NURSERY PAPERS
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GREEN ROOFS IMPROVE WORKER PRODUCTIVITY

Having a room with a view really does make a difference—even when you are at work or studying. This nursery paper outlines the psychological benefits of vegetation growing on city building roofs, on those working in nearby buildings. Dr Kate Lee's research investigated the type of roof-top vegetation that workers preferred as well as the effect of green micro-breaks on concentration, mood, and overall work performance.

Summary

- All living roofs are preferred over the standard concrete roof-top
- Living roofs could provide psychological restoration for office workers, lifting mood and overall performance
- Tall, green, grassy, meadow-like vegetation is the most appealing
- Flowering plants increase the appeal of a living roof
- Diversity in plant species improves the appeal of the vegetation
- Green roofs can be used effectively for micro-breaks at work, providing opportunities for employees to restore their cognitive resources and improve productivity

An apartment block in NewActon, Canberra.

PSYCHOLOGICAL RESTORATION EFFECT

The beneficial effect of viewing vegetation has been associated with improved mood and cognitive function, reduced stress and improved health and well-being. These improvements are observed even when the person has limited exposure.

This knowledge has supported the notion of providing green space in city environments and this current research confirms that the effect can also be achieved in environments where green space such as parks may not be visible. Roofs that have vegetation growing on them may also provide psychological restoration for people living and working in such environments.

Nursery & Garden Industry Australia

This project has been funded by Horticulture Innovation Australia Limited using the Australian Nursery Industry levy and funds from the Australian Government.

Horticulture Innovation Australia

THE RESEARCH

The study investigated the preferred vegetation for living roofs and their restorative effects on office workers in a city CBD environment.

STUDY OBJECTIVES

The study was conducted over three phases. This first phase set out to determine if the established preferences for vegetation type and diversity in green space environments also applied to living roof environments.

The researchers aimed to quantify the importance of plant characteristics such as life-form, foliage colour, flowering, vegetation height and diversity in an urban living roof context.

The second and third phases aimed to examine how green micro-breaks (defined as breaks spent viewing nature) may help workers stay on track, improving focus and performance.

PHASE 1: PREFERRED VEGETATION USING IMAGES

Photographic images

Researchers created a series of 41 different images using photo editing software. The images depicted the same city scene with a living roof in the foreground, from the perspective of someone looking out a high-rise window.

One image included a bare concrete roof, as the 'control'.

To create the different vegetation types the following characteristics were manipulated:

- plant life-form (succulent; grassy; mixed life-form)
- foliage colour (green; grey; red; mixed colour)
- vegetation height (lower; taller; mixed height)
- diversity (none; low; moderate; high).

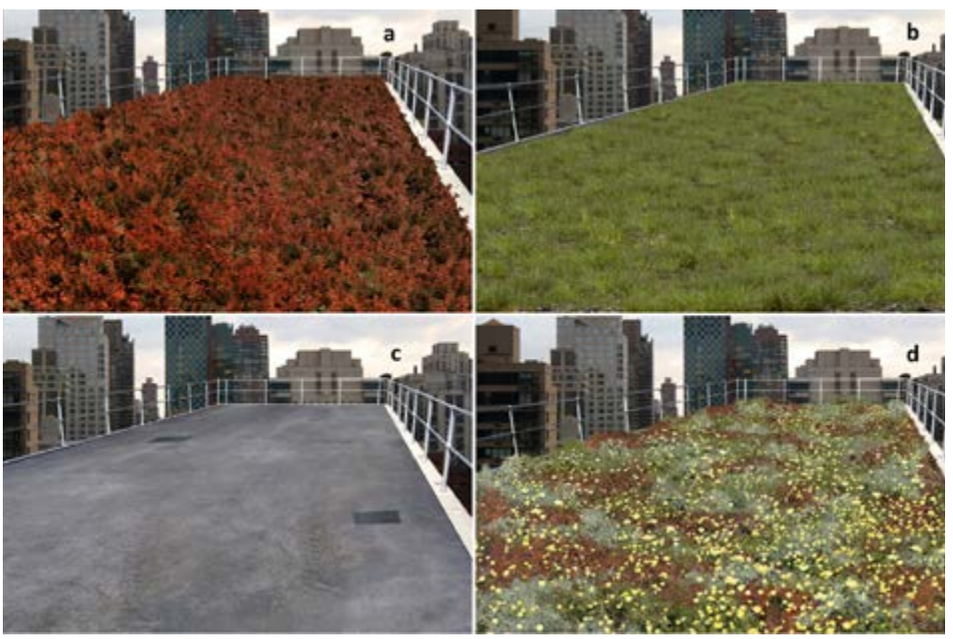
Procedure

The emails and newsletters sent to potential participants included a link to the 20-minute survey.

