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Perceptions and contributions of households towards sustainable urban green infrastructure in Malaysia

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ABSTRACT

Household perception of urban greenery is a vehicle for understanding socio-ecological dimensions of grassroots urban sustainability. It also helps in advancing public participation in urban green infrastructure initiatives. The present study measures public perception of urban households using questionnaire survey and observations of how people maintain plants in and around their homes and neighbourhoods in parts of Johor Bahru, Malaysia. The selection of the participating households reflects on Malaysia's racial composition of which about 60% is Malay, 30% Chinese, and 10% Indians respectively. The study compares gender, age, and job status of the respondents against 14 variables to determine perceptions on socio-ecological aspects of plant keeping practices. The Rasch model's Wright map and differential item functioning (DIF) were used to analyse the respondents' perceptions. The findings revealed that on average, households with the least number of plants keep 1-9 species, while those with the highest number keep over 30 plant species. In respect of ecosystem services, the three racial groups maintain plants for aesthetics, culinary, socio-cultural and spiritual purposes. Finally, the study underscores the need for urban planning authorities and urban landscape managers to encourage and engage households as part of strategies for streamlining and mainstreaming urban resilience and transformation to urban sustainability.

1. Introduction

The term green infrastructure originates from *Towards a Sustainable America*, the 1999 report of *President's Council on Sustainable Development* (Benedict & McMahon, 2002; Mell, 2008). The report views green infrastructure as a strategic tool for achieving sustainable community development. Green infrastructure is essentially a term that covers open spaces, parks, private gardens, scrublands, drainage, waterways, street trees, and vertical greenery (Ahern, 2007; Mell, Henneberry, Hehl-Lange, & Keskin, 2013; Schäffler & Swilling, 2013; Wong, Tan, Tan, Sia, & Wong, 2010). In recent times, the concept of green infrastructure has grown into an attractive urban sustainability research and policy theme. For instance, the proposed indicators and targets of the UN Sustainable Development Goals (SDGs) have recognised the role of spatial configuration in achieving urban sustainability, and the main focus is on urban biodiversity composition, accessibility to green spaces and improved urban living (UN Development Solutions Network, 2014; UN Habitat, 2013). Some studies reveal that green spaces close to residential areas contribute significantly in reducing stress and enhancing human health (Thompson et al., 2012). Unfortunately, almost in every country proximity to green spaces is a matter of luck. At the same time, rapid urbanisation in many parts of the world is pressurising green and open spaces. Hence, residential gardens may be one of the alternative urban greenery options with immense social and ecological utilities.

It is important for urban planners, urban designers, urban geographers, and policymakers to recognise the potentials of households in supporting grassroots development of green infrastructure in urban areas. According to Barthel and Isendahl (2013), households as basic units of society helped the ancient Maya and Byzantine civilisations to boost urban resilience and food security through urban gardens. Considering the nature of the prevailing social and ecological challenges of the new urban age, contemporary households should play even a greater role through home gardening. It is not surprising that some researchers stress the need for sustainability researchers to focus on identifying the lifestyles of households (Liu, 2010). In respect of green infrastructure, COST – the European Cooperation in Science and Technology (2012)

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cautions that the popularity of green infrastructure should not be at the detriment of its social benefits.

According to Villamor, Palomo, Santiago, Oteros-Rozas, and Hill (2014), incorporating public perceptions, values, and preferences is fundamental to achieving desired goals and targets of sustainability. The role of perception in green infrastructure is increasingly becoming important in science and policy discourse. For instance, the Green Health report (2014), a study commissioned by the Scottish Government used household surveys to establish and underscore the importance of perceptions, behaviours and preferences at all levels to determine better or worse health and well-being of communities. In Malaysia, some researchers argue that some major cities like Kuala Lumpur are lacking in green infrastructure network; interestingly, they consider informal home gardens as part of Malaysia's green infrastructure (Mansor, Said, & Mohamad, 2010). The present study sets to investigate household perceptions and their roles in maintaining plants as part of green infrastructure in urban Malaysia. Household plant keeping even as a voluntary and leisure activity has significant social and ecological significance that cannot be simply ignored. Therefore, it is important to understand how Malaysian urban households raise plants, what types of plants, their uses, and management strategies. The insights drawn from this study will be useful for many researchers, policymakers, urban sustainability practitioners, urban planners, green infrastructure managers and sustainable development stakeholders in Malaysia and other parts of Southeast Asia and the fast urbanising wet tropical regions.

