



Where Walls Breathe: The Rise of Vertical Gardens

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The word 'Vertical Gardening' reveals the way of employing a wide range of plants allowed to extend upwardly in lieu of growing them along the soil surface. thereby, the urban population is increasing day by day, resulting in congested cities and towns. The ambient temperature in urban areas can be as much as 6 °C higher than the air in rural areas. Nowadays, as people are becoming more conscious about a green and clean environment, the design, construction and maintenance of buildings have a tremendous impact on the environment and the natural resources. It is the way to implement a patch of gardening both in the external and interior segments of urban residential areas. The important issues in building include increasing the comfort, health and safety of people residing or working in that building. The development of 'Green Wall' at office premises or corporate places will fetch a chic look as graceful adornments along with an enlivened ambiance being created enriched microclimate supplemented with oxygen, offering good health for workers. Since there is no scope for horizontal expansion, and only vertical space is available, it can be converted to vertical gardens. It is evident from the history that greening of outside walls of buildings increases insulation by keeping cool in summer and warmth in winter, improves aesthetics, improves indoor and outdoor climate, reduces greenhouse gases such as Carbon dioxide (CO₂), Carbon monoxide (CO) and Nitrogen dioxide (NO₂), as well as increasing ecological values by creating habitats for birds and insects.

Benefits of Green Wall

- Aesthetic benefits: Enhancing a buildings public profile and increases the property value by increasing the amenity of building.
- Improved thermal efficiency of the building: Protects from ultra-violet rays and acidic rain The buildings durability is improved and its service life extended.
- Indoor air quality improvement : Plants act as bio-purifiers
- Urban Biodiversity & Sustainability
- Noise Reduction: Plants acts as a sound barrier Green Walls provide a noise buffer which significantly reduces outside and inside noise (up to 40dB).
- Improvement of Health and Wellness: The beauty of a greenwall can rejuvenate our minds and physical fatigue is greatly reduced.
- Conserves water and watering takes less effort: water is used up by the plants and there is very little waste.

Classification of Vertical Gardens/Green Walls

1. Green facades

- a) Modular trellis panel system
- b) Grid and wire-rope net system

2. Living wall

- a) Landscape wall

- b) Vegetated mat walls
- c) Modular living walls

1. Green facades

Refer to vines and climbers that grow from the ground or from large containers at various locations around the building supported either by the wall itself or by a supporting trellis/mesh. The wall-climbing type is the very common and traditional green walls method.

a) 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 like *Asparagus sp.*, *Pilea microphylla*, *Alternanthera sp.*, *Mentha sp.*, Jade plant, *Sedum morganianum*, *Portulaca sp.*, Dusty miller etc. This is designed to hold a green facade off the wall surface so that plant materials don't attach to the building provides a multiple supports for the tendrils, and helps to maintain the integrity of a building membrane.

b) Grid and wire-rope net system

It involves cables and wires. Grids are employed on green facades that are designed to support faster growing climbing plants like *Ivy*, *Trumpet vine*, *Clematis sp.*, *Wisteria chinensis*, *Star jasmine*, *Bougainvillea sp.*, *Climbing rose*, *Trachelospermum jasminoides*, *Vitis vinifera* etc.

2. Living walls

Vertical gardens or bio-walls are other names for living walls. Pre-vegetated panels, vertical modules, or planted blankets make up living wall systems. These panels, which sustain a wide variety and density of plant species, can be constructed from plastic, expanded polystyrene, synthetic fabric, clay, metal, and concrete. The maintenance of the system can be made easy. Generally, self-automated watering and nutrition systems, make maintenance of the living walls easy.

a) Landscape walls

This wall system is a development of landscape 'berms' and a tactical aid in the practice of 'living' architecture. The main purposes of landscape walls, which are usually sloped rather than vertical, are slope stabilization and reduction of noise. Suitable plants viz. *Lonicera japonica*, *Nephrolepis sp.*, *Parthenocissus tricuspidata*, *P. quinquefolia*, *P. inserta*, *Vitis berlandieri*, *V. riparia*, *Polygonum auberti*, *Pyracantha sp.*, *Selaginella sp.*, *Wisteria chinensis* etc.

b) Vegetated mat walls

Patrick Blanc invented a novel type of green wall known as the "Mur Vegetal" . It is made up of two synthetic fabric layers with pockets to hold plants and growing medium in place. Because of the building wall's high moisture content, the fabric walls are backed by a waterproof membrane and supported by a frame. Nutrients are primarily distributed through an irrigation system that cycles water from the top of the system to down. plants viz. *Actinidia sp.*, *Akebia quinata*, *Aristolochia sp.*, *Campsis sp.*, *Celastrus sp.*, *Clematis sp.*, *Cotoneaster sp.*, *Euonymus fortune*, *Hedera helix*, *Heuchera sp.*, *Humulus lupulus*, *Hydrangea petiolaris* etc.

c) Modular living walls

A modular living wall system emerged in part from the use of module 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. *Pepromia sp.*, *Syngonium sp.*, *Philodendron sp.*, *Epipremnum sp.*, *Begonia sp.*, *Anthurium sp.*, *Chlorophytum sp.*, *Pilea sp.*, *Rheo discolor*, *Fittonia sp.*, *Spathiphyllum sp.*, *Schefflera sp.*, *Zebrina pendula*, *Setcreasea purpurea*, *Nephrolepis sp.* etc.

Planning for the Vertical Garden

Planning includes suitable location, local climate, availability of plant material, set up of supporting structures including necessary preparations for integrated drip-tube irrigation etc. key to success is the selection of the right species for the right location.

Planning of Vertical Garden

- **Plant Material:** Plants selections are site-specific and determined by light availability, location, size, color, texture, and growth habits.
- **Planting Matrix:** Medium for the plants to root and anchor onto a vertical surface. These can be in the form of organics, such as soil, or inorganic like plastics or synthetic fibers.
- **Irrigation System:** To supply the plants with water and nutrients for proper growth.
- **Waterproof Barrier:** To protect the building's façade from moisture.
- **Structural Support:** For supporting, the structural load of the vertical garden system onto the building façade.
- **Lighting:** To supply plants with sufficient lighting to photosynthesize and promote natural growth habits. Lighting can either be supplied by a natural source (the sun) or artificial source (metal halide, high-pressure sodium, and LED lights).

Future Scope of Vertical Garden

- **Urban Sustainability:** Helps reduce pollution and urban heat
- **Space Optimization:** Ideal for cities with limited land availability
- **Smart Integration:** Use of sensors and automated systems for plant care
- **Food Security:** Growing herbs and vegetables in small urban spaces
- **Eco-Architecture:** Increasing use in green buildings and smart cities
- **Climate Impact:** Contributes to biodiversity and carbon absorption

Conclusion

vertical gardens are an innovative and sustainable solution for modern urban living, combining environmental, aesthetic, and functional benefits within limited spaces. Their successful implementation depends on proper planning, efficient construction, and regular maintenance to ensure healthy plant growth and long-term performance. By improving air quality, reducing urban heat, conserving biodiversity, and enhancing human well-being, vertical gardens contribute significantly to sustainable urban development. As technology and eco-friendly practices continue to advance, vertical gardens will play an even greater role in creating greener, healthier, and more resilient cities of the future.