is for a successfully used of greenery in the urban planning in any city around the world who wants to create and balance the nature with the existing living environment in the city, and invite flora and fauna to be again a component of the urban areas in the cityscape.

Chapter 01

Introduction

1.1 Introduction

Humans and animals convert food, water and oxygen into energy and waste products like urine and carbon dioxide. The energy they produced used to perform activities such as moving, breathing thinking or stored for any other activity . these processes form is a part of their metabolism — to stay alive and functioning, it requires resources and it generates waste products.
In much the same way, our cities need a lot of greenery, energy, materials, water and nutrients to provide sustenance and shelter to the citizens who live in it, to produce goods, services and utilities to grow and to eliminate waste and pollution.

In the same way that a human metabolism is the result of cooperation between the brain and organs , urban metabolism is facilitated by the city's governance policies, infrastructure and the citizens.

More people are moving to cities every year the numbers getting higher which must expand. Bigger cities demand more food, water and fuel which in turn causes an increase in releasing wastewater and more pollution. Unfortunately, this means that while urban systems depend on ecosystem services to expand, they also threaten the ecosystems.

In fact, the modern urbanisation effects boost the environmental change on a local to global scale. Many of these environmental effects lead to new bigger scale problems that affect the cities environment and the population health. Population density special in the cities are increasing dramatically for the past years, which causing a variety of infrastructure problems.

A unified goal to urban areas that spread more than the urban limits to reach the surroundings areas is an essential approach to provide a sustainable relationship between humans and the environment.

The connection of sustainable development is between many dimensions

- Environmental responsibility

- Social progress

- Economic development

- Governance liability

This four aspects will create a fair environment, viable environment and liveable environment for humans, animals and all living things in the urban areas of the cities. in return the sustainable approach will be achieved.

To evolve toward a sustainable cities, we have to think about many aspects that are very important, like urban greenery, energy generation and management, water collection and management, waste management, food supply, urban culture and public spaces and biodiversity.

The way we build our cities will define the sustainability we trying to achieve and we should consider the urban culture and the public spaces. Planning the architecture and the urban greenery in the city or even the transportation planning and mobility management, all of these aspects will create a very deep connection between the nature and the culture and how always should consider to include green materials and make breathable and liveable architecture and not only preclude heat.

The importance of environmental protection is becoming more and more of a concern for the environment and its importance. The protection of pollution from consumer and industrial civilization requires the recruitment of all concerned across the globe, considering that the threat of pollution is one of the challenges that does not concern a single country or geographic region. The natural environment in general means the surrounding conditions that affect growth and life and include all that lies on the geographical surface, atmosphere and the earth.
Its main components are:
1- The Weather
2- Greenery of all kind
3- Water network

Figure 01- Shows earth components Weather, greenery and water.

The concept of the natural environment has evolved in urban settings during the last decade, with local policies of environment and greenness, which are no longer complementary to the urban planning, due to the increasing pollution of the urban area with smoke, noise, waste, dirt and toxic water.

All these factors have very focused impacts on the urban ecosystem and human health.
Greenery is one of the most important elements of the structure of the natural environment in urban environments. At the same time, it is considered one of the most effective means to maintain the balance of the environment and quality of life; it represents a respiratory lung for the fabric that is suffocated under the influence of smoke condensation and waste accumulation.

environment in urban environments. At the same time, it is considered one of the most effective means to maintain the balance of the environment and quality of life; it represents a respiratory lung for the fabric that is suffocated under the influence of smoke condensation and waste accumulation.
The aim is to ventilate the city and feed urban spaces with greenery and recreation for sustainability.

In this regard, the term greenery is a complex concept that combines the maximalism as a geographical axis and the green statement as a variable or as a symbol of the natural environment.
The problem of redefining the concept of greenery in urban areas and go in more sustainable approach is by maintaining the urban structure by adding, merging, and melt the greenery in the urban fabric and think of sustainable future planning for the urban areas in the cities and redefining the cityscape as we know it, the way our cities are expanding, will define the urban greenery and its importance to detox the city and make it more liveable and breathable.

Many cities around the world start including more greenery in the urban areas and other cities need more study and directions to set on this way.

In this master thesis we will look over the urban greenery and its importance in the cityscape, which kind go of greenery we can include in the urban areas and how to achieve a sustainable approach for our cities environment, how to link that to the growing cities in the globe.

1.2 Basic form of greenery through the history

The most basic form of urban greenery can be traced back to the Hanging Gardens of Babylon. ''They were considered as one of the Seven Wonders of the Ancient World, were constructed around 500 B.C. Planted roofs, roofs gardens and climbing vertical gardens.'' Says by Preethi Kaluvakolanu, December 2006
The gardens in their current state did not come this way at once, but they have gone through many stages of development since the ancient Egyptians knew it as an organized engineering unit established on specific coordination bases and brought in plants from other environments.

The idea of establishing gardens from the ancient Egyptians moved to the Assyrians and Babylonians, then the Persians, the Romans and the Greeks who developed the gardens of their predecessors and set up an example in Rome and Athens. Then came the gardens of China and Japan, Andalusia, French, English and Italian gardens, until the modern time gardens were considered a place which planted with greenery inside the cities and kept of developing until now, where we can find it on top of buildings and on the buildings facade.

Many cities in Europe have a history of urban greenery such as London, which has significantly influenced the development of modern parks and green spaces, and is still one of the greenest capital cities in the world.

Thus, the urban greenery in the ancient time and throughout the history were considered as basic form of gardens, the gardens have developed rapidly and continuously, and their numbers and importance have increased. The art of design and coordination has developed so that we have reached the modern trend that combines natural coordination and engineering coordination in a simple design that reflects the tendency of man in the modern era to be simple in his food, clothing, housing furniture, and in his other life aspects.

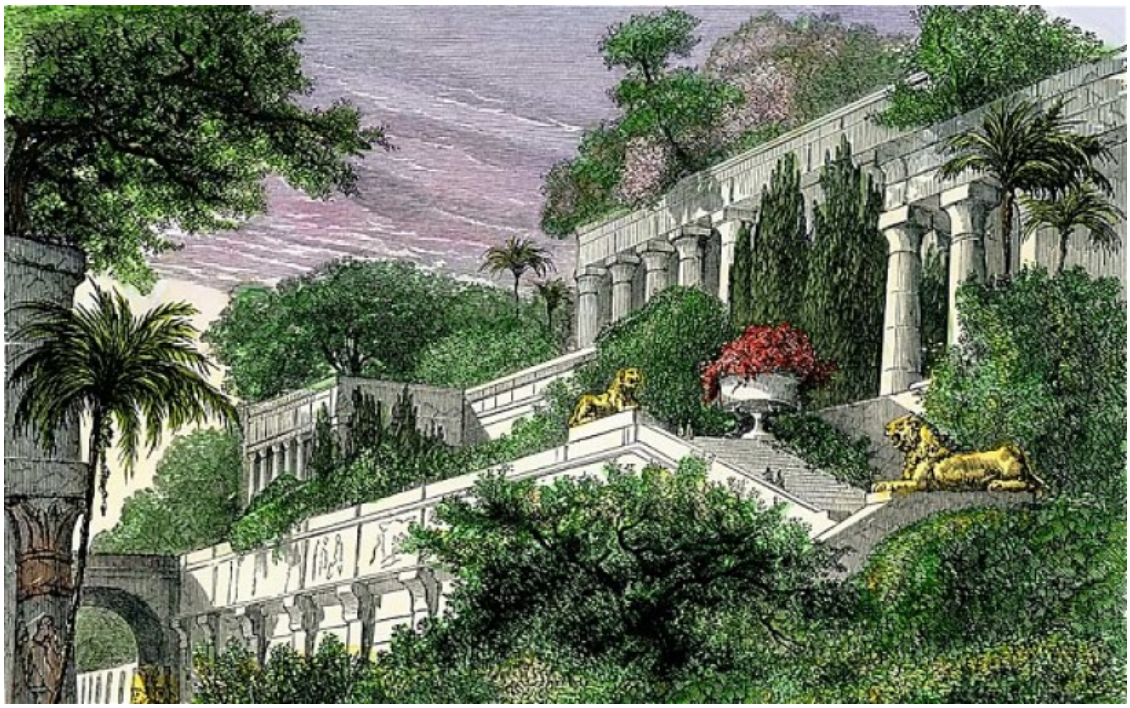


Figure 02- Shows the Hanging Gardens of Babylon.

Pharaonic Gardens

Was created purely for religious purposes, in order to beautify the temples and give them great importance in the lives of ancient Egyptians, and distinguished gardens in the era of the Pharaohs as follows:
The gardens were symmetrical geometry using straight lines.
The garden was exposed with a rectangular water basin with lotus plants and some fish.
Surrounded by sprigs, grassy shrubs and flowering shrubs are regularly distributed (such as daffodils, cresanthus, jasmine, jasmine) and are surrounded by rows of sycamore trees and figs, followed by tall trees of date palms and domes.
The statues of the gods were distributed regularly in the garden, and the garden was surrounded by a high wall from the outside.
The inscriptions are placed on the walls of the temples, and the pharaohs cut and trim trees and shrubs, and they also used the plants of lilim, daffodils, olives, grapes, almonds, pomegranates, apricots and sycamores.
Of the current applications. The reason for the ancient Egyptians is the interior decoration of the flowers, where they decorated their temples with flowers and palm leaves by digging them on these columns, and painted their garden scenes on the walls of the temples and houses on the floor and the Romans later transferred this art.

Figure 03- Shows the Pharaonic Gardens.

Ashourian and Babylonian gardens

Appeared in the mediterranean area between the two rivers (Tigris and Euphrates), and transferred after the invasion Babylonian Egypt through the geometric style Symmetric, They built their gardens at regular levels (in the form of terraces) graded (six levels or more) at the top is the king's palace, or Prince or Pergola view luxury these gardens, and have gardens on this model was held due to the lack of rainfall in the country, The slopes of the mountains were divided into level terraces above each other, such as stairs of the stairway, to facilitate irrigation, and the columns were built on the outer edges so that the terraces did not collapse on each other. Below these terraces there is a water fountain or a water pool flowing in the form of a waterfall surrounded by cypress trees - poplar - walnut - pomegranate With Iris plants - cloves - violet - anemones - roses.

One of the most famous gardens of this era is the Hanging Gardens of Babylon built by the king (Nebuchaz nezzar) in honor of his wife, which is now one of the seven wonders of the world.

Figure 04- Shows the Ashourian and Babylonian gardens.

Persian Gardens

After the invasion of Persians to the Assyrians, they transferred their gardens and symmetrical engineering and took care of it and developed, and distinguished by:
The garden was square in shape, usually divided by two perpendicular roads into four symmetrical parts. There is a round water well in the center or a pergola on which the grape and rose plants climb.Along the two perpendicular roads, a stream of water is surrounded by tall trees on both sides, and statues were used as a facelift in their gardens

They isolated the garden from the orchards gardens (vegetables and fruit) and they loved flowers and planted them in different seasons in groups close to each other to highlight each other's beauty.
The Persians are the first to create what is now known as aquatic gardens, wall gardens and submersible gardens.
They were interested in decoration and engraving and reached their interest in gardens and engravings that were painted on their carpets, which are in their finest form to be inside their palaces in the winter, when the snow covered their gardens.

Figure 05- Shows the Persian Gardens.

Indian Gardens

The garden was a mix of Pharaonic and Persian designs, in which the façades and ponds abounded, and the floor was covered with black granite. It looked like a mirror to reflect the image of palaces and buildings, so that there was something of awe and reverence in the soul.
The Indian style was concerned with the architecture at the expense of plants whose use was limited to some cones for regularity and some flowering grasses. One of the most famous Indian gardens was the Taj Mahal Park, which was erected as a memorial in honor of the Maharaja's wife.

Figure 06- Shows the Indian Gardens.

Romanian gardens

Emerged after the invasion of Alexander the Great of the East, which quoted many countries of the East and transferred to his country, and was characterized by the large number of architectural installations and statues and fountains at the expense of plants.
Sitting places were also planted and trees were planted in large pieces of decorative pottery, especially cypresses, pine trees and olives For the first time, the gardens and the public gardens of the people began to appear after the gardens were limited to the palaces of the kings and the rich.

Figure 07- Shows the Romanian Gardens.

Japanese Gardens

It appeared in the era of the Emperor Suiko, a natural park in its lines and all its elements. This is an ancient style of the country in which Korea, China and Japan did not imitate or quote from any previous design, in which the garden was considered a sacred place of worship, not only for its adornment and beautiful scenery.

The general idea in the design of this type of garden depends on the establishment of natural lakes topped by wooden bridges or stones and around the lake hills planted with trees and shrubs and places to sit.

In the middle of the lake, some of the islands can be reached through the bridges with the planting of a tree or a large shrub like a willow in the center of the island.

The roads in the garden are naturally curved and paved with flat stones in a natural way., to create new sceneries. The planting of trees and shrubs, which are always green and flowering in a sequential manner, is given to semi-permanent flowers throughout the year. The gardens were characterized by the absence of green surfaces that were replaced by sand or stones.

Figure 08- Shows the Japanese Gardens.

Italian Gardens

At the beginning of the fifteenth century, the Italian renaissance, which took care of reviving the ancient Roman and Greco-Roman heritage, began to resemble the style.
The rule of architecture on the coordination of plants so many buildings, statues, fountains, seats and stone vessels and paved roads with colored stones and then occurred in the seventeenth century that the plants recovered their place in the garden again
The gardens were built on the high hills and the slopes of the mountains in a symmetrical architectural design made up of several balconies. Walls were built under each balcony to strengthen them and protect them from falling, but they were hidden by planting trees and shrubs in front of them, especially the conical shape. Hence the foot of the mountain looked like a single garden, High walls to protect against wars, but erected at the base of the mountain so as not to block the view of the garden from the outside.
To take advantage of the landscape around the park, there were gaps between the trees so that they could look beyond them, and the first time predators and rare bird cages were introduced into the gardens, including zoos that are now spread throughout the world.
In general, Italian gardens to this day tend to multiply the rich architectural constructions, sculptures carved from stones and marble and the establishment of pergolas and arches interested in architecture rather than the art of coordination with flowers and plants.

Figure 09- Shows the Italian Gardens.

English Gardens

It appeared in the reign of King Henry VIII and was invented by the famous English designer Theodore and named after his style (Theodore style). The design was adopted in the symmetrical geometric style in which the tree and shrub formation was formed in regular geometric shapes, roads and straight walks shaded with pergolas and climbing plants. The park was divided into isolated parts with elaborate hedges, so the park contained independent gardens for roses, fish, flora and sparrows.

After people were fed up with regular geometrical style, which depended entirely on human ideas, some designers began to imitate nature and return to nature.

Figure 10- Shows the English Gardens.

French Gardens

In the late 15th century (the era of Louis XIV, the Golden Age of Fine Arts, especially the art of landscaping), this Renaissance was led by the French engineer Andrei Linotre who transferred the Pharaonic, Assyrian and Indian architectural styles to the famous Versailles Palace gardens, which were designed on straight lines with The presence of statues, fountains, water elements and the existence of different levels in the garden. Linotre has introduced in the design some deceptive ideas to give a sense of the apparent expansion, and that is through:
without creating fences for the garden to take advantage of the surrounding landscape.
Narrow width of roads with gradient or increase in dimension.
Cultivation of gradient trees along the sides of roads and walkways so that the lengths are placed at the beginning and shortest at the farthest point, as well as through the different distances of agriculture among them are gradually narrowing with increasing dimension.

Figure 11- Shows the French Gardens.

Chapter 02

Greenery in the urban fabric

02. Greenery in the urban fabric

The greenery in the city are of great importance and have a key role in providing the enjoyment, and the pleasures of nature to the urban population, so we see that the municipal departments and urban planning work to create a lot of green areas, and trying to distribute throughout the city in accordance with the requirements of residential neighbourhoods.

The city is considered to be the most densely populated community in the world, and many residents of the world want permanent housing and stability in cities. The main reason for this is the nature of the service system that the city provides to its residents on a regular basis. Etc. which is the city's service structure of administrative, economic, health, housing and recreational institutions, and other service sectors, which make the city the most desirable environment for contemporary human needs.
It can be said that the housing function is the first human activity that stabilized by humans to form cities and different urban systems. The man's need for housing made him think of creating different environments, rural and urban, and by looking to choose the right accommodation for him, Of the principle of the proximity of the population available in the urban environment, the city dwellers rely on each other's services and expertise of others without feeling it, and the city has also benefited from this interaction in the integration of urban environment, functional and planning, the principle of the urgent need for service made systems of assistance the land within the city and take a different and new sites, trying to serve residents of the city and the region together.
With the ever-increasing number of people, frequent transportation, many factories, and vertical and horizontal expansion of housing, there is an urgent need to expand green spaces in the urban areas of the cities. A city without greenery is not valuable. whether it is horizontal or vertical gardens, The gardens with their trees, shrubs, flowers and green spaces, or green facades and green roofs, playgrounds for children and adults represent the face and personality of any urban Area.

The environment leads to the protection of the environment from pollution, which affects the health of citizens, as well as providing shading and raising the humidity of the air and purification and reduce noise and modify the heat as well as it performs the functions of planning as it works to identify cities and residential areas and the separation of different facilities as well as beautification and coordination fields as well as areas of rest.

Figure 12- Shows the urban greenery in a city of Chicago.

2.1 Definition of Greenery

It is a space or space within a residential community, urban area or geographic region, where vegetation or natural vegetation is generally dominated.

In its primary state greenery can find in (forests, farms, agricultural areas, jungles, lakes, etc.).

Urban greenery is an important element of any city that seeks to achieve the element of comfort, prevention and walking of its inhabitants. It is considered the city's lung, and it is the only area to provide joyful in the urban environment, in addition to the additional of the preparation and processing.

Greenery is defined as spaces within or outside the city, the largest of which is covered by plants (meadows, trees, bushes, etc.). These spaces are used as parks and recreation areas. They contain areas for outdoor play and halls, ie swimming pools and playgrounds. It works to soften the atmosphere and purify it and give a beautiful view in addition to the role of health and environment.

There are many types of greenery are different depending on the

- purpose
- method
- location
- management

Includes in its classification a set of criteria, the most important of which are:

- Property system land use pattern
- area
- function
- photography
- water resources

2.2 Types of green spaces

Greenery is a complex word that can define a green space inside or outside the city, Urban greenery can be defined as green roofs, roof gardens, vertical gardens, green walls and and any green space inside the urban area of the city which we will go through afterwards.

On the other hand Through these criteria, some other types of green spaces summarized as follows:

Wooded areas:

Are the large forests and bush, such as: Amazonian forests in Central Africa and others, urban forests within cities and often the surrounding areas (orchards).

Agricultural areas:

Such as irrigated agricultural areas (intensive farming), large fields for growing grains (wheat, barley, rice, etc.), palm forests and citrus fields.

Agricultural orchards:

The orchards are mostly for individuals, and the orchard often contains fruit trees such as palm trees, oranges, lemons, grapes and many vegetables. Ornamental trees and flowers are often raised in these orchards.

Agricultural orchards:

The orchards are mostly for individuals, and the orchard often contains fruit trees such as palm trees, oranges, lemons, grapes and many vegetables. Ornamental trees and flowers are often raised in these orchards.

Parks:

It is a large area of land that can be thousands of hectares with different terraces and structures, including forests, pastures, waterways, beaches, swamps, mountains, valleys and waterfall hills, as well as wild animals.

Gardens:

Is a land that contains water and small areas not more than one hectare, and is established within a special fence of private buildings or tents or in limited areas, these areas can not be expanded, and remain these gardens confined to private buildings and homes.

