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Vertical Gardens –A Green Trend

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SUMMARY

Vertical Garden also known as Green Wall is the term of used to refer to all form of vegetaded wall surfaces. Vertical garden was invented by Stanley Hart White who patented a green wall system in the late 1930s. 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. They differ from green facades (ivy walls) as green walls have growing media supported on the face of the wall, while green facades have soil only at the base of the wall and support climbing plants on the face of the wall to create the green, or vegetated, facade. In vertical gardens, various types of modular panels can be used along with geotextile fabrics, growing media, irrigation systems, and plants. Living walls are particularly suitable for cities, as they allow good use of available vertical surface areas.

INTRODUCTION

One of the gardening world's hottest trends, "vertical gardens" allows plants to grow on walls and other non-horizontal surfaces. They're especially popular for small-space gardening where ground is at a premium, or as decoration for patios and outdoor rooms. Putting plants at eye-level also gives new appreciation to groundcovers, succulents and small perennials that usually take stooping to admire up close. Growing plants on a vertical surface has been possible after the studies of natural vertical locations – places without soil where in nature there may be great abundant of plant species. The technique imitates these locations, so it also functions without soil, having the benefits of making the surface very light and easy to tailor any geometry.

Irrigation

The irrigation system is designed to minimize water consumption. It consists of an automation-unit with equipment for control of nutrient injection and irrigation cycles. When a surface has a variation of sun exposures, the irrigation is divided into segments in order to program it specifically for each part. Within the multi-layered felt surface a drip-tube is integrated. Water consumption varies with heat and sun exposure, but compared to normal green spaces or a lawn, the consumption is normally lower. It averages between 2-5 l/m2/day.

Light

Direct sunlight can deliver over 100-1000 lux whereas the average light level in an office is around 300-500 lux. Even if the least light demanding species are used, artificial light is normally necessary indoor. A few species will stay fine at 900 lux, but a slightly increased level at some parts of the surface will broaden the variation of species that can be used. An artificially illuminated surface has shifting light levels, due to the fact that light reduces with the square of the distance from the light source. Some areas might have 3000 lux and others 900 lux. The plant design is made with this in mind, taking advantage of the higher levels for more demanding and interesting species. Not only is artificial light necessary for the plants survival and growth, but it also makes the garden more beautiful as it brings out colors and textures of flowers and leaves. A suitable light source is the metal halide. It produces the essential wave-lengths that plants need and is an energy-saving and cost-efficient alternative. Through an initial computer simulation, a study is made to calculate the required number and model of armatures. Finally, the levels are measured on location to fine-tune the setup.

Maintenance

As the supply of the basic needs of plants (light, water and nutrients) are automated, not only does this make for unusually healthy plants - it highly reduces maintenance demand and makes the vertical garden possible to use on high buildings or other places where accessibility is limited. The garden is designed so that the plants´ natural growth habit is given space, and for different species to have a dynamic

co-habitat with adjacent species. During a year, the garden will profit from pruning approximately 1-2 times per year. All plants that are used are perennial, but as the years go by, a few will have to be replaced. These maintenance measures will ensure a long term lush and attractive garden.

Choosing the Right Plants

Apart from aesthetic preferences and the plants ability to grow in a soilless, vertical location; the selection of plants is mainly decided by local climate and sun exposure. In an urban context these factors can be influenced by tall buildings that generate winds and irregular patterns of sun exposure. Studying local flora gives a good indication of which plants that might be used. Although wild species rarely are available in nurseries, it still tells about the hardiness zone and what related species that can work.

