Arboriculture & Urban Forestry 2019. 45(2):41–53

ARBORICULTURE & URBAN FORESTRY
Scientific Journal of the International Society of Arboriculture

Toward Urban Forest Diversity: Resident Tolerance for Mixtures of Tree Species Within Streets

Lyndal Plant and Dave Kendal

Abstract. Municipalities are setting targets for increasing street tree species diversity to support resilience and enhance the supply of ecosystem services from the urban forest. Assessments of street tree composition and structure, and consequent vulnerability to the stresses of urban climate change, pests, and disease, offer guidance for such targets. However, assessing local resident preferences toward species diversity within streets is also important to achieving such targets. Much of the research on street tree preference to date has focused on resident preferences for individual street tree characteristics, without reference to collective/contextual characteristics such as species diversity. We inferred resident preferences for collective street tree features, including species richness, from nearby house sale prices in the city of Brisbane, Australia. While home-buyers were willing to pay a premium for houses on streets with mature and aged trees, their tolerance for mixtures of species was limited to no more than six species nearby. Tolerance also varied within the city with greater sensitivity to mixtures of species in locations of greater socio-economic advantage. These findings suggest that increased diversity will not automatically be accepted by the community. Municipalities need to be cautious in their approach to increasing tree species diversity at finer scales, like streetscapes, within the urban forest.

Key words. Resident Preferences; Species Diversity; Street Trees.

INTRODUCTION

Inventories of urban tree populations show that streets can have high levels of species richness (Alvey 2006). However, many cities remain overly reliant on just a handful of species from one or two higher taxa irrespective of climate zone (Kendal et al. 2014; McPherson et al. 2016). Recognition of the importance of diversifying tree species composition to both the resilience of the urban forest (Raupp et al. 2006; Muller and Bornstein 2010; Morgenroth et al. 2016) and the ecosystem services it supplies (Alvey 2006; van Dillen et al. 2012) has translated to municipalities setting targets for increasing diversity across a range of urban forest components, including street trees (Young 2011; City of Melbourne 2013; City of Sydney 2013; Ordóñez and Duinker 2013; Sjöman et al. 2016).

Assessments of local urban forest structure, composition, and vulnerability have been suggested as a more appropriate guide to contemporary targets for increasing street tree diversity than generic guidelines such as the 10/20/30 rule of thumb, which calls for no more than 10% of the total tree population coming from any one species, 20% from any one genus, and 30% from any one family (Santamour 1990; Subburayalu and Sydnor 2012; Dobbs et al. 2013; Kendal et al. 2014; Sjöman et al. 2016). However, the success of street tree planting is also dependent on the views of local residents (Shakeel and Conway 2014). Assessment of local resident preferences for or against increasing diversity will also be important to achieving diversity targets (Braverman 2008; Jones et al. 2013; Conway and Bang 2014; Faehnle et al. 2014; Ives and Kendal 2014).

One option for increasing street tree diversity is the use of mixed plantings within particular streetscapes. Yet very few studies have explored resident preferences for street tree species diversity within streets or local streetscapes, and the results of these studies are not conclusive. Faced with removal and replacement of dead and dying ash trees attacked by Emerald Ash Borer, which had been planted some fifty years earlier to replace elm trees destroyed by Dutch Elm Disease, Toledo residents stated they would be satisfied with a mix of large-growing tree species within streets

(Heimlich et al. 2008). In less emotive circumstances, residents of Dresden and Cologne approved of more "wild" herbaceous streetside vegetation amongst tree-lined streetscapes, but still preferred planted and maintained vegetation (Weber et al. 2014), and house sale prices in Portland were higher when the nearest "green street stormwater facilities" contained more trees of mature age and diverse taxa (Netusil et al. 2014). Yet symmetrical, orderly, and homogenous streetscapes have been rated as more attractive (Weber et al. 2008) and both physically (van Dillen et al. 2012; de Vries et al. 2013) and psychologically more restorative (Lindal and Hartig 2015) in other cities.

In contrast, resident preferences for individual street tree characteristics have been widely reported in both stated and revealed preference research (Williams 2002; Todorova et al. 2004; Schroeder et al. 2006; Pandit et al. 2013; Camacho-Cervantes et al. 2014; Escobedo et al. 2015a; Ng et al. 2015). In survey responses, residents have often stated their preferences for aesthetically pleasing street trees over functionally beneficial ones and always over trees associated with excessive debris or perceived to be damaging to property or of risk to people (Schroeder et al. 2006). What is pleasing at an individual tree scale can depend on whether respondents have a street tree on their frontage (Gorman 2004) and varies between tall, leafy, shade trees in Morelia, Mexico (Camacho-Cervantes et al. 2014), and southern California (Avolio et al. 2015); small, slower-growing street trees in cool, cloudy climates of North Somerset, UK (Schroeder et al. 2006); large, spreading street trees rather than columnar trees in Chicago (Schroeder and Ruffolo 1996) and Germany (Gerstenberg and Hofmann 2016); medium-sized, globular street trees in Melbourne, Australia (Williams 2002); broad-leaved trees (not palms) on footpath frontages in Perth, Australia (Pandit et al. 2013); large hardwood species (not conifers) in Athens, Georgia (Anderson and Cordell 1988); and large, hardy, shady, and symbolic *Ficus* species in Kuala Lumpur (Sreetheran et al. 2011), Bangkok (Thaiutsa et al. 2008), and southern China (Jim and Liu 2001).