Figure 13- Wooded areas

Figure 14- Agricultural areas

Figure 15- Agricultural orchards

Figure 16- Parks

Figure 17- Gardens

2.3 The importance of urban greenery in the cities

2.3.1 Behavioural and aesthetic values of green spaces:

The tree has had a special aesthetic appreciation since ancient times, and it was one of the main reasons for planting trees in countries and cities. This value has increased its appreciation and its usefulness in the works of landscape architecture and coordination of the sites and used trees for their beauty and other benefits.
One of the most important aesthetic functions of trees is the factor of unity, it can connect and unite between the different elements of the landscape in the planning, trees in private and public gardens and streets and fields can cooperate a green network component works to connect elements and absorption of the city's cross-cutting features.

Improving social status: Studies have shown that green spaces have allowed the involvement of young people, older people, foreigners and the unemployed in social life in Zurich. Beyond that, green spaces help reduce crime. A study published in Environment and Behaviour highlighted criminal police reports to emphasize that increasing green spaces in slums reduces the number of crimes and abuses.

Increase the happiness: A number of English researchers wanted to know the happiness of urban residents if they lived near the green areas. To reach the desired goal, they conducted surveys on British households and the development of their well-being over time. Scientists have found a link between proximity to green spaces and family welfare. This welfare continues even after changes in income, social status or health. The scientists went on to study how green spaces affect one's well-being relative to other factors. Scientists have confirmed that the happiness associated with living next to a green space is equivalent to 1/3 one third of the happiness that accompanies a wedding or 10% of the happiness associated with employment.

Reduces of Diseases: It is a matter of practicing **Horticultural Treatments**, which require one to have a small plot of land and some plant. Improving memory, senses, encounters, maintaining contact with the outside world and manual labor are the advantages of this treatment. Which has convinced some hospitals and care centers to allocate space for the gardens in their own structure to help patients with Alzheimer's and people with autism.

"The cultivation of gardens prevents the emergence of some disorders or addiction, and contributes to the change of pathology (neurological and psychological)," said Dr. Dennis Richard, director of the Henri-Laborit de Poitiers Hospital.

2.3.2 Architectural Functions of Trees and Urban Greenery:

Trees can be used as architectural elements in the design and coordination of sites and the organization of outdoor spaces.
Organizing the areas enclosed by a fence, using trees to provide external spaces suitable for the required uses, or dividing the large areas into smaller areas that can be realized and exploited according to need and the nature of the site.
To strengthen the design, the designer must, prior to selecting the appropriate trees for the site, be aware of the site's function and its architectural nature, which can be supported by the proper use of trees.
Forests are used to show limits and identify land areas, especially on the borders of agricultural lands or gardens, and in areas where the landscape is intended to be open without specifying the high walls of the walls, which may impair the landscape formation or gain some degree of drought.
Trees are used to make plant curtains to reserve some undesirable scenes and in the case of large, tall structures that are to be concealed by the appropriate vegetation.
It is also possible to use the walls of the plant to protect against dust and noise in crowded places in cities, and works of green belts around the cities exposed to sandstorms, which are blowing in the desert areas, causing damage to humans, animals, plants, and buildings, especially the high.
In addition to the trees' visual and aesthetic functions, the trees have many engineering functions, such as resistance to turbulence, resistance to air pollution, noise reduction and glare from the eyes, especially from the summer. In the streets, air pollution can be resisted by trees.

2.3.3 Climatic functions of Urban Greenery:

Tree groups have a significant impact on the local climate of the regions, especially on the local scale in the urban or rural area, as follows:

- Protection from rain, wind and strong sun storms.
- Purification and filtration of air from airborne dust and other air pollutants.
- To temper the atmosphere, regulate its temperature and increase its humidity in dry places.
- It increases the oxygen content and reduces carbon dioxide in the atmosphere by making photosynthetic plants, which consume carbon dioxide, and produce oxygen gas.
- Soil erosion is prevented by its roots in the ground. When plants are planted, they implant their roots in the soil and stabilize them so that they do not drift due to various factors such as wind, rain and others.
- These spaces are often used as venues for play, self-recreation and landscaping.
- Home to many organisms, and a dietary source for many animals. The trees and shrubs within the vegetation cover as a sunshade and reduce the intensity of their rays.
- It causes the summer breeze.

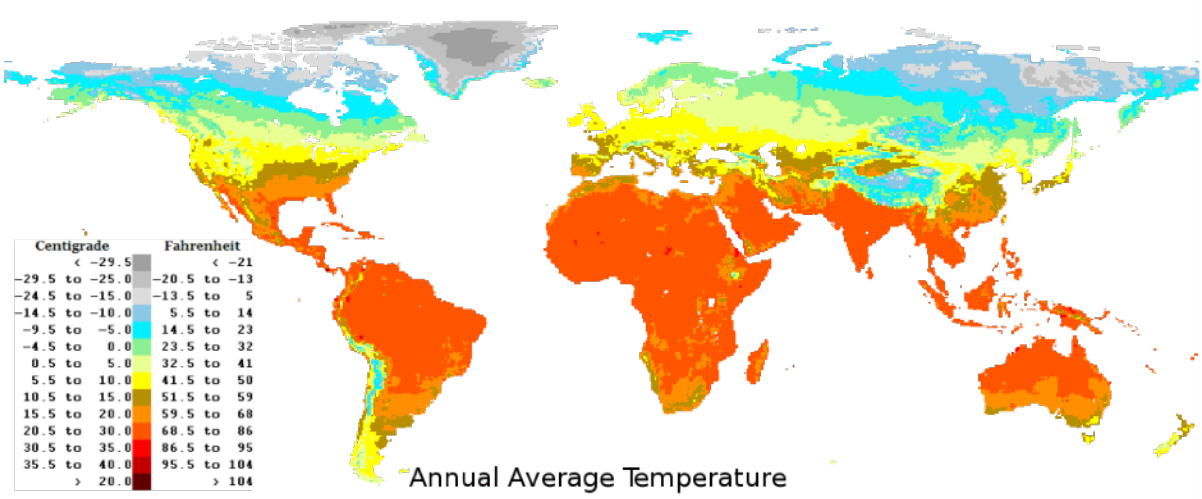


Figure 18- Annual average temperature in the world.

2.3.3.1 What is climate change?

Climate change is an imbalance in typical climatic conditions such as heat, wind patterns and precipitation that characterize each region on Earth. When we talk about global climate change we mean changes in the Earth's climate in general. The pace and magnitude of long-term global climate changes have enormous impacts on natural ecosystems.

What causes climate change, is due to the rise in anthropogenic activity of greenhouse gases in the atmosphere, which is holding more heat.

The more human societies have followed more complex lifestyles, depending on machines that needed more energy. Rising demand for energy means burning more fossil fuels (oil-gas-coal) and thus raising the proportion of greenhouse gases in the atmosphere. Humans have been able to amplify the natural greenhouse effect on heat retention. This amplified greenhouse effect is a cause for concern, as it can lift the planet's heat with unprecedented speed in human history.

2.3.4 Urban heat and climate change

The trend towards industrial development in the past 150 years has led to the extraction and burning of billions of tons of fossil fuels for power generation. These types of fossil fuels have released greenhouse gases that are the main causes of climate change, specially in the urban areas. The amounts of these gases were able to raise the planet's temperature to 1.2 degrees Celsius compared to pre-industrial levels. If we want to avoid the worst consequences, we should compute global warming to stay below 2 degrees Celsius.

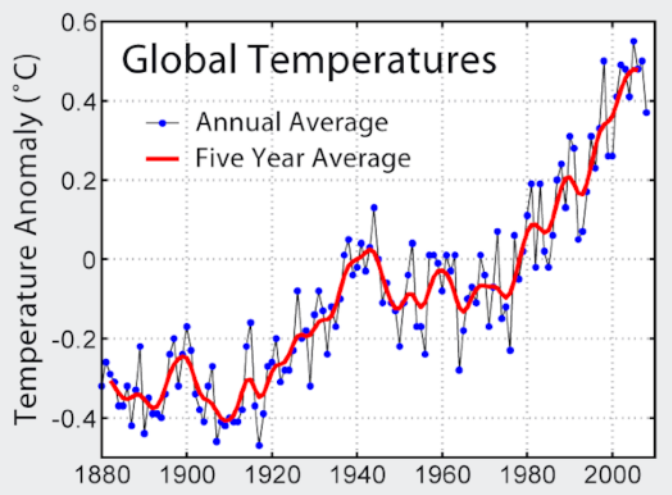


Chart 01- Global temperature.

2.3.5 Air Quality effects in the urban areas

Air is one of the most important elements necessary for the survival of life on earth and the survival of living organisms. Without air that contains oxygen, there is no life on the surface of the planet, but what happens if this air pollutes all types and types of contaminants? The earth has many gases around its surroundings, and each gas has an important role in maintaining environmental balance. This helps to eliminate any problem that may occur. Every environmental problem related to the surrounding gases is often very simple, but the most gas The spread is oxygen gas and carbon dioxide. The reason is that humans breathe oxygen and release carbon dioxide. Plants take carbon dioxide and release oxygen to achieve the cosmic equation.

The issue of protecting and preserving the environment is one of the most challenging issues today. It is no longer accepted that humanity must change its lifestyle to keep pace with modern technology. It is necessary to adapt technology to protect the environment. Strict environmental is the first priority.

Some of the most important things that work on air pollution include the following:
Contaminants related to the wrong exploitation of the global system, through which man works to dispense with the trees that produce oxygen tend to destroy them in order to obtain non-agricultural land to build houses, factories and others.

Industrial pollutants produced by various modern technologies, the most important of which are the production of factories and the resulting pollutants, including organic waste, odours and gases emitted. Cosmic radiation from volcanoes, etc.

These are natural pollutants that humans do not have any major with it but can be reduced by reducing pollution. Wars, and the ensuing consequences of the use of deadly weapons that plague human beings and the universe in general, and act on the death of organisms, plants that produce oxygen, in addition to leaks that affect human health to a large extent, and may lead to death from time to time. Pollution every day is increasing, and there should be a human-induced awareness, aimed at eliminating these pollutants and work mainly on the revival of projects such as afforestation projects that help in reducing pollution, which teaches the reconstruction of the environment in general, and the human to In particular.

Nitrogen oxides: Air pollution with Nitrogen oxides is dangerous because these oxides are easily dissolved in water and thus form a strong acid. If they reach the ozone layer, they can cause significant damage.

2.3.6 Strict majors to reduce air pollution in the urban areas

To enforce strict control and excessive laws and apply them equally to all those who violate them. These laws obligate anyone who commits an environmental violation, whatever its small impact, with a deterrent sanction that prevents it from committing such an offence in the future. Government control and enforcement should also be strictly enforced on factories that emit toxic gases and deadly fumes, as well as strict controls on public transport that also emit toxic gases, and not allow them to continue until the situation is resolved.

End unreasonable human consumption, which increases waste volumes, leading to increased pathogens in the atmosphere.

- Recycling waste instead of burning it, especially the wheels of cars and plastics, and not throwing them in different places, they produce many gases, and the waste of organic origin, such as paper and cardboard, and the remnants of food decompose in nature and therefore prefer burying; Get rid of them, and secure soil fertilizer, to grow plants better.
- Activating the laws that protect the green spaces, which punish anyone who begs himself to attack this huge wealth that will solve great problems that if humans have good management and pay good attention to it.
- Take care and pay more attention to the issue of rehabilitation of cities and make them more comfortable for the population, so that the streets do not cause traffic congestion and congestion that make the atmosphere in the region a bit bad, which also affect the human psyche.
- Establishing a convenient transportation network in all countries so that all areas of this country can reach each other and all areas of the same city. This reduces the dependence of citizens on their private cars in mobility, thus reducing air pollution by limiting Exhaust gases.
- Increase community awareness of the need to reduce air pollution in different regions of the world, which is the most important factor. Air is the basis of all human life. It is not allowed for certain categories of people to be overwhelmed, and to spoil it until it is only comfortable.
- Vegetation takes more carbon dioxide during the process of photosynthesis, turning it into carbon, in order to make food, and hence the air gets rid of it, it releases oxygen.

- Minimize the use of pesticides, which is an effect in the growing countries.
- Development of the exploitation of clean energy sources, such as solar energy, wind energy and others, they do not produce any pollutants to the environment, using the sun to heat the buildings naturally rather than the use of firewood, gas or electricity during the day and can be used to generate electricity Instead of fuel burning.

2.4 Types of greenery can be linked in the Urban areas

2.4.1 Green Roofs

The green roof is more than just a rooftop garden. The green roof starts with a traditional roof that serves as the base. Several layers of support and insulation are placed on top of the ceiling, and a strong layer is placed to protect the ceiling from water and roots. This protection layer is followed by a filtration and drainage system that allows the medium-growing plants to grow safely on the surface.

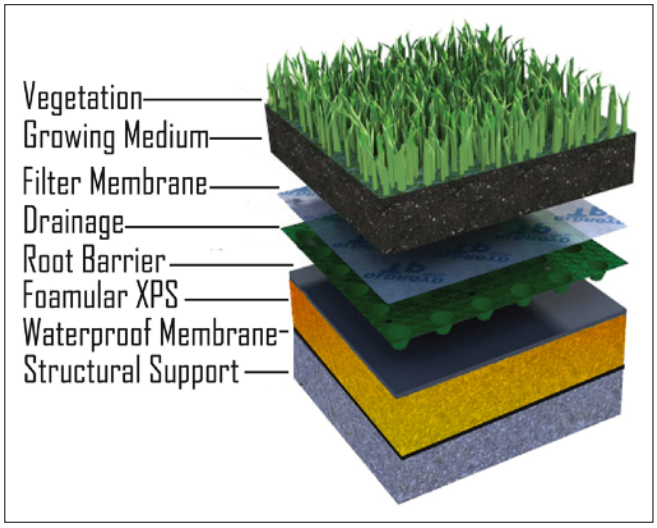


Figure 19- Shows the green roof layers.

2.4.1.1 The benefits of green roofs

The green roofs on top of buildings offer many benefits, the most obvious benefit is their potential as to improve environmental conditions in urban areas. Cities tend to retain a larger amount of heat than rural areas and can be several degrees higher than the surrounding areas. This is called heat island effect, and it's more important than it seems at first sight. The difference, even in a few degrees, can disrupt local weather patterns and potentially increase medical problems from exposure to heat, so plants absorb light and use it as a fuel for photosynthesis instead of retaining it. Plants also act as natural air filters and can reduce Air pollution that inevitably occurs when the small city is packed with hundreds of cars and houses.

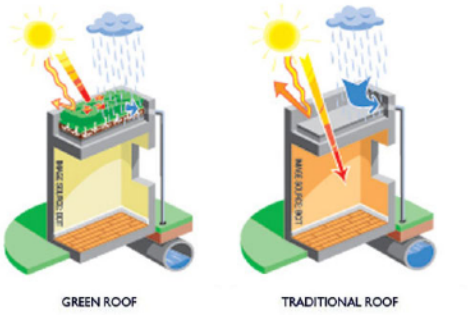


Figure 20- Shows isolation benefit of green roof.

The green roofs can be a source of food. Even in developed countries, so the roofs of green buildings provide an opportunity to produce food in the middle of cities. Many cities also suffer from food deserts, as people who can not travel long distances and have no opportunities to buy fresh and healthy food. Green roofs reduce the need for transport and long trips to the stores, and are working on a marked improvement in urban nutrition, as well as reduce the carbon in the urban ares from the transport trucks to transport the food.

Urban agriculture is still an essential part of food production in many cities in the world.

Place	% Proportion of households in urban agriculture
Berlin, Germany	20% (with 4% on a waiting list for community gardens)
Kampala, Uganda	33%
London, UK	14%
Maputo, Mozambique	37%
Moscow, Russia	65% in 1991, relative to 20% in 1970
Nairobi, Kenia	20%
Ouagadougou, Burkina Faso	65%
Suva, Fiji	40%
United States	25%
Yaounde, Cameroon	35%

Table 01- Shows the percent of agriculture in different cities.

2.4.2 Roof gardens

The roof tops of the buildings in the city are neglected most of the time, if we look on the bigger scale, the roof tops have a lot of benefits to the urban areas to produce a garden on top of it.

Roof garden is a garden on top go a building, in addition to benefiting from decorations, surface farms it also can provide food and play a role in temperature control in the city, hydrological cycles, Works to isolate sound, biodiversity and recreational opportunities.

Figure 21- Shows the roof gardens in France.

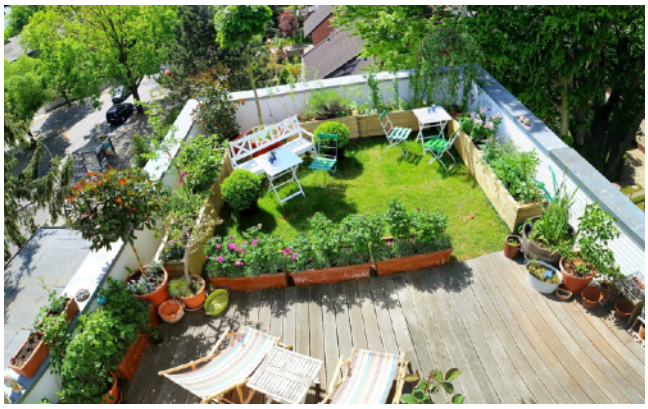


Figure 22- Shows the roof garden design, vegetation and seat area.

The roof of the building can be transformed into a fruitful garden with many types of plantations after the disappearance of the gardens because of the high population. Many species of ornamental plants can be planted, giving an aesthetic view of the roof of the house.

Vegetables can be grown for individual use. It is a good source of clean, safe and healthy food for household consumption. They are sold as a source of income for the owner.

Figure 23- Shows the roof garden agriculture.

Relieve the impact of sun rays on the roofs of buildings, which is leading to the warming of the lower floors of the house, which also means more energy cooling consumption.

To maintain the oxygen content in the air, the plants in the process of construction of light consumption of carbon dioxide and produce from that process oxygen, and studies have shown that 1.5 square meters of green surface produces enough oxygen to breathe one person for one year.

Teaching children to rely on themselves and teach them some basics of agriculture and love of green plants and filling their leisure time in useful, productive and useful activities, and invest the time of the door and provide a work of economic efficiency to them mitigate the negative effects of unemployment and job search The cultivation of the roofs of homes Good job opportunity, And raise morale to them is an important work for adults, especially after the age of the pension.

Figure 24- Shows children learning agriculture and planting.

One big thing can be done inside the cities is to revive the schools activities inside the schools, transforming the schools into a productive unit and transforming the schools roofs into a beautiful, proud view of the students before the schools administration, which is the fruit of their hand and their participation in the school's beautification.

Figure 25- Shows the roof garden of Toni- Areal Hochschule in Zürich, Switzerland.
Source: Author

Figure 25 is showing the roof garden of Toni-Areal Hochschule in Zürich, when I walked through it I couldn't believe it is on a roof top, it was huge and it has a lot of planting, shrubs and big trees.
The soil is 1 meter high, for the big trees to be planted over the roof they managed to add more soil and plant the tree over a hill.

Figure 26- Shows the roof garden of Toni- Areal Hochschule in Zürich, Switzerland.
Source: Author

Figure 27- Shows the dense of the vegetation at Toni-Areal Hochschule in Zürich, Switzerland.
Source: Author

2.4.3 Vertical gardens and Green walls

The idea of landscaping has evolved into new concepts, metaphorically called green engineering, which are meant to create green spaces other than the familiar ones.

Architects and landscaping professionals have devised sophisticated ideas to strengthen green spaces, combat pollution, and revitalize buildings that are naturally high and environmentally friendly. These ideas ranged from terraced terraces or even walls to full green buildings.

