



The Laneway House rooftop garden in Newtown, Sydney.

Wall to wall GREEN

BUILDINGS WITH ROOFTOP GARDENS AND LIVING WALLS ARE PART OF A REVOLUTION TO REGREEN OUR CITIES AND HOMES AND BRING MORE NATURE INTO OUR LIVES. HELEN CUSHING TELLS HOW.

Once upon a time, rustic farmhouses with grassy sod roofs were the norm in parts of Europe. The sod was cut from the fields and laid on sheets of birch bark that had been peeled from forest trees when the sap flowed in spring and summer. The bark was water and soil proof, lasting for generations.

No nails were needed as the friction of bark on rough planks, weighed down by the sod, prevented sliding. Weighing around 250kg per square metre, the sod compressed the log structure, reducing drafts while insulating the building and supporting a thick layer of snow in winter. The cottages were part of the landscape, a human habitation that merged into the ecosystem and when time decreed, returned to the earth.

During the 19th century, industrial materials gradually superseded birch bark and sod until the idea of growing grass on your roof became a quaint memory from the primitive past. In the mid-20th century those in quest of a naturalistic lifestyle revived the sod roof but it remained a curiosity. A friend of mine built one 30 years ago, astonishingly meeting City of Hobart building regulations. Revisiting it this spring, I was charmed by the daffodils flowering in the long-haired grass and the memory of its inspired creation.

Fast forward to the high-tech 21st century and the Ford Motor Company's Michigan truck plant, built in 1917, is

in need of a makeover. Chairman Bill Ford, grandson of Henry, decided to balance business needs with ecological and social concerns. Using a German system, a four-hectare green roof was installed. The roof grows 15 plant species, reduces stormwater, insulates the building by 10° up in winter and 10° down in summer, provides a nesting site for birds and absorbs carbon dioxide while pumping out oxygen. In 2004 it was listed in the *Guinness Book of World Records* as the world's largest green roof.

The Ford green roof is part of the 'green buildings' revolution that has begun to take off in recent years around the world, including Australia, to bring plants, nature, oxygen and cooling to our increasingly hot cities. It extends to domestic green wall kits and vertical gardens (more on that later).

The green building revolution

'Living infrastructure' is the preferred name these days for what most of us would just call "plants on buildings". Alongside rooftops, vertical gardens are the other direction (pun intended) the living infrastructure innovators are refining and developing.

Ivy-clad walls, climbing roses, window boxes, espaliered fruit trees, just like sod roofs, have for centuries graced buildings both grand and humble. But the new wave is going further, adopting the idea of 'biophilia'.



In his book *Nature by Design*, the late Yale professor Stephen Kellert, describes biophilia as “the inherent affinity people have for the natural world”.

Whereas previously such a theory may have been an unstated and accepted part of life, our biologically lonely concrete jungles are increasingly separating us from nature. Recognition that this is not good for us, that it is making us sick and unhappy (and therefore is not good for productivity) is propelling the living infrastructure boom. Just as technology made the concrete jungle possible, so technology is enabling the greening of that concrete.

Sydney's sky jungle

Sydney boasts one of the world's tallest vertical gardens, award-winning One Central Park, a 150m high oasis in the desert surrounding Central Station. The planting design is by renowned French botanist and artist Patrick Blanc, an original proponent of vertical gardens. Inspired by the ability of plants to grow naturally without soil on vertical surfaces such as trees and rocks, Blanc developed a felt-based growing system to bring the lush fecundity of nature into barren cityscapes.

One Central Park uses some 250 plant species, mainly Australian, many found on cliff faces in the Blue

Clockwise from left: The massive One Central Park in Sydney; the green carpark in Manly Vale, Sydney; a rooftop garden at Burnley University, Melbourne.

Mountains, west of Sydney. Blanc's ambitious vision to evoke this natural experience in the centre of Sydney was a challenge to install, but from 2012–14 Sydney company Junglefy took it on, developing world-first installation methods to ‘plant’ the 1120 square metres of garden.

“One Central Park was the first of its scale, globally,” says Junglefy founder Jock Gammon.

“It disproved the naysayers.”

