

GREEN ROOFS AND ITS SOCIO-CULTURE BENEFITS IN PENINSULAR MALAYSIA

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ABSTRACT

The contribution of green roofs to pressing environmental issues in urban areas is proven by much research to help mitigate problems like urban heat island effect, storm water runoff, thermal comfort, energy consumption, deterioration of air and water quality as well as loss of habitats. Green roofs also have a significant role to socio-cultural improvements of a place. The objective of this paper is to review the social and cultural benefits of green roofs that have become an increasingly popular architectural feature, particularly in Peninsular Malaysia. The methodology used is via literature and observations. Findings show that research into the behavioural sciences of green roofs is still lacking and further research in the context of Malaysia is pertinent.

Keywords: *green roofs, socio-cultural benefits, urban public space, urban living.*

INTRODUCTION

Nowadays, widespread concern over the depletion of non-renewable energy sources and global warming has provoked architects to be more sensitive in their approach towards designing buildings. One such attempt is by the integration of plants as part of a roof system which initially emerged during the advent of the green movement in the 1960's and has today becoming an increasingly popular feature for green buildings throughout the world.

Green roof or also known as roof garden, eco-roof, living roof or vegetated roof is defined as a roof or podium which is partially or completely covered with vegetation and soil or growing medium. [1]; [2]. It is a promising and viable solution to overcome environmental issues in the growing and populated urban area such as Kuala Lumpur where greenery has become scarce and are being gradually replaced by building and infrastructure footprints.

Being well-established in European countries especially in Germany and Switzerland, and gaining foothold in other countries like Australia, America, Japan, Hong Kong and Singapore, there has been much research undertaken to study about green roofs. By comparison, the study and acquisition of green roofs technology into current design and construction practice to the local context is still in its infancy stage. Malaysia has just launched its own green building rating this year i.e. Green Building Index whereas developed countries such as our neighbouring country Singapore has for the last couple of years started their way with a proper rating system, in which green roofs are one of its main rating criteria [3].

As it is relatively new in Malaysia, further studies are needed to study about green roofs, not simply on its environmental issues but also on its social and cultural aspects, especially looking at the impact it has towards a place. The reduction of public green

spaces due to development and rising cost of land in urban areas like in Kuala Lumpur could affect and deteriorate living quality [4]. Although today many commercial buildings have started to incorporate green roofs, the full potential of green roofs especially in housing projects (except for podium garden in medium/high cost condominium) has not been tapped.

Studies in Singapore shows that developers are in general often held back from incorporating green roofs in the design requirements mainly by concerns like high initial costs and structural loading capacity [5]. Further survey in Singapore shows that the general response from building professionals show a lack of technical know-how, lack of appreciation of the benefits and performance and the fear that green roof sending up as redundant and unused spaces [6]. Findings on residents' perception however indicate a positive response that there is a strong support of the provision of roof gardens [7].

It is the objective of this paper to review some of the benefits of green roof available to the society at large.

BACKGROUND

History

The concept of green roof went as far back as the hanging gardens of Babylon in 6th Century BC. These gardens were constructed by Nebuchandrezzar II during the rebuilding of Babylon to console his wife, Amytis, who missed her very green home land. He developed a series of terraces planted with trees, shrubs, vines and bushes that overhung the terrace edges [8], [9].

The green roof system today originated from the sod roofs of Iceland. The green movement started in the 1960's in Germany developed the modern versions of green roof technology before it become popular to other countries in Europe. The International Green Roof Association (IGRA) is a strong organization based in Germany that provides a platform for the worldwide promotion and dissemination of ecological green roof ideas and has a comprehensive resource for green roof information [10]. Similarly, the livingroofs.org, an independent resource from the UK also provides useful information for those who wish to design, install or promote green roofs. Their objectives are to highlight the benefits of green roofs as well as to study their pits-falls and problems [11].

In the United States, under the Leadership in Energy and Environmental Design (LEED) initiative [12], all of their buildings should include green roofs as a method of achieving a higher environmental rating which has now become an international benchmark.

In Asia, countries like Japan, Hong Kong and Singapore have strongly supported the movement of green roofs. Singapore for example, since 1990's has actively facilitated the usage of unused flat roofs as roof gardens. Its national planning authority (Urban Redevelopment Authority) has actively reviewed development control guidelines to exclude the space used for sky-bridges, sky terraces and communal open pavilions in roof gardens from overall gross floor area computations and relaxed development parameters to promote greater flexibility in the design of sky gardens [13].