Figure 28- Shows a vertical garden in MFO- Park Zürich, Switzerland.
Source: Author

A vertical garden is a green vegetation wall that either stands alone or is part of a building, partially or completely covered by plants. The concept of plant walls dates back to 600 BC.

Green walls can be internal or external and consist of climbing plants that grow either directly on the walls or more recently on specially designed support structures for the plant. Soil is used for plant growth or inorganic culture modes.

Figure 29- Shows a vertical garden with terrace in MFO- Park Zürich, Switzerland.
Source: Author

The buildings are equipped with green facades that provide oxygen, reduce the pollution of these buildings from different sources. In addition, the plants are natural air purifier, which helps improve the health of the people and improve the atmosphere in these buildings thanks to the natural moisturization given by the plants to the surrounding areas.
Creating a vegetation on existing architecture is one of the most revival ideas to create a breathable cities and reduce pollution and create more greenery in the cityscape.

Figure 30- Shows green facade on a building in Copenhagen, Denmark.
Source: Author

A lot of researches showed that the coverage of the walls of houses with green climbing plants would reduce the proportion of carbon dioxide that causes air pollution in the streets.

It also reduces pollution by 60% for small particles of nitrogen dioxide, which cause heart disease and lung cancer.

Green walls is not a monopoly on buildings facades only, it can be in neglected places in the city such as the railways walls.

Figure 31- Shows railways green walls in Copenhagen, Denmark.
Source: Author

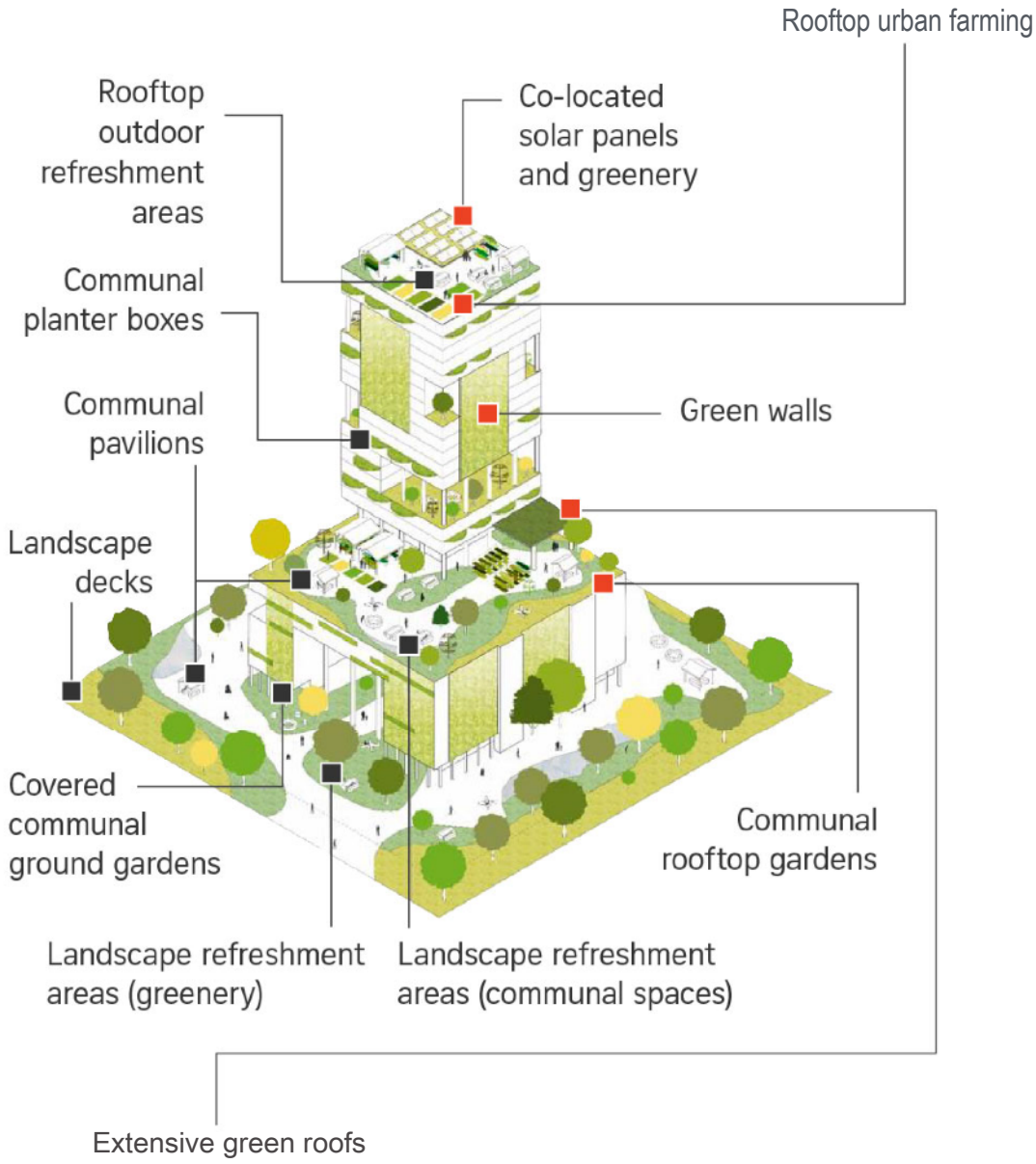


Figure 32- Shows types of urban greenery that can be liked to urban areas.

2.5 Linking the nature to the culture

The world's most significant instrument for conservation that brings together nature and culture in the urban areas, by aiming to explore, learn, and create new methods to support the connection characters between nature and culture.

The concept of Bio-cultural diversity, is the coming together of biological and cultural diversity.

Figure 33- Shows the connection between nature and culture in Malmö, Sweden.
Source: Author

Figure 34- Shows Bio-cultural diversity in one place Copenhagen, Denmark.
Source: Author

cultural diversity has always gotten a lot of attention, but it might be tempting to think and relink it with biological diversity.
Bio-cultural diversity innovation in urban areas, which are places where long-term interactions between human production activities and the surrounding nature.

This diversity of land uses comes from a wide variety of cultural, traditional and historical knowledge , climatical and environmental observation.
The biological solid foundation of cultural abstracts that ultimately interact in cities is essential what makes urban areas Bio-cultural.

The opportunity to form a more genuinely integrated consideration and invite the nature to be part of the culture has a range of obstacles need to be resolved.

- Setting and testing new standers for conserving urban greenery.
- Engaging the contribution between communities and sustainable development.
- Establishing an international networks observation between nature and culture.
- Provide training events and activities to support the work.

Figure 35- Shows when the nature and culture come together Copenhagen, Denmark.
Source: Author

2.5.1 Greenery within residential areas

Nearly everyone has a home, which makes in all sense everybody the target audience for promoting the benefits of greenery within neighbourhoods, where the residents can approach for enjoyment, social activities and much more physical and physiological benefits on all levels and for different ages.

Greenery in residential facilities promote residents' experiences crossing all the barriers in interacting with the environmental nature and with each other by strengthening the Bio-culture diversity, promoting a healthy relationship between humans and nature, providing the cityscape with more vegetation, colours and filtration.

Figure 37- Shows Wahlenpark big open green area for any activities in a residential area, Zürich, Switzerland.
Source: Author

Another important component in the urban space is the build structures, the urban planning should always be considering of these two important components in the same way and mix them together in a harmonic way for all of their importance for the cityscape and the urban sustainability.

Evidence pointing to the psychological benefits of greenery the neighbourhoods, for its important source of nature and how beneficial for the urban environment

Figure 36- Shows the harmony of greenery with the residential area in Malmö, Sweden.
Source: Author

Greenery is an important component in residential areas in the city and is highly importance for the living environment and the urban climate, it has a lot of benefits effects on many levels, the health of the residences, the social activity life, raising the property values, higher quality of life, higher enjoyment benefits, reduce the heat in the urban residential areas, and of course a lot of environmental benefits to the city.

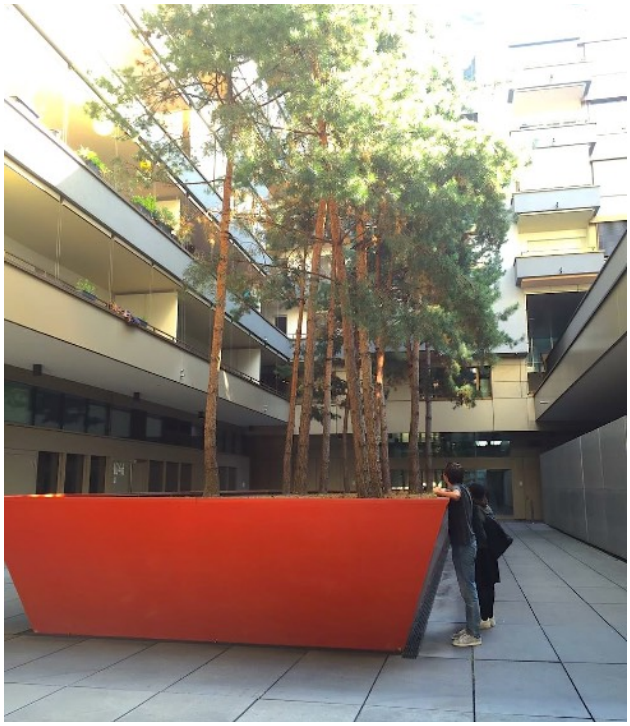


Figure 38- Shows greenery in the residential building yard, Zürich, Switzerland.
Source: Author

2.5.2 Greenery within commercial buildings

A Green Work Space Equals A Productive Work Space.

This one sentence can summaries a full book of describing a productive work spaces, people normally spend 8-10 hours at work, far from home and from the outside environment in a closed offices. While they can't reach the nature, the nature can reach them.

Indoor and outdoor greenery in commercial building is so important and must take a lot of space of planning, for more productive work environment on many health benefits for the employees.

Greenery in outdoor commercial building has a major boosting in cognition, employee engagement, concentration levels, productivity and less sickness. This is a big goal to improve the health of the people everyday.

Figure 40- Shows an office view to urban greenery, Toronto Canada.

Figure 41- Shows an office roof garden, England, UK.

Figure 39- Shows open space within a commercial buildings in , Zürich, Switzerland.
Source: Author

An accessible greenery spaces to a work environment is a substantial factor to create a Bio-culture diversity that can be a motivating measure for looking at human performance and a occur a sustainable healthy urban environment where humans can interact with nature in everyday life responsibilities.

The acceptance of sustainability and commitment by organizations to go green despite economic downturn should be high priority by authorities and stakeholder. While an expansion of initiatives beyond just going green a company's social impact matters too to the employees, the workers, the city and the environment.

There is countless of companies, offices and commercial buildings in the world which makes a huge affect on the urban greenery, and can turn around the whole Equation of the Bio-culture in the cities around the world.

2.5.3 Greenery in outdoor furniture

greenery not only supposed to be on land or on walls to be function we can create a green furniture for outdoor that we can acutely use it for seating and relaxing.
When we think about investing to create a live furniture, it is not only beneficial for humans but for the environment too.
It is an unique way to connect with nature comparing to other traditional outdoor furniture. As a designer and manufacturers to find an innovative way to build a bridge between humans and nature and fill up the gap between functionality and sustainability.

In Figure 00, this small live furniture piece will help the city to have more greenery, more sustainability and more benefits to the urban areas.

Figure 42- Shows a Live Green relaxing seat in Zürich, Switzerland.
Source: Author

conclusion

An important issue has helped to reduce the urban greenery and green spaces in some cities in the world, as a result of the focus of agricultural development priorities on achieving food security, and that afforestation in general is not one of the priorities that are of interest to officials as a kind of luxury.

Rich in the emphasis on afforestation and increase the greenery because of its resulting benefits in the middle east, such as reducing the erosion of soil, especially in the sandy areas, in addition to the cities of beauty and improvement in the environment and the local climate, increasing the problem of providing funding for urban landscaping and decoration. There is a clear interest on the part of donor countries or international organizations to provide funding for such activities. This is noted in the Arabian Gulf cities of Kuwait, Riyadh, Abu Dhabi, Dubai and Muscat. As well as their coordination in accordance with the rules and standards of the world.

On the other hand, the importance of greenery the urban areas and increasing, the green areas in most middle east countries among many related departments, which impedes the coordination between them to implement the required in an integrated manner, it is clear that those who produce the seedlings do not know who needs it and the required type and size required, And the lack of care for greenery allocated to parks and neglect, forgetting the importance of greenery for the city's residents, which are the lungs that breathe from them in time. When the urban planning is not integrated due to the rapid expansion of urban areas at a phenomenal scale, with population growth and limited resources. This has confused urban planning officials and turned into Urban mess.

Of course, many middle east cities are a clear neglect of green spaces, especially densely populated cities, which should be taken care of greenery as a natural treasure for the general public. Moreover, the greenery, in such cities note the absence of standards used in the establishment of the city of Baghdad, which has a population of more than 8 million, is characterized by a small number of green spaces prepared for recreation compared to its population, as well as in the city of Damascus, Rabat, Tripoli and others, did not take into account the uses of land intended for entertainment Which are gardens in the forefront and if they are not at the required level.

Most of the middle east countries are affected by various global, regional and local climatic factors, such as the expansion of inland deserts and the extension of sandy valleys, and the rise of temperatures to more than 45 ° C in the summer, especially in the interior, in addition to drought and lack of rain water and springs and wells, Lack of soil fertility, high salinity, lack of organic matter, wind speed and dust evaporation caused by sandstorms.

The middle east is in dire need of human intervention to take care of the afforestation projects and the creation of greenery in the urban areas to protect their environment and to preserve the appearance and beauty and reconnect with the nature and create a Bio-culture in the cities where most needed for a better sustainability, with the steady increase in their area and population.

If middle east cities are to become environmentally sustainable cities rich with greenery and biodiversity, should come across a greater awareness of the environmental ecosystem and provide green infrastructure to the cities. More opportunities and circumstances that makes it possible to export the cityscape and introduce it again to the nature.

A lot of awareness must be considered by the official authorities and the communities to understand the significant meaning and the role of greenery and their benefits on the urban areas and to the city to start to include more greenery, In addition to the aesthetic value offered by urban forestry, trees and other greenery can make a significant contribution to food security, well-being, health and also improve the quality of life.

The vegetation in the middle east should be chosen from species that will grow in the local environment or can be adapted to suit this environment away from their original habitat. Research and experiments conducted on local plant species and intervention to select species suitable for local environmental conditions and able to withstand and adapt to local climate, Species and tree species grown under the environmental conditions of the area include local trees and trees that adapt to the local environmental conditions in which they are grown, particularly in terms of temperature, drought and salinity changes, such as camphor, acacia, casuarina, palm, cedar, crocodile, , Acacia and much more..



In addition, it is necessary to know the environmental conditions of the area to be cultivated in order to select appropriate plant species suitable for planting under local environmental conditions, which also achieve the purpose of cultivation (for shade, beauty or other).

When selecting these trees, whether local or imported, It has the following characteristics: It is better to be a perennial species that has a high ability to withstand the local environmental conditions of the area in which it is grown in terms of high and low temperature, drought, wind, salinity and others. Have a high resistance to infection of insect pests and pathogens or worms. It should be fast, dense, and abundant. It has a strong root in depth and is not spread horizontally so as not to impede the growth of other plants and does not affect the neighbouring structures.

It is desirable to fit the nature of its growth and the shape of its crown and height with the place where it is grown and the purpose of planting, Plant seedlings of suitable size and age at planting to ensure their success and condition are good in terms of vegetative and root growth and sound of fractures and lesions of pests, and have the ability to reproduce and produce abundant seeds, available locally and need less care and costs possible during the period of cultivation and growth.

Trees, plants and green spaces in general are the basic element of the beauty of cities and the coordination of sites. Green spaces are adding the element of nature and beauty on the facilities and break the intensity and hardness.

The green spaces and their various plants have many functions, including the environmental function of the plants, their great contribution to the development of cities from the environmental aspect, and their absence or lack of numbers in any area that leads to the imbalance of the environment in this area, while the construction function plays a role, A group of fencing plants are close to each other to form fences that perform the purpose of isolating the garden or to identify and divide certain areas or to separate parts of the garden from each other or to block unwanted scenes, in addition to determining the sidewalks and roads in the garden by planting foliage plants has aspects to guide the visitor in a specific direction, as used in supplement parts or vacuum in units of houses in addition to covering defects buildings or work adjustments in forms and heights.

Chapter 03

Features of sustainable cities

people prefer to live in green cities, the house prices in green city or along water or areas of vegetation are relatively higher than elsewhere.
All the cities can develop buildings that help conserve energy and water while improving their internal environment by using solar energy, improving insulation in these buildings, increasing ventilation, using environmentally friendly building materials, and conserving water and using natural lighting to illuminate the house. And many other techniques. A building energy management system (BEMS) is a sophisticated method to monitor and control the building's energy needs.

Figure 43- Shows sustainable house planning.

Home energy manager is a responsible way for the homeowners to optimise the energy consumption, with help from few techniques for water heater and water filtration, energy storage and sun solar energy.
The solar energy the we can get from the sun will meet a house energy requirements. Water filtration will minimise the water waste and the water consumption.

3 Features of sustainable cities

3.1 Sustainability through urban farming

Agriculture is the process of producing food for humans mainly by cultivating the land with seeds and plants, and nurturing them until they grow and bear fruit, in addition to processing and plowing them before planting, fertilizing according to scientific rules and bases, as well as interest in irrigation and knowing the agricultural measures required for each agricultural variety. Soil is the ideal medium for agriculture.
Urban farming in allotment gardens has long been a popular pastime, Residents share a piece of land cultivated into gardens where they grow fruits and vegetables.
Urban agriculture may play an important social role in promoting a healthy food culture in cities, linking people to agricultural production directly, or making them involved in agricultural production.

Urban agriculture involves wide range of different types of food producing spaces, and there is a lot of benefits can achieve on many levels.

Health level
It is an easy access to a healthy food production chemical-free, the physical activity play a big role in this process and in the result achieving a healthy eating habits.

Social level
Urban farming is an access to a socially integrated for all ages in a safe spaces and food security, there is also an opportunity to get more education development about the process and socially interact.

Economic level
Food affordability and local economic stimulation.

Ecological level
Awareness of the food systems ecology and conservation, storm water management and soil improvement, Biodiversity and habitat improvement

Figure 44- Shows urban farming.