Likewise, few studies to date have specifically explored the influence of temporal, socio-economic, and demographic factors on tree species diversity within streetscapes. At the city-wide scale, we know such factors influence street tree abundance and private garden species diversity (Landry and Chakraborty 2009; Kendal et al. 2012). Socio-economically advantaged residents and those with greater knowledge of trees or positive experiences with trees/landscapes are more likely to already live in leafy suburbs, support tree-planting programs (Jones et al. 2013), and rate trees as important to their quality of life (Lohr et al. 2004). But it is not clear whether socio-economic status is a good predictor of tolerance for species diversity within local streetscapes. Escobedo et al. (2015) found greater species diversity across an aggregated inventory of public tree populations in the richest socio-economic areas of Bogota, and likewise Pedlowski et al. (2002) in street tree populations of nine districts of Rio de Janiero. Household income was also found to be the best discriminator of the seven attitude syndromes of residents, which were identified across suburbs in six Australian cities (Kirkpatrick et al. 2012), as strong predictors of tree planting and removal behaviours that directly influenced abundance and diversity of trees on private property as well as streetscape preferences. However, Avolio et al. (2015), Kendal (2012), and Luck et al. (2009) found stronger relationships between education levels and public tree diversity. Few studies have explored interactions between education and income on street tree preferences.

Municipalities would benefit from insights into local resident preference for mixtures of species within streets, either to incorporate alternative species as replacements for pest/drought-affected or vulnerable street tree species, or to evaluate shifts in streetscape design and functionality toward a mixed array of trees. This study explores resident preferences inferred from the effects of a range of street tree features, including species richness, on house sale prices in the city of Brisbane, Australia.

METHODS

This study used hedonic price modelling to measure home-buyers' preferences for street tree features. Hedonic pricing is based on the assumption that people choose their consumption of environmental qualities through their selection of a private-good consumption bundle (Freeman III et al. 2014) such as the purchase price of a house. Residential housing prices (the dependent variable in the hedonic model) provide a market value of a bundle of goods and can be broken down into both attributes of the house and land and locational characteristics, including environmental features (the explanatory or independent variables in the hedonic model). Significant explanatory variables reveal a marginal implicit price (or hedonic price) that represents home-buyers' willingness to pay (WTP) for an incremental increase in that component which may be positive or negative. The hedonic price modelling technique has become popular in valuing ecosystem services of urban forests and greenspace (Roy et al. 2012; Saphores and Li 2012).

Study Location

Our study was conducted in Brisbane, Australia. Brisbane is located 500 km south of the Tropic of Capricorn at latitude 27º 25' south and longitude 153º 9' east on the east coast of Australia and is the third most populated and one of the fastest growing cities in Australia (Australian Bureau of Statistics 2011). Rapid growth and changing patterns of residential development in Australian cities is reducing the space for trees on private house lots and increasing the importance of tree cover in the public realm, including streetscapes (Byrne et al. 2010; Hall 2010; Daniel 2012). In 2010, tree canopy covered 51.2% (70,673 ha [706.73 km^2]) of the land area within the Brisbane City Council (BCC) boundaries. Almost half of Brisbane's tree canopy cover was growing on public land, including 4.1% (2,960 ha [29.6 km^2]) of street tree canopies specifically within BCC road reserves. In Australia, trees in the footpath zone of the road reserve are, most often, the responsibility of the local municipality, yet residents have a strong influence on the presence and species of trees fronting their property (Kirkpatrick et al. 2012).

Brisbane is a useful place to explore resident preferences for street tree diversity. High levels of both species richness and diversity of Brisbane's street tree population have been reported (Plant and Sipe 2016). The municipal authority in Brisbane has also set requirements for developments to provide street frontage (verge) treatments that include a mixture of species within each level of the streetscape hierarchy to promote Brisbane's subtropical identity (Brisbane City Council 2014). To support multipurpose streetscapes, especially walking and cycling, BCC also aims to increase tree shade along residential footpaths from 35% canopy cover, measured in 2010, to 50% by 2031 by planting a variety of shade trees along the most "shade-hungry" parts of the footpath network (Plant 2006; Favelle and Plant 2009; Brisbane City Council 2013; Davison and Kirkpatrick 2014).

Study Data

Data from house sales between 2008 and 2010 within 80 sample sites were combined with attribute data from spatial analysis, Census 2011 data, and BCC 2010 street tree survey data. These same 80 sites were used by BCC in a separate field-based exercise to estimate street tree population, stocking level, composition, and condition within residential suburbs (residential suburbs are defined as those suburbs with 50% or more of their land area designated in Brisbane City Council - City Plan 2000 as a type of residential zoning). The sample sites were chosen using stratified random sampling to account for the uneven distribution and density of street tree canopy cover (Plant and Sipe 2016). Two data sets were analysed—house sales with street trees on their front footpath (n = 459), and house sales with street trees within 100 m of the property, but not on the front footpath (n = 1882). Four anomalies were removed from the second data set, three where average tree height was over 50 m and one where 146 species were recorded growing within 100 m of a house sale site. House, property, suburb, and street tree features used in this study are summarised in Table 1.

Street tree features from the 2010 BCC street tree survey data were converted to four (4) continuous variables—average number and height of trees, species richness, and species diversity (Shannon Weiner Index)—and three (3) coded variables—presence of overhead powerlines, tree health, and age categories—relevant to each house sale. Dummy variables were used to test the contribution of just two scenarios of a particular attribute, such as footpath frontages with or without powerline constraints and the effect of mature and aged street trees nearby compared to all other tree age categories. Street tree age categories from the survey data were *new*: 0 to 2 years; *juvenile*: 3 to 5 years; *maturing*: 6 to 15 years; *mature*: 16 to 30 years; *aged*: > 30 years.

Statistical Analysis

A series of hedonic price models were developed from analysis of the data. Those features of street trees on the front footpath not found to be significant in the first-stage models (i.e., powerline constrained and tree health) were not tested again in the nearby streetscape data set (second stage of analysis), and species richness was only explored within 100 m of house-sales sites and not frontages. Tolerance for

Table 1. Summary of the house, property, suburb, and features of street trees on the front footpath and nearby within the two house sales data sets.

