Chapter 22

Vertical Gardens

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Additional information is available at the end of the chapter

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1. Introduction

1.1. Green Walls

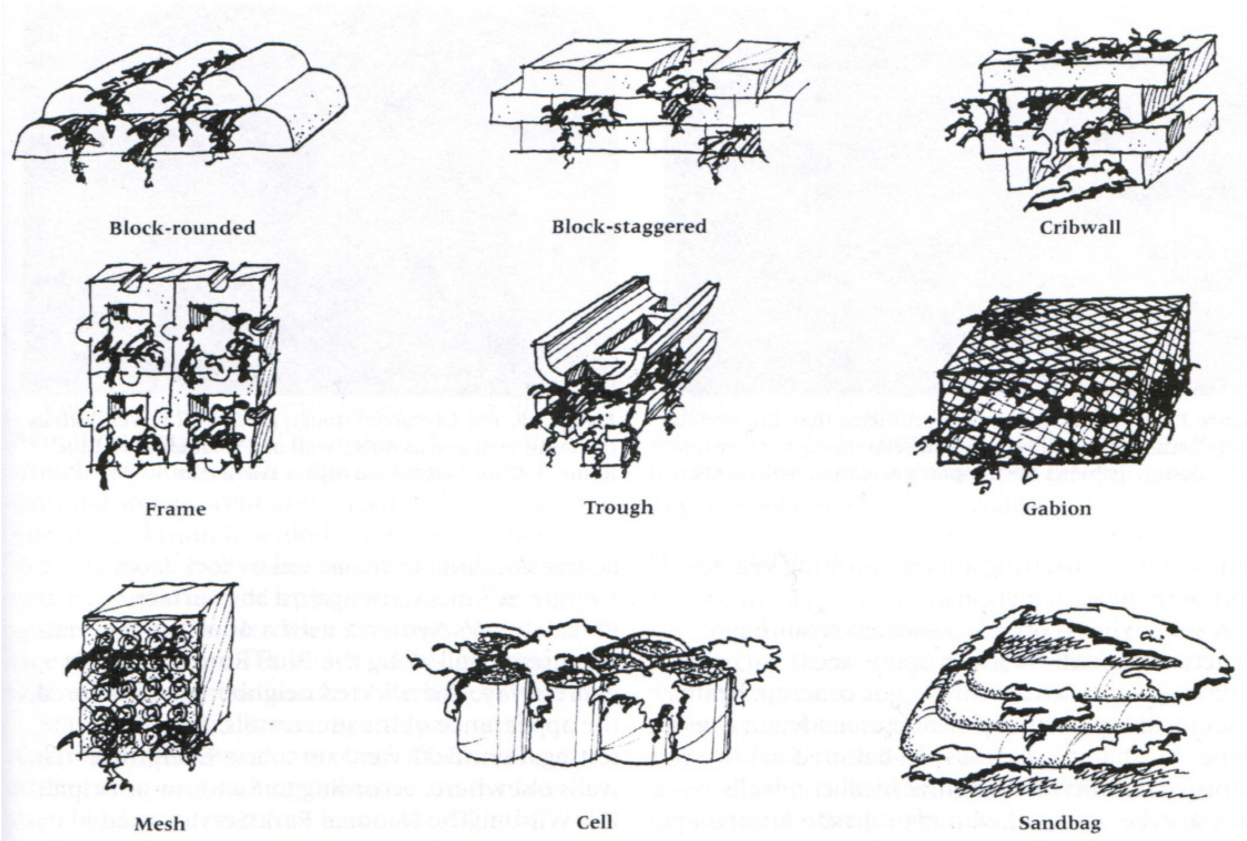
Green Wall with the another name Vertical Garden is the term of used to refer to all form of vegetaded wall surfaces (Gren roof organization 2008). Green walls are not only spectacularly beautiful, but also helpful in enlivening the ambiance. Green walls can absorb heated gas in the air, lower both indoor and outdoor temperature, providing a healthier indoor air quality as well as a more beautiful space (Yeh 2012). They holds or slows rainwater, providing food and shelter for wildlife (Thompson and Sorvig 2000). As already mentioned, some plants are able to grow on walls by taking root in the substance of the wall itself. Typical of these are the small herbaceous species such as ivy-leaved toadflax, wallflower and plants such as mosses, lichens and grasses. But other species are naturally adapted to climbing up and over obstacles such as rock faces, trees and shrubs. For these to grow successfully on walls and buildings some kind of support structure is usually essential (Johnson and Newton 2004). Also Green walls can be constructed with many systems. This systems include the following structural concepts (fig 1) (Thompson and Sorvig 2000):

Gren walls can examine two major categories: Gren Facades and Living Walls. This categories can be divided into other categories (fig2). Green façades are made up of climbing plants either growing directly on a wall or in specially designed supporting structures. The plant shoot system grows up the side of the building while being rooted to the ground. On the other hand, in a living wall the modular panels are often comprised of polypropylene plastic containers, geotextiles, irrigation systems, a growing medium and vegetation (Gren roof organization 2008, Sharp R. 2007).

2. Green facades

Green facades are a type of green wall system in which climbing plants or cascading vegetation. Green facades can be anchored to existing walls or built as freestanding structures, such as fences or columns (Gonchar 2009, Green roof organization 2008, Yeh 2012).

Three green facade systems that are frequently used are *Modular Trellis Panel, Grid System and Wire – Rope Net System* (Green roof organization 2008, Yeh 2012).



Block : Engineered with gaps where plants root through the wall
Crib Wall : In this system, elements of like tile, concrete, wood stacked log – cabin style
Frame : In this system, interlocking flor coverings stacked like massonry
Trough : Used soil filled tubs
Gabion : Used wire baskets filled with Stones to provide strong
Mesh : Like mini gabions
Cell : Used flexible and strong honeycombs which filled with soil
Sendbag : Make with geotextiles wrapped around soil. This systems formally called "vegetated geogrid"

Figure 1. Structural concepts of Vertical Garden (Thompson and Sorvig 2000).