3.1.1 Types of urban farming that we can find in the urban spaces

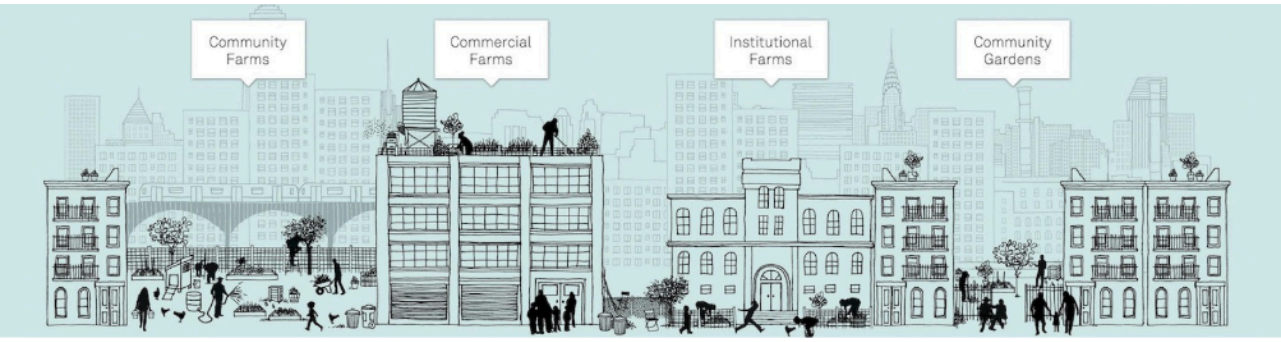


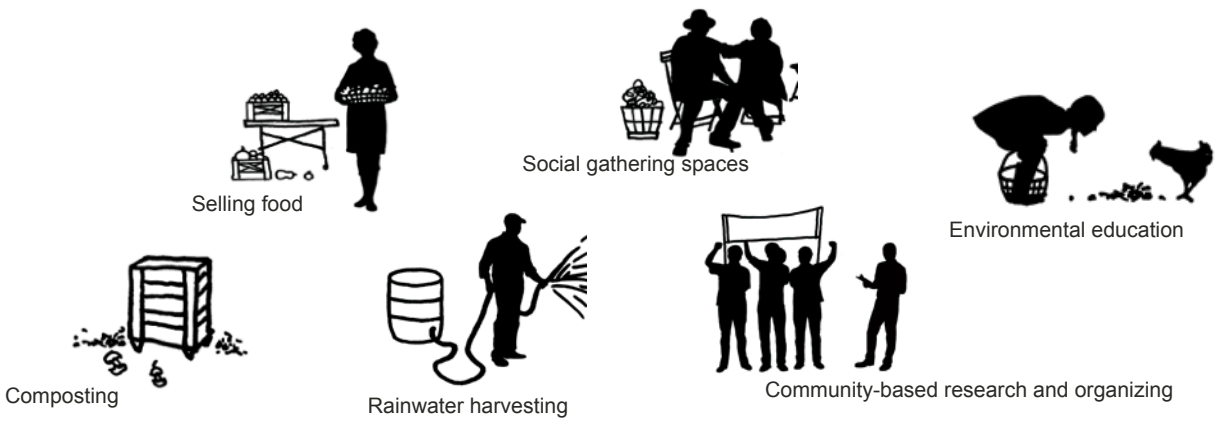
Figure 45- Shows types of urban farming.

Community Farms
Tend to be communal growing spaces operated by a nonprofit organization that engages the surrounding community in food production but also social and educational programming can be find for more productivity.

Commercial farms
In general, commercial farmers try to maximize crop performance in order to achieve more profits, however, some share many of the health and ecological goals of the broader urban agriculture community.

Institutional Farms
Affiliated with an institution (such as hospitals, churches, prisons, schools, public housing) whose primary mission is not food production, but which have goals that urban agriculture supports.

Community Gardens
Virtually all of the city's community gardens are located on publicly-owned land or land trusts. Typically managed by local resident volunteers, roughly 80% of these gardens grow food.



3.2 Agriculture without soil

Now urban farming is a grate idea to link it to the middle east, in some cities of the middle east there is no problem since they have treated water for farming and good weather with rains and mild winters, but if we think about linking this to the gulf region it will be challenging due to hot weather there.
So we have to go in a different approach to achieve the urban farming in the gulf region, and to reduce the heat in the same way through planting roofs and there is also a good method that have been used in Europe is Agriculture without soil, it has emerged as a result of several studies that showed that plants can live without soil if they have the water they need, along with other nutrients, and have emerged as a solution to drought-prone areas where soil is exposed to many Of environmental problems such as desertification and erosion. The principle of hydroponics and its most important forms of water-based aquaculture is the cultivation of many plant varieties according to water holes in the pipe, in addition to many other components.

3.2.1 Components of agriculture without soil, the feeding and unloading basin

Two water tanks, the first is devoted to the nutrients of the plant along with fertilizer, through the water pipe system, as well as the discharge basin where the water is discharged after leaving the pipes, Only one gets out of the water and then returns to it too.
Pump for transporting water through pipes: The pump does not necessarily have a high pump capacity because it does not need to pump large quantities of water to distant or high places.

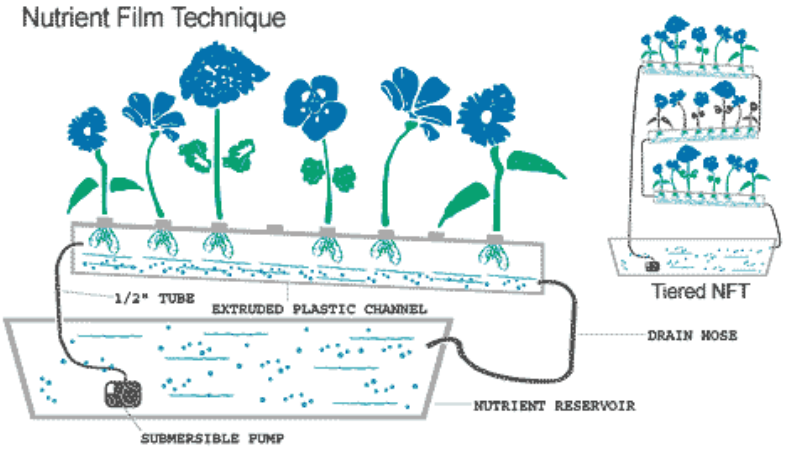


Figure 46- Shows the technique of Agriculture without soil.

Aquaculture is often piped at the mid-length of normal man. Pipeline: Aquaculture is based on the use of water pipes with a diameter of about four to six inches.
These pipes are fitted with openings from the top, where the seedlings are placed.
These pipes are often arranged horizontally, A hierarchical example. Pesticides are the clay vessels in which the seedlings are placed.

Figure 47- Shows the Agriculture without soil.

In the case of hydroponics, these elements contain some gravel to stabilize the seedlings in the openings in the pipes.

3.2.2 Characteristics of agriculture without soil

Open the field for cultivation anywhere without the need for soil and planting seedlings.

Saving water and nutrients (fertilizers) because there is no soil, and thus ensuring that there is no loss of water in them, where in water aquaculture reuse of water, as well as fertilizers that exceed the need for seedlings in the openings.

The need to do a lot of agricultural operations such as tillage, and weeding as normal farming in the soil, thus saving time and effort on the farmers.

Figure 48- Shows plants roots growing in water.

Figure 49- Shows the Agriculture without soil.

- Preserving the environment. Aquaculture is a highly environmentally friendly agriculture. There is no need to use insecticides or herbicides.

- The possibility of producing one crop more than once during the year, and raising the level of productivity as desired.

Aquaculture depends on the light and warmth of the plant, as well as the necessary nitrogen, potassium, phosphorus, and food, which makes this technique suitable for UAE where we can find the suitable environment for that.

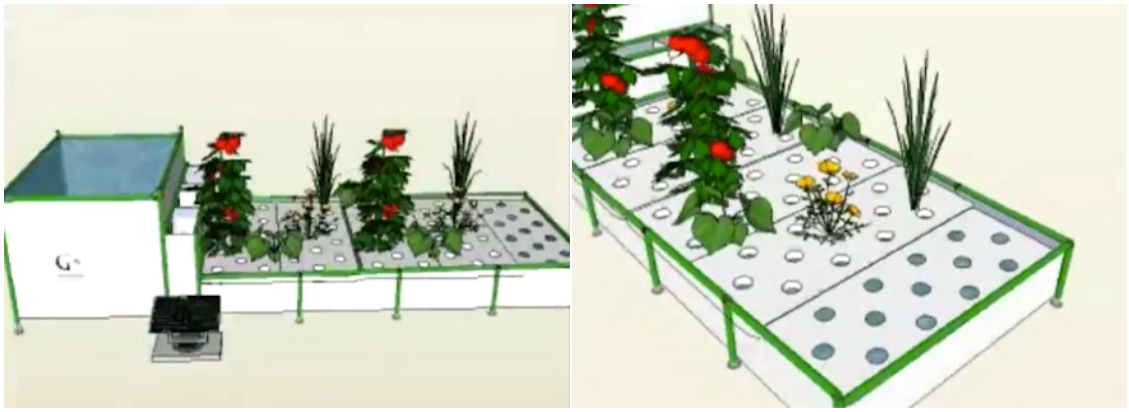


Figure 50- Shows the Agriculture without soil.

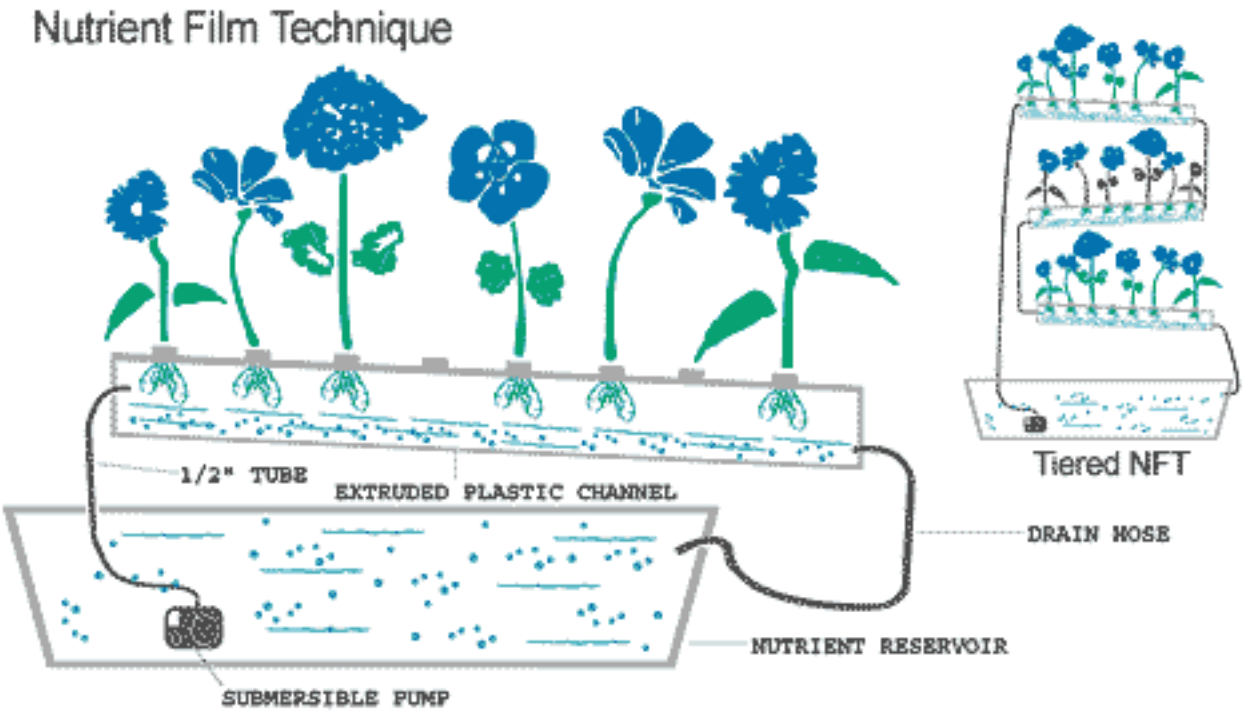


Figure 51- Shows the technique of Agriculture without soil.

Hydroponics technology allows almost any plant to be grown in nutrient-rich waters, from root crops such as radish and potatoes to fruits such as melons and even grains such as corn. There are several ways to do this, but hydroponics basically suspend plants in the middle, such as gravel, wool or volcanic ash known as plum, and drown the roots in a solution of nutrient-rich water. Continuous airflow provides the need for plants to absorb carbon dioxide. Any nutrients and water that is not absorbed by the roots can be recycled, rather than lost in the soil.

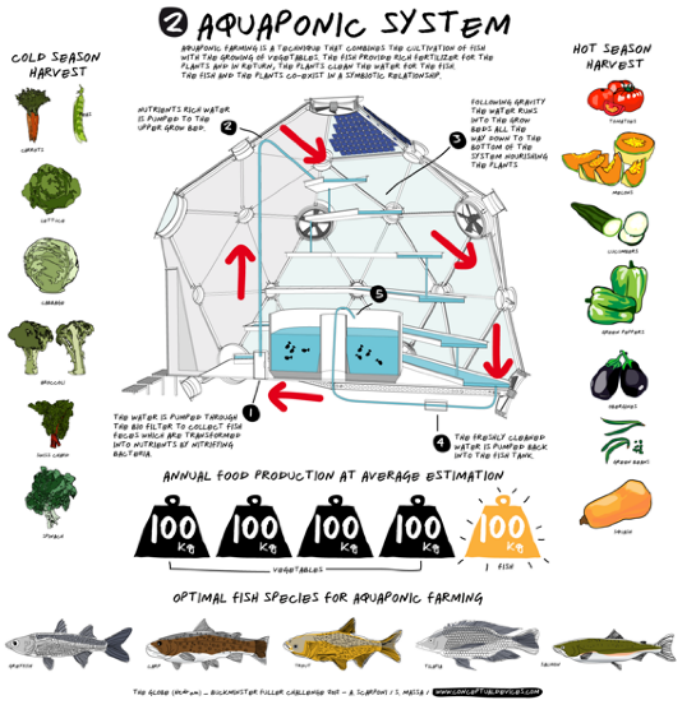


Figure 52- Shows the aquaponic system.

3.3 vertical gardens

How can exhaust gases and fine dust be eliminated? A question that preoccupies the world, which actively and actively proposes a number of recipes, one of which seems especially promising.
They make the air clean and the cities more beautiful. Vertical gardens that will help clean the air from pollution.
When the area of the earth is narrowed in the busy cities, construction must be up.
Vertical construction is the holy grail of cities to accommodate the growing numbers of people, homes, offices and shops.

Figure 53- Shows vertical garden in Zürich, Switzerland. Source: Author

With ''the world population projected to rise to more than 9 billion by 2050'', according to United Nations, it is necessary to increase food production to meet the food needs by increasing crops and expanding cultivated area.
But the additional land available for agriculture is unevenly distributed, many of which are suitable for limited crop cultivation. Thus, vertical garden which requires the construction of "skyscrapers", has to be built with orchards and crop fields throughout the year in cities around the world. Vertical gardens are gardens that are planted vertically either on wooden boards or in hanging agricultural containers.
The idea of vertical gardens first appeared in 1988 and dates back to the French botanist Patrick Blanc Svoyocan, whose purpose is to decorate buildings and temper the atmosphere.
The idea has been expanded and used in different and innovative ways inside and outside the buildings. It is a great way to decorate the walls and add life and sense of nature to the place and it is an alternative to the known gardens in the absence of space for a garden.
We can cultivate different types of plants and flowers in vertical gardens and to choose the appropriate plants take into account the size and quantity of water you need and prefer to plant similar plants in size and the amount of need for water and species that grow rapidly. Suitable for planting in vertical gardens: mint, basil, lettuce, spinach, cabbage, broccoli, fennel, thyme, strawberries, tomatoes and peppers .... and many more flowers like chrysanthemums, jasmine, etc.
Place it in a place where the sun reaches and only need water twice a week.

3.3.1 Environmental benefits

In addition to the development of more agricultural land, urban vertical farms reduce transport costs of food products and related carbon dioxide emissions, and maintain the quality of products threatened with damage during long distance transport.
The use of insecticides, herbicides and fungi can be reduced to a minimum because of the control of the internal environment in agricultural buildings.
There is no fear of soil erosion, because plants grow in a watery medium, in a solution of dissolved nutrients in water.
This water is recycled, which avoids wasting large amounts of irrigation water and nutrients, as in traditional agriculture, and eliminates the need for draining agricultural water.
It is now possible to adjust temperature, humidity, lighting, airflow and nutrient intake to achieve the best productivity of plants throughout the year anywhere in the world.

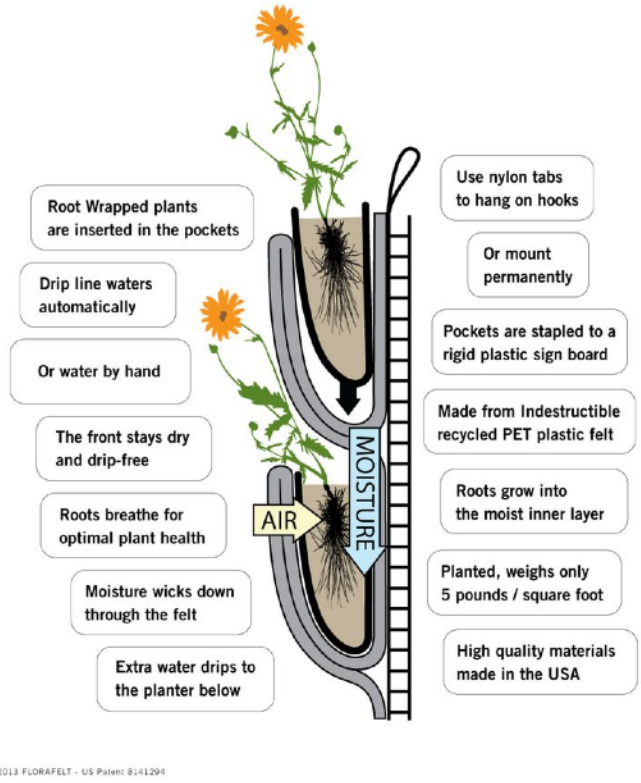


Figure 54- Shows vertical garden planting technique.

The Thanet Earth Project for vertical agriculture, opened in Kent in 2008, is the largest site of its kind in Britain UK, covering 90 hectares and producing 15 percent of the British lettuce. It has a small power plant to supply its plants with light for 15 hours a day during the winter months.

''This contradicts the idea that vertical agriculture saves energy and reduces carbon emissions''. Said by Peter Head, a global leader in planning and sustainable development at British engineering firm Arup. He has done several studies on this idea and found that vertical agriculture needs cheap renewable energy if it is to succeed.

3.4 Powering buildings through body heat

‘’The Stockholm’s Central Station captures body heat from over 250,000 daily commuters". according to Sweden development authorities. ‘’The heat is sourced into water via a heat regulator and the heated water is then pumped into the nearby Kungsbrohuset to provide heating. The cooling of the building is provided by water from the nearby Klara Lake, making maximum use of the surrounding environment.’’ Lola Akinmade Åkerström June 2016.

Figure 55- Shows T-Central in Stockholm, Sweden.

A Swedish company, they had this vision on the warmth that human body generates naturally a resource that can be befit from and not let it go to waste.

"This is old technology being used in a new way. The only difference here is that we've shifted energy between two different buildings," says Klas Johnasson, who is one of the creators of the system and head of Jernhusen's environmental division.
"There are about 250,000 people a day who pass through Stockholm Central Station. They in themselves generate a bit of heat. But they also do a lot of activities.’’ says Klas Johnasson.

This technology of using body heat can be a sustainable way to reduce energy to the city and can be benefit from to heat buildings in the winter, it is a source of energy that is one of the most effective ways to reduce energy.

All this energy generates from human body heat, can be used to for energy generators and be beneficial for heating the n´buildings which resulting in less energy consuming and more sustainable. If we don't use it then it will just be gone without any benefits.

This idea is basically save in energy levels, costs and environmentally friendly and more sustainable source of energy for future planning.

If we tried to link this idea to the middle east region for example Dubai the second largest city in the UAE, Dubai has a Metro station, and is a motor-free metro system that opened on 9 September 2009, which is working on electricity, this metro station aims at reducing the pollution caused by ordinary means of transportation.

The powering building through body heat can easily apply in this station which have almost 3 million trips a year, thousands of travellers pass by this station specially because it is a key link connecting it with Dubai International Airport, the Dubai Metro station claim that they choose the motor-free metro system to reduce the pollution from the ordinary transportation, but in fact the powering building through body heat can be sufficient even more in reducing pollution and reducing the electric coasts and powering the station from its travellers heat.