Type

Basically, there are two main design options for green roofs. The first is to utilize it as a roof garden with a pleasant view for the owner and optionally to utilize it as an undisturbed habitat for flora and fauna within grey city centres. Both variations provide a

broad range of private and public benefits. Deciding on which utilization to focus is crucial and has to be considered as early as the planning stage. In addition, the maximum load bearing capacity, maintenance, plant selection, substrates and the expense budgeting must correspond with the desired green roofs type [10].

There are three types of green roofs. The following table can be used to summarize the characteristics of the three different forms of green roofs:

Table 1.0: Summary of differences between extensive, semi-intensive and intensive green roofs.

	Extensive	Semi-Intensive	Intensive
			
Maintenance	Low	Periodically	High
Irrigation	No	Periodically	Regularly
Plant communities	Moss-Sedum-Herbs & Grasses	Grass-Herbs & Shrubs	Lawn or Perennials, Shrubs & Trees
System build-up height	60 - 200 mm	120 - 250 mm	150 - 400 mm on underground garages > 1000 mm
Weight	60 - 150 kg/m ² 13 -30 lb/sqft	120 - 200 kg/m ² 25 - 40 lb/sqft	180 - 500 kg/m ² 35 - 100 lb/sqft
Costs	Low	Middle	High
Use	Ecological protection layer	Designed Green Roof	Park like garden

Source: *igra-world.com* (retrieved 10th April, 2009)

Extensive green roofs are basically well-suited to roofs with little load bearing capacity and sites which are not meant to be used as roof gardens. The costs are lower than semi-intensive or intensive green roofs. The mineral substrate layer, containing little nutrients, is not very deep but suitable for less demanding and low-growing plant communities [14]. This system is not designed for public use and mainly developed for aesthetic and ecological benefits [15]. It can also be incorporated on pitched roofs of up to 30 degrees [16].

Semi-intensive green roofs in terms of requirements fall in between extensive and intensive green roof systems. More maintenance, higher costs and more weight are the characteristics for the intermediate green roof type compared to that of the extensive green roof [14].

Intensive green roofs are developed to be accessible for public [15]. Hence, walkways, benches, playgrounds or even ponds can be established as features on the roof. There are no limitations in design and individuality, but considerations should be given on the system build-up, and the selected plant communities need to be harmonious with one another. In addition, the amount of maintenance of intensive green roofs is higher than on extensive green roofs and permanent irrigation and fertilization have to be ensured [14].

GREEN ROOF IN PENINSULAR MALAYSIA

In Malaysia, green roofs have been incorporated in projects like commercial buildings, hotel developments, government buildings, housing developments (middle/high end condominiums) and multi-storey car parks. Most of the green roofs are located on podiums with easy access to the public as shown below (Figure 1-8).



Figure 1: Marc Apartment, a typical high-end condominium with green roofs at its podium level. (Source: Author)



Figure 2 (above left): Avenue K, a mixed development project with green roof at its podium level fronting KLCC. (Source: Author)

Figure 3 (above right): Shangri-La Hotel in Putrajaya uses green roof and landscape terraces to camouflage the hotel with its surrounding hilltop landscape. (Source: <http://www.shangri-la.com/kualalumpur/putrajayashangrila/photos-videos/>)



Figure 4: Aeon Jusco Shopping Complex, Setiawangsa introduces green roof above its carpark podium. (Source: Author)



Figure 5 (above left): Econsave Shopping Complex in Cheras utilizes the whole roof top as a leisure park. (Source: Author)

Figure 6 (above right): Mid Valley mixed development complex incorporated green roof and potted plants on the podium above its multi-level car park. (Source: Author)



Figure 7: Faculty of Science Social, Universiti Kebangsaan Malaysia, Bangi, Selangor. (Source: Author)



Figure 8: Laman Padi Museum in Langkawi Island, Kedah is a multi-tiered green roof cultivated with paddy for ecotourism purposes. (Source: Author)

Although there are many precedents of green roof, academic research is far lagging behind compared to other countries. There is little research done on green roof. At Universiti Kebangsaan Malaysia, studies were conducted to study the environmental benefits of extensive green roof for storm water and heat reduction [17], [18]. Another study at the same plot was conducted showing results that soil thickness and vegetation play an important role in reducing the surface temperature of roof and could contribute to thermal reduction of building [19].