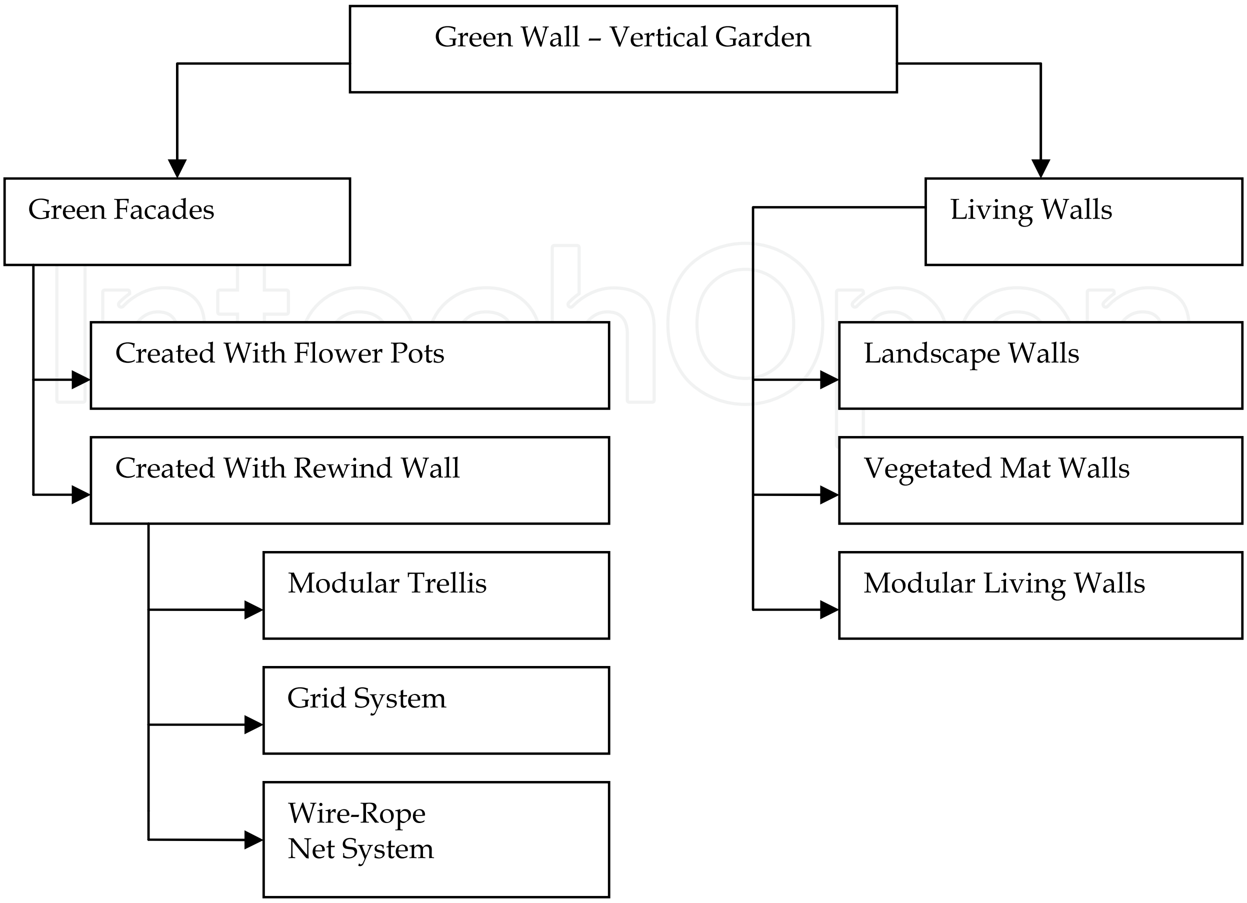


Figure 2. Types of Vertical Garden (Yeh 2012 , Greenroof organization 2008, www.landscapeurbanism.blogspot.com 2013, www.landscape-design-advisor.com 2013, Köhler 2008).

2.1. Modular trellis panel system

The building block of this modular system is a rigid, light weight, three-dimensional panel made from a powder coated galvanized and welded steel wire that supports plants with both a face grid and a panel depth. This system is designed to hold a green facade off the wall surface so that plant materials do not attach to the building, provides a "captive" growing environment for the plant with multiple supports for the tendrils, and helps to maintain the integrity of a building membrane. Panels can be stacked and joined to cover large areas, or formed to create shapes and curves, are made from recycledcontent steel and are recyclable (fig3, fig4). Because the panels are rigid, they can span between structures and can also be used for freestanding green walls (Gren roof organization 2008).

2.2. Grid and wire-rope net systems

Planning the Grid and wire-rope net systems used cables and wires (fig5, fig6). Grids are employed on green facades that are designed to support faster growing climbing plants with denser foliage. Wire-nets are often used to support slower growing plants that need the added support these systems provide at closer intervals. Both systems use high tensile steel cables, anchors and supplementary equipment. Various sizes and patterns can be accommodated as flexible vertical and horizontal wire-ropes are connected through cross clamps (Gren roof organization 2008, Yeh 2012).

Figure 3. Freestanding trellis fence (left), coloumn trellis (bottom), custom trellis shapes (right) (www.greenscrren.com2013).

Figure 4. Modular wall hung trellis (left), curved trellis (right) (www.greenroof.com 2013).

Figure 5. Grid System, Ex Ducati Office İtaly (http://preprodtest.archdaily.com 2013, http://www.archdaily.com 2013).

Figure 6. Grid and Wire-Rope Net Systems, MFO Park Switzerland (http://commons.wikimedia.org 2013, http://christianbarnardblog.blogspot.com 2013).

3. Living walls

Living walls, also called bio-walls or vertical gardens. Living wall systems are composed of pre vegetated panels, vertical modules or planted blankets These panels can be made of plastic, expanded polystyrene, synthetic fabric, clay, metal, and concrete, and support a great diversity and density of plant species. Living walls need more protection than green facades because of its diversity and density of vegetation. Living Walls are made with three parts: a metal frame, a PVC layer and an air layer (do not need soil). This system supports a variety of plant species, such as a mixture of vegetation, perennial flowers, low shrubs, and ferns etc (fig 7). It performs well in various climate environments. However, the selection of better species may adapt to the prevailing climatic condition, so that the maintenance of the system be made easy. Generally is used self-automated watering and nutrition system, to make maintenance of the living walls easy (Gren roof organization 2008, Yeh 2012).

Figure 7. Living wall, Semiahmoo Library in South Surrey (http://www.vancouversun.com 2013).

