Green Walls, Greener Cities:

Boosting Sustainability with Vertical Garden Systems



Fytogreen

Introduction

Australian cities face increasing pressure from rapid urbanisation and population growth. According to government estimates, more than two thirds of Australia's population are living in capital cities.[1] Reports also indicate that the country's total population size will reach 30 million by 2029[2], requiring further building activity and infrastructure to support the growing numbers.

Escalating urban growth has environmental, social and health consequences, from increasing energy demands and pollution levels to reduced water and air quality and rising city temperatures. Cities also face the direct impacts of climate change, including coastal erosion, stormwater run-off and flooding from heavy rainfall as well as heat extremes and drought.

"Green" infrastructure, which is an integrated network of environmental features within an urban landscape, is an evolving approach to urban design that aims to mitigate the effects of urbanisation and climate change. This approach focuses on integrating natural processes back into the built environment, delivering environmental, economic and social benefits such as cleaner air and water, climate regulation, erosion control and places for recreation.[3] A vital component to creating liveable, sustainable and resilient cities, specific examples of green infrastructure – namely green roofs, walls and facades – are gaining popularity across Australia.

Architects and designers have a social and environmental responsibility to consider green roofs, walls and facades as components of sustainable design that can deliver a range of benefits to occupants and the wider community. However, cheap and poorly designed or specified installations can negate these benefits.

In this whitepaper we explore the benefits of green infrastructure — focusing on green walls and facades — and highlight some of the key considerations for designing successful vertical garden systems.





Benefits of Green Infrastructure

Green infrastructure improves the quality and livability of urban environments, increasing their adaptability and resilience to climate change.[4] Recently, green walls have grown in popularity, with a vast majority of large-scale outdoor green walls built after 2007.[5] Green walls also feature in the planning policies of local governments across most major cities in Australia.[6]

The benefits of green roofs, walls and facades flow to individuals, communities and organisations. Some of these benefits are discussed below.

Improved air quality

Green infrastructure results in improved urban air quality due to the increased presence of greenery in cities, which remove pollutants from the air. Green walls can remove up to 40% NO2 (nitrogen dioxide) and 60% PM10 (particles with a diameter of 10 micrometres or less) from the air at street level.[7] They also sequester carbon dioxide (CO2) in plant biomass and substrate.[8]

Improved water quality

Green infrastructure can slow and clean rainwater run-off from buildings, improving water quality and minimising the effect that polluted run-off has on natural waterways. Green spaces, which require non-potable water for irrigation, also provide a re-use for harvested stormwater.

Biodiversity

Green roofs, walls and facades provide additional space for living organisms to find food and shelter, increasing urban biodiversity. Designers can encourage biodiversity by, for example, adding nesting houses for birds and focusing on indigenous vegetation local to the area.

Thermal and acoustic comfort

Green roofs, walls and facades protect buildings from outside noise, creating healthier and peaceful indoor environments. They can also provide thermal insulation, reducing the reliance on artificial heating and cooling. According to City of Melbourne’s Valuing Green Guide: Green Roofs, Walls and Facades, an extensive green roof can save a multi-storey building up to 5% on annual heating and cooling while single-storey buildings can save approximately 25% to 35%.[9] Green walls and facades have been shown to deliver similar energy savings.[10]

Green infrastructure also mitigates the “Urban Heat Island” (UHI) effect, which refers to an urban microclimate that is significantly warmer than surrounding areas due to the lack of green cover and the prevalence of hard surfaces that absorb and radiate heat.[11] Studies have shown that vertical greening systems are an effective strategy to mitigate UHI effects.[12]

Improved health, wellbeing and productivity

The combined effect of the above benefits contributes to improved health and wellbeing for occupants and urban city dwellers. An effective network of green infrastructure has a cooling effect that reduces heat stress and heat-related illnesses, improves air quality and enhances thermal and acoustic comfort. Research has also shown that there are psychological benefits and increased rates of productivity when humans are surrounded by elements from the natural environment.[13]

Designing and Specifying Vertical Garden Systems

Types of vertical gardens

There are two main types of vertical garden systems, green facades and green or "living" walls.[14]

- Green facades are systems where the plants are grown into media and trained up a vertical frame to spread and provide cover over a building.
- Green walls (also known as living walls) refer to a more complex installation that is comprised of plants grown in a vertical system of panels or pockets fixed into a wall.

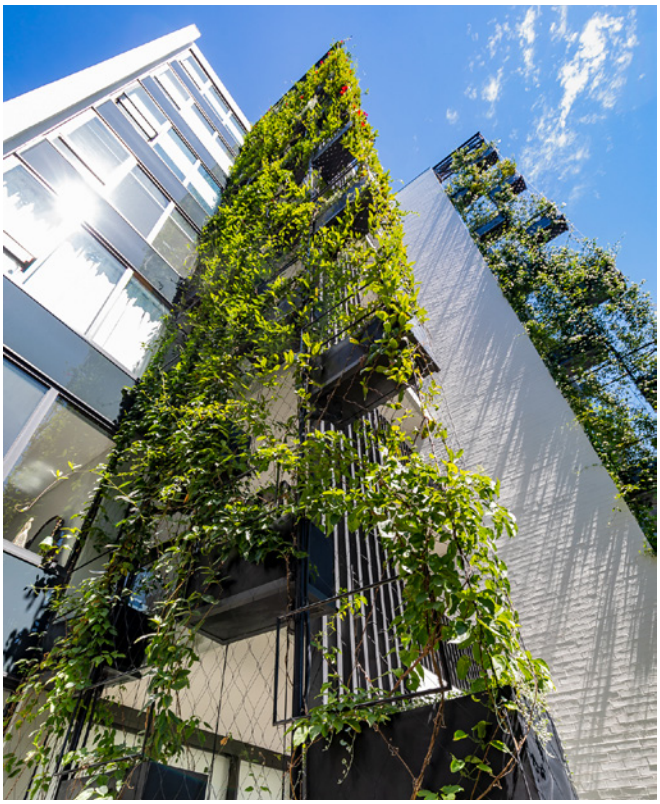
Key considerations

Not all vertical garden systems are created equal. The longevity and sustainability of a vertical garden corresponds to the quality and design of the system, particularly its suitability for the intended purpose and installation context. Systems that have finite root volumes, particular type media or require continuous plant replacement will increase maintenance costs, decrease sustainability and compromise the longevity of the system.