Each of the 41 images was shown in a randomised order at full screen size, representing a window view.

To complete the survey, participants were asked to rate each image against the question 'How much would you like to have this view from your office?' using a number scale where 1 indicated 'not at all' and 10 indicated 'very much'.

An additional question was included for the taller green grassy image and the concrete image, as pilot testing had revealed these received the highest and lowest preferences respectively. Participants were asked "To what extent do you feel that you would be able to rest and recover your attention while looking at this view?" with a view to gauging the restorative potential of the living roof. The same number scale (1 = not at all; 10 = very much) was used.



Images of different vegetation types for a living roof created using photo editing software.

Key findings

Participants in the survey indicated a preference for certain plant life-forms, foliage colour and vegetation height. These preferences are in line with those preferences expressed for other green space environments.

1. Grassy life-forms were preferred over shrubby succulent forms.
2. Green foliage was preferred over grey and red foliage.
3. Taller vegetation was preferred over lower-growing vegetation, particularly for participants with a stronger connection to nature.

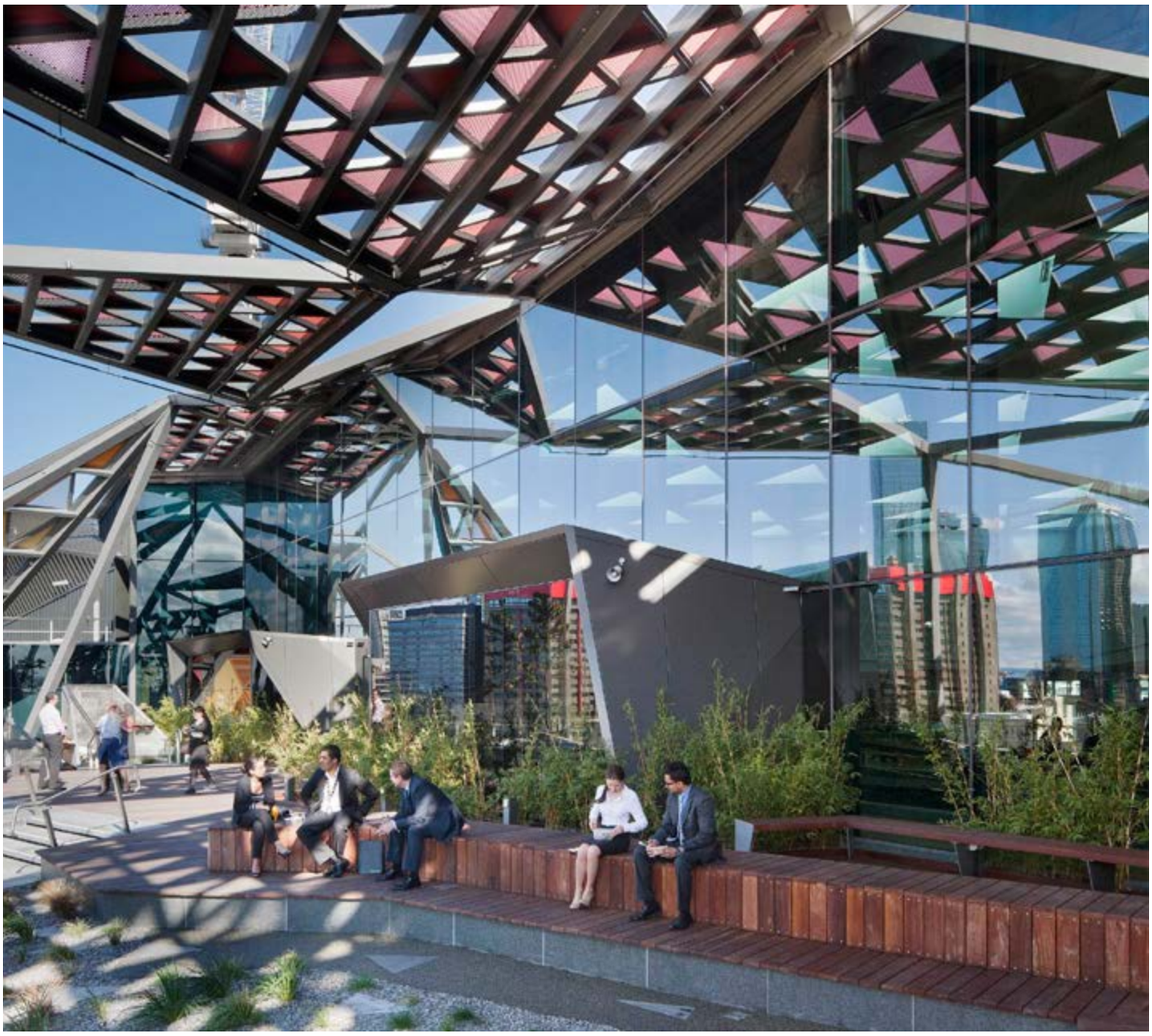
The images which included flowers were all preferred over the alternative for that vegetation type, with median preference scores one point higher than the original non-flowering image.