2. Conceptual framework

Urban green infrastructure is not only about green areas but entails recognising their socio-ecological multiple functions. The experiences of many cities relay many examples of practical and theoretical dimensions of urban green development and management. For instance, one of the renowned classical ideas for urban greening is the theory of 'garden city' which originated from the 19th century work of Ebenezer Howard namely *To-morrow: a Peaceful Path to Real Reform*. Howard hypothesized that a garden city was a utopian-like city that could result in perfect balance between humans and the nature mainly through efforts made by individuals (Howard with Hall et al., 2003). The time-honoured garden city theory has greatly influenced cities like London to maintain food security during 20th century war times through productive home gardens and neighbourhood plants. Besides food provisioning, private gardens contribute significantly in improving microclimate, aesthetics, flood control, and air quality in urban areas (Cameron et al., 2012; Vandermeulen, Verspecht, Vermeire, Huylenbroeck, & Gellynck, 2011).

Numerous studies have investigated the social and ecological merits of domestic gardening such as health, food security, medicinal and energy resources for the poor (Cameron et al., 2012; Kaoma & Shackleton, 2014; Thomson et al., 2012); while only a few studies critically investigated household perceptions on green infrastructure (Green Health, 2014; Wong et al., 2010). Against this backdrop, the present study seeks to underscore the importance of public perception in understanding green infrastructure from socio-ecological viewpoint. Recently, there is surge in interest in exploring the socio-ecological contributions of home gardens to sustainability in areas undergoing rapid urbanisation (Barau, Ludin, & Said, 2013; Clarke, Li, Jenerette, & Yu, 2014; Kaoma & Shackleton, 2014). However, only few of these studies explore how households perceive home gardening and this is crucial to understanding why households maintain garden within their personal spaces and vicinities. To achieve a proper understanding of the socio-ecological dimension of perceptions in urban greening, this study's conceptual framework shown in Fig. 1 guides the researcher to link household perception and green infrastructure development. The socio-ecological approach is important in this context because it involves informal and voluntary actions and local knowledge on ecosystem services that support urban resilience (Barthel, Folke, & Colding, 2010) and belief systems (Barau et al., 2013).

Basically, there are four categories of ecosystem services (provisioning, regulating, supporting and cultural). Following some studies on ecosystem services relating to home gardens and urban greens (Barau et al., 2013; Barthel et al., 2010; Kaoma & Shackleton, 2014; Thomson et al., 2012), examples of provisioning services include food, raw materials and water; while regulating services include reducing extreme events, controlling erosion and microclimate. On the other hand, a good example of supporting services is providing habitat to species; while cultural services include health and mental services, recreation, inspiration, spiritual experiences etc. Hence, ecosystem services are the driving forces of social and ecological dimensions of urban sustainability.

3. Urbanisation, housing, and green infrastructure development in Malaysia

It is important to link urbanisation, housing, and green infrastructure development in Malaysia. Formal green infrastructure development policy and strategy is quite recent in Malaysia. For instance, the Second National Physical Plan (NPP-2) makes it mandatory for every housing project to set aside 10% of the development area for public open space (Federal Town and Country Department, 2011). Another major breakthrough is made in 2013 through promulgation of the National Landscape Policy (NLP) by the Malaysian Government (Ministry of Housing and Local Government, 2013). The NLP hopes to preserve biodiversity and visual appeal of Malaysian landscapes through involvement of stakeholders. Households should be directly involved in realising the objectives of the NLP. At the same time, it is important to link this new agenda to the challenge of rapid urbanisation in the country. Some studies suggest that the pattern of Malaysian urbanisation is highly dynamic in space and time particularly in the peninsula states (Jamaliah, 2004; Masron, Yaakob, Ayob, & Mokhtar, 2012). For instance, Penang, Selangor, Melaka and Johor grew at 88–63% between 1950s and 2000, while Kelantan registered about 33% in its urban growth trend.

In Malaysian context, urbanisation is linked to housing development which has grown overwhelmingly since the 1980s. According to Tan (2008), the success of housing industry has created the problem of oversupply. In other words, large-scale housing development has increased the rate of land conversion in the country. Since this is creating some ecological crises, Malaysia has introduced the Green Building Index (GBI), which aims at strengthening the existing measures for sustainability, and address challenges arising from the rapidly growing housing development sector (Yiing, Yaacob, & Hussein, 2013).

The GBI is not yet compulsory; nevertheless, it reflects on some of the global best practices on green building (Zuo & Zhao, 2014). Malaysia's GBI could be attractive to new developers and clients interested in retrofitting their structures. However, it is very important to consider potentials of individual homes in supporting urban green infrastructure. This paper assumes that, at present, Green Building Index and similar formal concepts and tools are mostly promoted in the circles of building, architecture, urban planning professionals, corporate businesses and policymakers. Therefore, it is very important to recognise that individual households can also contribute greatly in advancing urban green infrastructure in many ways unnoticed by planning authorities and professionals.