Figures 56- Shows Train station in Dubai.

conclusion

In the path of sustainability, middle east cities need alternative energy conservation and conservation schemes and a healthy environment that protects against emissions and develops environmentally friendly transport systems and social life for the city's population. Combining these elements is not easy. Some cities have made great strides in this area, but the majority of middle east needs more efforts and work.

Promoting inclusive and sustainable urbanization, and the capacity to plan and manage human settlements in all countries but the middle east in particularly in a participatory, integrated and sustainable manner. More over a strengthen efforts to protect and preserve the cultural and natural heritage for more transparency to reduce the individual negative environmental impact for the cities, including by paying special attention to air quality, municipal waste management and others.

To lift and boost positive economic, social and environmental linkages between urban and peri-urban areas and rural areas, by strengthening national and regional development planning and provide universal access to safe, affordable, accessible and sustainable transport systems and improve road safety, in particular through the expansion of public transport, with particular attention to the needs of people living in fragile conditions.

A significant increase of greenery in the urban areas for humans settlements to adopt more sustainable living in the cities where there is a lot of environmental impacts. To improve the relationship of the city's population to nature and make it more consistent. The city is also home to more than 2000 species of plants, 28 species of mammals and 184 species of birds, in addition to many reptiles and fish, which makes it rich of biodiversity treasure that needs to be protected.

provides many opportunities for alternative energy in the cities in buildings and skyscrapers taking into account the environment. The city must supports local food projects for the lack of food transport in the city. The city has to developed more plans to be environmentally-friendly. The government have to introduced a number of laws and launch and number of policies to protect the environment and the green areas in the city.

Chapter 04

Breathing and Living Architecture (Case study)

4. case study Singapore

Figure 57- Shows the city of Singapore.

City Data

Location
Singapore is located at the southern tip of the Malaysian peninsula within the Southeast Asia region.

Area
Land area 710 km2

Population
Over 5.1 million

Singapore is a high populated city with high-rise buildings and filled with landscape gardens. Rich with harmonious blend of culture and nature, filled with contrast and color
The city blends Malay, Chinese, Arabs, Indians and English cultures and religions.

Singapore's trend in architecture and skyscrapers is that green plants, huge trees, and various types of flowers and roses cover Singapore, giving Singapore the uniqueness of being a city where the park is everywhere - on the bidders and on the buildings.

Since the 1960s, Singapore has been slowly regrouping as a garden city, although it may seem a little strange. From a small, densely populated urban area that constantly takes land from the sea to accommodate its booming center, the city has seen a green creep spreading in every corner, in any central resort, and everywhere in the land, including the remains of sidewalks. Plants thrive in Singapore thanks to tropical climate throughout the year so that vegetation grows in the most recessive places. The impact of this spread has become impressive, as it has become a city of skyscrapers, but framed by trees and palms and flowering American plants that are everywhere.

Whatever the degree of vegetation that has covered different places, cities are always known by architects more than their gardeners. More recently, Marina Bay Sands, a large casino and hotel complex, has become a real symbol of the city, with it’s skypark.

Due to Singapore's keenness not to lose its emerging urban centers in the Middle East and the Far East, it has been attracting tourists by building the world's most expensive hotel with a cost of more than $ 5 billion, surpassing the Emirates Palace Hotel in Abu Dhabi. this feature .

Figure 58- Shows the urban greenery in Singapore (Vertical Green facade).

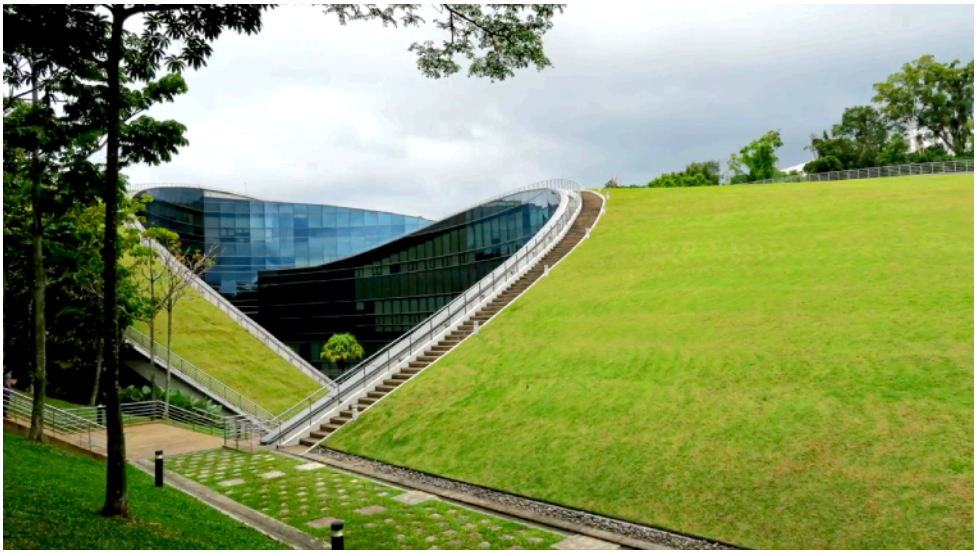


Figure 59- Shows the urban greenery in Singapore (Green roof).

Figure 60- Shows the urban greenery in Singapore (Green roof).

4.1 Green buildings in Singapore

Singapore the country's vision of building green buildings can be attributed mainly to the first woman to lead the country's urban development agency, Dr. Cheong Koon Hean, a veteran architect and chief executive of the Housing and Development Council, which builds and manages public housing for Singaporeans. Hean is working to restore the green spaces to the city by creating green spaces on the balconies of houses and residential buildings and also the establishment of high-rise buildings.

Dr. Hean believes going to this direction is not a choice but a necessity for a city like Singapore. ''Despite population density and skyscrapers, Singapore can be considered a green city by 2030 and hopes other cities will follow suit'', she says.

Dr. Cheong Koon highlights ''how Housing and Development board of Singapore is using technology to build a sustainably smart city for a better future''.
As Dr. Hean is the head of Housing and Development Board of Singapore, she oversees the development and management of some 1 million public housing flats in 23 towns.
She formulated a roadmap to develop better designed, more sustainable and community centric towns. She led the planning of the Marina Bay precinct, creating a signature skyline for Singapore and a vibrant live-work-play destination.

Figure 61-The development planning of the greenery at the Marina Bay.

4.2 Bringing the ground to the sky

Bringing the ground to the sky was the worlds famous architect Moshe Safdie, design architect of Marina Bay Sands.
Architect Safdie has a new vision of how skyscrapers can be. He designed the Marina Bay Sands resort in Singapore. Brings the new concept of the horizontal to the skyscrapers.
The huge giant platform is large enough to park 4 A3 passengers jets, creating enough space for gardens, swimmingpools and sun index, 600 feet of the ground.

''Creating open public space that connect to the nature above the ground''. Says Safdie.

Figure 62- Shows the Marina Bay Sands.

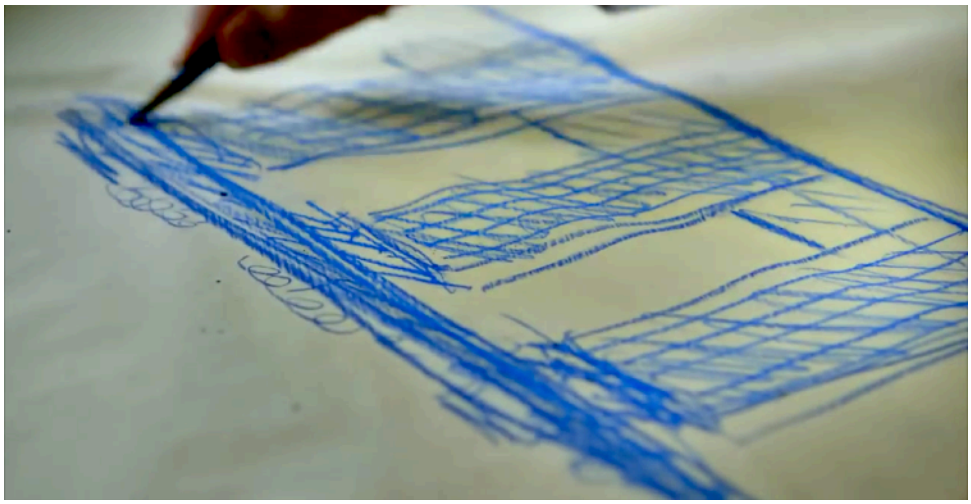


Figure 63- Shows Sketche by architect Moshe Safdie for the Marina Bay Sands.

Figure 64- Shows the rooftop of the Marina Bay Sands.

4.3 More green spaces in high-rise buildings

The government of Singapore set goals to double the coverage of greenery by 2030, ''currently there are around 100ha high-rise greenery. This is equivalent to more than 100 football fields.
The target goals to Singapore is to hit 200ha of buildings greenery for more sustainable Singapore, the Urban development will enhance the existing landscaping in the urban spaces and high rise greenery programs.'' According to the urban development department of Singapore.

Figure 65- Well designed and maintained green walls on the facade of the tree house, visually impactful and may help reduce the temperature in the vicinity.
Source: Finbarr Fallon

Singapore is integrating more nature in the high-rise buildings such as green roofs, green walls and vertical green walls and gardens to temper the air quality and insulate high-rise buildings from the harsh tropical heat.
Singapore awarded Guinness in Sep 2013/ Apr 2014 the worlds largest vertical gardens where more than 100ha of sky-rise greenery.

4.4 The importance of green High-rise buildings

In the recent years there has been a wide attention on living in a high-rise buildings as the city capacity population of Singapore needs a strict majors and more developments in the urban areas.
Several European cities are building high-rise housing as part of their urban housing strategy to supply more residential housing in the crowded cities to expand it in a vertical way.
In Asia, Hong Kong and Singapore are outstanding by their high-rise public housing developments.
If we think about it nearly half of the world's population are living in urban areas, according to many statistics about cities population around the globe. The importance of living in a high-rise building is becoming more and more sort of a solution for the high density of the cities.
Singapore took it more forward and is aiming toward living in a green high-rise building, expanding the city vertically, and converted into a garden city image when we can live in a building inside the city and still be surrounding by green nature.

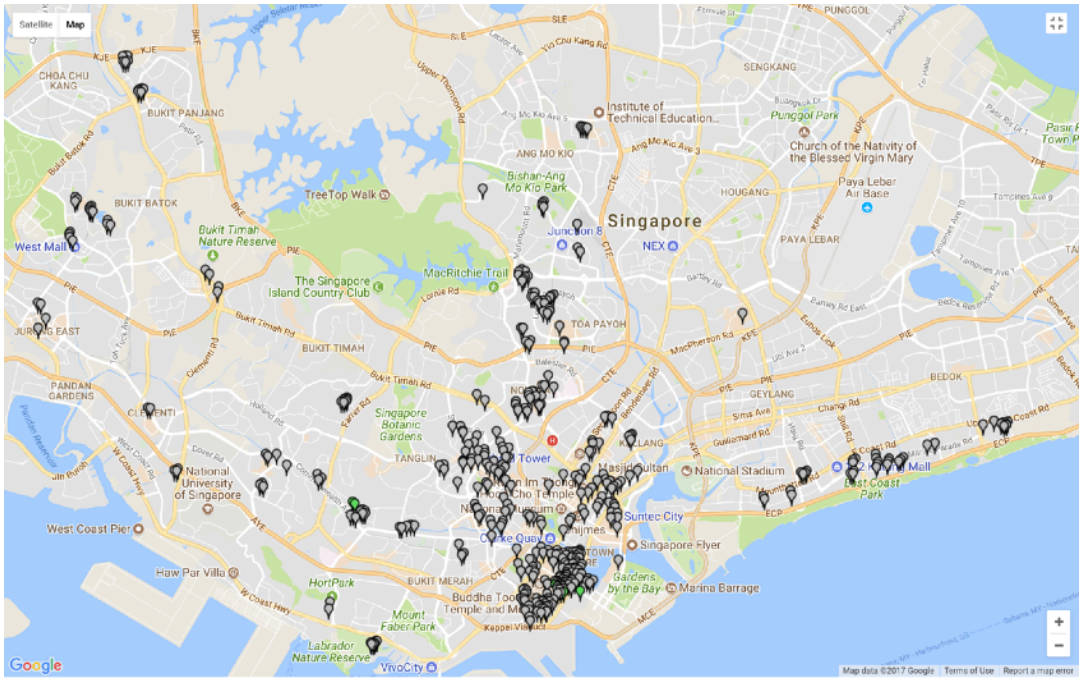


Figure 66- Shows the total of high rise buildings marked- at least 426 in Singapore

The national parks board in Singapore has developed NParks publications and recourses such as CUGE and Standers. These resources set to provide knowledge and guidelines on the designs in sky-rise greenery such as green roofs and vertical greenery…
Sky-rise greenery incentive scheme was introduced in 2009 provides financial in centavos to green-up existing buildings in Singapore. Which in this way Singapore will achieve the point of redefining the cityscape for more sustainability.


Figure 67- Shows the Urban greenery in high-rise buildings

''Today there is more than 150 buildings have benefited from the Scheme, funds up to 50% of installation coasts.'' says by Sky-rise greenery incentive scheme.

''Urban greenery reduce the temperature up to 4°C in midday'' according to a lot of researches in the city development in Singapore. While sky-rise greenery enhances biodiversity by creating natural habitats.

Figure 68- Linking nature to architecture and culture. Shows the greenery in the urban areas.

4.5 Green Roofs in Singapore

A blanket green roofs in Singapore is an unique strategy to blend the nature to the urban areas, providing the cityscape a natural layer of insulation to help cool the buildings and it has many Eco-features including an aircon system and rainwater collection system.

One of spectacular examples in roof design in Singapore providing a sustainable cooling, it is not just a park, it is a recreational space to cover up the pumps of the reservoir of the Marina Barrage.
22000 sq/m of green space for community to use for all sort of activities.
The grass itself has a function to reduce the surface temperature above the roof as well as the pumps that below the roof by 3°C.

Figure 69- Shows the green roof of the Marina Barrage.
Source: PUB

4.6 Vertical Greenery in Singapore

One fascinating example for vertical gardens in Singapore which is linking the nature to the architecture and blend it together to create a breathable architecture is the Garden by the Bay in central Singapore.
It is a spanning 101 hectares in reclaimed land, the park consists of three waterfront gardens:
Bay south garden, Bay east garden and Bay central garden.

The largest of all is the south garden at 54 hectares.
Gardens by the Bay is the government strategy to trafare Singapore from a "Garden City" to a "City in a Garden". According to government of Singapore

Figure 70- Shows the Supertree grove at Gardens by the Bay.

''Supertrees are tree-like structures that dominate the Gardens landscape their heights range between 25 metres and 50 metres.'' according to garden by the bay official website information [no date].

They are vertical gardens that provide a lot of functions, which include planting, shading in the day and an refreshing display of light and sound at night and also working as environmental engines for the gardens.

Figure 71- Shows the Supertree at night.

''More than 162,900 plants including over 200 species and varieties of bromeliads, orchids, ferns and tropical flowering climbers are planted on the Supertrees.
Green functions for the supertrees
11 of the them are embedded with environmentally sustainable functions like photovoltaic cells to harvest solar energy.'' according to garden by the bay official website information [no date].

Figure 72- Shows the green function of Supertree.

Figure 73- Shows the plantings of the supertrees..

4.7 Goals towards more sustainability by 2030

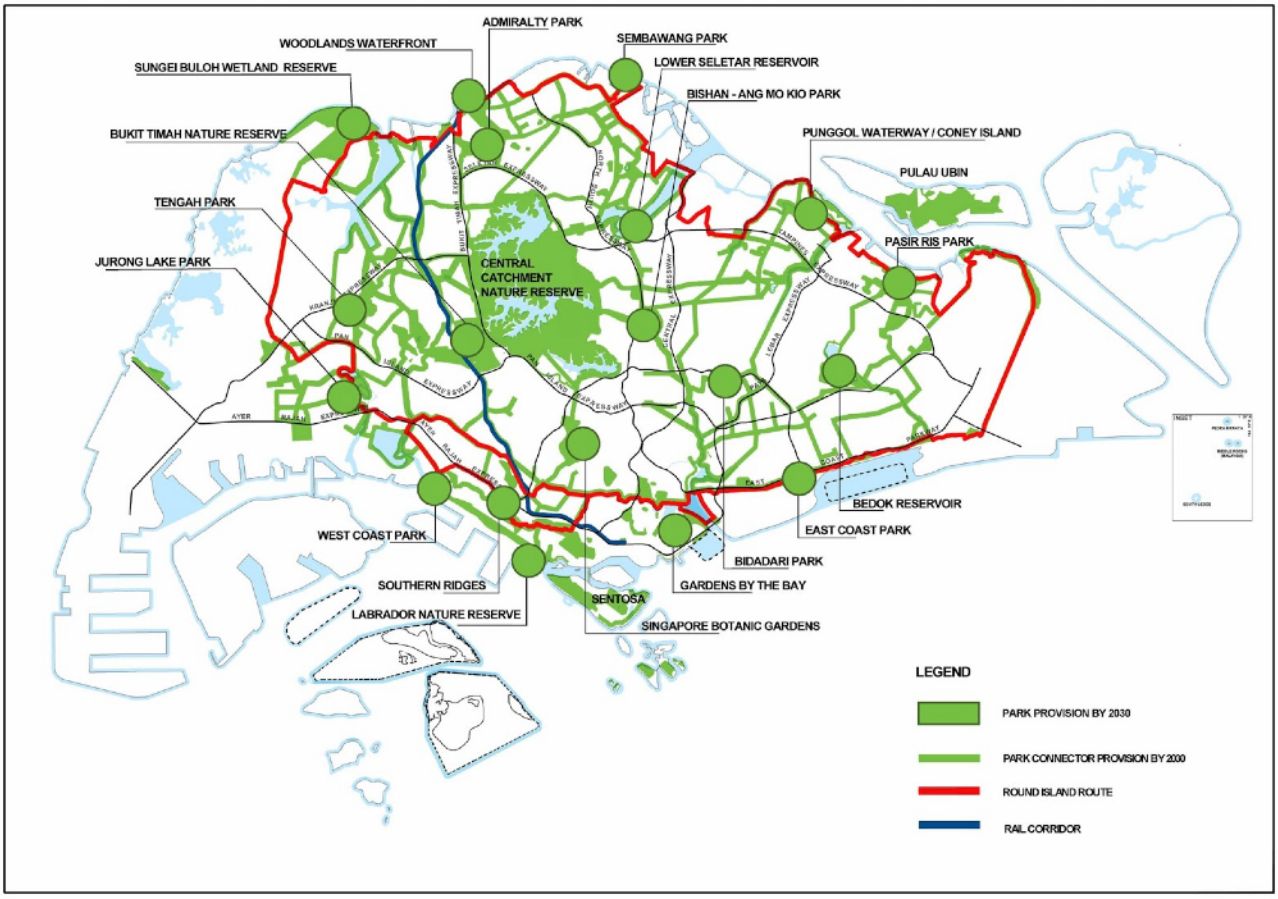


Figure 74- mapped out the Land Use Plan by 2030.

This figure shows the promise, is that even as Singapore gears up for a population of up to 6.9 million, its urban landscape will still remain largely green, and ''the government plans by 2030 is 85% of the residents will be living within a 10- mintes walk to a park.'' according to urban city development.

The demand that Singapore pushing so hard to achieve so that green ecology and green buildings to become a reality by the next years, and most of the existing buildings will have to be certified ecologically friendly.

