



Original article

Preference for site conservation in relation to on-site biodiversity and perceived site attributes: An on-site survey of unmanaged urban greenery in a tropical city



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ABSTRACT

Singapore is a densely-populated tropical city with a heavy investment in managed greenery and intensive landscape maintenance practices. Unmanaged greenery such as unprotected young secondary forests continues to be lost in the face of continuous development despite its socio-ecological values. In this study, we assessed perceptions of 11 patches of unmanaged forested areas using an on-site questionnaire. The questionnaire covered site attributes pertaining to ecosystem services and disservices, as well as sensory experience, maintenance, and biodiversity, and recorded preference for retaining diverse forest patches in residential areas as opposed to replacing them with manicured greenery. To explore the association of on-site biodiversity with preference for site conservation, we surveyed flora and fauna at all 11 sites. We analysed the inter-relationship between perceived site attributes using Principal Component Analysis (PCA). The resulting factors, plus recorded site-level biodiversity, were then used as predictor variables in a confounder-adjusted binomial regression for preference for site conservation. The results highlight the joint importance of biodiversity, environmental function, and aesthetics in a stated preference for conservation of unmanaged urban greenery. We conclude with a discussion of design and management strategies aimed at balancing these site attributes and encouraging acceptance of unmanaged landscape in the tropical context.

1. Introduction

Urbanization has caused the removal and extensive deterioration of urban forests in cities, even though an extensive body of literature notes their value. These include ecological, economic, socio-cultural, health, and environmental benefits (Jim and Chen, 2009; Konijnendijk, 2000; Roy et al., 2012; McDonnell and Kendal, 2015). Although the provision of urban ecosystem services is central to decision making in urban planning and policy processes (Gómez-Baggethun et al., 2013), and unmanaged urban secondary forests, are able to provide those services, they are often subject to competing interests between intensification of land development and environmental sustainability (Krajter Ostoić et al., 2015; Kowarik and Körner, 2005). Moreover, the factors that drive public support for conservation of urban forests are often overlooked.

Many studies in the past four decades have addressed people's preferences for nature (Kaplan et al., 1972; Ulrich, 1981; Kaplan and Kaplan, 1980; Berg et al., 2007; Han, 2010), with recent perception studies of urban forests citing a range of factors guiding preferences, from the size of greenery (Rink and Emmrich, 2005), to psychological

restoration (Hartig et al., 2006), health (Karjalainen et al., 2010), microclimate amelioration (Chen and Nakama, 2015), plant diversity (Mathey et al., 2016; Huang, 2014; Fuller et al., 2007; Laforteza et al., 2008), quality of management (Ostoić et al., 2017), recreational value (Tyrväinen, 2001), landscape beauty (Huang, 2014), and economic benefits (Huang, 2014). On the other hand, urban forests are politically neglected (Gudurić et al., 2011), and detractors point to the misbehaviour of users (Ostoić et al., 2017), poor quality of maintenance (Verlič et al., 2015), or safety issues such as fear of crime (Jorgensen et al., 2005; Sreetheran and Van Den Bosch, 2014).

In contrast, relatively few empirical studies about what drives people to conserve urban forests have been conducted. Such studies are even scarcer in the context of an Asian tropical city. To begin to address this deficit, this study used Singapore as a case study. Situated at the southern tip of the Malaysian peninsula (103°50'E, 1°20'N), Singapore is a tropical city-state with a total landmass of 719.1 km². Over recent decades, large tracts of secondary rainforest have been removed with rapid urbanization and intensification (O'dempsey, 2014) and, as a result, natural terrestrial habitats have been subject to a "catastrophic rate of extinction" (Brook et al., 2003). Singapore's widely-employed

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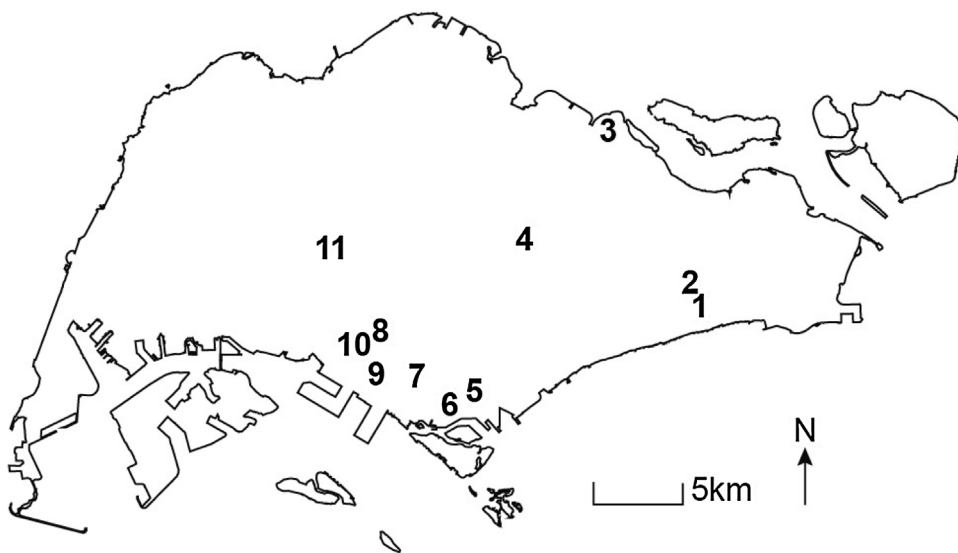


Fig. 1. Eleven sites are indicated in the map with site photos; the outermost North, East, South, and West sites are located respectively in Punggol, Bedok, Bukit Merah, and Bukit Batok planning areas.



Table rasa approach to development – combined with government-led strategic investment in heavily-managed and manicured greening (Neo et al., 2012) – continues to lead to the rapid transition of Singapore’s remaining unmanaged green spaces into curated gardens and lawns (Yee et al., 2011; Auger, 2013).

Singapore provides an excellent case study for urban ecosystem services (Friess, 2016), and cultural ecosystem services such as recreation are of increasing importance in the country’s nature areas (Thiagarajah et al., 2015). Secondary forests that grew on abandoned agricultural land since the 1960s are typically dominated by exotic

species (Yee et al., 2016a), and are often overlooked in assessments of ecosystem services. However, several leading ecologists and environmentalists have highlighted the biodiversity conservation value of secondary forests in Singapore (Breugel et al., 2013; Tan et al., 2016b; NSS, 2011; Yee et al., 2016b; Koh and Sodhi, 2004). There has also been a steady growth in public concern, with petitions to protect secondary forests as socio-cultural assets (Tan et al., 2016b). The quantification of ecosystem services provided by greenery in a tropical context – such as the reduction of the urban heat island effect (Wong and Yu, 2005) and the amelioration of outdoor thermal comfort (Yang et al., 2013) –

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