Public Perceptions of Nature and Landscape Preference in Singapore

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Abstract Widespread urbanization has led to urban areas becoming increasingly seen as sites for biodiversity conservation. Urban and landscape planners are required to concurrently tackle environmental and social issues, such as facilitating public acceptance towards naturalistic habitats and its associated biodiversity in urban areas. The research presented here quantifies public perception of nature in relation to landscape choices in Singapore, a highly urbanized city in which sustainable landscape planning movements have recently begun to take root. Results indicate that landscape preference tended towards manicured landscapes despite an overall tendency towards nature conservation, which is best achieved in naturalistic habitats. Reasons driving landscape choice were found to be aesthetic, with a focus on visual hues present in a landscape. Specific education in ecology/conservation as well as increased opportunities to experience first-hand natural areas abroad were factors that may influence landscape choice to encompass more naturalistic habitats.

Keywords Urban green space · Nature perception ·
Landscape preference · Tropical biodiversity · Singapore

Introduction

In the face of widespread urbanization and its related impacts on the natural environment, urban areas are increasingly seen as sites for biodiversity conservation, resulting in the rise of landscape planning movements that have actively incorporated ecological concepts over the last 40 years (Rosenzweig 2003; Kühn *et al.* 2004; Dearborn and Kark 2010). Pioneered

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in Europe and the United States, these movements are often referred to as "bringing nature back" into the built environment (McHarg 1992; Forbes *et al.* 1997).

In Singapore, a highly urbanized island country with few remaining natural areas, urban biodiversity conservation is a pressing issue. What remains of Singapore's primary vegetation is confined to 0.16 % (Yee 2010) of a total land area of 714.3 km^2 (DOS 2012). Despite a post-independence greening movement that resulted in 47 % of the country being classified as green areas, 60 % of land area consists of a combination of urban areas and manicured landscapes (Tan 2009; Yee 2010) that have irreversibly replaced native habitats. This widespread clearance of native habitats has been cited as the main factor driving the extinction of native species (Sodhi *et al.* 2004). Urban biodiversity conservation thus presents a viable solution to maintaining a balance between the conservation of threatened species and further urbanization.

Over the last decade, with the advent of an increasingly proactive and ecologically-aware general public urban biodiversity conservation in Singapore has become a more participatory movement (Soh and Yuen 2005). Though this presents new opportunities, planners have to tackle the issue of how to increase biodiversity conservation in urban areas in a socially acceptable manner, an issue closely tied to public perceptions and hence, acceptance of nature and landscape types within urban settings (Saito 2007).

Public Perception of Nature in Relation to Landscape Preference and Biodiversity Conservation in Urban Landscapes

Broad public acceptance has been recognized as essential for continued policy success. The expansion of avenues opened to the general public in Singapore for participation in the country's decision-making process serve to highlight the

increasing relevance of public opinion in issues of governance (Noh and Tumin 2008). In this context public perceptions of nature and landscape preferences function as predictive factors in determining the extent to which urban green spaces are made more ecological or natural (Fischer and Young 2007; Saito 2007).

A number of studies in the field of environmental psychology have identified six dimensions in relation to how nature is perceived and link an individual's perceptions of nature to the degree of responsibility he/she feels towards conservation (e.g., Schultz 2000; Clayton 2003; Frantz *et al.* 2005; Fischer and Young 2007; Schroeder 2007; Bruni and Schultz 2010). Furthermore, these dimensions are recognized to be collapsible into two higher order factors: nature preservation and utilization (Milfont and Duckitt 2004; Fischer and Young 2007; Schultz 2000) (Fig. 1). Researchers have also concluded that higher scores for nature preservation and should generally translate into a greater commitment to conserve nature (Wiseman and Bogner 2003; Milfont and Duckitt 2004; Milfont and Gouveia 2006).