Due to the limitation of the land space in Singapore, ''sky-rise greenery has highly become an essential component of sustainable urban greenery'' to be developed in Singapore. This was announced that the urban development authorities set a program called (LUSH) ''Landscaping for Urban Spaces and High-rises'', which enhance the development to green the buildings.
This program will expand to increase landscaping on walls and roofs.

conclusion

Singapore's efforts towards more green and sustainability can be tracked back to the late 60s when the country was undergoing rapid industrialisation and urbanisation. One of the earliest initiatives was the launch of the ''Garden City'' which is a vision by former Prime Minister to turn Singapore into a city urban greenery and a clean environment. ''Singapore had become a world-renowned garden city by the late 1980s.'' says by Valerie Chew.

Singapore has come a long way in integrating greenery into the urban areas, making it one of the most advanced cities in sustainable applications. By motivating its citizens to be environmentally conscious, through many developed national projects, I think that Singapore has achieved its dream to truly become a city in a garden. Other cities in the world could follow this vision of Singapore and go with more greenery.

Encouraging the increase of green spaces is a luxury in any way, but a necessity especially for cities like Singapore. The limits imposed by Singapore's natural limits are bound to expand vertically in an urban pattern that fosters increased population density. However, despite congestion and skyscrapers, Singapore can increase green space through grasses, allowing space to merge in the city's sky, in an attempt to suggest space and mitigate the impact of high population density. To achieve the so-called "Green Classification" by 2030.

Other cities can follow up Singapore's development buildings that help conserve urban greenery and sustainable energy and water while improving their internal environment by using solar energy, improving insulation in the buildings, increasing ventilation, using environmentally friendly building materials, and conserving water and using natural lighting to illuminate the buildings, and many other techniques can be benefited from to acquire more sustainability.

All this can be done in modern buildings in densely populated cities around the world, specially in the middle east where needs the most, in an effort to reduce carbon dioxide emissions.
In most of middle east cities have similar climate to Singapore which give us a full successful vision of the developments that can be done in those cities, to achieve more urban greenery and transform and detonxide the cityscape.

Singapore is the perfect example comparing to the middle east on how Singapore was able to be transformed from ashes to most top green cities ranged around the globe.
The techniques and the strategies can be linked to the middle east to set stringent targets to serve the environment and the communities and overcome the constraints through innovative solutions, and turn obstacles into opportunities for growth and creating a liveable and endearing urban ares and a vibrant and sustainable cities.

In conclusion, Singapore urban greenery is an Eco-friendly finish to the cityscape which blend the nature with the culture and the architecture, the harmony of the city that allows to blend the ground with the sky with no limitation and expand vertically, all of these efforts awarded Singapore to be the ''City in a Garden''.

Chapter 05
Design (Bio-culture Bus Shelter)

5.1 Design Concept

Most of green roofs are high above the streets and out of sight. Bio- culture green shelter bus-stop will not only serve as a bus stop but also a mini garden and an educational center that gives people on the go the chance to see and experience the greenery in the city, be a part of understanding and interact with the nature.

This bus stop will have on the roof top a selection of local plants that will provide home and food for various bird species to invite them back to the city, that help to ease the heat and reduce the amount of rainwater that direct to the sewer system, that recluse the chances of flooding that impact the city urban environment.

Also a sun solar panels which provide electricity to the shelter to be self sufficient, a screen inside the shelter for showing educational of environmental awareness and/ or advertisements.
There will also be a written information about birds, native plants and the environment.

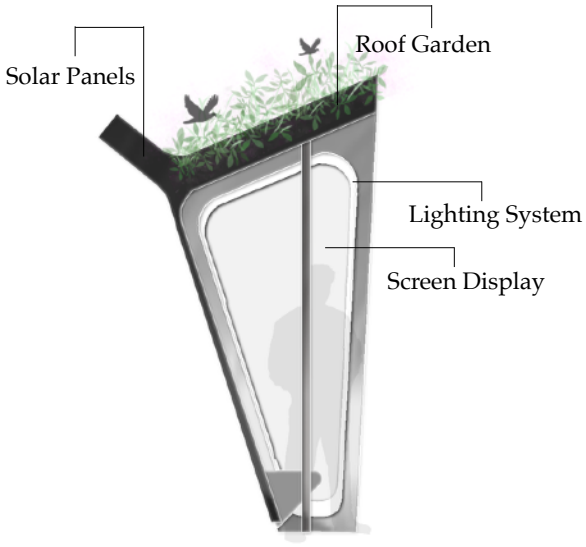


Figure 75- Side elevation

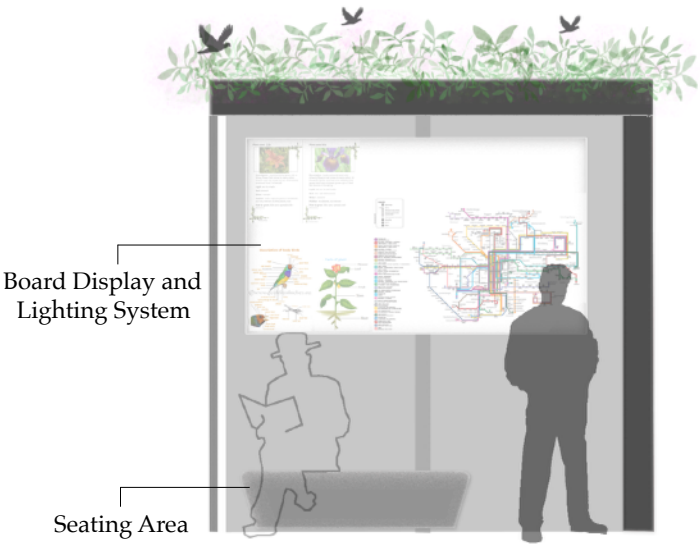


Figure 76- Front elevation

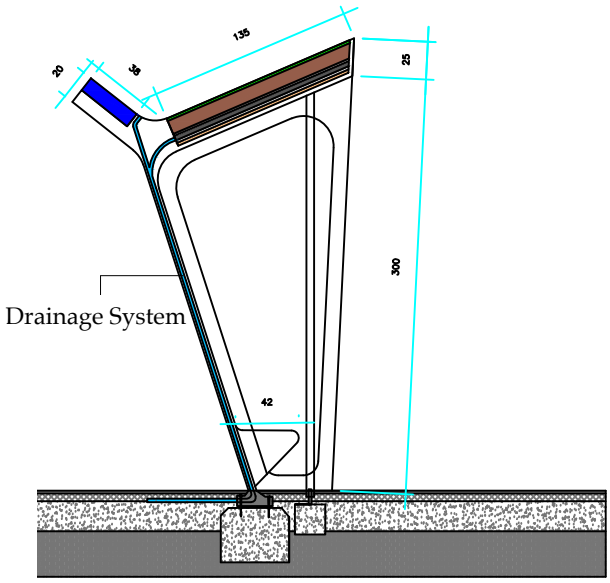


Figure 77- Side section. Scale 1:5

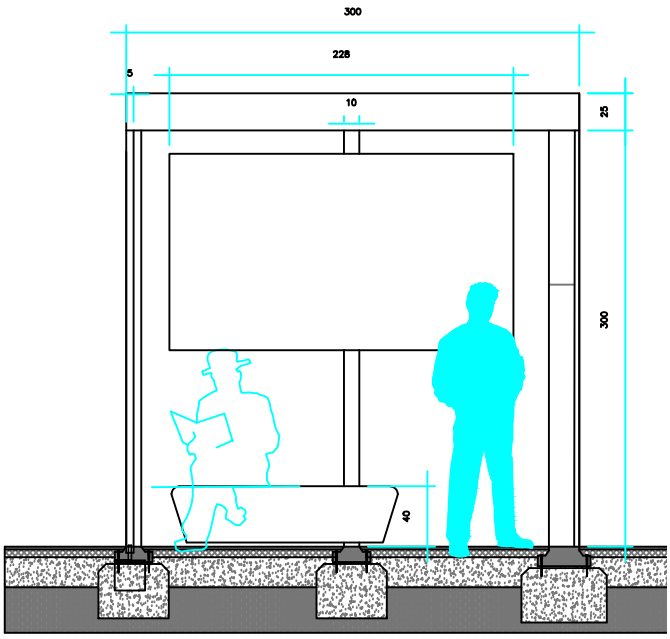


Figure 78- Front section. Scale 1:5

This Eco bus shelter aiming to reduce CO2 emissions inside the crowded cities as well as encourage people to use the bus, in addition gives the cityscape more greenery.
The living vegetation installed on the roof working as a filtration to the city pollution, while the success design will be capturing the publics attention and develop more sustainable technology.

This design concept is to bring the greenery of green roofs to the street level, to increase the awareness of the benefits of green roofs and sustainability, as well as the urban greenery which is so beneficial to the cityscape.

The project proposes to install local plants, which provide a law maintenance. If we imagine the city beautification where nature can stand in urbanisation laws and harsh climate standers.
Through out this simple project a lot of cities in the world, middle east in particular can reduce the CO2 levels in the urban areas, where there is heat and low air quality.

This Green Living Roofs are a "green infrastructure" technologies that have many advantages to the environment and the urban areas - some particular to this application: passive air conditioning, stormwater management, shading, roof membrane protection, air improvement, aesthetics and color, habitat, etc.

Figure 79- done by me, shows a 3D perspective .

5.2 Solar panels

Solar panels- Lightweight, flexible high performance solar panels along the roof of the bus shelter to provide energy.
Bus shelters solar panels is a creative design thinking, which is based on a modern look featuring and pure aesthetic appearance shapes that can give the cityscape.

These solar panels designed to include lighting along with guttering & drainage systems to ensure rainwater is directed away from the shelter. The versatility of this shelter means that it can be adapted to meet the exacting requirements for more and more sustainable infrastructure in the cities.

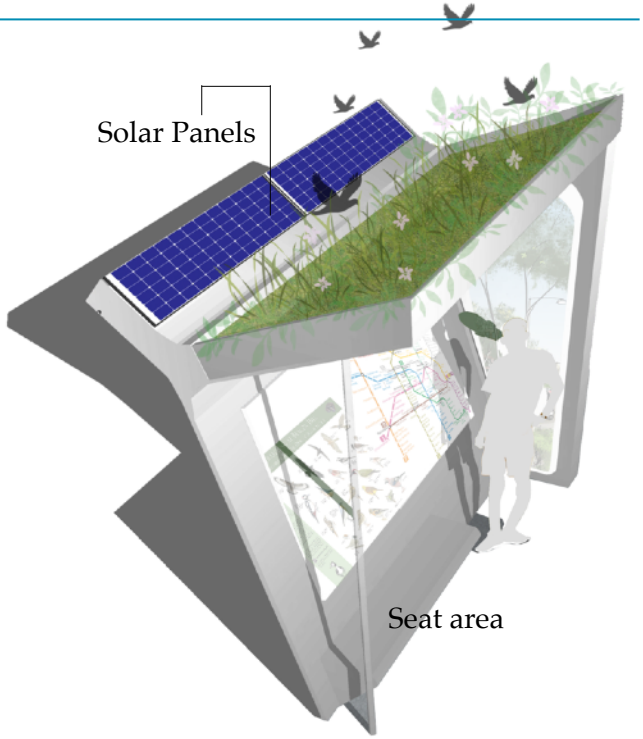


Figure 80- Shows a 3D perspective of roof and the inside of the bus shelter.

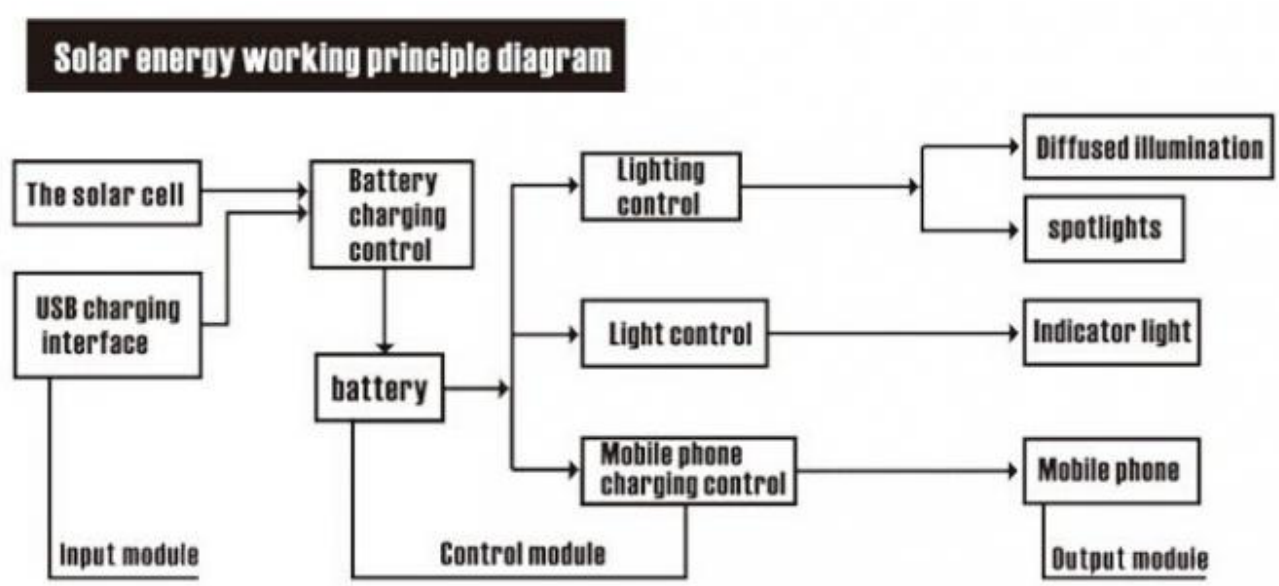


Diagram 01- Shows solar panels specifications to be used.
Source: GSAD® Solar panels products.

Product specification from the company website:

Certification: CE ,ROHS
Model Number: GSBS5-2.7
Panel :Tempered glass
Characteristic
outdoor used; double sided
Frame color: Aluminium silver, black or other custom-color
Base: Galvanized Sheet

5.3 Rain water management

Rain water management- The rai
management layer is responsible
excess water to be drained to the
system of the city. which there is no r
maintenance. Figure 00

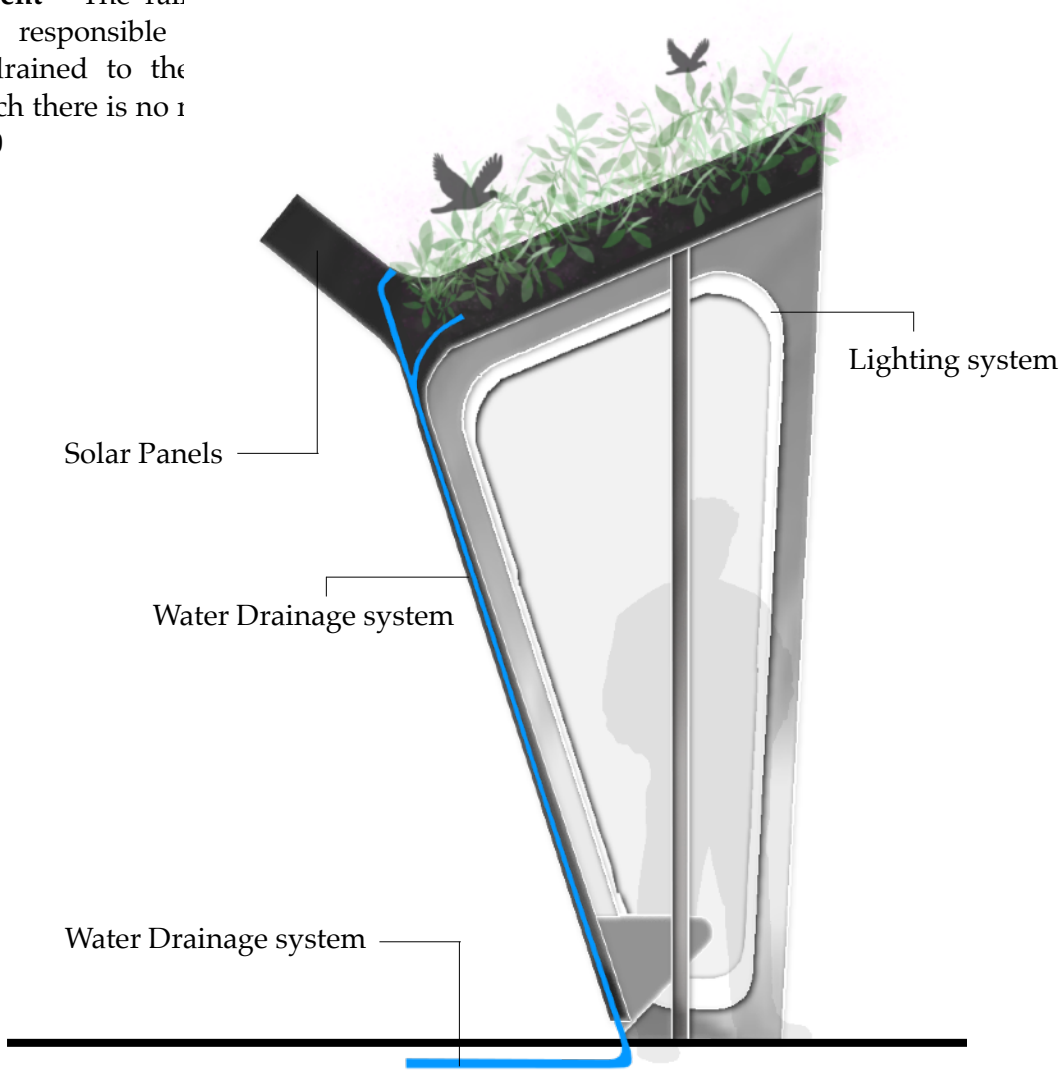


Figure 81-Shows a section of the bus shelter water drainage.

5.4 Roof top garden

This roof garden of the Bio-culture bus shelter will have a variety of plants, and bring back greenery to the urban areas in the cities.
This small garden will benefit the city in many ways, by reducing CO2 in the air, improve the city climate, filter the air, reduce the heat by reflecting it, and much more environmental benefits.

