

Green Facade: Strategic Tool For Urban greening

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Abstract- Greening of the urban areas in cities is considered as one of the major ecological measures to mitigate some environmental issues. Rapid increase in footprints of urban architecture has led to scarcity of land for landscaping. Challenging the urbanization, environmental preservation and sustainability is the need of the hour. Green facade (vertical greening) could be a major step towards achieving these goals. The demand of increasing the green cover in the urban areas is met by utilizing the spaces in making Hanging or Vertical garden, Vertical vegetable farms, Balcony garden, Container or planter box greening, Green or eco building, green roof or rooftop garden, wall planter, and green envelop which are the enhanced solutions used by architects to mitigate the effect of pollution, rise in temperature, improvement in the air quality and looking after the psychological wellbeing of city dwellers. The green façade grows vertical and is normally rooted into the ground, on the wall or in modular panels. Green wall or vertical garden is the term related to all forms of vegetated wall surfaces where it not only gives an exuberant and aesthetic look to the infrastructure but also provides a sustainable, energy saving, comfortable and healthy environment for building occupant. The plants used to construct the vertical garden model are combination of various types of plants which are more often the climbers. Typically, these are small Ivy plants, Mosses, Lichens and different types of grasses

Index Terms- Green Façade, Vertical Garden, Sustainability

I. INTRODUCTION

Sustainability deals with achieving a balance between existence of mankind and the natural resources, which is one of the major concern for the world today. There are main challenges in integrating sustainability with urbanization (Jageda et al,2021).The advent of industrialization has led to the rise of population density, significantly in the urban areas which has become the root cause of major ecological problems. Mushrooming of the urban areas have caused a detrimental impact on the environment, creating a jungle of concrete, replacing forests and almost depleting the natural vegetation (Tzortzi & Sophocleous,2018). The deterioration of the environmental conditions in urban areas is due to rise in air temperature and pollution levels and hence causing the green house effect (Oberndorfer, et al., 2007) .To cope up with the environmental issues, the green technology has emerged as the latest concept in town planning practise (Manso and Gomes,2015). The percentage

of greenery in the urban areas can be enhanced by reducing the amount of heat transferred from a building to its surrounding environment and also by protecting with the solar shade which helps in absorbing the energy from the sun. Green façade is one of the most popular and the latest solutions to a sustainable design in the building architecture. This style is referred by different terminologies by different authors but generally as vertical greening systems(VGS). The green façade is defined as greening of the building walls partially or completely which include a growing medium.

Currently there are several greening systems available which are used as a strategic tool in sustainable development, covering buildings which not only enhance the aesthetical look but work on the principal of increased longevity and performance of the concrete used, like green roofs and green walls (Lundholm,2006). Vertical greening, also referred to as vertical gardens, is growing the vegetation vertically. Shortage of ground space makes it the most appropriate method to save urban environment and that is why it is also known as urban gardening. Merging nature with the concrete buildings is the underlying principle of Vertical greening. Different species of evergreens take a leap in solving the ecological problems in thickly populated urban areas by making a wonderful green envelop on a little quantity of growing medium (Pan & Xiao 2014).The new projects with this sustainable architecture are being designed to beautify the buildings, enhance the air purification naturally and lowering the temperature (Dunnett & Kingsbury 2008). Based on the growing methods, Vertical greening it is basically of two types: Green façades and living walls systems (Köhler,2008, Ottelé et al,2011).

The prime focus is to highlight the different types and the importance of the green facades on the buildings. Green façades are the type of greening systems in which the climbers cling to the elevation of the concrete and taking the support of various system like steel cables, mesh or trellis. The most common and pocket friendly type of facades are where the climbers grow from the base of the building, rooted to the base level on the ground or at the intermediate level in the planter boxes or on the rooftops, The climbers normally may reach up to the height of 25m and take a span of 3-5 years to give the full green cover to the structure (Rakhshandehroo et al,2015)

