



# Green roofs turn cities upside down

As urban density increases, green roof and wall technology is evolving fast. It provides a way to replace vegetation lost on the ground as well as a host of energy, water management and aesthetic benefits.

Imagine flying into an Australian city where instead of the traditional sprawl of rooftops, buildings are covered by a blanket of green. Such a scenario may be some way off but green roofs are appearing on commercial and residential buildings as people start recognising their potential to moderate the effects of global warming.

Green roofs range from those that have a simple covering of grass – such as Australia's parliament house – to the 'busstop' systems being developed in Adelaide which include biodiversity as well as significant insulation and stormwater management benefits.

Sidonie Carpenter, President of Green Roofs Australia and owner of the Brisbane-based green roof and green wall consultancy Green Canopy, has recently returned from the first meeting of the World Green Roof Infrastructure Network (WGRIN)<sup>1</sup> in the United States.

She says that while green roof

**Designed by Lyons architects, the 6-star rated Marine and Freshwater Resources Institute building at Queenscliff, Victoria, has landscaping which forms the roof and acts as a thermal mass.** Lyons architects

technologies have developed in other parts of the world over the last 30 years, Australia is rapidly catching up.

'It is exciting to see green roofs being embraced as a way of dealing with climate change, but daunting because we don't have a deep sense of the specific skills required,' she says.

Germany is viewed as the world leader in green roof technology, with some 60 years' experience in design and construction and whole suburban developments covered by green roofs. Other European countries, such as Iceland, Norway and France, also have very strong green roof industries.

In North America, green roofs have

<sup>1</sup> The World Green Roof Infrastructure Network was launched in December 2006, bringing together more than 15 green roof professional associations on four continents, and headed by Professor Manfred Kohler, a pioneer of green roof technology in Germany. Green Roofs Australia is Australia's member of WGRIN.





**Stormwater management is a major driver for green roofs in North America and Europe and something which is becoming increasingly important in Australian cities.**

been on the scene for the last 10 to 15 years. Toronto has more than 100 green roofs and an incentive scheme to encourage their construction. Chicago, with more than 300 green roofs, also has a policy to encourage their inclusion in new developments.

In Asia, Japan is the leader in green roof technology with some innovative examples, such as the Roppongi Hills building in Tokyo where a rice paddy on the sixth floor, planted by local school

**The Subaru building in Singapore has a vehicle testing circuit and garden on its roof.**

Graeme Hopkins, Fifth Creek Studio

children, produces 60 kilograms of rice per year. It also has an organic vegetable plot, a breeding colony of frogs in the water feature and a barbecue area for corporate functions.

In Australia, as more architects, urban planners and developers and their clients start demanding buildings that are more energy efficient, the idea of incorporating rooftop gardens and greenery on walls is becoming more common.

Benefits of green roofs include thermal insulation, which reduces energy use in heating and cooling. For a multi-storey building, this energy saving is about 10 per cent and for a single storey building it is 20 per cent, says Adelaide architect, landscape architect and 'busstop' pioneer, Graeme Hopkins.

Stormwater management is a major driver for green roofs in North America and Europe and something which is becoming increasingly important in Australian cities.

Research is being carried out by Monash University and Melbourne Water on the benefits of green roofs for stormwater management.

Green roofs also reduce the 'heat island' effect in cities by lowering the temperature of the building surface and



**The ACROS Fukuoka building, Japan, uses cascading greenery to cool its interior and add high aesthetic value.** Graeme Hopkins, Fifth Creek Studio



## Adelaide bushtops recreate biodiversity

Landscape architect Graeme Hopkins and his partner Christine Goodwin are taking the idea of green roofs a step further with their urban 'bushtop' concept, which involves creating a whole ecosystem above city buildings.

The couple, co-directors of Adelaide design firm Fifth Creek Studio, initiated a series of bushtop living roofs throughout the CBD. The first bushtop to be constructed is on the fourth floor of a community housing development at Hocking Place, which recently won the Australian Institute of Landscape Architects SA Award for Residential Design and a Special Citation for Future Directions for Cities.

The bushtop is an accessible green roof that combines animal and insect habitat with passive recreational access by the residents of the building's 15 apartments. It includes native plant species such as sedges and grasses to attract butterflies and birds.

Hopkins says the most important requirement for supporting biodiversity on green roofs is water. Other factors are the limited space to establish permanent populations, access to the roofs and availability of nutrients.

'Green roofs can serve as essential "stepping-stone habitats" in an urban landscape. In fact, a close mosaic of stepping-stone habitat patches may be as



**Native grasses and shrubs on the roof of Hocking Place in Adelaide are attracting local insect and birdlife.** Fifth Creek Studio

effective as a continuous strip in allowing many species to live in an area,' he says.

As well as plants to attract birds and insects, the Hocking Place rooftop includes

a bat nesting box to attract some of the nine species of micro-bats in the CBD.

In his role as principal urban designer with Planning SA, Graeme Hopkins is trying to offset some of the impacts of urban density on the city's parks and open spaces by increasing vegetation – albeit on walls and roofs, rather than on the ground.