Classification of Vertical Gardens

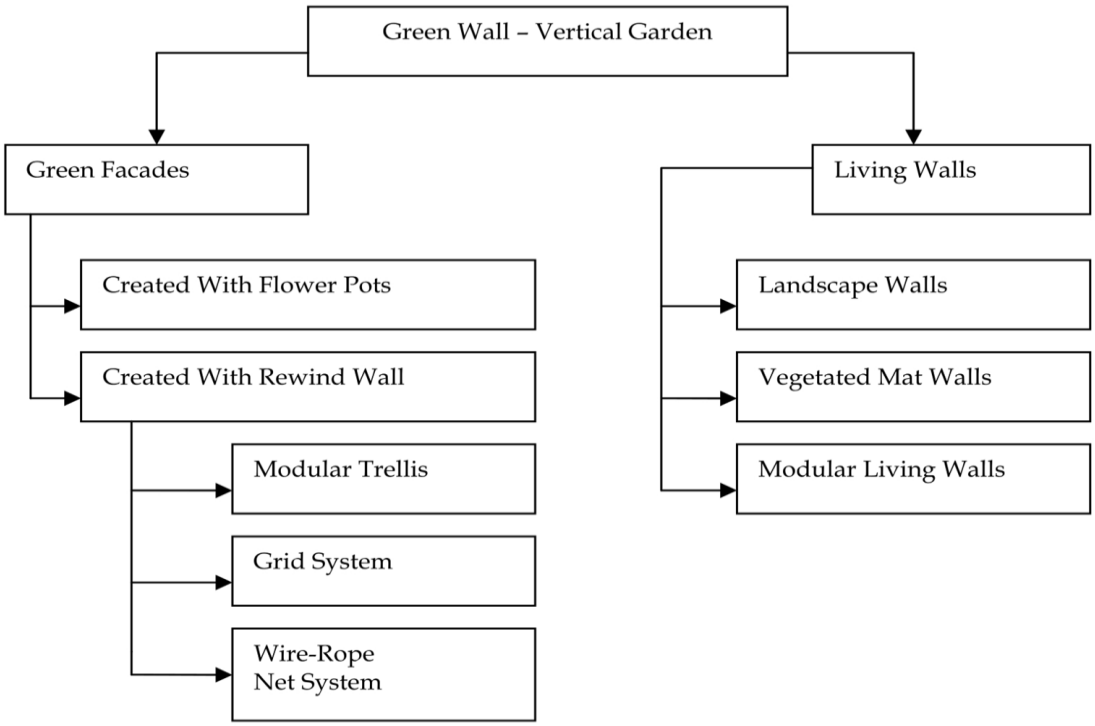

Figure 1: Flowchart of classification of vertical garden

Benefits of Vertical Garden

There are various benefits of vertical gardens or green wall. It can be sum up into 3 categories:-

- Public benefits
- Private benefits
- Design specific benefits

Public Benefits

Aesthetic Improvements

Green walls can reclaim disregarded space by providing aesthetic stimulation where it would not otherwise be found. They can also serve to create privacy and a sense of enclosure while limiting the negative psychological effects associated with property demarcation.

Reduction of the Urban Heat Island Effect

The reintroduction of vegetation into urban environments promotes the occurrence of natural cooling processes, such as photosynthesis and evapotranspiration. With strategic placement of green walls, plants can create enough turbulence to break vertical airflow, which slows and cools down the air.

Improved Exterior Air Quality

Green walls mitigate air pollution levels by lowering extreme summer temperatures through photosynthesis, trapping particulate matter, and capturing gases. The ability of green walls to provide thermal insulation for buildings means less demand on power, and as a result fewer polluting by-products are released into the air.

Local Job Creation

Green walls draw upon several disciplines for their design, installation and maintenance - such as landscape architects, architects, irrigation consultants, and more. Demand for a local supply of plant materials, blended growing media, greenhouse production, and fabrication of structural frames creates further business activity.

Private Benefits

Improved Energy Efficiency

Green walls can reduce the temperature fluctuations at a wall's surface from a range of 10-60ºC (50-140ºF) to one of 5-30ºC (41-86ºF), in turn limiting the movement of heat between building walls. They cause this reduction by:

- Trapping a layer of air within the plant mass.
- Reducing ambient temperature via evapotranspiration and shading.
- Creating a buffer against wind during winter months.

Green walls can help lower the air temperature around intake valves, which means HVAC units will require less energy to cool air before being circulated around a building.

Building Structure Protection

Temperature fluctuations over a building's lifetime can be damaging to organic construction materials in building facades. Green walls provide an additional layer of exterior insulation and thereby limit thermal fluctuations. Green walls protect exterior finishes and masonry from UV radiation and rain. They can also increase the seal or air tightness of doors, windows, and cladding by decreasing the effect of wind pressure

Improved Indoor Air Quality

Most North Americans spend 80-90% of their time indoors and as a result are highly influenced by the effectiveness of interior air circulation systems. It has been estimated that problems associated with poor indoor air quality negatively affect workplace production by $60 billion per year in the United States. Air that has been circulated throughout a building with a strategically placed green wall (such as near an air intake valve) will be cleaner than that on an uncovered building. The presence of vegetation indoors will have the same effect.
These processes remove airborne pollutants such as toluene, ethyl benzene, xylene, and other volatile organic compounds.

Noise Reduction

The vegetated surface provided by strategic urban greenery such as green walls and roofs will block high frequency sounds, and when constructed with a substrate or growing medium support can also block low-frequency noises. For over 30 years plant life has been used to this end along freeways, arterials, and rail lines in North America and Europe.

Marketing Potential

Green buildings, products, and services now possess a competitive edge in the marketplace. Green walls are an easily identifiable symbol of the green building movement since they are visible and directly impact the amount of green space in urban centers.

Design Specific Benefits

Increased Biodiversity

Green walls can help mitigate loss of biodiversity due to the effects of urbanization, help sustain a variety of plants, pollinators and invertebrates, and provide habitat and nesting places for various bird species.

Improved Health and Well-Being

Buildings that feature and promote access to vegetation have been documented as having a greater positive human health impact than those without.

Studies have shown that visual access to natural settings leads to increased job satisfaction and productivity and post-operative recovery rates in medical facilities.

Urban Agriculture

Green walls offer the opportunity for urban agriculture, such as vertical gardens of small fruits, vegetables, and herbs.

Onsite Wastewater Treatment

Several water-recycling systems can be applied to green walls. These systems pump grey water through a green wall, which then passes through filters, gravel, and marine plants. Treated water is then sent to a grey water holding tank for household or irrigation use or released into the public water treatment system. Some of these systems also collect storm water, which is filtered for household use or irrigation purposes.

CONCLUSIONS

Vertical gardening is basically about growing your plants upwards on vertical surfaces, be it on the wall of a home or a large facade of a building. As space is a constraint for many urban areas these days, having a vertical garden is certainly an option to still include some greenery in the house/building. Vertical gardening is more than just aesthetics; it can help to cool and insulate buildings, reducing the need and cost for air-conditioning. Growing plants in the building can also help to filter air particulates and improve air quality as well as add some humidity to centrally cooled offices at the same time. Vertical gardening requires little maintenance/trimming and mostly does not use soil. It also helps to save water by reducing the need for irrigation and watering. With vertical greenery, it also helps to soften the grey, hard and cold look of concrete especially in concrete urban jungles.

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