	(n = 459 house sales)	*(n = 1,882 house sales)*
	Front footpath of house sale site	**Nearby footpaths** within 100 m of house sale site
House sale price		
Median sale price (AU$)	513,500	525,000
House variables		
Average number of bedrooms	3.44	3.45
Average number of bathrooms	1.64	1.70
Average number of garages	1.50	1.53
Property variables		
Average lot size (m^2)	618.44	582.19
Average distance to nearest park (m)	181.01	194.09
Suburb variables		
% house sale sites in prewar suburbs	35.07	23.9
% house sale sites in postwar suburbs	45.1	60.2
% house sale sites in suburbs where household income was upper quartile	9.71	10.08
% house sale sites in suburbs where household education level was yr 12 or above	49.0	49.0
Average distance to CBD (Translink zone)	3.49	3.350
Street tree features		
Average tree height (m)	5.76	5.55
% properties powerline constrained	30.24	-
% properties with trees poor health	5.87	-
% properties with trees good health	26.63	-
% properties with mature + aged trees	28.35	27.66
% properties with maturing aged trees	58.20	55.47
% properties with new + juvenile trees	13.45	16.87
Average number of footpath trees	1.42	17.09
Average species richness (number of species)	-	5.85
Average species diversity (Shannon-Weiner)	-	1.30

species richness within the streetscape above or below average richness for the sample (5.85) was tested in a third stage of analysis by substituting a coded variable (D_species richness ≤ 6) in the data set. In the final stage of analyses, interactions between revealed tolerance for species richness and suburb scale socio-economic characteristics were tested by adding two separate interactive variables (D_species richness ≤ 6 × income and D_species richness ≤ 6 × education) to the models.

Spatial relationships among neighbouring house sales and among residuals (unexplained variation) can be common in house-sale price data sets (Anselin and Bera 1998; Pandit et al. 2013). We accounted for spatial dependence by using a simultaneous autocorrelation regression (SAR) least squares estimations in MATLAB®. Our spatial weight matrix was limited to six nearest neighbours to prevent neighbouring transactions from non-neighbouring sample plots from misrepresenting the specification.

RESULTS

As shown in Table 2, the model including front footpath tree features explained 70.4% of the variance in house sale prices of that data set. However only one of the six street tree attributes was significant at the 90% probability level. Street trees in the mature and aged (> 16 years) categories had a significant positive effect and, when other variables were held constant, were adding a 6.9% premium to median house sale price. The small size of the data set limits the robustness of this model.

The second model excluding front footpath tree features and adding features of street trees up to 100 m from house sale sites confirmed the significant effect of mature and aged street trees nearby on house sale prices and an indifference to tree size in a model

Table 2. Spatial hedonic price modelling results for house, property, suburb, and features of street trees on the front footpath (Stage 1), and nearby footpaths (Stage 2 and Stage 3).

	Front footpath				*Footpath nearby (100 m)*			
Variable	**Coeff**	**SE**	**t-value**		**Coeff**	**SE**	**t-value**	
Intercept	11.8939	0.2083	57.1000	***	11.8749	0.0908	130.8110	***
D_2010	0.0573	0.0200	2.8650	***	0.0458	0.0113	4.0518	***
House								
No. bedrooms	0.0447	0.0204	2.1912	**	0.0535	0.0087	6.1250	***
No. bathrooms	0.1437	0.0251	5.7251	***	0.1541	0.0099	15.5500	***
No. garage spaces	0.0052	0.0131	0.397		0.0236	0.0066	3.6009	**
Property								
Lot size	0.0004	0.0001	4.0000	***	0.0004	0.0000	12.8794	***
D_ < 200 m to nearest park	-0.0287	0.0217	-1.3226	*	-0.0436	0.0120	-3.6369	**
Suburb								
D_Prewar0.17010.04693.6269***	0.2419	0.0247	9.7825	***				
D_Postwar	0.0147	0.0396	0.3712		0.1030	0.0213	4.8392	***
Suburb household income	0.0184	0.0036	5.1111	***	0.0204	0.0016	12.7219	***
Suburb education	0.0095	0.0025	3.8	***	0.0086	0.0010	8.7634	***
Location-distance to CBD	-0.0358	0.019	-1.8842	*	-0.0338	0.010	-3.3329	**
Front Footpath Street Tree Features								
No. of footpath trees	-0.0181	0.0184	-0.9837					
D_Powerlines	0.0299	0.0281	1.0641					
Hgt tallest tree (m)	-0.0041	0.0039	-1.0513					
Health D_poor	0.0172	0.0649	0.265					
Health D_good	0.0074	0.0242	0.3058					
Age D_maturing	0.0028	0.0282	0.0993					
Age D_mature/aged	0.0692	0.0368	1.8804	*				
Nearby Footpath Street Tree Features								
Age D_mature/aged					0.0327	0.0134	2.4311	**
Age D_new/juvenile					-0.0045	0.0120	-0.3793	
Species richness					-0.0050	0.0024	-2.0705	**
(D_Species richness ≤ 6)#					0.0286	0.0138	2.0644	**
Av_Height					-0.0012	0.0021	-0.5792	
No. of nearby street trees					0.0013	0.0007	1.7783	*
Adjusted R^2	**0.704**				**0.6513**			
rho				*				*

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$
\# 6 species or less - run in Stage 3 model

which explained 65.1% of pricing variance across the sample. While species diversity (measured using the Shannon Index) had no significant effect on house price, species richness (number of species) was significant and a negative predictor of house price. The greater the number of different tree species in the street, the lower the house sale price. Each additional street tree within 100 m of a house sale site added $682 to median house sale price, but when that additional tree was a new species, house sale price was $2,625 lower.