While exhibiting the intention to preserve nature bodes well for biodiversity conservation strategies, the extent to which intention may be translated to action is often unpredictable (Corral-Verdugo and Armendáriz 2000; Van Vugt and Samuelson 1999). To date, there has been limited study on how conservation intent translates into management strategies, such as landscape choices in urban areas (Fischer and Young 2007; van der Windt *et al.* 2007). Research conducted by Zagorski *et al.* (2004), Caula *et al.* (2009) and van der Windt *et al.* (2007) has demonstrated that occupational/pre-existing nature preservation tendencies result in a preference for naturalistic landscapes. Caula *et al.* (2009) focused on how information on bird biodiversity conservation potential of urban green spaces in Montpellier (France) affected preference. Results showed that provision of bird diversity information effected a significant increase in preference for green spaces with higher avian conservation potential among respondents (the majority of the surveyed population) who already had prior preference for naturalistic green spaces over ornamental areas.

van der Windt *et al.* (2007) studied nature and landscape preference among 35 people from three occupational groups in the Netherlands, asking respondents to rank landscape preference from descriptions of four landscapes with varying degrees of human interference. Findings revealed that respondents held different views on nature, reflected in landscape preference, depending on their occupation, with conservationists and officials preferring naturalistic landscapes. These results are similar to Zagorski *et al.*'s (2004) study, which found that gardeners who appreciated conservation tended to prefer native, naturalistic-looking gardens.

However, studies focusing on landscape preference as an independent factor suggest that in addition to a preference for nature preservation scenic aesthetics could function as a decisive factor affecting how the degree of naturalness in a landscape is perceived (Gobster 1999; Özgüner and Kendle 2006). In this context, it is interesting to note that naturalistic landscape types selected by people with a pro-nature preservation preference would likely not be preferred by individuals selecting on the basis of scenic aesthetics (Parsons and Daniel 2002).

Previous studies in this area have focused on landscape perception of the general public in temperate or sub-tropical cities (Herzog 1989; Jim and Chen 2006; Özgüner and Kendle 2006; Bonnes *et al.* 2011). Their results point to a neutral preference with regards to naturalistic landscapes and manicured/aesthetic landscapes, possibly because these two landscape types do not differ drastically in appearance in temperate and subtropical environments (Özgüner and Kendle 2006).

In light of these studies, results reported by Caula *et al.* (2009), though not explicitly connected with landscape aesthetics, differ in the sense that 72 % of the people surveyed in Montpellier (France) were found to prefer natural over manicured green spaces. However, this difference could be explained through closer examination of the picture choices used in the study. Natural landscapes were represented by a native-tree park with leisure spaces while ornamental landscapes were represented by a public square with decorative plants. Thus, functionally both areas were not drastically different, though the naturalistic area benefitted avifauna conservation more than the ornamental area. The presence of prominent built areas in the ornamental landscape representation could have lead respondents to classify landscape choices
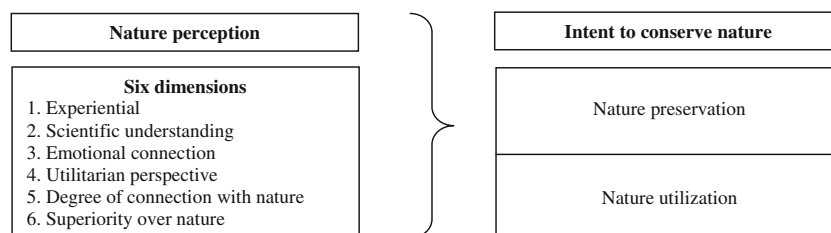
Fig. 1 Six dimensions used to measure nature perception and the two higher order factors, measuring biodiversity conservation intent, within which scores for the six nature perception dimensions can fall under (Adapted from Milfont and Duckitt 2004; 2010; Fischer and Young 2007; Schultz 2000)

presented as "urban" versus "natural" rather than "naturalistic" versus "ornamental," possibly causing it to be less favoured as compared to landscapes with lesser apparent human influence (Herzog 1989).

Landscapes with natural and manicured characteristics in temperate or subtropical regions were also found to have components such as tidiness and a level of comfort that were rated positive (Özgüner and Kendle 2006), thus making it possible for urban dwellers in these cities to maintain an aesthetic landscape preference while providing planners more social freedom to naturalize city spaces.

Problems with an Aesthetic Landscape Preference for Biodiversity Conservation in Singapore

The social flexibility present in temperate or sub-tropical cities could shed light on the driving forces that have shaped the field of landscape planning for urban biodiversity conservation. Spearheaded by the USA and Europe, studies in urban biodiversity conservation have mainly focussed on testing techniques for increasing biodiversity in cities on the assumption that conservation techniques would likely be socially acceptable (e.g. Caro et al. 1994; Forman 1995; Cornelis and Hermy 2004; Alvey 2006; Naidu 2011).