A cascading tangle of ferns, vines, succulents, flowers, strap-leaved clumpers, and more, create a lush sky-jungle in one of Sydney city's busiest streets for approximately 5,300 residents and 1,750 workers.

There are many pragmatic environmental and economic reasons to love this and other living infrastructure: shading and insulating building surfaces; cooling the surrounds through evapotranspiration and purifying the air by storing carbon dioxide; producing oxygen; removing toxins; and even ‘harvesting’ airborne particles. The latter is a heavy burden traditionally borne by street trees and parks.

The building complex also provides research opportunities for students across the road at the University of Technology Sydney. Projects include researching the biodiversity enhancement of the gardens, and the feasibility of anaerobic organic waste management in the city. The latter includes the abundant cuttings from the gardens and food waste from the numerous kitchens within the building.

Another excellent example of city greening is on a multistorey carpark in Sydney's Manly Vale, where Junglery has used green walls to transform an ugly utilitarian structure on a busy road into something bright and beautiful.

Rooftop biodiversity

Leaving Sydney, let's return to rooftops. In Melbourne, the roof garden of Victoria's newly renovated Parliament House restores a patch of biodiversity to the CBD. Designed by Paul Thompson, a leading light in the use of indigenous plants in landscape design, the garden features drifts of native grasses, wildflowers and small shrubs, planted around a winding bluestone path.

The Burnley Campus of Melbourne University has installed three green roofs, one for research, one for demonstration, and a third for biodiversity, fostering animal life. Trials include different depths of growing media, irrigated and non-irrigated beds, the use of endemic species, and a wetland.

Until this century, rooftop gardens remained a novelty due to problems of weight and waterproofing. Mark Paul, horticulturalist and founder of The Greenwall Company, Australia's original living infrastructure innovator of over 30 years, developed a solution.

According to Paul, his lightweight modular system made up of what he calls ecoPillows, is "the solution architects, builders and designers have been looking for." Made from 94 per cent recycled inorganic local waste, they can be any shape or size. "They are not only adaptable but also sustainable," he explains. "Our plantings last the lifetime of the building."

They are also perfect for collecting drainage and stormwater run-off, as elegantly demonstrated in an award-winning renovation of a small inner-city family home. Architect Jon Jacka used ecoPillows in the stormwater system of a green roof in his retrofit of the Laneway House in Sydney's Newtown (see picture on page 40 and top right). An inner courtyard is enveloped in cascading vines and greenery, with the guttering transformed into ecoPillow gardens fringing a sloping green roof.

Paul's own house takes things a step further, integrating rainwater collection and a rooftop fishpond to create an ecological system including greenwalls, and a green roof.



Top right: The Laneway House in Newtown.

Right: Brisbane City Council's 'Buildings that Breathe' guidelines have encouraged rooftop gardens such as this at Oxley and Stirling.



Top: Gardens in the home of The Greenwall Company's Mark Paul.
Above: The vertical garden in the Global Change Institute in Brisbane.

Walls that breathe

Air pollution is not only a street problem. Sick building syndrome (SBS) is prevalent in artificially lit and air-conditioned buildings which are generally outfitted with synthetic building and furnishing materials that quietly outgas fumes known as volatile organic compounds (VOCs).

We add to the problem by breathing out carbon dioxide, which builds up in our sealed offices. Fatigue, headaches, eye, nose and throat irritation, asthma and nausea are just some of symptoms. Indoor pot plants, like street trees, are often grown to purify and heal the air while soothing our suppressed primal, biophilic urges.

Going further, many buildings are incorporating green walls on both a small and large scale, with cascading plants greening atriums and courtyards.

Junglefy has developed an 'active breathing wall': a modular green wall system designed specifically to tackle poor indoor air quality. To the untrained eye it just looks like a lovely green wall, but hiding unseen is a small fan that draws the air through the growing medium and across plants at quite a rate.

The planting medium, which is high in coconut fibre, traps particles and VOCs while increasing carbon dioxide draw down by 80 per cent. The particles and VOCs are broken down by bacteria in the planting medium. The air comes out the other side of the wall oxygen-rich.