4. Landscape walls

These walls are an evolution of landscape 'berms' and a strategic tool in an approach to 'living' architecture. Landscape walls are typically sloped as opposed to vertical and have the primary function of noise reduction and slope stabilization (fig 8). They usually are structured from some form of stacking material made of plastic or concrete with room for growing media and plants (Gren roof organization 2008).

Figure 8. Landscape Walls (http://www.landscapeonline.com 2013).

5. Vegetated mat walls

The 'Mur Vegetal' is a unique form of green wall pioneered by Patrick Blanc (fig 9). It is composed of two layers of synthetic fabric with pockets that physically support plants and growing media. The fabric walls are supported by a frame and backed by a waterproof membrane against the building wall because of its high moisture content. Nutrients are primarily distributed through an irrigation system that cycles water from the top of the system down (Gren roof organization 2008).

Figure 9. Vegetated Mat Walls, Madrid Spain (http://www.museumofthecity.org 2013, http://www.eyeonspain.com 2013).

6. Modular living walls

A modular living wall system emerged in part from the use of modules for green roof applications, with a number of technological innovations. Modular systems consist of square or rectangular panels that hold growing media to support plant material (fig 10). (Gren roof organization 2008).

Figure 10. Modular Living Wall Canada (above), Atlanta Botanical Garden (below) (http://www.greenthinkers.org 2013, http://blog.phyllisodessey.com 2013).

7. History of vertical garden

The ancient concept of Gren walls was built in Babylon (fig 11) about 2500 years ago. In ancient Babylon, King Nebuchadnezzar II built the Hanging Gardens of Babylon: a wonder of the ancient world, and ancestor of the modern green wall (Ashmawy 2006, Hamilton 2009, Green roofs for healthy cities, 2008).

Between 3rd BC 17th AD Romans train grape on garden trellies and on villa walls.

In 1920's Britania and North America promote trellis structures and self-climbing plants on houses and gardens

In 1988 started to use stainless steel cable system for green facades

Early 1990's cable and wire-rope net systems (fig 12) and modular trellis panel systems (fig 13) enter the North American marketplace.

Figure 11. Babylon (http://purpleopurple.com 2013).

Figure 12. Cable and wire-rope net systems (Green roofs organization 2008).

Figure 13. Modular trellis panel system (Green roofs organization 2008).

First major application of a trellis panel system had been used in Universal City Walk on California in 1993 and in 1994 (fig 14). Indoor living wall with bio filtration system installed in Canada Life Building in Toronto (fig 15) (Gren Roofs Organization 2008).

Figure 14. Universal City Walk on California (http://www.examiner.com 2013, http://pinterest.com 2013).

Figure 15. Longwood Gardens in Kennett Square (http://www.livingwallart.com 2013, http://gsky.com/projects 2013).

Green walls are not only spectacularly beautiful, but also helpful in enlivening the ambiance. Green walls can absorb heated gas in the air, lower both indoor and outdoor temperature, providing a healthier indoor air quality as well as a more beautiful space. (Yeh 2012, http://www.nodai.ac.jp)

8. Benefits of vertical gardening

Vertical Gardens provide economic and ecologic benefits as well as aesthetic value. The benefits change with options such as different buildings, green wall technologies, plant selections and plant coverage. In this part is examined important values of Green Walls.

1. Beauty abounds and adds visual drama (fig 16)

Plants are one of the fastest, most cost effective agents for rectifying negative perceptions of an area, enhancing a buildings public profile and significantly improving the visual amenity, economic, and social conditions of the city. The application of vertical gardens is shown to increase property values by dramatically increasing the amenity of buildings, and establishing higher public acclaim, transforming them into recognisable landmarks (http://www.greenology.sg 2013)

Figure 16. Quai Branly Museum (http://www.minus25.com 2013).

2. Covers up views of plain or ugly walls (fig 17) and provide building protection

Building protection is primarily produced by reducing temperature fluctuations of the building envelope. Decreased temperature fluctuations reduce the expansion and contraction of building materials and extend the building's lifespan. Green Walls shield the building envelope from ultra-violet rays and acidic rain by reducing cracking and carbonization of the building envelope, the buildings durability is improved and its service-life extended (Doernach 1979, http://gsky.com).

Before **After**

Figure 17. Bridge in France (http://pixpeedia.blogspot.com 2013, http://twistedsifter.com 2013).

3. Decrease voice level (fig 18)

Soil and plants which used for plantal arrengements in Vertical Gardens, have a voice absorption feature. For this reason they perform to decrease voice function which happened both in building and its close area Green Walls provide a noise buffer which significantly reduces outside noise and vibration (up to 40dB) inside our homes and workplaces. A small indoor hedge placed around a workspace will reduce noise by 5 decibels (Dunnett and Kingsbury 2004, Erdogan and Aliasghari Khabbazi 2013, http://gsky.com 2013, Jacobs 2008, Wong et al 2010).

Figure 18. Living Wall for voice level (Jacobs 2008).

4. Conserves water and watering takes less effort

One of the biggest benefits of vertical gardens is how they manage water. For starters, watering is very efficient as it is done using a drip irrigation system or a hydroponic system (fig 19). Any waste water is collected at the bottom of the garden in a special tray where it is drained away. Alternatively, it can be recycled and put back on the garden. This means that practically all the water is used up by the plants and there is very little waste. There is also no runoff into stormwater systems so natural waterways are not affected by pollutants that can be found in stormwater or waste water (fig 20) (http://www.homeimprovementpages.com 2013).

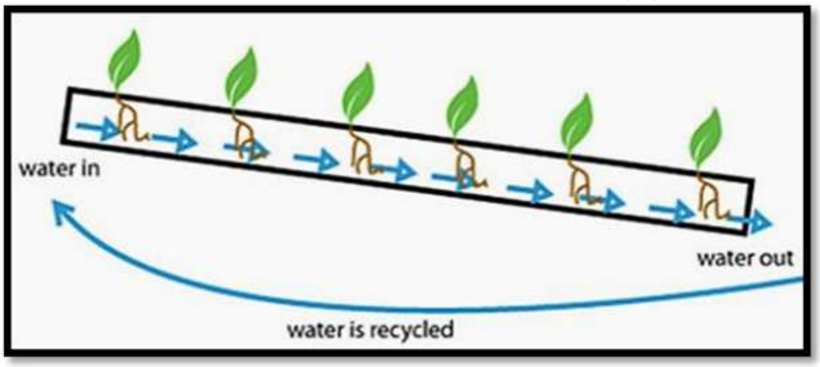


Figure 19. Hydrophonic Vertical Garden.