In the third-stage models, a threshold of no more than six species reversed this negative effect to a significant positive effect. Six or fewer different species nearby added $15,015 (or 2.9%) to median house sale price. The presence of some mature or aged street trees nearby added greatest value (i.e., $17,168 or 3.3% above median house sale price). Results of the first three stages of revealed preference analysis are shown in Table 2. In summary, home-buyers were expressing their preference for more street trees, especially of mature age, but there was a threshold of tolerance for species mix within streetscapes nearby, where more than six species had a negative effect on house prices.

Of all the location characteristics in the data set, only household income and education levels of suburbs had significant, although weak, correlations (using Pearson's 2-tailed t-test) with street tree species richness nearby (suburb income × richness = 0.060 at $p < 0.01$; suburb education × richness = 0.067 at $p < 0.01$). When tested within the models, these location variables significantly influenced the value that home-buyers placed on a limited mix of species within streets. In locations with a greater proportion of households with education levels at year 12 or above, home-buyers were willing to pay an additional premium of 9.1% above other suburbs for houses with streetscapes with six street tree species or less nearby. In locations with a greater proportion of households with income levels in the top quartile, the premium was 3.1% above other suburbs (Table 3).

DISCUSSION

This study explored one of the many types of human-environment interactions (Williams 2002; Ives and Kendal 2014; Avolio et al. 2015; Kabisch et al. 2015; Säumel et al. 2016), that must also be taken into account when seeking to diversify and sustain street tree populations (i.e., resident preferences). We found that home-buyers expressed a preference for more street trees nearby, especially if those trees were mature or aged. However, additional tree species nearby, beyond six species, discounted house sale prices. This threshold of tolerance for species diversity varied by location, with less diversity preferred in locations of greater socio-economic advantage.

Low levels of street tree species diversity found across many cities, despite a large species pool to choose from, suggest that there are strong drivers which limit diversity in roadside environments. Biophysical challenges presented by the harsh, varied, and constrained nature of roadsides can limit the number of species that can tolerate such conditions in any climate (Jim 1998; Kendal et al. 2014; Miller et al. 2015). Our study suggests that resident preferences are well adapted to these low levels of species richness, and strategies such as trialling native species (Sjöman et al. 2016), expanding municipal species lists (Laćan and McBride 2008), and encouraging nurseries to

Table 3. Summary of interactions between tolerance for species mixtures within streets and socio-economic levels of suburbs.

Variables of interest	Base model		Interactive models: Income		Interactive models: Education		% change
	R^2 0.6513		R^2 0.6513		R^2 0.6513		
	Coeff.		Coeff.		Coeff.		
Suburb household income	0.0204	***	0.0226	***	0.0208	***	< 1%
Suburb household education	0.0086	***	0.0084	***	0.0095	***	< 1%
D_Species richness ≤ 6	0.0286	**	0.0629	***	0.1213	**	
D_Species richness ≤ 6 X income			-0.0031	*			3.12%
D_Species richness ≤ 6 X education					-0.0018	*	9.09%

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

grow a broader range of species (Lohr 2013) in time for planting projects (Pincetl et al. 2013; Campbell 2014) may be countered by local resident preferences for a limited mix of species within streets.

At the finer scale of nearby streetscapes investigated in this study, we found significant preferences for the aesthetic features of streetscapes (i.e., maturity of trees and species mix), which can be classed as life fulfilling or as cultural ecosystem services. In contrast, street tree size and condition, which are critical to provisioning or life-supporting ecosystem services, and which are highly valued by urban forest professionals (Kirkpatrick et al. 2013a; Kirkpatrick et al. 2013b; Davison and Kirkpatrick 2014; Jones and Instone 2016) were not significant. Resident preferences for aesthetics above function and concerns about disservices is consistent with other studies at city-wide scales (Summit and McPherson 1998; Gorman 2004; Flannigan 2005; Schroeder et al. 2006; Heimlich et al. 2008; Escobedo et al. 2011; Birtles et al. 2014; Camacho-Cervantes et al. 2014). Yet, street tree species choices are more often decided at municipal, developer, or designer levels, whose professional streetscape preferences may not align with each other's, let alone with residents' and other stakeholders' preferences (Gjerde 2011; Conway and Vander Vecht 2015). Divergent preferences can be linked to divergent functions of tree-lined streets, which have evolved from earliest European neoclassical symbols of luxury and power to please a small group of people to a mixture of aesthetic, recreational, ecological, and economic contributions to the broader public (Lawrence 1993). Although mainstreaming of environmental benefits of street trees, such as air quality improvement, cooling urban heat islands, energy conservation, and stormwater management, has served to engage decision makers (Silvera Seamans 2013), residents who live closest to this subset of the urban forest may continue to require a balance between the aesthetic and functional features of street trees—supporting further exploration of an "ecological aesthetic" (Kazemi et al. 2011; Rosley et al. 2014).

Within their nearest streetscapes, our study indicated that Brisbane residents prefer a limited mixture of tree species, which is not consistent with previous studies. Recreational users of informal parks (Qiu et al. 2013) and natural areas (Fuller et al. 2007; Botzat et al. 2016; Shanahan et al. 2017) and residents at regional scales (Ambrey and Fleming 2014) have been found to prefer greater levels of diversity and complex vegetation. Our study suggests that home-owners and home-buyers do not prefer a rich mixture of species closer to home. Mixtures of species at this scale may challenge preferences for homogeneity, orderliness, and tidiness across built and non-built forms within streetscapes (Weber et al. 2008; Weber et al. 2014). In Australian cities it is common practice for residents to maintain the footpath zone, even though this zone is controlled by the municipality, which is also responsible for planting and maintaining the street trees (Plant and Sipe 2016). Residents in Australia consequently have a strong influence on the presence and species of trees in the footpath zone fronting their property (Kirkpatrick et al. 2012), which may spill over to their preference for the greater order found in lower species diversity at the streetscape scale.