Additionally, the wall absorbs noise, humidifies the dehydrated air-conditioned atmosphere and reduces the need for air conditioning by up to 33 per cent.

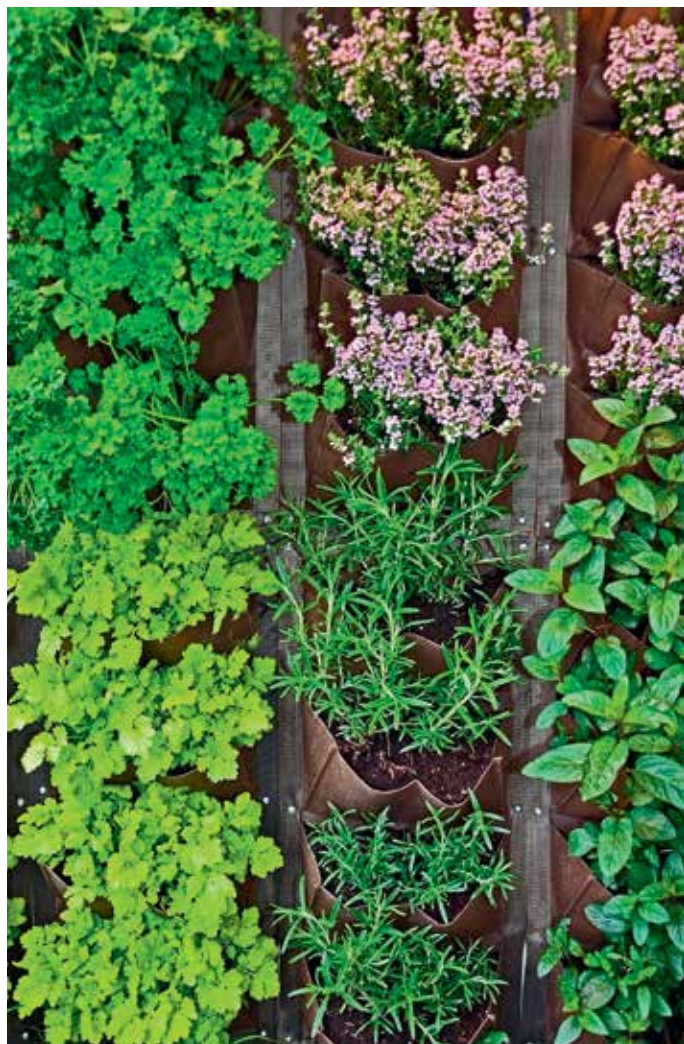
"The microbes are in a symbiotic relationship with the plants," says Junglefy's Jock Gammon.

"Both are needed for the breathing wall to survive. It's the bacteria, not the plants, that break down the VOCs and particles."

Perhaps the ultimate test of Junglefy's breathing wall is a new installation on Sydney's Eastern Distributor Motorway coming off the Harbour Bridge. Panels of bold plants have been installed in a world-first research collaboration backed by the NSW Government to determine the effectiveness of green walls in tackling air pollution.

Another significant project by The Greenwall Company is a green wall garden in the atrium garden in the offices of the Global Change Institute (GCI) at the University of Queensland.

Recently featured on ABC TV's *Gardening Australia*, the gardens rise dramatically within a glass-roofed two-storey atrium that doubles as a light well. Including a wetland/pond system, water and nutrients are recycled, and the green walls are part of an air-cooling and filtering system that contribute to the sustainable building design. The GCI building aims to meet Living Building Challenge requirements, the most rigorous international sustainability standards available for the built environment.



SMALL SCALE *vertical* GARDENS

WHETHER EDIBLE OR ORNAMENTAL, THERE'S
A WALL GARDEN FOR YOU.

There are many small-scale vertical garden kits suitable for balconies and courtyards, or any spot you like. Some will work better than others. Before you invest time, money and enthusiasm, pause to consider the following, and also discuss at garden centres or see if you can find people with systems working well.

Your purpose

Are you inspired to disguise an ugly wall, bring greenery into a built environment or grow herbs and food plants? Or maybe you are trying to resolve space issues on a balcony garden or you just love a gardening project?

