

# GREEN ROOFS AND VERTICAL GARDENS



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The Pratt Foundation/ISS Institute Overseas Fellowship

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***Please consider the environment before printing this report.*** Wherever possible during the course of Sidonie Carpenter's trip and the writing of this report she has sought to achieve a carbon neutral footprint. 'Green Roofs for Healthy Cities' conference achieved a zero carbon footprint. Neutralising the greenhouse gas emissions resulting from the production and distribution processes and travel.

# Executive Summary

By 2005, 50% of the world's population lived in cities (Bindé, 1998), and in the industrialised world, the figure has already surpassed 80%. The growth in urban populations has and will continue to create a unique set of environmental problems, both within cities and in the surrounding areas, due to the large demands for food, energy and water. Many of these problems are either directly caused, or exacerbated by the removal of vegetation to accommodate urban expansion. It is expected that many of these problems will be further affected by climate change, particularly impacts that contribute to heat waves and the associated health problems, rapid temperature changes, stormwater runoff, water quality, biodiversity and food security.

Green roofs and vertical gardens have never been widely recognised or understood in Australia; hence we have a very limited knowledge and skill base for their design and implementation. It is an area that offers many diverse applications with outcomes that directly benefit the client and the environment, while giving the industry a competitive edge and future growth.



*Ford Motor Plant – Dearborn, Michigan. The biggest green roof in the world at 10.4 acres*

Green roofs offer a number of environmental benefits, both to the public and private sectors.

## **What are the benefits of Green Roofs?**

- Aesthetically pleasing
- Reduction of the Urban Heat Island effect  
The envelope of hot air that hovers over cities due to heat reflective material and the lack of vegetation is known as the 'Urban Heat Island' effect. It is the aggregate of all the heat absorbed and generated by buildings, roads, vehicles, HVAC systems, etc., and can result in cities being as much as 7 to 10 degrees warmer than their suburban and rural counterparts....LBNL (Lawrence Berkeley National Laboratory) scientists indicate that widespread heat-reduction measures, such as planting rooftop vegetation, could easily lower a city's temperature by five degrees.
- Reduction of carbon dioxide - greenhouse effect  
Carbon Dioxide/Oxygen Exchange is through the process of photosynthesis, plants convert carbon dioxide, water and sunlight/energy into oxygen and glucose. This cyclical process supplies animals and humans with oxygen and food.
- Reduction of air pollution  
1 m<sup>2</sup> of grass roof can remove between 0.2 kg of airborne particulates from the air every year.

# Executive Summary

- Reduction of heating and cooling loads  
...can reduce heating and cooling requirements by as much as 20 to 30 percent for a one story structure. Cutting energy consumption. A three to seven degree temperature drop translates into a 10% reduction in air conditioning requirements.
- Lengthen roof life by two to three times  
...can last twice as long as standard roofs, the life expectancy of waterproofing is increased to more than 40 years. Increased life expectancy of the membrane because it is better protected from mechanical damage, UV-rays, hail and extreme temperature differences.
- Reduction of sound reflectance and transmission  
Tests have shown that green roofs can reduce indoor sound by as much as 40 decibels, providing particular benefit to buildings in noise impacted areas, such as those close to airports or industry.
- Reduction of rainfall run off impacts  
In Germany alone, more than 1.8 million square metres of new green roofs are installed every year. Many cities require green roofs for buildings in districts that are plagued by chronic runoff related problems.... a typical green roof with about 100mm of growing media can be designed to reduce annual runoff by more than 50 percent.

Ref - Green Roofs for Healthy Cities. Green Roof Design 101 Introductory Course. 2nd edition, 2006



Schiphol Airport – extensive green roofs



Germany - Stuttgart rooftops



Germany - Berlin rooftops

Green roofs and vertical gardens can help reduce some of the impact that urbanisation imposes on the environment and our quality of life. This is being successfully achieved in a number of areas in the world, specifically Europe and North America. There is a need to investigate how this is achieved and then adapt and apply this knowledge and skill to Australian conditions.

Identified skills gaps:

- Understanding what a green roof is and its benefits
- Different green roof systems
  - Modular
  - Loose laid
- Budget development and cost estimation
- Green roof standards
- Specifications

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- Basic design parameters
  - Access
  - Structural load bearing
  - Sloped roofs
- Installation
  - Waterproofing
  - Drainage systems
  - Irrigation
  - Growing media
  - Vegetation
  - Maintenance
- Design and installation team selection
- Education and training
- Liability and system warranty

The Fellowship program took Carpenter to Singapore, the United States and Canada and encompassed many site visits, both planned and impromptu, to green roofs and vertical gardens. Meetings were held with individuals and councils involved at all levels of green roof design, implementation, maintenance, promotion and education. Carpenter also attended the 'Green Roof for Healthy Cities' conference and completed two green roof specific design and implementation courses.