Types of Green Facades

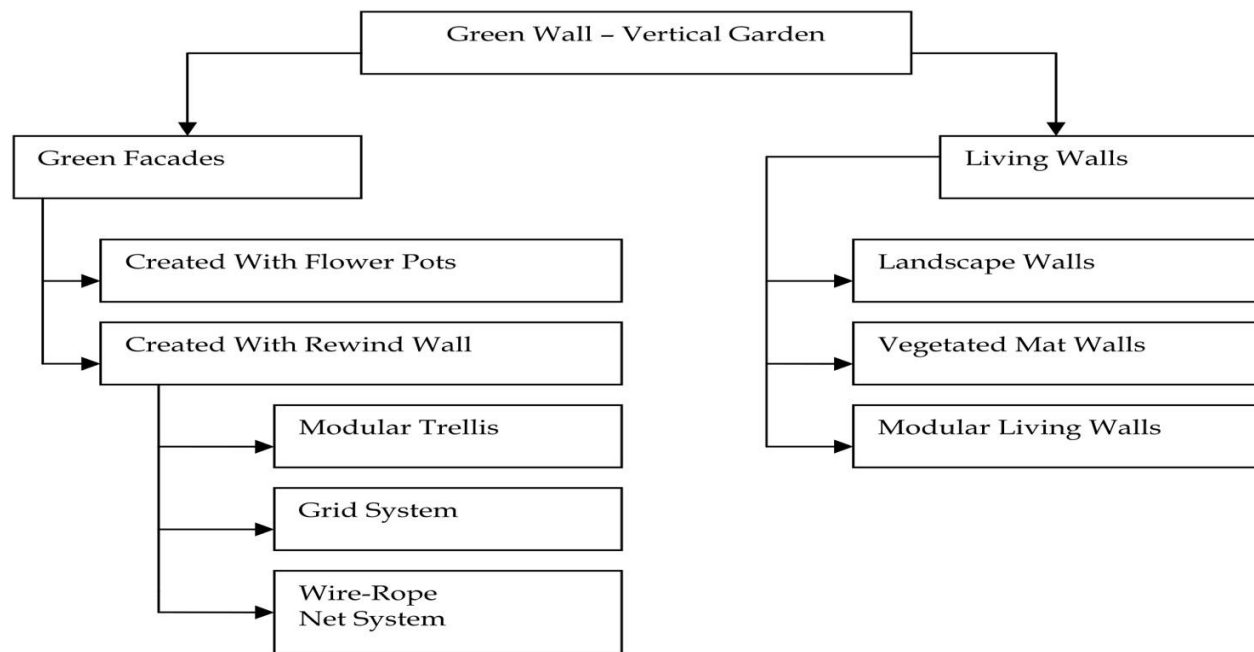
Direct system of green façade: In this system, the greens are grown by planting climbers at the base of the building and is considered as the most economical method of greening. The climbers are usually the self-clinging plants, with the modified root system, the sucker with the help of which they attach to the entire elevation giving it a green cover. On the other hand the maintenance issues of the building may arise such as decaying of the walls by these climbers so these are not considered suitable for all building facades (Perini & Rosasco,2013).

Indirect system of green façade In these systems the greening is done by using different support system as cables or meshes so that they are not in contact with the wall and other surfaces of the building. The materials like aluminium, plastic, wood, steel are generally used for supporting the climbers. These materials used may play a role in the functional and aesthetical properties in evaluating their costs, profile thickness, different weight and durability. Another technique of indirect greening system is placing the planter boxes at various levels of the façade meeting the requirement of nutrients and a watering system .The two types indirect green facade systems which are commonly used are Modular trellis panel and Cable and wire-rope net systems

Modular Trellis Panel System In order to avoid the direct contact of the building to this modular system, a Lightweight three-dimensional rigid, panel is designed to support a green facade. These Panels are generally made from a powder coated, galvanized and welded steel wire

Cable or Wire-Rope Net System Cable Net System These are the cables made of steel and of high-tensile strength, anchors and the prime function is to support the climbers. Wire-nets is the another indirect method which are comparatively flexible than the cables and are mainly used for slower growing plants, but for faster growing climbers the cables are used.

The advantage of the planter boxes placed at different heights is that it gives a vaster coverage to the façade area. If the rooting space is inadequate, the system can survive on water and nutrients ,so referred to as a living wall system (Perini et al,2013).



Source- www.landscapeurbanism.blogspot.com2013

Types of Vertical Gardens Vertical gardens also known as Vertical greens, Living walls, Green walls or even Green facades is the latest terminology used for all forms of wall surfaces covered with vegetation. (Georgi et al,2009)

Green Wall Systems: A Green wall is a wall covered with vegetation of the appropriate type and is generally of two types :Natural Green walls and Artificial Green walls (Mahendrakumar et al,2022).

Natural Green Walls: The plants may be the climbers are grown in soil or in planters, absorbing water and the required

nutrients from the soil. Green Facades are mostly visible outdoors (Hasan et al,2012).

Artificial Green Walls: The climbing plants are not used to make artificial green walls instead these are grown in the growing mediums in the modular facades which supplies the water and nutrients and for this an irrigation system is essential. Living Walls can be incorporated both in interior and exterior walls (Hasan et al,2012).

Vertical Systems: Vertical gardens or the systems, include artificial layering and also the pots filled with soil It is dependent on added nutrients into the layers and watering them (Urban-Imbeault,2014)

Living Wall Systems: Living wall systems are made of vertical modules or panels. These panels are designed using materials synthetic materials like polystyrene, plastic, synthetic fabric, metal, clay and concrete, to which the diversity of plants can grow. So these walls require more protection as compared to green facades. A Living wall is basically made of a metal frame, following a PVC layer and an air space but the selection of a vegetation has to be made ensuring the longevity of the plants. These work on the principle of self-automated watering and nutrition system, so that the maintenance is minimum (Tzortzi & Sophocleous,2018).