A threshold of tolerance of no more than six different street tree species in nearby streetscapes emerged from this study, beyond which preference declined. This provides quantifiable guidance for urban forest managers seeking to balance the need for increased diversity to maintain a sustainable and resilient urban forest and the needs of residents. The threshold can also be used to evaluate the estimated effect of Brisbane's streetscape policy. This Infrastructure Design Planning Scheme Policy – Streetscape Hierarchy – Neighbourhood Street, requires "a mix of species laid out in an informal manner with clusters of trees at 2- to 6-m centres" (Brisbane City Council 2014). For a collective of "neighbourhood streets" within a residential zone, the policy would require the planting of no more than six street tree species within a 100-m length of street. Our findings suggest residents may therefore be supportive of the policy.

Preferences for species diversity in streetscapes are likely to be highly location dependent. Within the limited scope of our study, we chose to further explore the influence of socio-economic status as a locational characteristic that has already been found to influence urban tree abundance in the form of canopy cover (Heynen et al. 2006; Shanahan et al. 2014).

Limited species mixtures in nearby streets in our study area were more strongly preferred in locations with higher education and income levels. It is possible that more affluent and educated suburbs have lower levels of species richness within streets, and familiarity has reinforced this preference. Areas of socio-economic advantage are amongst older suburbs, in the case of

Brisbane, where early street tree plantings along wide verges consisting of monocultures of fashionable species (Plant 1996) have persisted to provide both mature and less diverse streetscapes. Though others have found that higher education and income levels can be strong predictors of species richness (Escobedo et al. 2015b) and support for street tree planting (Conway and Bang 2014), at the neighbourhood scale, there are clearly complex interactions between existing species diversity, socio-economics, patterns of development, and other factors (Rosiers et al. 2007; Kirkpatrick et al. 2011; Lowry et al. 2012; Flint et al. 2013; Ives and Kendal 2014; Shakeel and Conway 2014) that can influence resident tolerance to streetscape diversity at the finer scale of nearby streets, reinforcing the need for local assessments (Williams 2002).

Given education level was a stronger predictor of sensitivity to species richness than income, targeted knowledge sharing may be effective when increases to species richness are being considered. Changes from monocultures of existing street species to variations from block to block along major residential streets in precincts of Melbourne have been supported by community stakeholders following information sharing and engagement about the vulnerability of existing species to changing climate (City of Melbourne 2015). Similar "information interventions" about the role of green infrastructure in mitigating the impacts of heat waves and flooding have been found to shift preferences in streetscape composition toward more trees, rather than shrubs or grass (Derkzen et al. 2017) The importance of consultative approaches in Australian cities where councils/municipalities are responsible for street trees, but residents are highly involved, cannot be underestimated. Equally important is building awareness across the range of decision makers and stakeholders. Recent studies in Canadian cities credit both improved availability of native tree nursery stock, urban forest practitioner awareness of the importance of species diversity, and species diversification goals in urban forest management plans for increased street tree diversity in newer versus older neighbourhoods (Almas and Conway 2016; Nitoslawski and Duinker 2016).

In managing resident sensitivity to mixtures of tree species in streets there is scope for achieving both species richness and visual homogeneity and order through the use of different species of similar forms and textures (Trowbridge and Bassuk 2004; Gerstenberg and Hofmann 2016). While our study used inventory survey measures of species richness and diversity, residents are unlikely to detect species differences in the same way (Fischer et al. 2014). People often express their street tree preferences through traits such as size, growth rate, shape, and foliage type and densities (Williams 2002; Schroeder et al. 2006) rather than species identity, although some particular species have been identified as least preferred by "hazard minimisers" and "native wildlife enthusiasts" (Kirkpatrick et al. 2012). Achieving greater perceived coherence in tree traits could allow for an increase in tree species richness without greatly changing perceived diversity. Promoting greater genetic diversity within species, such as various provenance sources or cultivars, may also provide greater ecological resilience while maintaining some visual orderliness, but further studies are required (Botzat et al. 2016; MacIvor et al. 2016).

Exploring contextual and temporal gradients in species diversity tolerance in streetscapes across other types of residential land-uses and cities elsewhere are also important directions for future research. For example, mixtures of tree forms and uneven street tree placement, rather than closed, continuous street tree canopies in narrow, deep street canyons, can deliver greater air quality improvement (Vos et al. 2013). Residents in highly compact dwelling forms such as Hong Kong have already indicated greater receptiveness to functional over aesthetic benefits of nearby greenspace, especially air purification (Lo and Jim 2012), and may consequently be less sensitive to mixtures of species in streets that contribute to cleaner air. Understanding how people's values for different kinds of urban landscapes can be incorporated into urban forest planning will also help balance needs for diversity and people's diverse needs from the urban forest (Ordóñez and Duinker 2014).

The approach used in this study demonstrates the advantages of integrating street tree inventory data into hedonic price modelling to reveal resident preferences. Such techniques are valuable in comparing urban forest needs, in relation to optimising and sustaining ecosystem services, to community needs and preferences at fine scales such as local streetscapes. Advancing such techniques also provides tools for policy evaluation and can assist in developing business cases for strategic investment in shared outcomes. An earlier study, using a similar approach, found that municipal goals for increasing street tree canopy cover along footpaths in residential areas was supported by home-buyers' preferences for increased tree cover (Plant et al. 2017).

It is also important to recognise that the scope of this study has been limited to the preferences of house-buyers. A more comprehensive understanding of community preferences for species diversity should consider renters and the multi-unit residential sectors whose streetscape values may vary. The hedonic pricing approach also limits our understanding to "*what*" is preferred, not "*why.*" We encourage further exploration of stakeholder perceptions and values, alongside assessments of urban forest structure and services, to better inform urban forest decision making at finer scales.