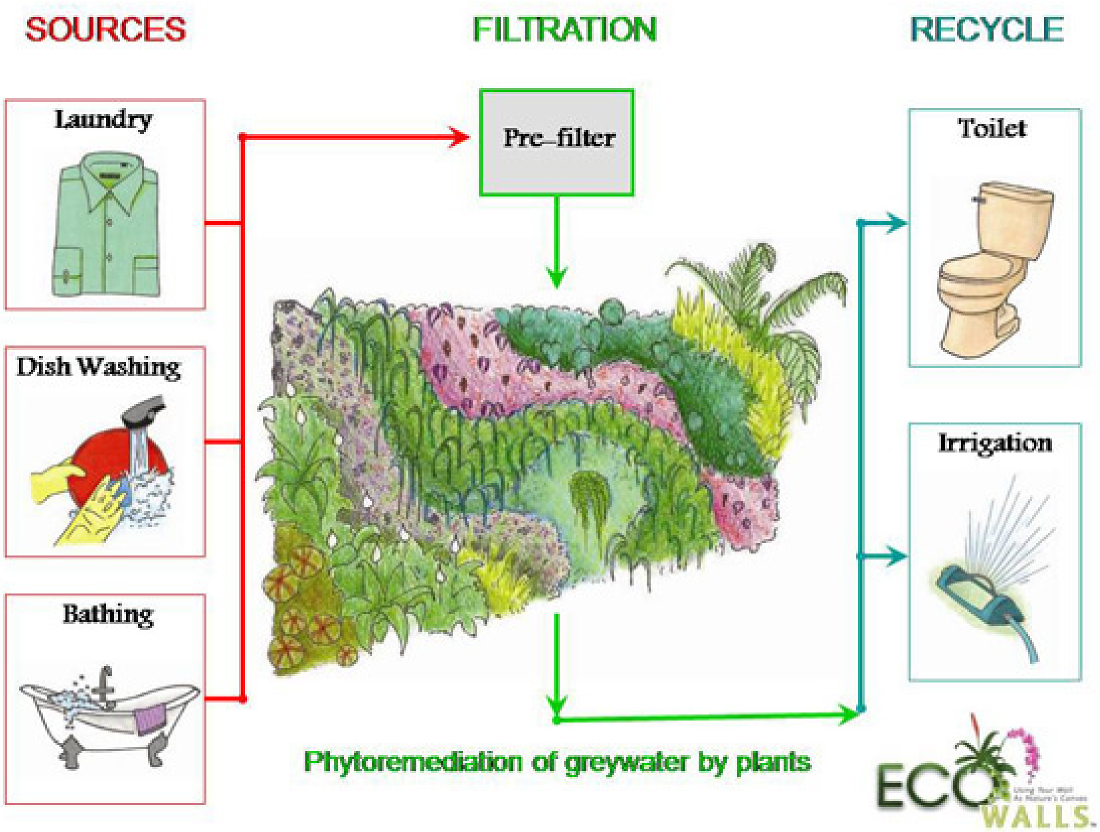


Figure 20. Greywater Treatment (http://www.greenecowalls.com 2013).

5. Reduces CO2 levels and increases oxygen and improved air quality

A greenwall offers immediate environmental advances in reducing existing greenhouse and other volatile organic compounds from our polluted cities. Plants act as bio-purifiers and can play a dramatic role in improving the quality of city air through a number of biochemical processes by removing and breaking down airborne contaminants from both inside and outside a building. When combined with plant photosynthesis, which produces clean, oxygen rich air, it becomes easy to see the value of employing living plants as bio-purifiers in polluted urban environments. Approximately 1 square foot of vegetated wall area will filter the air for approximately 100 square feet of office area. Considered in very general sense, planting one wall of any house which situated 50 houses on the street is equal to plant 50 trees on this street (Erdogan and Aliasghari Khabbazi 2013, http://www.greenology.sg 2013, Truett 2003,).

Yet another benefit of vertical gardens is that they improve the air quality of built up areas, both inside the home and outside. This is because plants are natural filters – taking carbon dioxide from the air and replacing it with much needed oxygen (fig 21). They also help to filter pollutants from the air (fig 22). This means that the air that you breathe is much cleaner and healthier (http://www.homeimprovementpages.com.au 2013). Studies have shown that there are significantly lower concentrations of toxins in the area surrounding a living wall (Loh 2008).