However, we argue that urban biodiversity conservation techniques may not be as feasible to implement in tropical cities such as Singapore due mainly to the significant difference in appearance and biodiversity harboured in tropical natural landscapes in comparison with temperate and subtropical regions. Therefore, when addressing public perceptions of nature and preferences regarding biodiversity conservation in urban areas it is necessary to consider the scenic aesthetic of the local natural landscape.

We aim to quantify public perceptions of nature in Singapore and elucidate if preferences for urban areas are consistent with landscape preferences. Despite a recent heightened public interest in environmental concerns in Singapore (Briffet 1991; Choo 2011), a large majority of the general public have been brought up in the post-independence period where 99 % of the country's natural habitats have been cleared for urbanization and manicured landscape creation (Corlett 1997; Tan 2009). Experiences that could have shaped perceptions of nature could have resulted mainly from interactions with manicured landscapes created ultimately for aesthetics and human enjoyment. It is unclear if the recent increase in environmental-awareness may be translated into interest in nature preservation and if this interest may be subsequently reflected in landscape preference, especially taking into consideration the vast difference in aesthetic appearance of landscape types within tropical cities. Therefore, we employ the hypothesis that the general public in Singapore, despite preferring to preserve nature due to a heightened awareness of the need for biodiversity conservation, maintain a contrary preference for aesthetic landscapes.

In addition, we aim to determine specific predicating factors that affect perceptions of nature and landscape preference among the general public of Singapore, which comprise demographic information pertaining to the 1) age, 2) sex, 3) occupation, 4) experience of living abroad for more than 2 years, 5) studying ecology/conservation-related courses, and 6) frequency of exposure to nature-related activities. Factors 4 and 6 were included as possible indicators of respondents' degree of exposure to non built-up areas (with regards to factor 4, this would apply to countries that have easily accessible non-urbanized areas), which could in turn affect how respondents perceive nature and their landscape preference (Burgess et al. 1988; Henwood and Pidgeon 2001). Factor 5 (respondents' experience in taking conservation or ecology-related classes) has been shown to positively affect how nature is perceived and possibly increase pro-conservation tendencies (Caro et al. 1994).

This study provides data that aid in the conception of socially-acceptable green spaces in Singapore as public perception of nature has been recognized as important in determining the long-term acceptability of green-space policies (Leong 2000). It also provides fundamental information for planning more ecologically sustainable and socially acceptable nature-urbanization and public education projects (Beer 1991; Chua et al. 2008).

Methodology

Public perception of nature in relation to landscape preference was quantified through the administration of a questionnaire with 44 compulsory questions and one optional feedback question. The questionnaire was divided into three sections.

The first section consisted of seven questions profiling respondents' demographic information according to the six factors listed above. Questionnaires were distributed only to Singaporeans and permanent residents as these two groups have potentially more leverage (as compared to foreign residents) in making decisions with regards to nature and landscape policies in Singapore (Soh and Yuen 2005; Choo 2011). Thus, nationality was not used as an independent factor in the questionnaire analysis.

The second section consists of two questions which targeted respondents' landscape preference through the use of pictorial aids (Fig. 2). Respondents were asked to select any number of landscapes from four picture choices that fall into their definition of "nature" and which they would prefer to be featured more prominently in Singapore's landscape in the future. The landscape examples chosed were easily recognizable to the public yet representative of varying degrees of

Fig. 2 Pictorial landscape choices presented in the survey: **A**) primary vegetation; **B**) secondary vegetation; **C**) manicured landscape; **D**) urban areas

human interference (with primary vegetation having the least and urban areas the most).

The third section consists of 35 Likert Scale (1 to 5) questions that measure tendency to either preserve or utilize nature using six separate preservation categories (Table 1).

Questions were designed after an analysis of available questions from previous studies on environmental attitudes (Caro *et al.* 1994; Chua *et al.* 2008; Milfont and Duckitt 2010). The six categories contain questions that measure respondents' perception towards nature and its biotic components in an indirect manner. The categories also quantify multi-faceted responses to nature and are designed to explain perceptions of nature based on the end-effect of

respondents behavioral responses (Yin 1999; Schultz *et al.* 2004).