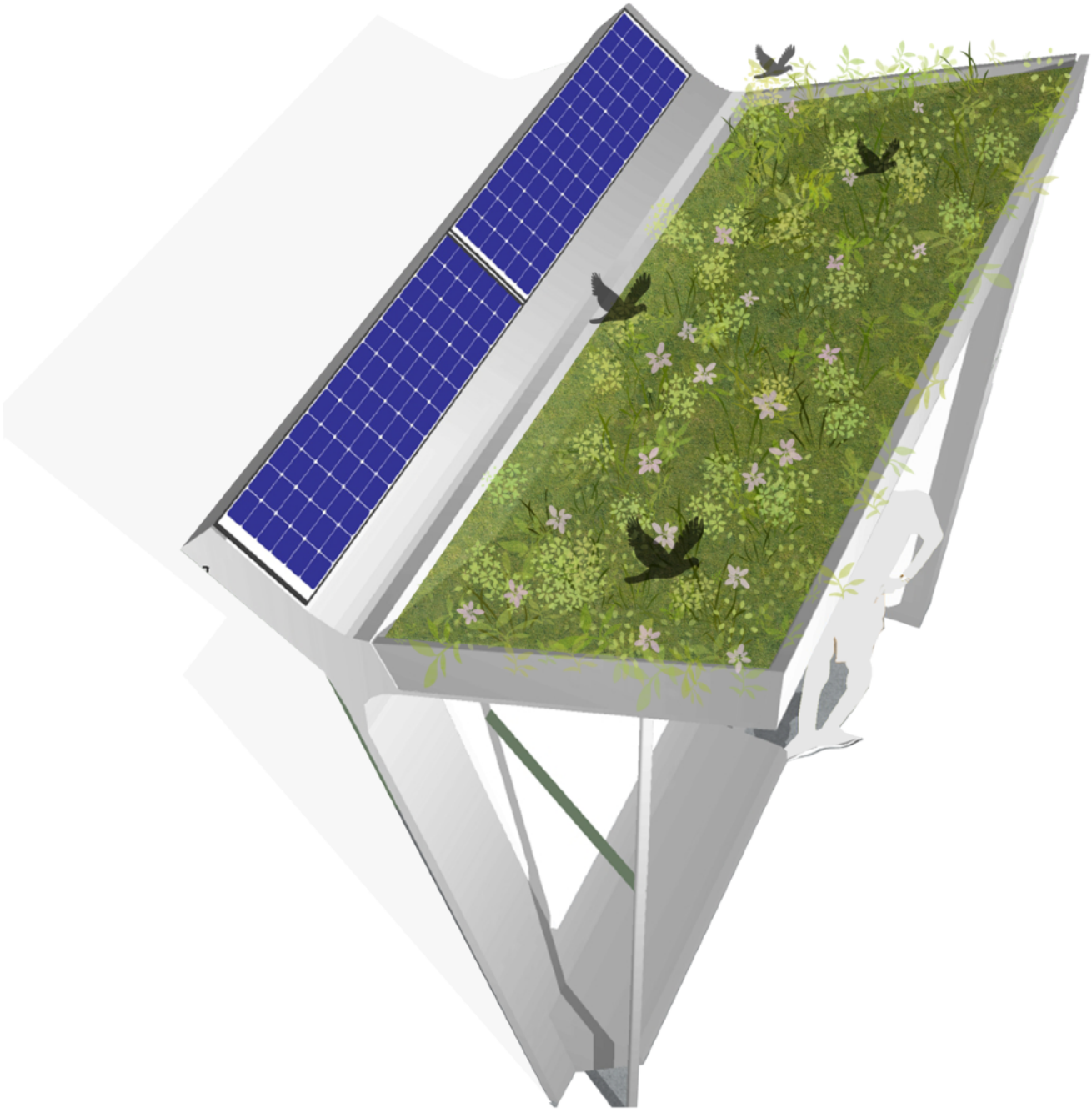


Figure 82- Roof top perspective that shows the roof garden.

5.5 Technical details

Each layer of the green shelter system has a crucial role in successful maintaining the rain water management and protecting the structure underneath it, whether it is a hot dry weather or a mild to rainy weather, this green roof shelter bus can survive all the weather aspects.
The depth ranges is starting from 10 to 20 cm.
It is light in weight and need low cost and low maintenance, which makes it suitable to any city in the world.

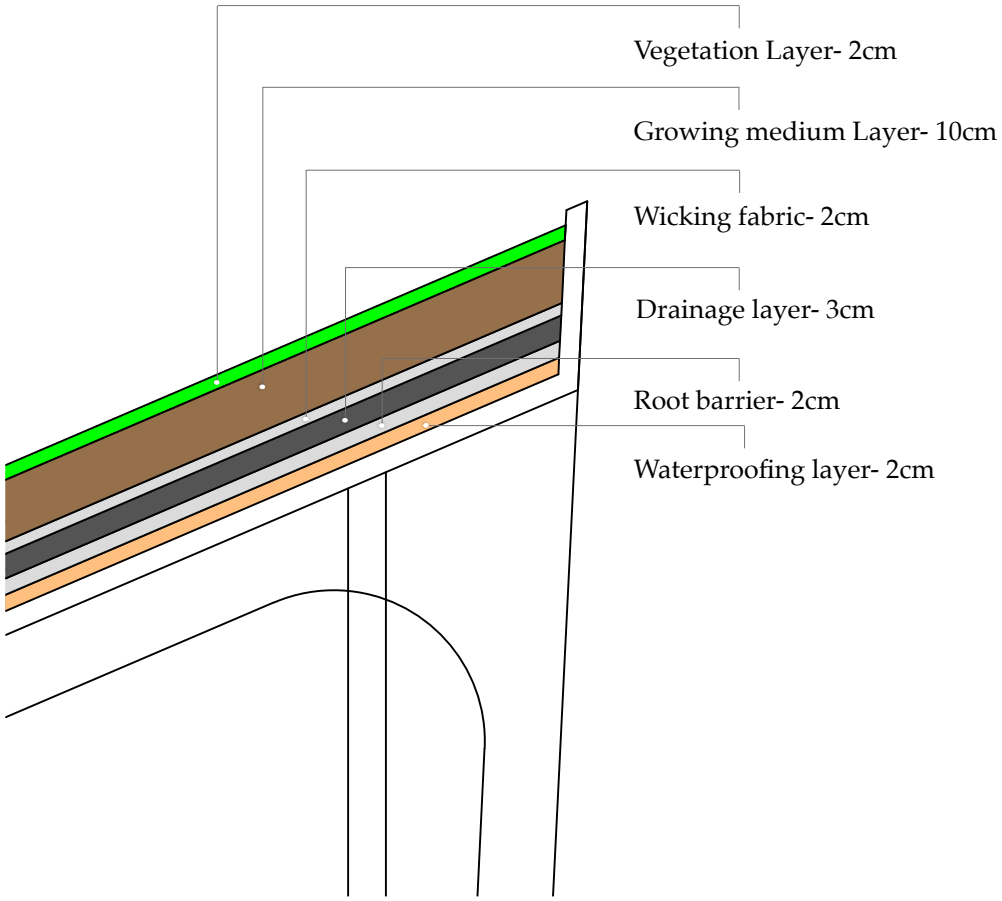


Figure 83- Shows the layers of the bus shelter.
Scale 1:1
Source: Author.

Vegetation layer- Made up from variety of local plants species, this plants can be pre- grown first to protect the plants from wind blown. Figure 84
A photodegradable wind net will be placed over the newly planted for protection. Figure 85

Figure 84- Vegetation layer.

Figure 85- photodegradable wind net.

Growing medium- Lightweight soil (media) to support the plants growth by creates a suitable growing environment with keeping in mind the weight that can supported by the shelter structure. The soil is full of mixture of native soil upgraded with organic or mineral additives, which this option is less expensive and can be done by soil experts.
Density and erosion control necessary to support the green roof vegetation. Figure 86


Figure 86- growing medium.

Wicking fabric- A filter Cloth must be added to enhance water retention, that holds and evenly distributes water, and prevent the drainage from clogging from fine soil particles, this cloth weigh 500 to 900 g/m^2. Made from recycled polyester. Figure 87


Figure 87- Wicking fabric.

Drainage layer- This layer is beneficial for the roof to store water and help the plants survive in dry weathers which is so beneficial for areas with hot dry climate such as middle east. Figure 88

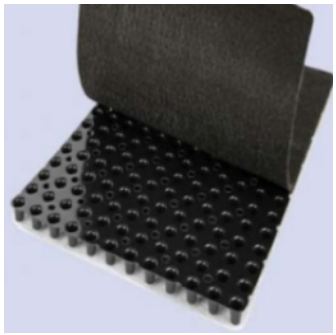


Figure 88- Drainage layer.

Root barrier- This layer is an important one for protecting the roof from plants roots or organic material which could cause decay and prevent a mechanical damage. Figure 89


Figure 89- Root barrier.

Waterproofing layer- Water resistant layer to protect all the elements and the drainage of excess water to prevent damage to the structure. This layer will holds the majority of rain water in the soil and excess the rest of the water to the drainage. Figure 90

Figure 90- Waterproofing layer.

Steel structure- Quality of steel structure that can support between 15 to 45 kg in square meter . Figure 91

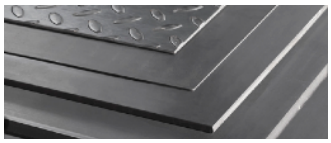


Figure 91- Steel structure.

5.6 Choosing a site

Before we choose the location we have to inspect the drainage locations in the city.

Choose the appropriate plants that can be planted depends on the local plants or the suitable climate of the city on the plants that need to be chosen.

Check the wind strength and velocity to choose which plants can be survive on the roof, with keeping in mind to install photodegradable wind net on the new planted plants to protect them.

The middle east region is a perfect place to link this design to, the city of Damascus in Syria, is a great location for that.
The problem of urban encroachment on agricultural land is a global problem that afflicts all the poor and rich countries of the world.

Figure 92- Middle East Map.

The largest evidence of this is what happened in the Gauta of Damascus which is a huge green open space that Damascus is famous for, it has decreased to one-third of what it was, and this has had many negative effects, including: the decline of cultivated areas around the cities and the increase of built-up, helped in one way or another to pave the way to desertification, The random growth of housing and the degradation of the ecosystem that has helped pollution to increase. Also the drop in agricultural land, never the less the elimination of vegetation and the deforestation of cities that harm the environment.


Figure 93- Urbanization of Damascus, Syria.

If urbanization and random housing continue in this way in this city *(see Figure 96)*, it will eventually lead to the desertification of Damascus.
The city of Damascus derives its prestigious historical status from its water environment, and the River Barada comes at the very core of its existence *(see Figure 95)*, for the past few years, and because of the urbanization and the urban heat and lack of greenery, this river started to dry.
In the recent years Damascus witnessed the dramatical situation of war, which led to more greenery destruction and more urban heat, and the biggest impact is the pollution from the weapons.

Damascus has more inhabitant than before due to the country situation a lot of people from other areas and cities in Syria started to migrate to Damascus which led to more pressure on the urban areas of the city to be handle.
The amount of carbon that covers the city is increasing everyday. This means there is an urgent need for solutions to

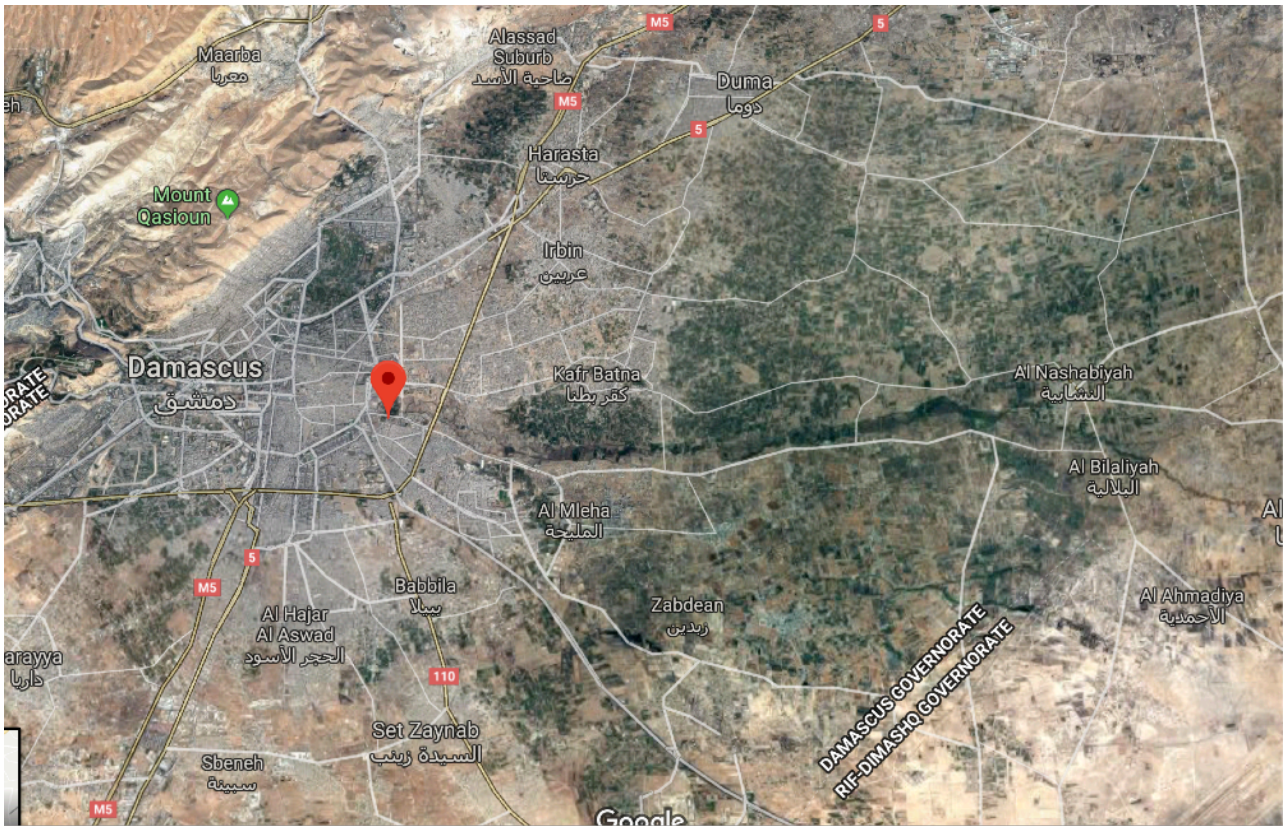


Figure 94- urbanization and the shrinking of the green areas in Damascus.

This map is showing the urbanization and the shrinking of the green areas near the city and how the urban areas is increasing at the expense of the green areas.

The urban areas of the city need more greenery and this design will be a start to increase the greenery in the city, because the public transportation is cheap in this city, which makes a lot of people the targets to include such a design. Bio-culture Bus shelter would bring back the greenery to the city and educate the people of Damascus about the risks that the city is facing in this very moment and introduce more plants into the urban areas.

Figure 95- Barada river in Damascus before it is dried.

Figure 96- Random housing in Damascus.

The conditions of the current reality of Damascus is one of the most important challenges facing us as landscape architects, architects, planners, demographers, economists, socialists, geophysicists, archeologists and politicians when considering the development of an organizational plan for the city.
Any resident in Damascus is aware of its plan and its urban reality. The failure to develop a future vision for the expansion of Damascus, which accompanied us for decades, is

unfortunately still the predominant nature. The development of a realistic future vision for the city of Damascus requires the participation of all the spectrums of the city and its vital environment and its effectiveness.

Dialogue, participation, opinion and the interest of the public is one way to achieve the desired plan.
The greenery in Damascus city is less than 20% of the total city area, and the greenery is not missing a connection.

The city of Damascus need more urban greenery by redefining the cityscape, by including the greenery types that this master thesis has explained, green roofs, vertical gardens and green walls… etc.
A strict measures should be set immediately to avoid more random housing in the city and avoid greenery destruction and include more greenery.

Figure 97- Greenery in Damascus city.

Chapter 06
Conclusion

Conclusion

The global issue of urbanization is becoming more and more demanding to fallow a system of planning and conducting greenery in urban areas of the cities that can be developed through application and measurements.
The cities are growing so fast and within the next 50 years more than 80 percent of the world's population will live in an urban environment. Therefore it is highly important that the city develop in a sustainable way. Europe is moving towards more sustainability and aware of the environmental impacts, a lot of environmental management system are integrated to be developed to avoid environmental crises in the next years, these goals have been setting for a long- term use, for urban greenery, environmental management plans, Eco-management, biodiversity and much more environmental targets.
According to European Commission the estimation percent of European cities who have environmental management plans.

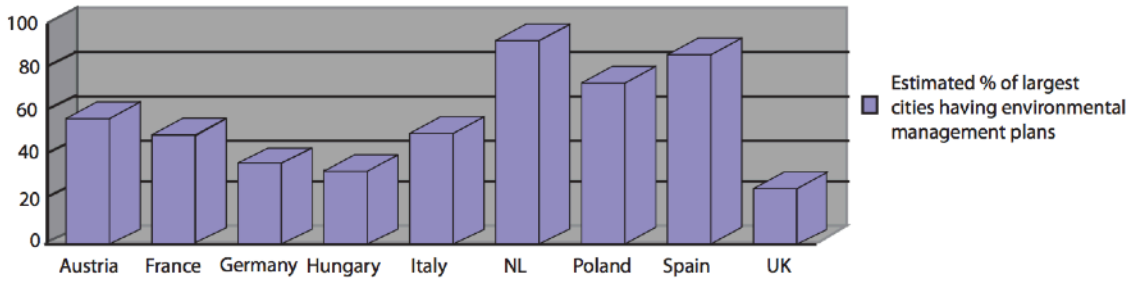


Chart 02-EU cities having environmental plans.
Source: EU Commission

It is worth the subject of the coordination and landscaping of the greenery in the urban areas. The need to develop the work to take advantage of modern technologies based on green construction, whether green roofs, roof gardens, green walls and vertical gardens, etc. All of this attitudes to consolidate its concept by adhering to the application of heat insulation code in construction and energy-saving codes. it should be stressing on the importance of relying on green buildings, especially as they consume less than traditional buildings between 40% to 50% of energy.

Green buildings preserve environmental safety from the risks of pollution and global warming. This concept has an effective role in protecting the environment, conserving water resources, exploiting energy efficiently and recycling the resources used to build it, in addition to the use of renewable energy.

Sustainable green-roofed buildings require less cooling in the summer than traditional roofed buildings require. They are one of the most effective thermal insulation methods, and if used extensively, they contribute to addressing the thermal accumulation phenomenon in the built environment, also known as the urban heat island effect. In which the temperature of the city is higher than the surrounding areas from 3 to 5 degrees Celsius, because of the absorption of buildings and streets of heat, and the inability of the city to get rid of this heat during the night, which leads to the accumulation of heat, and the green roofs isolates the external sounds It represents a green area that meets the needs of the community of greenery of diverse uses in large cities.

Diagram 02- Shows the importance of green roofs.
Source: Author

The cultivation on roofs and facades is one of the elements and requirements of green buildings in all global systems, and the cultivation of roofs and facades is an environmental requirement at the global level is applied in many countries of the world for the benefits of many and the most important thing is to bring more greenery to the cities which reduce the pollution in all different ways, and support the biodiversity in the cities. Never the less to obtain sustainable development and establish a culture of green environment. All of this achievements will increase the strategic objectives of green area per person.

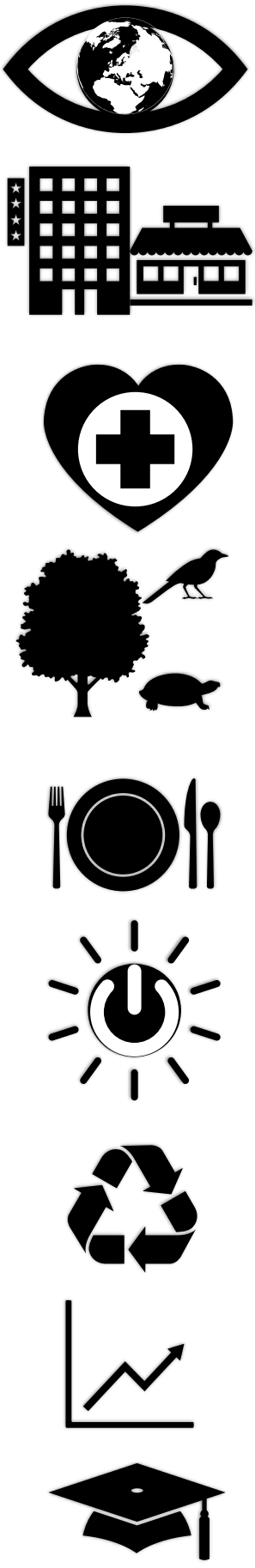
Urban Greenery Projects in the cities specially in the middle east, should be the government's strategic orientations aimed at acquiring environmental sustainability in that region, where it is so important specially in this time where the pollution levels increased dramatically high and the destruction of greenery inside and outside the cities done by the unstable situations in that areas.
Most of the middle east region cities suffer from neglect and lack of gardens and green spaces, in addition to a discrepancy between the number of inhabitants and green spaces in a manner that does not meet international standards. Urban greenery benefits reflects on many aspects in life, such as climate, health and well-being, nature and biodiversity, hunger and food production, affordable energy, economy and productivity.