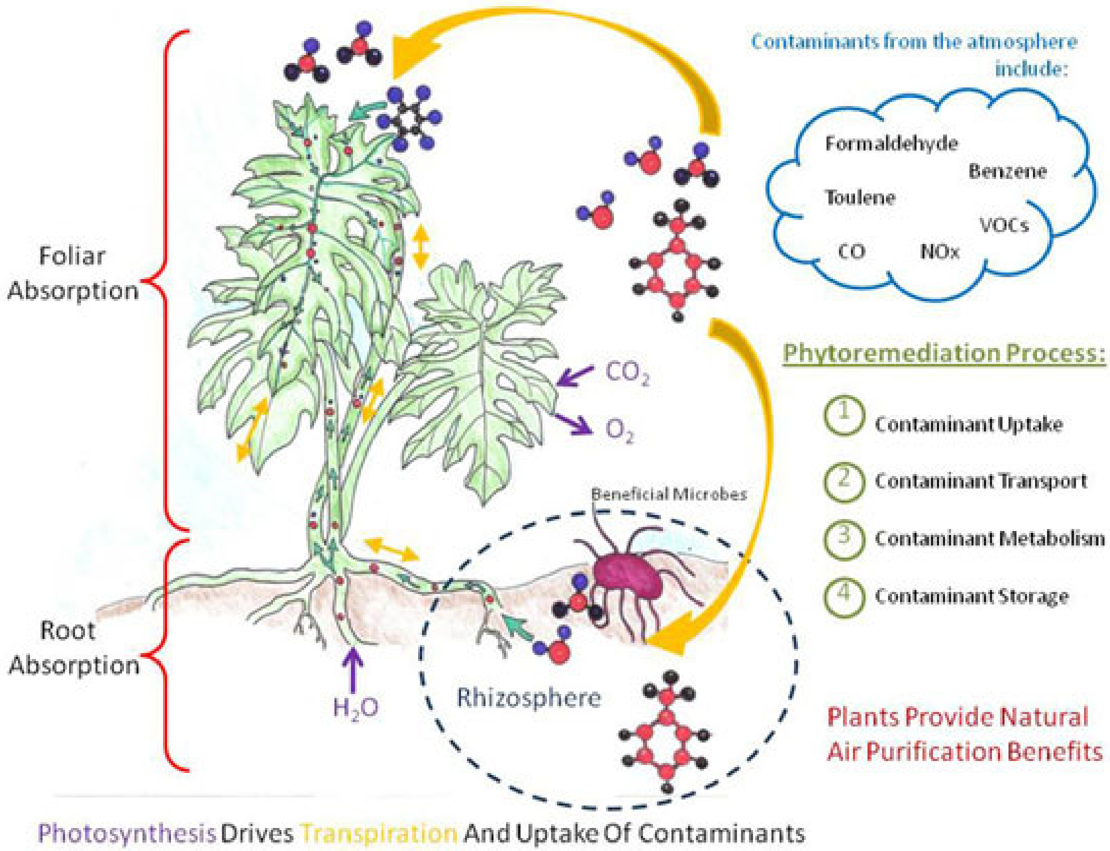


Figure 21. Indoor Air Quality (http://www.greenecowalls.com 2013)

Figure 22. Dom Aquitectura Unveils Green Master Plan to Clean Air and Reduce Pollution in Huizhou, China LoriZimmer,10/12/12 (http://inhabitat.com 2013)

6. Prevent from dust and harmful microorganisms

Plants reduce wind-speed also they prevent dust with wet environments (fig 23) which created with their roots and leafs. By means of this event, plants bring about extinction to harmful microorganisms with on site sap and juice. Air quality improvement from plants has been shown to reduce coughs by thirty percent and dry throat and irritation by twenty-four percent also, the plants clean the office air by absorbing pollutants into their leaves and transmitting the toxin to their roots, where they are turned into food for the plant. With cleaner office air building occupants are less likely to be sick and rooms with plants contain 50% to 60% fewer of airborne molds and bacteria than rooms without plants (Fjeld at al. 1998, Kemaloğlu and Yılmaz 1991, Wolf 2002).

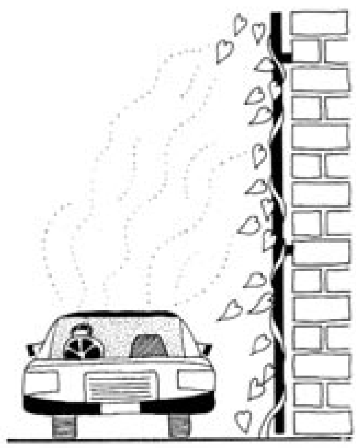


Figure 23. Drawing about prevent dust with plants (Johnston and Newton 2004).

7. Acts as natural insulation for hot and cold air and a save energy for your building.

Indirectly, living walls reduce air-conditioning requirements and energy consumption of urban buildings through cooling the city. Vegetation on walls can assist in cooling buildings in summer and insulating them in winter. In winter, evergreen species offer a degree of insulation by trapping a layer of air against the facade and reducing convectional heat loss. An insulating effect of up to 30% has been recorded although such a high percentage is only likely when temperatures fall close to freezing. Energy savings are less significant on well-insulated buildings, such as those with brick cavity walls. During the summer, hot walls cause temperatures to rise inside buildings, increasing demand on cooling systems and consuming more energy. A Green Wall surface temperature is reduced when covered with plants, reducing the wall temperature and building cooling load (fig 24). Green Walls can reduce wall temperature as much as 15°F which results in significant air conditioning savings (Baumann 1986, Doernach 1979, http://www.marthastewart.com 2013, Johnston and Newton 2004).

In Tokyo Institute of Technology Wall tests shown here, it was discovered that Green Wall panels reduce the wall temperature by 10°C. It was also concluded that Green Wall panel reduce energy transfer into a building by ~0.24kWh/m². Green Wall energy savings calculations depend greatly on the direction the wall is facing, the sun's angle, and many other factors (http://gsky.com 2013).

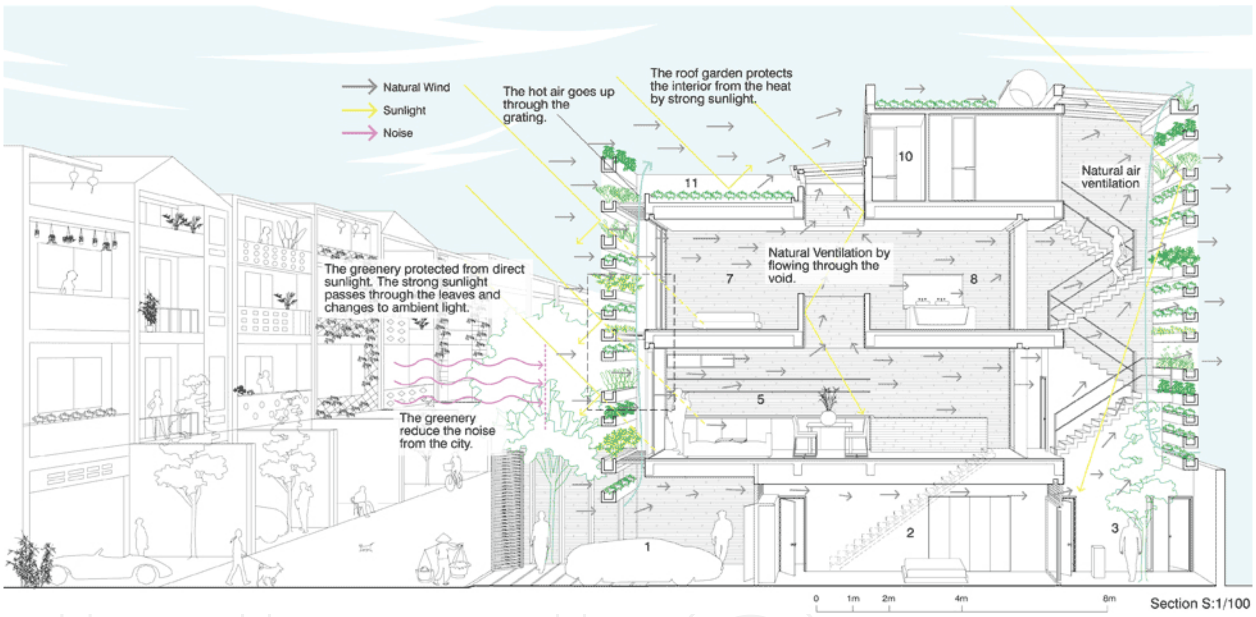


Figure 24. Stacking green (http://www.dezeen.com 2013).