Questionnaire Distribution

Questionnaires were hand delivered to 300 randomly selected households throughout Singapore from 2 to 9 March 2012. The map of the mainland of Singapore was divided into 46 equal sized grids and 10 girds were selected with the aid of a random number table. Questionnaires were placed into mailboxes of 30 random residential units in each grid. A return postage-paid envelope was included in each survey package and participants were asked to mail the completed surveys

Table 1 Six categories of questions used in the survey to quantify public perception towards either preservation or utilization of nature

Perception measured	Category	Dimension	Definition
Preservation	P1 (Enjoyment of nature)	Experiential	Perception that time spent in non-built up and natural areas is more enjoyable/pleasant than time spent in the former areas.
	P2 (Pro-conservation behaviour)	Scientific	Perception that concrete steps should be taken to ensure biodiversity conservation.
	P3 (Ecocentric concern)	Emotional	Perception that loss of nature or biodiversity would also result in emotional loss or regret.
Utilization	U1 (Conservation motivated by anthropogenic concern)	Utilitarian	Perception that nature should be conserved insofar as conservation has human benefits.
	U2 (Humanistic perception)	Connectedness with nature	Perception that nature exists primarily for human use instead of humans having equal rights with the rest of nature.
	U3 (Advocating human control over nature)	Superiority over nature	Perception that humans have the right to modify the natural environment to suit human comfort and needs.

back by 28 March 2012. Data obtained from the questionnaires were analyzed with the aid of the IBM Statistical Package for Social Sciences (SPSS V19).

Interviews

Open-ended interview sessions were conducted with five academics in the field of biodiversity conservation and landscape planning in Singapore (12 August-2 September 2011) and a private eco-landscaping practitioner (21 March 2012) in order to complement questionnaire analysis. Informal interviews were also conducted with three survey respondents who were present at their mailboxes when the questionnaire was delivered. Respondents completed the questionnaire in the presence of the researcher and upon completion, were asked for the reason(s) behind their landscape preference choice.

Statistical Analysis

The independent sample t-test was carried out at a significance level of $\alpha=0.05$ to determine significant differences between landscape types selected in the surveys. Selection of any number of landscape categories in this survey had a maximum selection combination of 16 different selection categories. Selections for each landscape category were analyzed to determine if they differed significantly from a non-weighted category mean occurrence probability of 0.625, under the assumption that each combination of landscape types was equally likely to be selected. The difference in the mean value between each perception category in Section C of the questionnaire were analyzed using a two-way ANOVA at a significance level of $\alpha=0.05$ with a Least Significance Difference (LSD) posthoc test.

Landscape choices presented in the survey were analyzed as a dependent variable and tested against the six independent variables using the Pearson's chi-squared test. Post-hoc testing was done by comparing the size of the standardized residuals to a critical value of +/− 1.96. This test was used to determine which dependent variables had a significant effect on landscape choices.

Scores for questions in the third section of the questionnaire which were grouped into six perception categories (Table 1) were averaged by scale and analyzed as dependent variables against each independent variable using stepwise linear regression (General Linear Model). Due to the analysis having six independent variables, the Bonferroni's correction was used and results of both the Pearson's chi-squared test with post-hoc and the stepwise linear regression were only considered significant at $\alpha=0.0083$.

Prior to analysis, independent variables were checked for collinearity through checking the Variance Inflation Factor (VIF) of each independent variable against the others. In this study, each independent variable had a VIF score of less than

10 and were therefore analysed independently (O'Brien 2007) to determine which factors could be predictor factors for nature perception (stepwise linear regression) and landscape choice (Pearson's chi-squared test) among survey respondents.

Results and Discussion

Questionnaire Results

Survey response rate was 30 % (90/300 questionnaires returned). However, only questionnaires from Singaporeans and permanent residents were considered in this study, resulting in two questionnaires from foreign residents having to be omitted. Of the 88 remaining questionnaires, 52.27 % were male respondents and 47.73 % female respondents. Singaporean nationals made up 87.5 % of the sample, the remainder being permanent residents. A majority of the respondents (43.18 %) were working adults aged either 31–40 (26.14 %) or 51–65 (25 %).