CONCLUSION

The results of this study sound a warning for urban forest managers seeking to increase species diversity within streets based on assessments of street tree population structure alone. We revealed resident preference for limited species richness at the local streetscape scale, which was not reflected in previous studies at neighbourhood- and city-wide scales, and significant interactions between sensitivity for street tree species richness in streets and socio-economic status of locations.

Planning must take into consideration the scale at which diversity needs to be managed in the urban forest. Municipalities that integrate assessments of both urban forest structure and insights about how residents experience and value structural features, at the scale they are experienced, are more likely to lead to better outcomes for *both* urban trees and the residents they live with.

Acknowledgments. Achieving the research objectives has been made possible by data made available under licence agreement from Brisbane City Council and generous support from the Nursery and Garden Industry of Australia, who have championed significant advances in promoting and sustaining the benefits of trees to the quality of life in Australian cities.

LITERATURE CITED

Almas, A.D. and T.M. Conway (2016). The role of native species in urban forest planning and practice: A case study of Carolinian Canada. Urban Forestry & Urban Greening 17: 54-62.

Alvey, A.A. (2006). Promoting and preserving biodiversity in the urban forest. Urban Forestry & Urban Greening 5(4): 195-201.

Ambrey, C.L. and C.M. Fleming (2014). Valuing ecosystem diversity in South East Queensland: A life satisfaction approach. Social Indicators Research 115(1): 45-65.

Anderson, L.M. and H.K. Cordell (1988). Influence of trees on residential property values in Athens, Georgia (U.S.A.): A survey based on actual sales prices. Landscape and Urban Planning 15(1-2): 153-164.

Anselin, L. and A.K. Bera (1998). Spatial dependence in linear regression models with an introduction to spatial econometrics. Handbook of Applied Economic Statistics. A.U. a. D.E. Giles. New York, Marcel Dekker: 237-289.

Australian Bureau of Statistics. (2011). Census Quick Stats, Brisbane–Dwellings. Retrieved 9 June 2014 from http://www.censusdata.abs.gov.au/census_services/getproduct/census/2011/quickstat/3001?opendocument&navpos=220.

Avolio, M., D. Pataki, S. Pincetl, T. Gillespie, G.D. Jenerette, and H. McCarthy (2015). Understanding preferences for tree attributes: the relative effects of socio-economic and local environmental factors. Urban Ecosystems 18(1): 73-86.

Birtles, P.J., J. Hore, M. Dean, R. Hamilton, J. Dahlenburg, J. Moore, and M. Bailey (2014). Creating a liveable city—The role of ecosystem services. Blacktown City Council & Sydney Co-operative for Urban Water Research Independent.

Botzat, A., L.K. Fischer, and I. Kowarik (2016). Unexploited opportunities in understanding liveable and biodiverse cities. A review on urban biodiversity perception and valuation. Global Environmental Change 39: 220-233.

Braverman, I. (2008). Everybody loves trees. Duke Environmental Law and Policy Forum(19): 81-118.

Brisbane City Council. (2013). Street Trees. Retrieved 30 Jun 2013 from http://www.brisbane.qld.gov.au/environment-waste/natural-environment/plants-trees-gardens/brisbanes-trees/street-trees/index.htm.

Brisbane City Council. (2014). City Plan 2014. Retrieved 28 Mar 2015 from http://www.brisbane.qld.gov.au/planning-building/planning-guidelines-tools/brisbane-city-plan-2014.

Byrne, J., N. Sipe, and G. Searle (2010). Green around the gills? The challenge of density for urban greenspace planning in SEQ. Australian Planner 47(3): 162-177.

Camacho-Cervantes, M., J.E. Schondube, A. Castillo, and I. MacGregor-Fors (2014). How do people perceive urban trees? Assessing likes and dislikes in relation to the trees of a city. Urban Ecosystems: 1-13.

Campbell, L.K. (2014). Constructing New York City's urban forest. The politics and governance of the MillionTreesNYC campaign.

City of Melbourne. (2013). Urban Forest Strategy. Retrieved 17 Jun 2013 from http://www.melbourne.vic.gov.au/Sustainability/UrbanForest/Pages/About.aspx.

City of Melbourne. (2015). Urban Forest Precinct Plans. Retrieved 21 Oct 2015 from http://www.melbourne.vic.gov.au/community/parks-open-spaces/urban-forest/pages/urban-forest-precinct-plans.aspx.

City of Sydney. (2013). Urban Forest Strategy. Retrieved 26 Aug 2013 from http://www.cityofsydney.nsw.gov.au/__data/assets/pdf_file/0003/132249/Urban-Forest-Strategy-Adopted-Feb-2013.pdf.

Conway, T.M. and E. Bang (2014). Willing partners? Residential support for municipal urban forestry policies. Urban Forestry & Urban Greening 13(2): 234-243.

Conway, T.M. and J. Vander Vecht (2015). Growing a diverse urban forest: Species selection decisions by practitioners planting and supplying trees. Landscape and Urban Planning 138: 1-10.

Daniel, C. (2012). The Pattern of Tree Cover in Brisbane's Suburbs: Does planning have a role to play? Honours Thesis, University of Queensland.

Davison, A. and J. Kirkpatrick (2014). Re-inventing the urban forest: The rise of arboriculture in Australia. Urban Policy and Research 32(2): 145-162.

de Vries, S., S.M. van Dillen, P.P. Groenewegen, and P. Spreeuwenberg (2013). Streetscape greenery and health: Stress, social cohesion and physical activity as mediators. Social Science & Medicine 94: 26-33.

Derkzen, M. L., A. J. A. van Teeffelen, and P. H. Verburg (2017). Green infrastructure for urban climate adaptation: How do residents' views on climate impacts and green infrastructure shape adaptation preferences? Landscape and Urban Planning 157: 106-130.

Dobbs, C., D. Kendal, and C. Nitschke (2013). The effects of land tenure and land use on the urban forest structure and composition of Melbourne. Urban Forestry & Urban Greening 12(4): 417-425.