8. Plants are less accessible to diseases and pests

As they grow vertically, many pests cannot even get to the plants. This means that you have very little problems with pests attacking your plants so you do not need to use pesticides or insecticides on your plants, saving you using chemicals. As well, air circulates well around the vertical garden and they also get plenty of sunshine, so there is much less risk of the plants suffering from mildew, fungus or disease (http://www.homeimprovement pages.com.au 2013).

9. Live plants decrease stress levels, create peaceful ambiance

Vertical gardens have demonstrated that restorative effect of natural scenery holds the viewer's attention (fig 25), diverts their awareness from themselves and from worrisome thoughts and elicits a meditation-like state. They help ease physiological and psychological pressures of city life by providing a spiritual and physical connection to nature. The beauty of a green wall (covering concrete and steel) can rejuvenate our minds and physical fatigue is greatly reduced. The presence of plants in the office not only reduce stress but also helps increase workers productivity (Peck et al 1999, http://gsky.com 2013).

Participants of Texas A&M University and Surrey University study also reported feeling more attentive when plants were present. Participants of who worked in an environment with plants were 12% more productive and less stressed than those who worked in an environment with no plants (Gilhooley 2002).

Figure 25. Living walls at Gutman Library (http://isites.harvard.edu 2013, Kim 2011)

10. Increases value and salability of your home or office building

Plants are one of the fastest, most cost effective agents for rectifying negative perceptions of an area, enhancing a buildings public profile and significantly improving the visual amenity, economic, and social conditions of the city (fig 26). The application of vertical gardens is shown to increase property values by dramatically increasing the amenity of buildings, and establishing higher public acclaim, transforming them into recognisable landmarks. American and British Studies show that having a green plant can increase the value of property by 6-15%. (http://www.greenology.sg 2013, Peck et al, 1999)

Figure 26. BHV Homme in Paris (left) (http://retailsquare.blogspot.com 2013), Pacha, The Driver, London (right) (http://twistedsifter.com 2013).

11. Help restore the places where wildlife can survive

Natural habitats are disappearing at an alarming rate, and habitat loss is the number one threat to wildlife today. Green Walls are part of the solution to help restore wildlife habitats. By carefully choosing and planting attractive plant species, a Green Wall will attract birds and butterflies (fig 27). Green Walls can be designed to provide the ideal conditions for birds, bees and butterflies to survive. It can provide water, food sources, protection, and places to bear and raise offspring (Johnston and Newton 2004, http://gsky.com 2013).

12. There are also benefits to having an outdoor living wall. They help mitigate the Urban Heat Island Effect (fig 28)

An urban heat island (UHI) is a metropolitan area which is significantly warmer than its surrounding rural area (fig 29), especially in late afternoons and nights at winter season. To avoid confusion with global warming, scientists call this phenomenon the "Urban Heat Island Effect. "There are several reasons that may explain the Heat Island Effect, but the main reason is the excessive urban development. Green walls are by far the most popular way to cooling the city. Green Walls in cooling buildings and combating the Heat Island Effect and greatly reduce this effect by absorbing a lot of the heat through the evaporation process (http://www.marthastewart.com 2013, Yamada 2008, Yeh 2012).

Figure 27. Guggenheim Museum, Bilbao, Spain (http://www.environmentalgraffiti.com 2013).

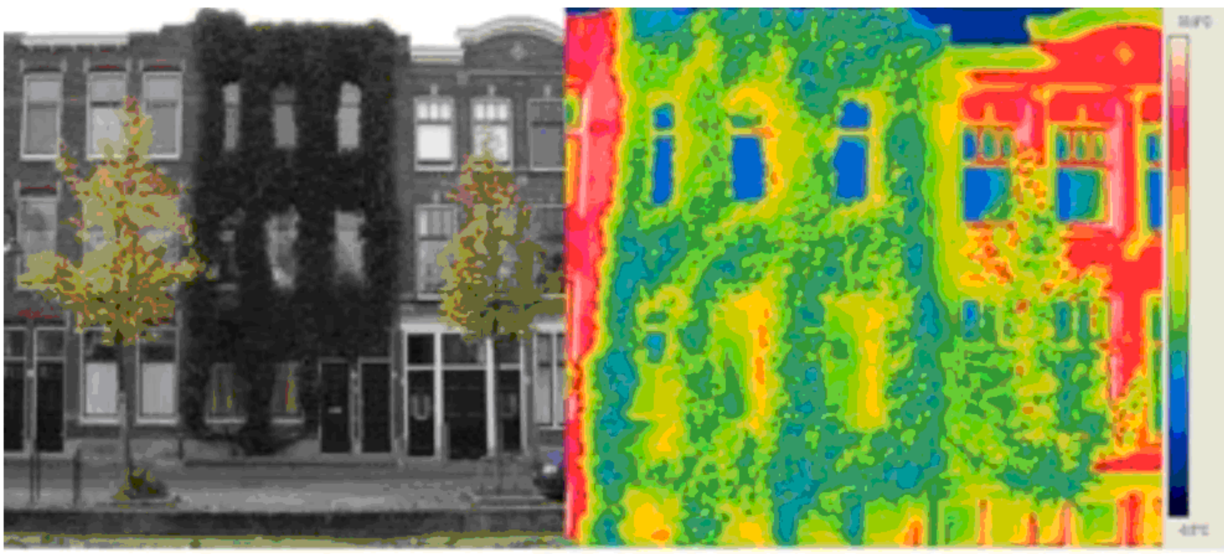


Figure 28. Urban Heat Island Effect, (Ottele, 2010).