Nature Perception Scores

Results obtained from the questionnaire showed that although there is an overall preference towards preservation of nature, landscape preferences tended towards manicured landscapes rather than more naturalistic landscapes that would better serve the purpose of biodiversity conservation. Interviews with survey respondents and professionals in the field of biodiversity conservation and landscape design further revealed that scenic aesthetic landscape preference could be the main driver behind landscape choice.

The general public in Singapore had a significantly higher score for preservation of nature (3.89±0.07) as compared to utilization (3.09±0.14) (ANOVA, $df_1=2$ $df_2=3060$, $p<0.001$). Scores for all three categories measuring tendency to preserve nature were found to be significantly higher than all categories measuring tendency to utilize nature (Table 2).

The overall tendency to preserve rather than utilize nature is consistent with the trend of increasing awareness of ecological issues in a more informed populace (Briffet 1991; Choo 2011). Since the beginning of the 21st century, the general public has been increasingly vocal about development projects involving matters concerning nature, even halting government development plans on a natural area (Chek Jawa Cape) in 2001 (Sivasothi 2002).

Studies linking nature perception and the degree of connectedness humans feel with nature point to the general trend that the more people see themselves as part of nature, the more they support its preservation (see Schultz 2000; Clayton 2003; Frantz *et al.* 2005; Fischer and Young 2007; Schroeder 2007;

Table 2 Scores for each of the 6 categories quantifying attitudes for preservation and utilization of biodiversity

Perception category		Mean difference (I − J)	2 way ANOVA p value	95 % Confidence interval	
(I)	(J)			Lower bound	Upper bound
P1 Mean±SE = 3.89±0.01	P2	- 0.030	0.619	- 0.15	0.09
	P3	0.03	0.597	- 0.09	0.15
	U1	0.31	< 0.001	0.19	0.43
	U2	1.11	< 0.001	0.99	1.24
	U3	1.01	< 0.001	0.89	1.13
P2 Mean±SE = 3.92±0.00	P1	0.03	0.619	-0.09	0.15
	P3	0.06	0.305	-0.06	0.18
	U1	0.34	< 0.001	0.22	0.46
	U2	1.15	< 0.001	1.02	1.27
	U3	1.04	< 0.001	0.92	1.16
P3 Mean±SE = 3.86±0.00	P1	-0.03	0.597	-0.015	0.09
	P2	-0.06	0.305	-0.018	0.06
	U1	0.28	< 0.001	0.16	0.40
	U2	1.08	< 0.001	0.96	1.21
	U3	0.98	< 0.001	0.86	1.10
U1 Mean±SE = 3.58±0.00	P1	-0.31	< 0.001	-0.43	-0.19
	P2	-0.34	< 0.001	-0.46	-0.22
	P3	-0.28	< 0.001	-0.40	-0.16
	U2	0.80	< 0.001	0.68	0.93
	U3	070	< 0.001	0.58	0.82
U2 Mean±SE = 2.75±0.00	P1	-1.11	< 0.001	-1.24	-0.99
	P2	-1.15	< 0.001	-1.27	-1.02
	P3	-1.08	< 0.001	-1.21	-0.96
	U1	-0.80	< 0.001	-0.93	-0.68
	U3	-0.10	< 0.001	-0.23	0.02
U3 Mean±SE = 2.88±0.00	P1	-1.01	< 0.001	-1.13	-0.89
	P2	-1.03	< 0.001	-1.16	-0.92
	P3	-0.98	< 0.001	-1.10	-0.86
	U1	-0.70	< 0.001	-0.82	-0.58
	U2	0.10	< 0.001	-0.02	0.23

Bruni and Schultz 2010). This trend is also evident from our questionnaire results where the majority of respondents showed a significantly higher overall tendency to preserve nature while exhibiting lowest scores for the category in testing for the degree of disconnection with nature (Table 2, measurement category U2: Humanistic perception).

Results obtained also show that there were no significant differences in scores for all three nature preservation categories (Table 2), possibly indicating that the tendency for nature preservation could be equally motivated by an individual's intellectual understanding of, emotional attachment to, and enjoyment of the environment in what they term natural areas. Analysis of landscapes that respondents believe should be included in the term "nature" revealed that most of respondents (47 %) viewed manicured landscapes as much a part of nature as primary and secondary vegetation (Table 3).