Landscape Walls: These are the sloped walls helping in noise reduction. These are made of plastic or concrete making space for the plants to grow (Ottel   et al,2011).

Vegetated Walls: Vegetated mat walls or ‘mur vegetal’ consisting of a double layer of synthetic fabric having pockets supporting the growing media and plants. A frame holds the fabric wall with a waterproof membrane against the concrete wall due to the high moisture content, the irrigation system is involved which pumps water along with the nutrients from top to bottom and these are distributed (Tong,2017).

Advantages of Green solutions;

The Green architecture not only complements the building aesthetically but lowers the noise pollution as well. They also form the envelope of extra insulation around the building (Fern  ndez-Ca  ero et al,2018). Since few years the architects have played a crucial role by taking measures to reduce the carbon foot prints.

Environmental Friendly: The main purpose of vertical gardens is that the plants act as bio-filters, cutting down on the percentage of toxins from the surrounding air and hence reducing the air borne pollution from internal and external of the building. Theoretically a single Living wall present in every house in a row of 50 houses, is like 50 trees planted on the street, making the air breathed fresher and healthier ((Morrison & Sweet,2011).

Heat insulation-The green cover on the buildings insulates the walls by its dense foliage which decreases the amount of heat radiation from the external walls by being insulated by the dense green cover thus helping to lower the temperature of the building (Ottel   et al,2011). The approximately 5-30% of the sun light passes through the leaves as energy. The rest is reflected back, as heat and is a source for photosynthesis or evapotranspiration. The principle of blocking the direct sunlight by the vegetation ensures the lowering of heat island effect especially in the cities . By the evaporation, green fa  ades the heated air is cooled . The green envelope also reduces the exposure to the UV radiations, increasing the building durability (Morrison & Sweet,2011).

Water Conservation: The water management of the vertical greens is done through the irrigation system. The collection of waste water is done in a container placed at the bottom of the garden where it can be recycled and hence little wastage (Timur & Karaca,2013)

Minimum pest intrusion: The plants growing vertically are exposed to sunshine and have a better air circulation hence they are safe from pests, therefore the amount of pesticides used would be minimum saving costs on the chemicals.

Restoration of Natural Habitats: The alarming rate of vanishing of the natural habitats is the biggest threat to ecology. The vertical bio-walls can be helpful in housing different birds,

bees attracting the butterflies and other insects, hence helping to restore their natural habitat.

Reducing energy consumption: Living walls acting as natural air-conditions, balancing humidity, playing an important role in reduction of energy consumption by evapotranspiration, making houses and offices cooler in summer and warm in winters by acting as insulators ((Tzortzi & Sophocleous,2018). According to the data available the interior Green walls can cut down the electricity bills up to 30%.

Structure protection: The green architecture creates a protective layer around the building and saves it from contraction and expansion due to temperature variations, rain acidity, UV rays and other vagaries of the weather ,reducing on the possibility of developing cracks and the carbonization on the envelope of the building (Tzortzi & Sophocleous,2018) .

Serenity: The green always being eye catching puts a calm and a peaceful impact on the viewer’s mind hence relieving of day to day stresses through a physical and spiritual connection to nature.

Risks of Green Facades:

Damage and Deterioration: The building walls are not damaged by the plants if they have a strong covering of building materials but only if these develop cracks and crevices the roots penetrate and grow fast causing the deterioration. Still they protect protect the facade from the nature and can enhance the life span of a building by ‘holding’ the facade together. Damage to the building can be determined only after removing plants from facades.

Material Used: The different types of Vertical garden systems available have different impact on the environment depending on the materials used. The synthetic structures as panels, planter boxes, tubes, support structures, made from crude oil, aluminium or steel, are not environmentally safe materials. On the other hand, the use of ecological and organic materials for Green facades, such as wood, steel and wire, generate dangers of viability whereas deriving from water, microorganisms and the low pH environment of these systems are much preferred (Weavers, 2011).

Medical Issues: Installation of Living walls in interior spaces may cause allergic reactions from specific plants and their pollens to the inhabitants. To play safe from these medical issues selection of plants should be done carefully especially those which produce less of pollens and also the experimental survey could be done on the building users to establish the allergic reactions (Weavers, 2011).

Conclusion: The various environmental issues need to be addressed in dense urban areas, looking up to the sustainable solutions in order to eventually improve quality of life. Taking into consideration the urgency of creating green spaces in such areas, the bare facades are used for these and hence an effective solution for tackling many issues.

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