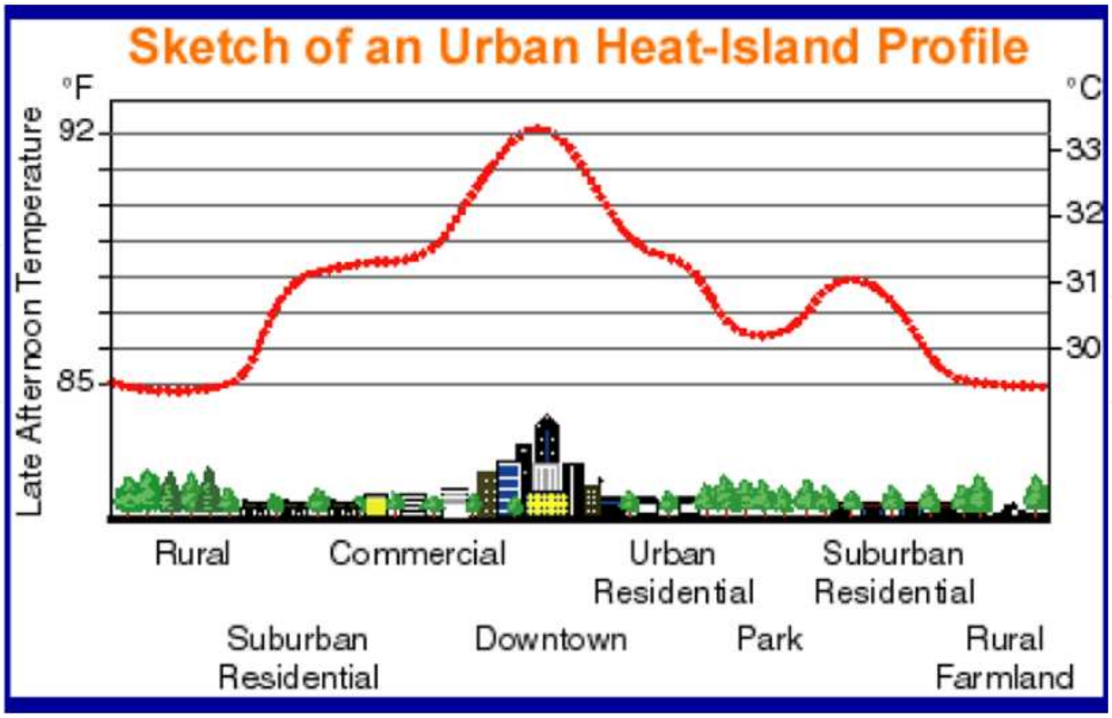


Figure 29. Urban Heat Island Profile (http://www.ssbx.org 2013, http://www.lsgi.polyu.edu.hk 2013).

9. Some of suitable plants for vertical gardens

A lot of plant species can be used for Vertical Gardens. For example there are 15000 plant from nearly 150 different species on the Caixa Forum Museum vertical garden who has designed Patrick Blank (http://www.greenroofs.com 2013). In this case, impossible to give all the plants one by one so in this part some plants given used for Vertical Gardens.

1. Self-clinging climbers (Generally no support needed. May need support on very smooth walls.) (Johnston and Newton 2004).

SPECİES	Decidius (D) Evergreen (E) Annual (A)	ASPECT Bold:preffered Light:tolerated	Growth Rate	Soil	Native (N) Exotic (E)	Speciality
Hedera helix (fig 30)	E	**N** E S W	Slow	Rich	N	*Excellent wildlife plant. Good nesting site for robins and wrens, and hibernating butterflies – esp. brimstone. Nectar and pollen for bees and hoverflies.*
Parthenocissus quinquefolia (fig 30)	D	N **E** S W	Average	Any	E	*Useful for nesting birds if grown on a trellis. Provides nectar and pollen for bees. May attract nesting spotted flycatcher.*

SPECİES	Decidius (D) Evergreen (E) Annual (A)	ASPECT Bold:preffered Light:tolerated	Growth Rate	Soil	Native (N) Exotic (E)	Speciality
Parthenocissus tricuspidata (fig 30)	D	N **E** S W	Fast	Any	E	
Hydrangea petiolaris (fig 31)	D	**N E W**	Average	Loamy	E	*Good for nesting birds and produces nectar for bees and other insects.*
Euonymus fortunei (fig 31)	E	**N** E W	Slow	Any	E	

Figure 30. *Hedera helix*(left) (Erdoğan and Aliasghari Khabbazi 2012), *Parthenocissus quinquefolia* (bottom) (http://www.henriettesherbal.com 2013), *Parthenocissus tricuspidata* (right) (http://www.missouribotanicalgarden.org 2013)

Figure 31. *Hydrangea petiolaris* (left) (http://www.gardenwithoutdoors.org.uk 2013), *Euonymus fortunei* (right) (http://commons.wikimedia.org 2013)

2. Twining climbers (Suport needed. Thin steel wires, roughened plastic lines or timber battens running vertically will suffice for some species. Others will need a good network of wire or wooden trellis-work.) (Johnston and Newton 2004).

SPECİES	Decidius (D) Evergreen (E) Annual (A)	ASPECT Bold:preffered Light:tolerated	Growth Rate	Soil	Native (N) Exotic (E)	Speciality
Polygonum bauldschianicum (fig 32)	D	N E **S** W	Fast	Any	E	*Good for nesting birds.*
Lonicera Periclymenum (fig 32)	D	**E** S **W**	Average	Good Loam	N	*Must be kept bushy for nesting birds. Excellent for insects, especially moths, due to nightscented flowers. Bark from older stems used by nesting birds. Berries eaten by birds.*
Lonicera spp.	D-E	N **E** S **W**	Average	Good Rich	E	*Several varieties are useful nectar and seed plants. Evergreen honeysuckly trained up a trellis makes a good bird roosting site.*
Clematis vitalba (fig 32)	D	E S W	Fast	Prefers Alkaline	N	*Seeds for birds. Nesting sites. Nectar for insects.*
Clematis spp.	D	**E W**	Fast	Various	E	*Useful nectar and/or seed providers. Useful for nesting sites if trained thickly on a trellis.*
Humulus lupulus (fig 33)	D	**E** S **W**	Fast	Rich moist	N	*Good for bees.*
Aristolochia spp. (fig 33)	D	**N** S **W**	Average	Most	E	
Jasminum officinale (fig 33)	D	**E W**	Fast	Well drained	E	*Night-scented, attracting moths and other night-flying insects.*
Vitis spp. (fig 34)	D	E **S** W	Average Fast	Rich Loamy Moist	E	*Provides fruit for birds and nectar and pollen for bees.*
Wisteria spp (fig 34)	D	E **S W**	Average	Rich Moist Loam	E	*Excellent nectar and pollen for bees. Can be used by nesting.*