This selection is interesting, especially in light of questionnaire results showing that respondents viewed themselves as being connected with nature (evident from the category U2: Humanistic perception, having significantly lower scores than all other categories measuring nature perception, Table 2), leading us to expect that urban environments would be included as being part of the definition of nature.

However, having urban environments excluded by the majority of the questionnaire respondents could point to the possibility of humans, but not anthropogenic products, as being part of nature. When analysed in terms of individual landscapes, primary vegetation was the landscape most frequently cited in respondents' definition of nature, followed by secondary vegetation, manicured landscapes and urban areas. Thus, a large majority (77 %) of survey respondents recognize "nature" as landscapes with at most, intermediate - high levels of human disturbance (Blair 1999). Results suggest that respondents believe that humans are part of nature at a conceptual level, but this belief did not extend to the visual grouping of pictures with high levels of human impact and minimal greenery in the same category as pictures that clearly show more biotic components.

Landscape Preference Scores

In order to investigate if nature perception was consistent with landscape choice, questionnaire respondents were asked to select any combination of landscapes from four pictorial choices as landscapes which should be featured more prominently in Singapore's landscape in the future. Despite a high preservation score, and ranking manicured landscapes with primary and secondary vegetation in the same category, respondents selected manicured landscapes as the single preferred landscape type. Naturalistic landscapes were ranked alongside manicured landscapes in the second and third highest scored category (Table 4).

Table 3 Landscape categories which respondents believe should be included in the term "nature"

Landscape categories	Percentage	Rank
Primary nature+Secondary nature+Manicured landscape	47	1
Primary nature+Secondary nature	28	2
Primary nature	0.1	3
Primary nature+Secondary nature+Manicured landscape+Urban Areas	0.1	3

Categories shown are only those which were considered significant (Pearson's Chi-squared test, $p < 0.05$)

Table 4 Categories which respondents believe should be allocated more land area for in the future

Landscape categories	Percentage	Rank
Manicured landscape	20	1
Manicured landscape+Primary nature	15	2
Manicured landscape + Primary nature+Secondary nature	12	3

Categories shown are only those which were considered significant (Pearson's Chi-squared test, $p < 0.05$)

This apparent contradiction between high nature preservation scores and selecting for manicured landscapes as the single preferred landscape could be partially explained by the earlier finding that respondents believe manicured landscapes as much a part of nature as primary and secondary vegetation (Table 3). Respondents under the impression that manicured landscapes could contribute as much to nature conservation as their naturalistic counterparts could have thus felt their selection was in line with nature preservation. This view was expressed by an interviewed questionnaire respondent (Interviewee 1; 3rd March, 2012) who said that "*Parks … are also areas with nature so you can definitely find some biodiversity inside.*"

The absence of urban environments from respondents' selection of preferred landscapes could point to consistency between the perception of wanting to preserve nature and not selecting for environments in direct contrast to nature. However, landscapes that were preferred by the majority of respondents were also not natural landscapes, i.e., primary and secondary vegetation with higher biodiversity conservation potential. These results differ from previous studies of landscape preference in urban areas, where the general public in temperate and subtropical cities were found to have a neutral preference with regards to naturalistic and manicured landscapes (Herzog 1989; Jim and Chen 2006; Özgüner and Kendle 2006; Bonnes *et al.* 2011). While Caula *et al.*'s (2009) findings that the general public in Montpellier preferred natural landscapes also seem to contrast with our results, in light of their picture examples they actually may be similar to preferences for manicured landscapes found in this study (see earlier discussion).