Urban development, urbanization and overcrowding have led to increasing demand for land for commercial, industrial and residential use at the expense of green areas. This problem has been exacerbated by the steady population growth witnessed in most Arab cities. The issue of recreation and the lack of green spaces and public parks has become more complicated with the horizontal extension Of cities and rising land prices in their suburbs, creating an unfair competition between land uses at the expense of recreational use.

There is no binding legislation in the urban planning of new cities to establish more greenery in terms of size and proportionate with the size of cities and residential neighborhoods and administrative and natural resources available from water, nature and soil.
The lack of investment awareness in the field of greenery in the cityscape and estimate the economic return and lack of good preparation for feasibility studies for such projects had a major effect on the cities development which also led to environmental impacts.

The weak experience of some members of the technical staff in the implementation of agricultural service and maintenance was reflected in the status of afforestation and greenery services. However as a modern model, Dubai's green spaces and parks are typically observed, with all the standards in place in the world, as well as the private gardens that serve the well-distributed residential neighborhood, as well as Dubai is a distinct location, is most of the cities of the middle east are no less important as a location and climate, in addition, the presence of the effects that give it a tourist character, but the gardens are almost neglected, and also noted the presence of urban encroachment on the areas of agricultural looks, Green surrounds the city, and breathes its inhabitants.

The full attention and the need to take care of the green spaces and parks in the middle east urban areas in the cities, and allocate spaces that included in the residential areas, which are designed to meet the needs of the population.



Figures 98- Important of greenery on living earth. Source: Author

There is an urgent need for a comprehensive database on green spaces, in light of which development plans can be developed for these services from the authorities. The figure 00 shows the range effects of Desertification risk in the Middle east and Africa by 2050. The green spaces is shrinking dramatically in the middle east region unless a new urban greenery strategies be done for more development.
Unless new straits and roles follow in the next years, more than 50 million are facing the risk of desertification, which will lead to more pressure and more impacts on the neighbouring cities.

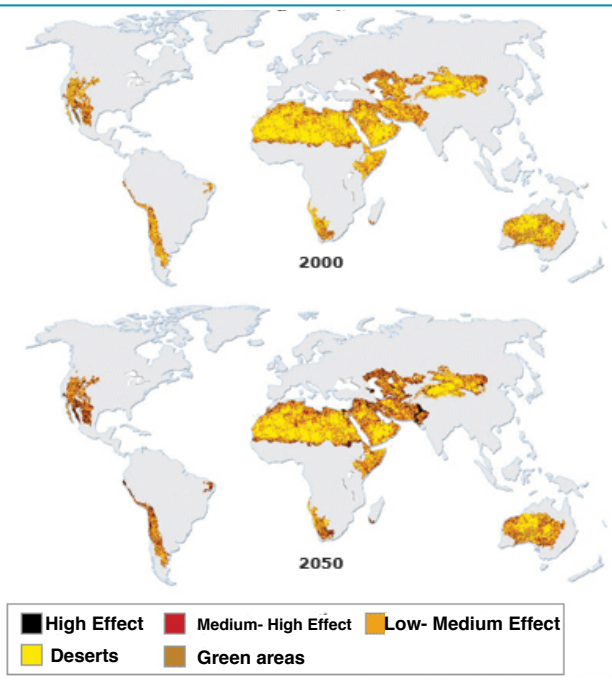


Figure 99- Shows Desertification effects and risks by 2050.
Source: UNEP 2004

The big role for improving the shape of the middle east cities is by using trees to cover unplanned residential areas or unplanned buildings located in the center, and always try to include and merge between the architecture and the nature in any kind of way, by adding roof garden, vertical garden, or even just green roofs, which will give an impact on the climate and the environment.
The importance and benefits of exploiting the wasted spaces in buildings, whether in the abrasions or the yards or roofs, and how to convert it from an abandoned place to a green beneficial place to the person and the cityscape.

Provide the infrastructure necessary for the establishment of parks and parks within the framework of urban planning, in a manner that achieves the recreation of the inhabitants of the city.

Interest in planting shade trees to take advantage of them in the hot summer months to be trees that fit the general nature and can add some beauty to the garden, provided by the flowers or form distinct, especially those that bloom in the months when there are flowers for most of the plants planted garden .
Raise the efficiency of agricultural technicians in the secretariats and municipalities in line with the tasks assigned to them, and increasing environmental awareness at the level of the communities of the importance of gardens and parks and maintenance.

Ensure that species and plant varieties to be cultivated are suitable for local environmental conditions before planting.
reduce the urban encroachment on areas of agricultural, and intensify efforts to protect and care for them, especially that most Arab cities suffer from extreme harsh climate.

The experience of Singapore is one of the most impressive experiences. It is the most organized. With the narrow space, the inhabitants of the buildings residents putting gardens on the roofs as a place to sit. Singapore has an image as a city in a garden, a liveable place that has been seen and ranked as Asia's most liveable city.
In many high rise buildings in Singapore you can walk in the 20th floor level, and yet you can still feel you are on the ground level where you can walk through a garden in the sky.

The design proposal in these Master Thesis, “Bio-culture bus shelter”, is so suitable to any city who wants to develop more greenery and more sustainable environment. The middle east can get

a lot of benefits from this design, specially when the middle east cities use the public bus transport system more than the cars, inside the cities due to crowded streets and lack of parking spots.
This design desire is to fill the gap of the missing connection between humans and nature in the middle east, educate the people about nature, environment, biodiversity and what is more important than that is the Bio-culture, which the combination between nature and culture.

Many shapes, types and techniques of greenery can be applied and adjust in the middle east or in any city in the world, and develop the urban areas in the cities in more sustainable and environmentally friendly.

The Bio-culture bus shelter proposal design in Chapter 05, is not a new invention in Europe and in more developed countries around the world, but in the Middle East and growing countries it is, which make it a great invention to be imported to the city of Damascus. After many cities in the world did this project, will guide us through to make it happen in the Damascus or any other city in the Middle East, which is a practical bus shelter for urban greenery in the cities.

All the similar projects that have been done in other cities were either solar panels roof bus shelter, or planted green roof bus shelter, but my idea to combine the two ideas in an more creative way, with the education possibility in the same way. The design idea makes the bus shelter self sufficient with low to zero maintenance.

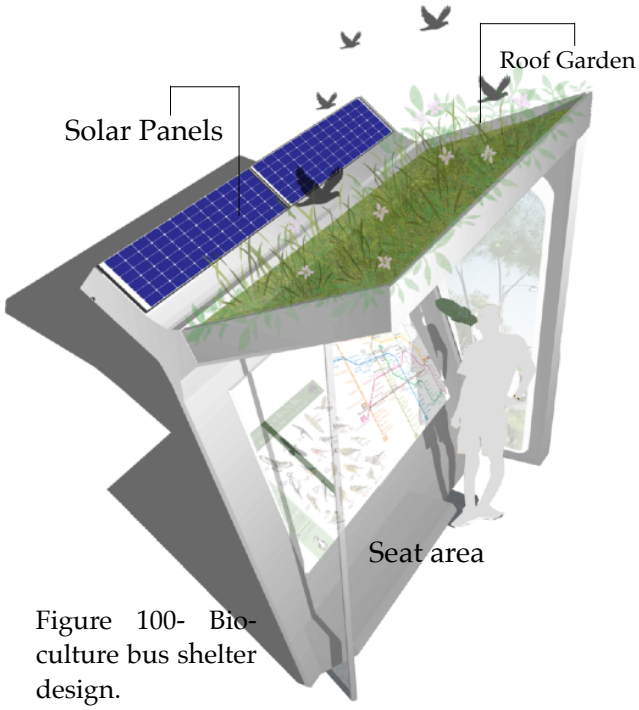


Figure 100- Bio-culture bus shelter design.
Source: Author

This design will improve the sustainability and the environment in the Damascus while improving the city appearance and make it more fresh and more friendly, and invite the birds to the city and improving the air quality by filtering and bring the nature to the culture.

The temperature variation of bare and green roof can affect the city temperature, This chart shows how green roof can temperate urban climate and improve air quality in the city.

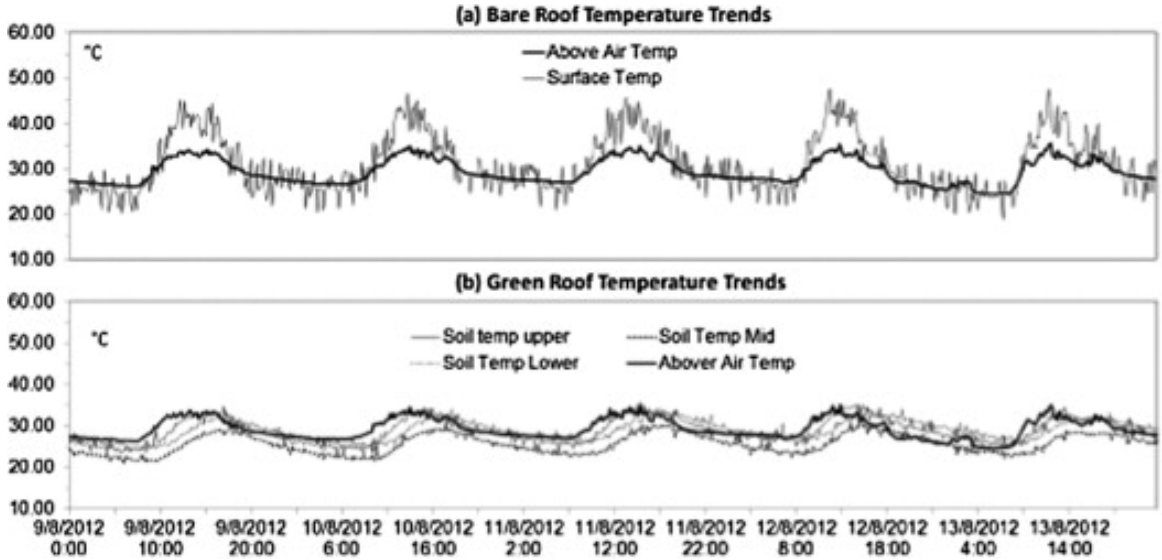


Chart 03- Shows bare and green roofs temperature effects.
Source: Applied Energy, Jinyue Yan.

We always notice that temperatures are higher in cities than in the surrounding rural areas. This temperature contrast is the result of a strange phenomenon known as the urban heat island effect. As the name suggests, this effect makes cities turn into heat islands. Temperatures in cities can reach 4 degrees Celsius higher than the surrounding areas. Usually this temperature variation is not much, but a few degrees can make a big difference in the climate.

When the surfaces in the cities absorbs light, it converts this light into heat energy, and emits it again as heat. Asphalt, concrete and all of the man made materials absorbs a lot of heat and consecrating in the cities and the urban areas which resulting in higher temperatures in those areas than the surroundings areas.

The existing of air heat is mostly likely to be found in the cities, which makes it one of the examples that shows the effect of humans in climate change. This makes the urban greenery the urgent solution to reduce the urban heat and balance the urban environment once again

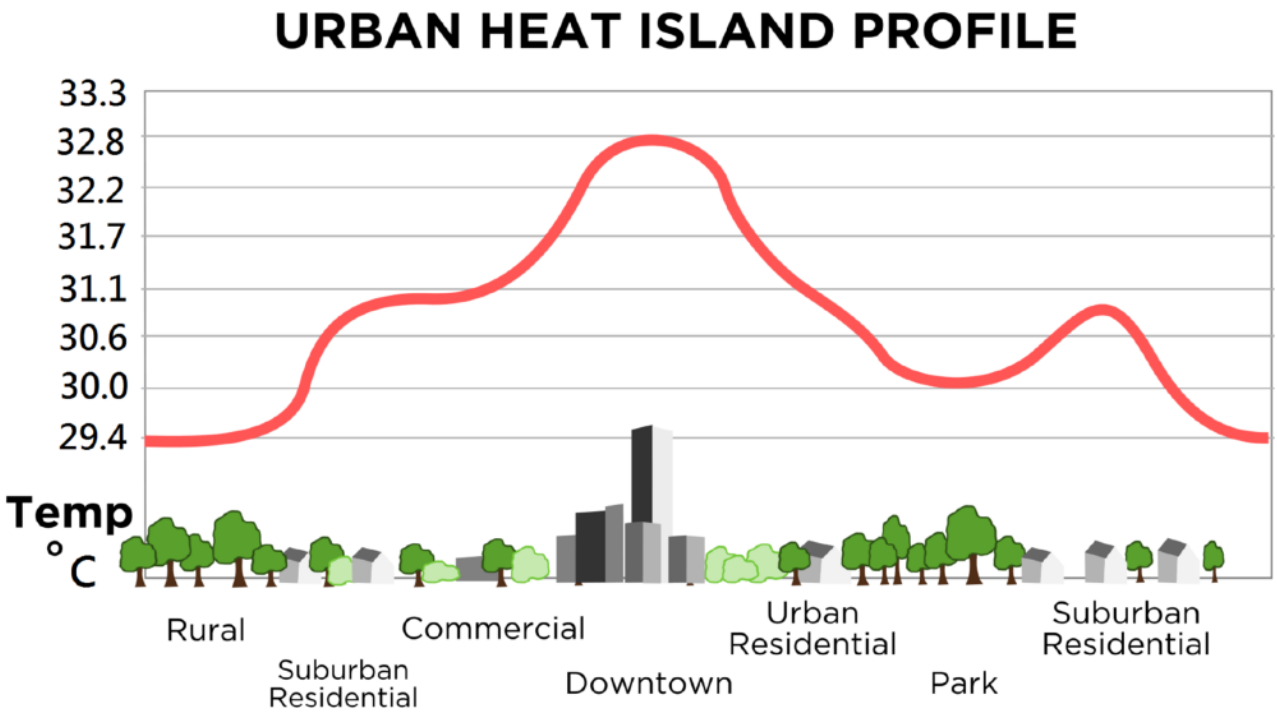


Chart 04-Shows urban heat island.
Source: Urban heat island: The New Phobia, Alex chris.

Green roofs in the urban areas in the cities, helps to reduce the heat temperature through evapotranspiration.

This figure example shows the heats that produce from the buildings surfaces in the cities which makes green roofs the most effective way to produce more greenery in the cities and reduce the heat and improve air quality and improve the cityscape.

Figure 101- Shows the heat on green and conventional roofs.
Source: Reducing urban heat island: Compendium of Strategies.

The clearest examples of human impact on climate is the urban heat and lack of greenery in urban cities. In recent years, climate scientists have become increasingly interested in the impact of heat and air pollution on the urban climate, but what is so obvious is we humans tend to destroy our cities climate and apart from the environments.
Nature base solutions to bring back the biodiversity in the urban cities and balance back the ecosystem in our nature environment in all of our cities, there is a growing awareness of the effects in some countries and they started to establish many measurements to improve urban greenery in redefining the cityscape, but in other cities more awareness need to improve growing counties such as Middle east, Asia and Africa. etc.

The barrier between humans and nature relationship needs to be crossed and introduce the greenery back in our cities and in our lives. This change toward more greenery will guid us toward more sustainable environment

Figure 102- Show the split between the nature and culture.
Source: Polo Centre of Sustainability

Bibliographic Description

Adams, Lowell W., Thomas M. Franklin, Louise E. Dove, and Joan M. Duf eld. (1986) Design Considerations for Wildlife in Urban Stormwater Management.

Herzog, T.R., Barnes, G.J., 1999. Tranquillity and prefer- ence revisited. Journal of Environmental Psychology.

Kaplan, S., 1995. The restorative bene ts of nature: To- wards an integrative framework. Journal of Environmental Psychology.

Given, D. and Meurk, C. (2000). Biodiversity of the urban environment.

Goryshina T.K. Green World of Old Petersburg. - St-Pe- tersburg: Iskusstvo-SPB, 2003.

Hedfors, P. & Berg, P.G. 2003. The Sounds of Two Landscape Settings – Auditory concepts for physical planning and design.

Chen, Jie (2004) Master Thesis "The role of green structure in development of the sustainable city.

Berglund, U., 1996 Perspektiv på stadens natur (Perspec- tives on nature in the city).

UN Population Division. 2004. World Urbanization Prospects: the 2003 Revision.

Chaberlain, Lisa. "Green Roofs sprouting across U.S. Skylines." The New York Times, August 10, 2005.

Uzhinova I. 2003. Landscape architect in St Petersburg. Personal communication.

Borén T. 2005. Meeting places of Transformation, Urban Identity, Spatial Representations and Local Politics in Saint Petersburg, Russia.

Berglund, U., 2005. Neighbourhood Nature: Joy or Fear.

https://www.google.se/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwityLX1zsXXAhVmOpoKHdb4DT8QjRwIBw&url=https%3A%2F%2Fcorradobonora.photoshelter.com%2Fimage%2FI0000AOI_sZo7lDY&psig=AOvVaw3-dUVEchKEG1o8MTBckSPL&ust=1511008341127575

http://www.greenroofs.com/Greenroofs101/industry_support.htm

https://www.visitdubai.com/ar/articles/dubai-metro

https://www.google.se/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwiXj4m5yMXXAhUlDJoKHeWLAEMQjRwIBw&url=https%3A%2F%2Fen.wikipedia.org%2Fwiki%2FFile%3AStockholm_Central_Station_September_2013.jpg&psig=AOvVaw3N5eAtuswt21KlvDX2xwLK&ust=1511006610723790

https://www.google.se/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwi844fBnsjXAhUlYJoKHbxiB1AQjRwIBw&url=https%3A%2F%2Fwww.pinterest.com%2Fmls0407%2Fgreen-walls%2F&psig=AOvVaw1DXNfguj-DqrNcPs2sDZnM&ust=1511098403050451

https://www.google.se/url?sa=i&rct=j&q=&esrc=s&source=images&cd=

Bibliographic Description

https://www.google.se/url
sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwjYjY6-38XXAhUoApoK
HSvrC-

https://www.google.se/url?sa=i&rct=https://www.google.se/url?

https://www.google.se/url?

https://www.greenprophet.com/2014/07/modular-off-grid-livingbox-grows-fresh-food-without-soil/
http://similkameenvalley.com/food/fruit/

http://www.top10berlin.de/de/cat/freizeit-268/parks-1375
http://www.alowyngardens.com.au

http://www.ahta.org/horticultural-therapy

http://similkameenvalley.com/food/fruit/

http://www.top10berlin.de/de/cat/freizeit-268/parks-1375

http://similkameenvalley.com/food/fruit/

http://irregulartimes.com/2009/09/13/global-temperature-statistics-the-denial-edition/

https://dreamlandia.com/a/acacia-tree.html

http://www.rowantreegardens.co.uk/blog/entry/the-history-of-garden-design-egypt.html

https://www.contactsingapore.sg

http://www.rowantreegardens.co.uk/blog/entry/the-history-of-garden-design-egypt.html

http://projectevergreen.org/resources/environmental-benefits-of-green-space/

http://mississippientomologicalmuseum.org.msstate.edu/Crosstrips/
CrossTrip2009.html#.WXyJp1KB21s

http://www.picassocapital.com/#about

http://urbanpeek.com/wp-content/gallery/marina-bay-sands/marina-bay-sands-06.jpg

http://urbanpeek.com/wp-content/uploads/2011/06/Marina-Bay-Sands-16-e1307302778706.jpg

https://thislandisparkland.com/category/inbetween-spaces/

List of Figures

Cover Figure- Author

List of Figures

List of Figures

List of Figures

List of Charts

List of Diagrams

List of Tables