Escobedo, F.J., D.C. Adams, and N. Timilsina (2015a). Urban forest structure effects on property value. Ecosystem Services 12: 209-217.

Escobedo, F.J., N. Clerici, C.L. Staudhammer, and G.T. Corzo (2015b). Socio-ecological dynamics and inequality in Bogotá, Colombia's public urban forests and their ecosystem services. Urban Forestry & Urban Greening 14(4): 1040-1053.

Escobedo, F.J., T. Kroeger, and J.E. Wagner (2011). Urban forests and pollution mitigation: Analyzing ecosystem services and disservices. Environmental Pollution 159(8–9): 2078-2087.

Faehnle, M., P. Bäcklund, L. Tyrväinen, J. Niemelä, and V. Yli-Pelkonen (2014). How can residents' experiences inform planning of urban green infrastructure? Case Finland. Landscape and Urban Planning 130: 171-183.

Favelle, H. and L. Plant (2009). The importance of shade for healthy places and spaces. Australian Planner 46(2): 16-17.

Fischer, A., S. Selge, R. van der Wal, and B.M. Larson (2014). The public and professionals reason similarly about the management of non-native invasive species: A quantitative investigation of the relationship between beliefs and attitudes. PloS one 9(8): e105495.

Flannigan, J. (2005). An evaluation of residents' attitudes to street trees in southwest England. Arboricultural Journal 28(4): 219-241.

Flint, C.G., I. Kunze, A. Muhar, Y. Yoshida, and M. Penker (2013). Exploring empirical typologies of human–nature relationships and linkages to the ecosystem services concept. Landscape and Urban Planning 120: 208-217.

Freeman III, A.M., J.A. Herriges, and C.L. Kling (2014). The measurement of environmental and resource values: Theory and methods. Routledge.

Fuller, R.A., K.N. Irvine, P. Devine-Wright, P.H. Warren, and K.J. Gaston (2007). Psychological benefits of greenspace increase with biodiversity. Biology Letters 3(4): 390-394.

Gerstenberg, T. and M. Hofmann (2016). Perception and preference of trees: A psychological contribution to tree species selection in urban areas. Urban Forestry & Urban Greening 15: 103-111.

Gjerde, M. (2011). Visual evaluation of urban streetscapes: How do public preferences reconcile with those held by experts? Urban Design International 16(3): 153-161.

Gorman, J. (2004). Residents' opinions on the value of street trees depending on tree location. Journal of Arboriculture 30(1): 36-44.

Hall, T. (2010). Life and death of the Australian backyard. Collingwood, Victoria, CSIRO Publishing.

Heimlich, J., T.D. Sydnor, M. Bumgardner, and P. O'Brien (2008). Attitudes of residents toward street trees on four streets in Toledo, Ohio, U.S. before removal of ash trees (*Fraxinus* spp.) from Emerald ash borer (*Agrilus planipennis*). Arboriculture and Urban Forestry 34(1): 47-53.

Heynen, N., H.A. Perkins, and P. Roy (2006). The political ecology of uneven urban green space: The impact of political economy on race and ethnicity in producing environmental inequality in Milwaukee. Urban Affairs Review 42(1): 3-25.

Ives, C.D. and D. Kendal (2014). The role of social values in the management of ecological systems. Journal of Environmental Management 144: 67-72.

Jim, C.Y. (1998). Urban soil characteristics and limitations for landscape planting in Hong Kong. Landscape and Urban Planning 40(4): 235-249.

Jim, C.Y. and H.T. Liu (2001). Species diversity of three major urban forest types in Guangzhou City, China. Forest Ecology and Management 146(1–3): 99-114.

Jones, R. and L. Instone (2016). Becoming–urban, becoming–forest: A historical geography of urban forest projects in Australia. Geographical Research 54: 433-445.

Jones, R.E., K.L. Davis, and J. Bradford (2013). The value of trees factors influencing homeowner support for protecting local urban trees. Environment and Behavior 45(5): 650-676.

Kabisch, N., S. Qureshi, and D. Haase (2015). Human–environment interactions in urban green spaces—A systematic review of contemporary issues and prospects for future research. Environmental Impact Assessment Review 50: 25-34.

Kazemi, F., S. Beecham, and J. Gibbs (2011). Streetscape biodiversity and the role of bioretention swales in an Australian urban environment. Landscape and Urban Planning 101(2): 139-148.

Kendal, D., C. Dobbs, and V.I. Lohr (2014). Global patterns of diversity in the urban forest: Is there evidence to support the 10/20/30 rule? Urban Forestry & Urban Greening 13(3): 411-417.

Kendal, D., N.S.G. Williams, and K.J.H. Williams (2012). Drivers of diversity and tree cover in gardens, parks and streetscapes in an Australian city. Urban Forestry and Urban Greening 11(3): 257-265.

Kirkpatrick, J.B., G.D. Daniels, and A. Davison (2011). Temporal and spatial variation in garden and street trees in six eastern Australian cities. Landscape and Urban Planning 101(3): 244-252.

Kirkpatrick, J.B., A. Davison, and G.D. Daniels (2012). Resident attitudes towards trees influence the planting and removal of different types of trees in eastern Australian cities. Landscape and Urban Planning 107(2)(2): 147-158.

Kirkpatrick, J.B., A. Davison, and G.D. Daniels (2013a). Sinners, scapegoats or fashion victims? Understanding the deaths of trees in the green city. Geoforum 48: 165-176.

Kirkpatrick, J.B., A. Davison, and A. Harwood (2013b). How tree professionals perceive trees and conflicts about trees in Australia's urban forest. Landscape and Urban Planning 119(0): 124-130.

Laćan, I. and J.R. McBride (2008). Pest Vulnerability Matrix (PVM): A graphic model for assessing the interaction between tree species diversity and urban forest susceptibility to insects and diseases. Urban Forestry & Urban Greening 7(4): 291-300.