Selection of manicured landscapes, even with the option of selecting a combination of landscape types, could indicate that landscape preference was driven by scenic aesthetics, especially through consideration of visual hues present in a landscape (e.g., flowering plants). Özgüner and Kendle (2006) suggest a positive correlation between landscape orderliness and aesthetic pleasure. However, in our study, visual hues could be a more dominant factor than perceived orderliness in determining landscape preference. Secondary vegetation was not preferred over manicured landscapes despite the picture also presenting components of orderliness such as a clear foreground and height-ordered vegetation, suggesting that selection of manicured landscapes could be due to a wider availability of vegetation colour. This view was also supported by one interviewee (Private eco-landscaping practitioner; 21 March 2012) who stated:

> People definitely have some sort of aesthetic or idealistic perception of nature. Generally, people appreciate things in a landscape that they can see at eye level. So eye-level planting of green, contrasting with colours from flowers or leaves is important when planting a landscape that people would accept as being beautiful. For my newest work…people at first say why the place I have designed here is not like one of my previous designs where there are more flowers and colours.

This quote reflects the nature of biodiversity in Singapore's manicured landscapes, which are predominantly exotic plants with ornamental value. Reasons why native plants are currently unpopular for landscaping use could be due to logistical issues such as slow growth, lack of propagation knowledge and lack of demand as opposed to popular aesthetically pleasing exotic plant species (Kong and Yeoh 1996; Tan 2006).

Interviews with questionnaire respondents further revealed that manicured landscapes could have been selected based on their aesthetic quality. The three respondents interviewed all remarked that they chose manicured landscapes because "parks look nice" (Interviewee 1; 3 March 2012), "parks are pretty and can be enjoyed by everyone" (Interviewee 2; 3 March 2012) and that "the manicured landscape picture look(ed) nicer than the primary and secondary vegetation pictures" (Interviewee 3; 7 March 2012).

Preference for aesthetic landscapes could have arisen due to the conditions that the majority of respondents were brought up in. This view was supported by a interviewee (Lecturer and researcher at the School of Design and Environment, National University of Singapore; 16 August 2011) who stated that Singaporeans are "likely to prefer manicured landscapes as the type of nature to have within the city as those are familiar landscapes that they have grown up with."

About 75 % of the respondents grew up in the post-independence period where large tracts of natural areas were already cleared for urbanization and manicured landscape creation (Corlett 1992; 1997). Many manicured landscapes in Singapore were created based on British garden models, possibly tying aesthetic preference with the country's history as a British colony (1819–1945). Parks such as the iconic People's Park were designed for scenic aesthetics and recreation (Tinsley 1983). Characteristic elements of such designs include bridle paths for horse-carriages, planting of stately trees and the creation of vast landscape vistas (Burkill 1959). Therefore, the prevalent attitude towards wanting to preserve biodiversity found in this study may have been merely at the

level of intention, without follow-through to actual landscape choices.

Predictor Factors of Nature Perception and Landscape Preference

Out of the six independent variables tested, respondents who have taken ecology/conservation classes (19.32 %) and those who have lived abroad for more than 2 years (23.86 %) expressed a higher overall tendency towards preservation of nature, scoring significantly higher in the three preservation categories compared to other survey respondents (Table 5).

These respondents were also found to acknowledge the need for more native landscapes (primary and secondary vegetation) and were found to prefer a combination of 1) manicured landscapes and primary vegetation, as well as 2) manicured landscapes, primary and secondary vegetation (Pearson's chi-squared test, $p < 0.002$, standard residual $_{overseas\ residence} = 1.97$, 2.00, standard residual $_{ecology\ classes} = 2.00$, 2.21).

Previous studies have shown that conservation-related education has a significant effect in increasing awareness environmental protection issues (Caro *et al.* 1994). In this study, respondents who have been exposed to conservation-related education could thus have a better knowledge of and higher pre-disposition towards nature preservation, leading to preference for both naturalistic and manicured landscapes. Respondents could also have a greater in-depth understanding of biodiversity and biological processes produced within a landscape, so that they are able to value a landscape more holistically, rather than primarily aesthetically (Caro *et al.* 1994). Our results here are consistent with previous studies (Caula *et al.* 2009; van der Windt *et al.* 2007; Zagorski *et al.* 2004) where respondents who were pre-disposed to nature

preservation either through occupation or personal preference chose naturalistic landscapes as part of their landscape preference.