While not an exhaustive list, some of the key considerations for designing and specifying long-lasting, sustainable vertical garden systems are discussed below.

Maintenance costs

While almost all vertical garden systems are aesthetically impressive after installation, expert maintenance knowledge in elevated horticulture care will determine if the system delivers value over a longer period of time. Design and specification of a vertical garden system must account for how the system will be maintained. Access, cost of maintenance, plant replacement and other similar requirements should be considered at the outset of the project and will impact design choices.[15]



Leading suppliers can provide information on different design options and the likely cost of materials and maintenance.[16] Architects, designers and specifiers should be wary of service providers offering maintenance at low cost as the quality may not be at the required level for elevated horticulture.

Plant species

Plant choice should be determined by the intended purpose of the installation and the reliability and suitability of species for the given climate and environment.[17] In Australia within the "Built Environment", light levels (shading for adjacent buildings), wind (potential wind tunnels created aby adjacent buildings) and reliable monitored irrigation are important factors. The compatibility of plant with adjacent species within the design should also be considered.

Note that the vertical garden being installed may not be able to support all plant species. It is critical to identify suppliers with a track record for specifying plant species for successful installations in Australian conditions.

Planting media

In general, planting media for vertical garden systems should be lightweight, able to hold nutrients and moisture, capable of developing a firm root zone for plant stability, and drain easily.[18] Leading suppliers offer lightweight, soil-less growing media that is nutrient enriched and supports a wide variety of plant species.

Drainage and irrigation requirements

Irrigation and drainage are critical to the success of a vertical garden.[19] Irrigation keeps plants alive and healthy, while sufficient drainage ensures that the building's structural integrity is not compromised by the vertical garden system.[20] The garden's water demands should be estimated early on in the project and factored into drainage and irrigation system design. Non-potable water sources should be considered for systems that are water-intensive, consistent with water sensitive urban design principles.

Other considerations

Designers must consider a wide range of factors, such as installation costs, load-bearing capacity, waterproofing (to prevent moisture damage to the building wall) and ventilation, when considering a vertical garden system. In addition, planning regulations, standards and local laws need to be observed and the correct permits should be obtained where required. Vertical garden systems may also need to be assessed in relation to the requirements of Australian building sustainability ratings schemes.

Green wall design can be complex, so it is critical to engage with green wall experts at the design and consultation phase and identify systems that can be adapted to the project's specific requirements. Leading suppliers offer a wide range of horticulture and architectural products that can meet specific project requirements along with consultative services to assist in designing bespoke solutions.

Fytogreen

Over the past 17 years, Fytogreen has become the industry leader and innovator in horticultural technologies. Fytogreen supplies, installs and maintains both commercial and residential projects and is the largest supplier to the roof garden industry in Australia. Fytogreen also has a proven track record of success with more than 300 successful vertical garden projects, encompassing over 7,000m^2 of living walls within Australia and around the world.

Fytogreen offers a unique capability to design bespoke greening solutions. Working collaboratively with clients, architects, landscape architects and consultant project teams, the company leverages its extensive technical know-how to deliver extensive, sustainable solutions to fit any project vision. The company also has a dedicated research division that continuously develops new greening systems to meet the changing demands of the industry.

Key Products and Services

Fytogreen has the widest range of greening solutions on the market, offering multi-dimensional systems that increase the diversity, quantity and density of biophilic design and the industry know-how to create brand new solutions if required.

Fytogreen also provide a specialist elevated horticultural maintenance service utilising specific inhouse technology that is incomparable to general or indoor garden maintenance. This comprehensive offering – which includes irrigation and fertigation monitoring, plant care and all other aspects of vertical garden maintenance – ensures Fytogreen's unique garden systems remain vibrant, healthy and sustainable for many years.

The Fytogreen range includes:

- FytoWall, a panel vertical garden system suitable for indoor or outdoor applications;
- FytoFelt, a pocket green wall system available individually-designed, pre-grown, installed and maintained by Fytogreen or packaged for DIY installation;
- FC FytoFelt, an AS1530.3-1999 fire-compliant green wall system for maximum safety;
- FytoArbour, an ultra-lightweight, self-contained hydroponic garden that can be suspended or mounted above the ground;
- FytoColumns and Curved Fytowalls, which offer 3-D vertical garden column and pillar systems that can be designed for any size or diameter;
- FytoCylinders, a system of suspended stalactite vertical garden cylinders;
- Green Facades, cost-effective vertical greening using climbers and creeper plants; and
- Preserved Foliage, maintenance-free preserved greening solution for indoor spaces.
- Roof Gardens - Intensive, Extensive and sloping sustainable living roofs for residential and commercial projects
- Planter Boxes - Custom planter boxes suitable for nearly any indoor or outdoor application.
- Floating Wetlands, designed to vegetate waterbodies for aesthetic treatment, habitat production or water rehabilitation.



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