As with the other photos, the most preferred flowering living roof consisted of taller green foliage and a grassy life-form.

PHASE 2: COMPUTER TASK BEFORE AND AFTER MICRO-BREAK

Procedure

The second part of the study used a neuropsychology test called the Sustained Attention to Response Task (SART). 150 participants were asked to work at a computer and respond correctly to numbers flashing up on the screen. Each time a number flashed up, they had to press a key unless that number was '3' , where they had to stop themselves from pressing a key. This test links with everyday focus.



The roof of the National Australia Bank building, 700 Bourke Street, Melbourne. PHOTO: Shannon McGarth.

As the participants grew tired from the SART, they were given a 40 second micro-break. During this break, half the participants saw a city scene with a concrete roof while the other saw a green roof with flowers and foliage. Following the break, the participants sat the SART again and the performance between the two groups was compared.

Key findings

After the break participants who saw the green roof image performed better than those who saw the concrete roof. They made fewer errors on the task and showed more consistent alertness and concentration after the green roof micro-break.

PHASE 3: WORK SIMULATION TASK BEFORE AND AFTER MICRO-BREAK

Procedure

The third phase of this research asked participants to complete a work task reviewing two different pieces of academic writing – one before and one after a 90 second micro-break. The participants were tested in a city building overlooking the roof of the floor below. Conducted over six weeks, the green roof (inspired by the images used in phase 2) was installed halfway through the study, so that half the participants viewed the concrete 'control' and half the participants viewed the green living roof for the last three weeks of the study. The results were then compared.