SPECİES	Decidius (D) Evergreen (E) Annual (A)	ASPECT Bold:preffered Light:tolerated	Growth Rate	Soil	Native (N) Exotic (E)	Speciality
Capsis radicans (fig 34)	D	E **S W**	Slow	Rich-Well drained	E	
Passiflora caerulea (fig 35)	D	E **S W**	Fast	Any	E	*Nectar and pollen for bees.*
Lathyrus odoratus (fig 35)	A	**S** W	Fast	Rich Well drained	E	
Tropaeolum spp. (fig 35)	Mainly A	E **S** W	Fast	Poor	E	*Nectar/pollen for bees and beetles. Seeds eaten by birds and small mammals. Food plant of small and large white butterflies.*

Figure 32. *Polygonum bauldschianicum* (left) (http://www.thegardeningbible.com 2013), *Lonicera periclymenum* (bottom) (http://www.about-garden.com 2013), *Clematis vitalba* (right) (http://www.phytoimages.siu.edu 2013)

Figure 33. *Humulus lupulus* (left) (http://www.crocus.co.uk 2013), *Aristolochia macrophylla* (bottom) (http://www.pfaf.org 2013), *Jasminum officinale* (right) (http://www.gardenersworld.com 2013).

Figure 34. *Vitis amurensis* (left) (http://luirig.altervista.org 2013), *Wisteria floribunda* (bottom) (http://www.redbuttegarden.org 2013), *Capsis radicans* (right) (http://www.dhz-tuinwinkel.nl 2013).

Figure 35. *Passiflora caerulea* (left) (http://davisla.wordpress.com 2013), *Lathyrus odoratus*(bottom) (http://loghouseplants.com 2013), *Tropaeolum tricolorum* (right) (http://www.anythinggarden.co.uk 2013).

3. Rambling shrubs (Not true climbers but can be trained on wide meshed grid structures or by tying to wall.) (Johnston and Newton 2004).

SPECİES	Decidius (D) Evergreen (E) Annual (A)	ASPECT Bold:preffered Light:tolerated	Growth Rate	Soil	Native (N) Exotic (E)	Speciality
Rubus fruiticous (fig 36)	E	N E S W	Average	Most Like asid	N	*Provides pollen for bees and nectar for bees and butterflies. Berries for birds and small mammals, Night-scented and attracts moths.*
Jasminum nodiflorum (fig 36)	D	N **S** W	Average	Most	E	
Rosa canina (fig 36)	D	E **S** W	Average	Good	N	*Night-scented for moths. Nectar for insects, rosehips for birds and small mammals. Good nesting cover for birds.*
Rosa spp.	D	E **S** W	Average	Most	E	*Excellent nectar for bees. Nesting sites for birds.*

SPECİES	Decidius (D) Evergreen (E) Annual (A)	ASPECT Bold:preffered Light:tolerated	Growth Rate	Soil	Native (N) Exotic (E)	Speciality
Forsythia suspensa (fig 37)	D	N E **S** W	Average	Most	E	*Nesting sites for birds, as above*
Cotoneaster spp. (fig 37)	D Some E	**N E**	Slow	Any	E	*Thick growth may be used by nesting blackbirds and tbrushes. Berries for birds, especially blackbirds and small mammals. Nectar and pollen for bees.*
Pyracantha atalantiodes (fig 37)	E	**E** S W	Slow	Most Well drained	E	*Good for nesting birds e.g. thrushes, and provides nectar and pollen for bees and berries for birds, particularly blackbirds.*

Figure 36. Figure 36. *Rubus fruiticous* (left) (http://www.gardenworldimages.com 2013), *Jasminum nodiflorum* (bottom) (http://digilander.libero.it 2013), *Rosa canina* (right) (http://www.pnwflowers.com 2013).

Figure 37. *Forsythia suspensa* (left) (http://www.stevenfoster.com 2013), *Cotoneaster lacteus* (bottom) (http://commons.wikimedia.org 2013), *Pyracantha atalantiodes* (right) (http://www.ebay.co.uk 2013).

Other typical plants for Vertical Gardens:

Figure 38. Plants for Vertical Gardens (http://www.ebay.com 2013, http://www.lillealternativet.no 2013, http://www.dracaena.com 2013, http://www.ikea.com 2013, http://www.agaclar.net 2013, http://www.cicekstra.com 2013, http://www.jrexotic.com 2013, http://www.krischanphoto.com 2013, http://hobibahcemiz.net 2013, http://www.csi.eu.com 2013, http://www.flowershopnetwork.com 2013, http://nathistoc.bio.uci.edu 2013, http://www.vert-espace.fr 2013, http://commons.wikimedia.org 2013, http://www.johnstowngardencentre.ie 2013, http://www.yaban.gen.tr 2013, http://ru.wikipedia.org 2013,http://www.kaliteliresimler.com 2013, http://www.doriangreen.fr 2013, http://fr.questmachine.org 2013, http://www.floweroffice.cz 2013, http://princelandscape.com 2013, http://tuteka.wordpress.com 2013).

10. Applications from Turkey

Vertical Gardens applications have been just started as a new trend by Municipalities in Turkey. Applications are continued in a lot of cities such as İstanbul, Antalya, Balıkesir, Rize.

Figure 39. İstanbul Siemens Building (http://tuketicidostu.net 2013).

Figure 40. Application from Balıkesir (http://www.aktasplant.com 2013).

Figure 41. İstanbul airport roadside (left), Antalya airport roadside (right) (http://www.aktasplant.com 2013).

Figure 42. Viaduct pillars from Rize (http://www.zaman53.com 2013).

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