A research carried out at University Teknologi Malaysia studied on the economics of green roof, i.e. on the affordability of green roof system for middle-income households. However, the paper was tailored to middle-income households in Pakistan and not Malaysia. The system was designed using locally available materials and met the specific demands of middle-income residents including affordability and little maintenance [20]. A recent study in USM is currently studying potted plants on roof tops and measuring the effect of potted plants on flat roofs to the indoor thermal performance of buildings and CO₂ reduction in atmosphere [21].

RESEARCH ON SOCIAL-CULTURAL BENEFITS OF GREEN ROOF

Facilitate leisure, recreational and cultural activities

Green roofs provide additional space which would otherwise be left vacant, redundant or used for services etc. Figure 9 below is a typical view of terrace housing estates in Malaysia. There is a big potential of changing the current trend of harsh concrete tiles roofscape to a more sustainable and useable green roof which can be enjoyed by the residents as a private family area.

For general public use, the semi-intensive and intensive green roofs are the most effective as they are designed to be more accessible and can accommodate more facilities and shady trees. Peck [22] has studied that urban cities can be made more livable by providing significant amount of accessible outdoor recreation or amenity space. Furthermore, given high premium for areas at street levels in city areas, green roofs provide opportunities for a more secluded, less polluted and less noisy spaces for informal recreation [23].



Figure 9: A typical view of terrace housing and low-cost flats in Kuala Lumpur. Converting the concrete tile roofs to green roofs can be a possible solution to the social ills due to lack of private space in urban areas. (Source: Author)

Green roofs would provide enjoyment by having landscape define the space and provide urban residents the setting for outdoor recreational pursuits. This is very relevant for the less able-bodied people (elderly, handicapped and children) and those who cannot afford the time or the money to travel far who are dependent on near-home recreation spaces [24].

Improve community interactions

By having green roofs, the community of a housing area would have the opportunity to create communal gardens for various activities, thus improving participation of the residents. This would foster better interaction, create a feeling of co-ownership and security as green roofs are protected semi-public areas, away from ground.

Therapeutic and healing effects on health

Visual as well as physical contacts with plants have a direct health benefits which can generate restorative effects. This would reduce stress, provide better health to resist illness as well as improve recovery period for recuperating patients [25]. Studies by Johnston & Newton [23] also found that residents with balcony or terrace gardens are less susceptible to illness in a high-density environment. Further, the “white noise” of the wind rustling through leaves, fragrant of flowers and plants can trigger responses that are cognitive, and tend to be remembered more vividly [26] thus having a better healing effects on health.

Improve aesthetic appeal

Green roofs provide habitats for flora and fauna to grow. Having landscape on roof tops is pleasing to the eye and is an attraction to urbanites and provides visual contrast and relief to the highly-built up city environment [24]. Green roofs also hide ugly rooftop services which sore the view, especially for residents and workers in high rise developments which often look down on a large expanse of asphalt, tiles, and chillers of the flat roofs [23].

Cultivation of vegetables and food

Laman Padi in Langkawi (Figure 7) is an example of the possibility of cultivating paddy as proposed by Datuk Seri Sanusi Junid, the former Chief Minister of Kedah. Although the proposal is not carried out widely, yet the idea is viable. This was studied by Graneme [27] which showed that an agricultural firm (Annex Organics) that managed to produce saleable tomatoes using innovative semi-hydroponics system on a roof garden in Toronto. Even Changi Hospital has harvested several crops of leafy greens and fruits, including 150kg of cherry tomatoes from hydroponics planters on its roof top [28].

Other benefits

Economy-wise, provision of green roofs would give a higher value to the property. It is a social benefit to the community and an added value especially to units that are fronting the green roofs. Studies in America and UK show that good tree cover increases property value by 6-15% [22].

CONCLUSION

Green roofs have been shown to be able to mitigate not just the environmental issues but also on the socio-culture of a place. The study finds that research into the behavioural sciences of green roof is still inadequate and further studies into the qualitative aspect of green roofs and how it is able to improve society's quality of living in the context of Malaysia is pertinent. Further studies should be carried out to evaluate on this issue.

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