Planting systems

Modular kits are readily available. Some have built-in irrigation and drainage collection systems. You need to be able to attach a hose, and for best results, an irrigation timer is recommended. These are ideal for situations where drainage is an issue.

Cheaper versions are simply panels of planting pockets with a range of sizes and materials available. You'll need to water by hand or install your own drip-irrigation. The size of each pocket influences plant choice and fertiliser requirements.

A couple of options for green wall gardens with good-sized planting pockets are the slim modular systems from Atlantis (atlantiscorporation.com.au), Holman (holmanindustries.com.au). Whites has a selection of wall mounted options (whitesgroup.com.au).

Top: Herbs are ideal for small wall garden pockets.

Above: This portable vertical garden is perfect for small spaces.





Above: A more permanent wall garden

Growing medium

This can be organic or inorganic, the latter being a hydroponic system. Always choose premium potting mix or enrich with your own compost. Cheaper mixes tend to underperform.


Location

Is it indoors, outdoors, shady or sunny or both, windy, damp, under eaves, over a hard surface that will heat up? Can you leave a hose hooked up for auto-watering? Where will water drain to?

Plants

The plants you choose need to be suited to the location. Plant selection is key to success. Plants that naturally grow on vertical surfaces without soil are called epiphytes. They tend to grow on trees or rocks in moist, often warm, protected environments such as rainforests or damp gullies. Many ferns, orchids, bromeliads and vines are epiphytic.

Plants with shallow root systems are also suitable. Ornamental green walls come into their own when the plants grow so well that you can't see the wall. Choose plants that are fast-growing and have dense, spreading foliage and a variety of forms. The chosen plants need to all like the same growing conditions.

Of course, if your mission is to grow herbs and food plants, you'll choose edibles (see the list at right). An edible garden will thrive with larger planting pockets, a nutrient-rich medium (a quality potting mix with some added compost) and good water supply. You can easily grow a range of edibles, including leafy greens, herbs, cherry tomatoes, strawberries, chillies and more. 

PLANT CHOICES

SUNNY SPOT EDIBLES

Alpine strawberry (P)
Arugula/rocket (P)
Basil (A)
Chillies (P)
Chives (P)
Garlic chives (P)
Gotu Kola (P)
Lemongrass (P)
Lettuce (A)
Nasturtium (P)
Oregano (P)
Parsley (A)
Radish (baby) (A)
Prostrate rosemary (P)
Strawberry (P)
Thyme (P)
Cherry tomatoes (Bush) (A)
Vietnamese mint (P)
Warrigal greens (P)

SEMI-SHADE EDIBLES

Chervil (A)
Gotu Kola (P)
Mint (P)
Nasturtium (P)
Parsley (A)
Peppermint (P)
Watercress (A)

SUNNY SPOT ORNAMENTAL

Bromeliads (P)
Dianella (P)
Dichondra (P)
Geranium (P)
Lobelia (A)
Lomandra (P)
Nandina domestica
'nana' (P)
Orchids (P)
Petunia (A)
Strobilanthes spp. (P)
Succulents (P)

SHADY SPOT ORNAMENTAL

These are all perennials:
Aspidistra – cast iron plant
Blechnum – fishbone fern
Bromeliad
Chlorophytum
Cissus – grape ivy
Coleus
Davallia – hare's foot fern
Hoya australis – wax
flower
Nephrolepis – Boston fern
Orchid
Philodendron
Pilea – aluminium plant
Spathiphyllum
Viola hederacea – native
violet
Zygocactus

WALL GARDEN PLANTS

Don't be afraid of experimenting with plants that aren't on this list. If you live in a cold climate, ensure the location is protected from frost, or select frost-hardy species.

Watch where the sun moves and put the most sun loving plants in positions that get the most sun.

If you live in a mild climate, most indoor plants are suitable for shaded, sheltered outdoor areas.

KEY:

A = annual
P = perennial

INFORMATION AND INSPIRATION

- The Greenwall Company: greenwall.com.au
- Junglify: junglify.com.au
- growinggreenguide.org/
- greenroofs.com/projects/global-change-institute/
- brooklyngrangefarm.com/farms