Hopkins is working closely with the School of Urban Ecology at the University of South Australia to plot the old migratory patterns of birds and insects through the city in order to target developments on the migratory path as future bushtop refuges.

In collaboration with the University of South Australia and Adelaide City Council, he is also working on a pilot project, which takes the stepping-stone system further, using ground level, walls and rooftops to create a vegetated corridor that will provide pedestrian and cycle access across the city.

'It includes about 12 layers of separate designs, from harvesting stormwater, cleaning it, storing it under the road pavement, recirculating it back into the building using biofilters and the roofs and walls for biodiversity corridors and pedestrian usage, all totally integrated,' says Hopkins.

The first stage is expected to commence later this year and will provide a demonstration site for other developments in the city.

thus the ambient temperature. The City of Toronto estimates that eight per cent of green-roofed buildings will reduce the temperature by about 2°C.

Another benefit is cleaner air from plants trapping harmful particulates and dust. Also, solar panels have been found to work more efficiently on green roofs than on a normal roof surface because of the lower surface temperature.

Benefits can be extended from the rooftop to the sides of the building by green or living walls, where plants are grown onto a vertical system, based on principles of hydroponics for moisture and nutrients.

Graeme Hopkins is trialling the suitability of various native plants, such as grasses, sedges and saltbush, in living walls at his Adelaide Hills home and office. He says the living walls capture people's imagination and are ideally suited for medium density developments where they can introduce a whole new aspect.

'If you get the right plants they look so luscious and tactile, you just want to pat them,' he says.



**The Roppongi Hills roof garden in Tokyo includes a rice paddy that produces 60 kg of rice a year.** Graeme Hopkins, Fifth Creek Studio



'They are very low maintenance, such that I've weeded the walls once in 12 months and the watering requirement is no more than five minutes a day on a drip system.'

Living walls can also be used to link rooftops to the ground to create a green corridor that provides habitats for birds, insects and small lizards to colonise.

Melbourne's Council House 2, a six-star rated green building, uses some of the building's recycled water in a rooftop garden and 'vertical gardens' that run up the northern facade and provide shading to the building.

Challenges for the industry are the need for standards and policies, which will make inclusion of green roofs and walls in buildings much easier, says Sidonie Carpenter.

'Plant selection, growing mediums and the requirement in Australia for year-round maintenance are other challenges for the industry,' she says.

'The places where green roofs were developed experience a short summer and long winter so the growing season is much tighter. In Australia, maintenance is required for 12 months of the year.'

A number of landscape firms are researching plant selection and species for green roofs and walls. Other research is investigating new methods of waterproofing and soil profiles for Australian conditions.

But, Ms Carpenter says, every site is specific as different buildings have different solar access, wind conditions and infrastructure on the roof.

She says for this reason Green Roofs



**Completed in 2001, the primary purpose of Chicago's City Hall Green Roof Pilot Project was to facilitate research and educational outreach within the context of a mid-western US climate.**

Graeme Hopkins, Fifth Creek Studio

Australia won't publish a plant list on its website, despite receiving many enquiries, and she recommends including a horticulturist in any green-roof design team.

Another area where she sees great potential is the retrofitting of residential buildings. 'This is a huge opportunity and market to get whole communities to embrace green roof technology.'

● **Robin Taylor**

*The second annual Green Roofs Australia conference will be held in Brisbane, 18–20 June 2008.*

**More information:**

Green Roofs Australia,  
<http://greenroofs.wordpress.com>

World Green Roof Infrastructure Network,  
<http://www.worldgreenroof.org>

Green Roofs for Healthy Cities North America,  
[www.greenroofs.org](http://www.greenroofs.org)

## Food from the rooftop



**Sky Vegetables are working towards US supermarkets growing saleable produce from their own roof spaces.** Sky Vegetables

A project led by Central Queensland University is investigating growing food plants on rooftops. The aim is to recycle organic wastes into fresh food within half a kilometre of where the wastes are generated.

It is one aspect of an urban organic waste management pilot project being developed in the Brisbane–Ipswich urban corridor. Research and demonstrations are aimed at extracting

plant nutrients from urban organic wastes with vermiculture (where worms break down organic matter) to produce vegetables, some of which will be grown on rooftops.

Leader of the project, Dr David Midmore, hopes to develop a business model, as well as training and operational manuals, for an urban rooftop micro-farm concept that can be repeated for innovative waste

management in shopping malls, isolated communities and mine sites.

Growing vegetables in rooftop gardens is an idea also attracting interest in the United States, where students at the University of Wisconsin-Madison recently won a university award for their business idea, known as Sky Vegetables, to grow vegetables on supermarket roofs. Vegetables, fruits, herbs and flowers would be cultivated year round in rooftop greenhouses and sold in the supermarkets below. 'Produce will be picked as it ripens, and taken to the sales shelf in less than half an hour,' says Keith Agoada, one of the three students who developed the scheme.

He says a few supermarkets have expressed interest in the plan and, while it is still early days, the fledgling company is optimistic about implementing the first system in 2009.