Key findings

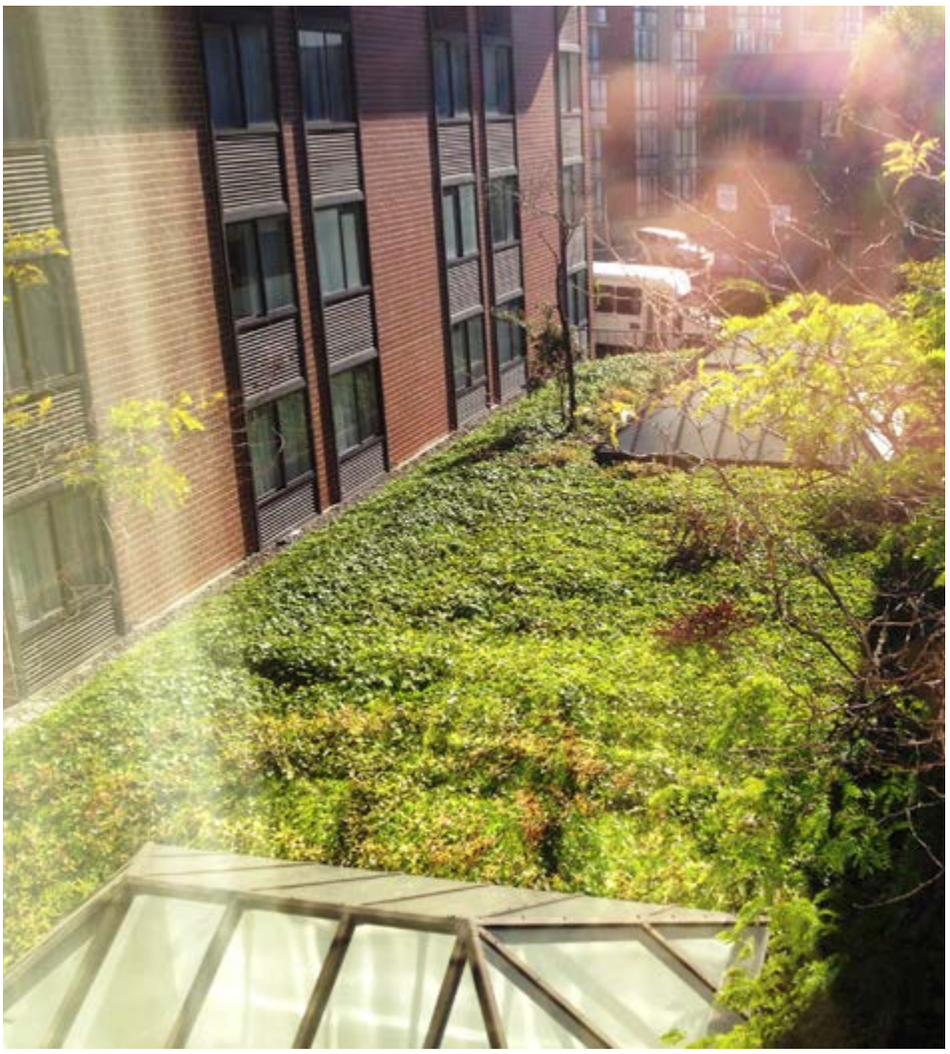
Phase three of this study showed that the green micro-break allowed a period of psychological restoration, affecting attention span and performance.

IMPLICATIONS OF THE FINDINGS FOR THE NURSERY INDUSTRY

Unlike ground-level landscapes, living roofs are integrated into the building fabric and require specialised design and maintenance. This research demonstrates the value of living roofs in CBD environments and provides designers with clear direction regarding the preferred consumer characteristics of the vegetation installed on roof tops.

This adds weight to the industry's commitment to increased green space in urban environments, providing further evidence to support 202020 Vision and similar efforts to encourage those making decisions on urban development to recognise the social and economic benefits of green space.

Clear preferences for tall grassy vegetation with green foliage along with compatible flowering plants provides the industry with direction for the supply of species that meet the practical building design requirements, are aesthetically pleasing for the people working in these environments and provide other services such as ecological, heat and water management benefits.



The green roof of an American hotel.

Burwood Council in Sydney is one of the latest decision-makers to recognise the benefits of living landscapes in situations where traditional green space options are limited, requiring all new residential towers to have rooftop gardens. From the end of 2016, all new developments must have at least 50 per cent of the roof area filled with grass, shrubs or trees.

LINKS TO RESOURCES

Lee, K E, Williams, K J H, Sargent, L D, Farrell, C & Williams, N S, Living roof preference is influenced by plant characteristics and diversity', Landscape and Urban Planning 122 (2014) 152–159 *http://www.sciencedirect.com/science/article/pii/S0169204613001904*

Green Roofs Australasia *https://greenroofsaustralasia.com.au/associations*

Growing Green Guide – A guide to green roofs, walls and facades in Melbourne and Victoria, Australia *http://www.growinggreenguide.org/*

Living Wall and Green Roof Plants for Australia, RIRDC *https://rirdc.infoservices.com.au/items/11-175*

The Green Infrastructure Research Group *https://thegirg.org/*

Daily Telegraph – Burwood Council will now require all residential towers to have rooftop gardens *http://www.dailytelegraph.com.au/newslocal/inner-west/burwood-council-will-now-require-all-residental-towers-to-have-rooftop-gardens/news-story/d1fa3326feb5775ba2a0249431dd86f4*

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The study was undertaken by Dr Kate Lee, School of Ecosystem & Forest Sciences, University of Melbourne, supported by a PhD scholarship funded through the Cybec Foundation.

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