A similar trend was found with regards to respondents who have lived overseas for an extended period of time. Respondents reported living in Australia, the United States or England - countries where primary and secondary natural areas remain intact and accessible to the public. Thus, exposure to relatively vast natural landscapes typically present in these countries could be an indicator of an individual's degree connectedness to non-built-up areas. Though there is no easily observable trend in relation to the degree of connectedness to activities in non-built-up areas and perceptions towards nature and landscape preference (Burgess *et al.* 1988; Henwood and Pidgeon 2001), experiences in natural areas abroad could also produce a more profound appreciation of nature and biodiversity as a whole (Bonnes *et al.* 2011). This view that overseas experience could be tied to increasing one's tendency to preserve nature through selecting for more biodiversity-friendly habitats is also expressed by an interviewee (Lecturer and researcher at the Department of Biological Sciences, National University of Singapore; 2 September 2011) who stated: "… more young people are educated in issues concerning nature and they are better travelled. They are able to observe people around the world valuing nature, and are able to observe untouched nature in its beauty overseas. That would likely make them try to value nature more."

It is also interesting to note that while experiences abroad affected survey responses, exposure to non-built-up areas within Singapore did not. This could be because many of the green areas created in post-independence Singapore are manicured and considered small in comparison to the natural areas in countries such as Australia, the United States and England.

Table 5 Scores for categories representing perceptions towards preservation and utilization of nature against experience of taking ecology/ conservation related classes and long-term overseas residence

	Dependent variable	Mean±SE		p value
		OVS	No OVS	
Long-term overseas residence (OVS)	P1	4.09±0.13	3.83±0.09	0.0082*
$df_1 = 1$, $df_2 = 68$	P2	4.08±0.12	3.87±0.05	0.0035*
	P3	4.02±0.10	3.82±0.06	0.0074*
	U1	3.53±0.10	3.62±0.05	0.0720
	U2	2.61±0.13	2.86±0.07	0.0200
	U3	2.68±0.16	2.94±0.07	0.1060
		ECO	No ECO	
Ecology/ conservation classes (ECO)	P1	4.26±0.15	3.80±0.08	0.0068*
$df_1 = 1$, $df_2 = 86$	P2	4.04±0.13	3.89±0.05	0.0081*
	P3	4.13±0.13	3.79±0.06	0.0054*
	U1	3.51±0.07	3.59±0.06	0.4730
	U2	2.74±0.14	3.75±0.07	0.9460
	U3	2.59±0.19	2.95±0.07	0.0360

Results which are significant at an $\alpha = 0.0083$ level

Conclusion

Though it is encouraging that the general public in Singapore has a tendency towards nature preservation, results have shown that this is not consistent with landscape selection. Preferred landscapes selected due to aesthetic reasons were manicured and thus generally have lower biodiversity conservation potential as compared to more naturalistic landscapes. Consequently, this preference for manicured landscapes could possibly lead to objections against naturalizing parks to resemble native vegetation for biodiversity conservation.

However, the general preference for nature preservation possibly foreshadows an increase in public education in ecology/conservation that may help guide the public in looking beyond aesthetics to appreciate more biodiversity friendly landscapes. Our study also found that respondents who had prolonged exposure to environments abroad had a higher tendency to preserve nature and had landscape preferences which included naturalistic landscapes. Therefore, creating more ecological biodiversity within existing manicured landscapes without disrupting their aesthetic quality could enhance human-nature experience even within Singapore. This can be achieved without changing their aesthetic value through the wider use of biodiversity conservation strategies that have already been used in adaptations to manicured landscapes and urban areas. At present, sustainable landscape planning approaches in Singapore and several other tropical urban centres are focussed on adopting solutions applied in temperate regions (e.g., green corridors, increasing manicured landscape cover) (Briffet *et al.* 2004). However, these strategies are potentially ineffective for tropical biodiversity which has different behaviour and habitat requirements (Chong *et al.* 2010).

Manicured landscapes can be made more suitable for biodiversity conservation through small steps such as planting conservation-targeted plant species and varying vegetation complexity (e.g., making artificial enclaves in trees, and engaging in higher-density planting) to create more habitats for threatened native species such as the Horsfield's flying squirrel (*Lomys horsfieldii*) and the Greater wooly horseshoe bat (*Rhinolophus luctus*). Such solutions could facilitate human-nature interaction on a daily basis through increasing exposure to native species rather than confining experiences with nature to the predominant exotic species in parks. This solution could also have an effect similar to lengthy exposure to naturalistic areas abroad except that these areas would now be created and maintained within the country.

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