Landry, S.M. and J. Chakraborty (2009). Street trees and equity: Evaluating the spatial distribution of an urban amenity. Environment and Planning A 41(11): 2651.

Lawrence, H.W. (1993). The neoclassical origins of modern urban forests. Forest & Conservation History 37(1): 26-36.

Lindal, P.J. and T. Hartig (2015). Effects of urban street vegetation on judgments of restoration likelihood. Urban Forestry & Urban Greening 14(2): 200-209.

Lo, A.Y. and C. Jim (2012). Citizen attitude and expectation towards greenspace provision in compact urban milieu. Land Use Policy 29(3): 577-586.

Lohr, V.I. (2013). Diversity in landscape plantings: Broader understanding and more teaching needed. HortTechnology 23(1): 126-129.

Lohr, V.I., C.H. Pearson-Mims, J. Tarnai, and D.A. Dillman (2004). How urban residents rate and rank the benefits and problems associated with trees in cities. Journal of Arboriculture 30(1): 28-35.

Lowry, J., Jr., M. Baker, and R.D. Ramsey (2012). Determinants of urban tree canopy in residential neighborhoods: Household characteristics, urban form, and the geophysical landscape. Urban Ecosystems 15(1): 247-266.

Luck, G.W., L.T. Smallbone, and R. O'Brien (2009). Socioeconomics and vegetation change in urban ecosystems: Patterns in space and time. Ecosystems 12(4): 604-620.

MacIvor, J.S., M.W. Cadotte, S.W. Livingstone, J.T. Lundholm, and S.L.E. Yasui (2016). Phylogenetic ecology and the greening of cities. Journal of Applied Ecology 53: 1470-1476.

McPherson, E.G., N. van Doorn, and J. de Goede (2016). Structure, function and value of street trees in California, U.S.A. Urban Forestry and Urban Greening 17: 104-115.

Miller, R.W., R.J. Hauer, and L.P. Werner (2015). Urban Forestry: Planning and Managing Urban Greenspaces. Waveland Press.

Morgenroth, J., J. Östberg, C. Konijnendijk van den Bosch, A.B. Nielsen, R. Hauer, H. Sjöman, W. Chen, and M. Jansson (2016). Urban tree diversity—Taking stock and looking ahead. Urban Forestry & Urban Greening 15: 1-5.

Muller, R.N. and C. Bornstein (2010). Maintaining the diversity of California's municipal forests. Arboriculture and Urban Forestry 36(1): 18-27.

Netusil, N.R., Z. Levin, V. Shandas, and T. Hart (2014). Valuing green infrastructure in Portland, Oregon. Landscape and Urban Planning 124: 14-21.

Ng, W.Y., C.K. Chau, G. Powell, and T.M. Leung (2015). Preferences for street configuration and street tree planting in urban Hong Kong. Urban Forestry & Urban Greening 14(1): 30-38.

Nitoslawski, S.A. and P.N. Duinker (2016). Managing tree diversity: A comparison of suburban development in two canadian cities. Forests 7(6): 119.

Ordóñez, C. and P. Duinker (2014). Urban forest values of the citizenry in three Colombian cities. Society & Natural Resources 27(8): 834-849.

Ordóñez, C. and P.N. Duinker (2013). An analysis of urban forest management plans in Canada: Implications for urban forest management. Landscape and Urban Planning 116(0): 36-47.

Pandit, R., M. Polyakov, S. Tapsuwan, and T. Moran (2013). The effect of street trees on property value in Perth, Western Australia. Landscape and Urban Planning 110: 134-142.

Pincetl, S., T. Gillespie, D.E. Pataki, S. Saatchi, and J.D. Saphores (2013). Urban tree planting programs, function or fashion? Los Angeles and urban tree planting campaigns. GeoJournal 78(3): 475-493.

Plant, L. (1996). Brisbane's urban forest: past influences, current trends and future needs. Trees and Natural Resources 38(1): 6.

Plant, L. (2006). Brisbane: "Beautiful one day, perfect the next"—Is there room for improvement? Proceedings of 7th National Street Tree Symposium, University of Adelaide, Australia.

Plant, L., A. Rambaldi, and N. Sipe (2017). Evaluating revealed preferences for street tree cover targets: A business case for collaborative investment in leafier streetscapes in Brisbane, Australia. Ecological Economics 134: 238-249.

Plant, L. and N. Sipe (2016). Adapting and applying evidence gathering techniques for planning and investment in street trees: A case study from Brisbane, Australia. Urban Forestry & Urban Greening 19: 79-87.

Qiu, L., S. Lindberg, and A.B. Nielsen (2013). Is biodiversity attractive?—On-site perception of recreational and biodiversity values in urban green space. Landscape and Urban Planning 119: 136-146.

Raupp, M.J., A.B. Cumming, and E.C. Raupp (2006). Street tree diversity in eastern North America and its potential for tree loss to exotic borers. Arboriculture and Urban Forestry 32(6): 297-304.

Rosiers, F.D., M. Theriault, Y. Kestens, and P. Villeneuve (2007). Landscaping attributes and property buyers' profiles: Their joint effect on house prices. Housing Studies 22(6): 945-964.

Rosley, M.S.F., S.R.A. Rahman, and H. Lamit (2014). Biophilia theory revisited: Experts and non-experts perception on aesthetic quality of ecological landscape. Procedia-Social and Behavioral Sciences 153: 349-362.

Roy, S., J. Byrne, and C. Pickering (2012). A systematic quantitative review of urban tree benefits, costs, and assessment methods across cities in different climatic zones. Urban Forestry & Urban Greening 11(4): 351-363.

Santamour Jr., R.S. (1990). Trees and urban planting: Diversity, uniformity and common sense. Proceedings of the 7th Conference of the Metropolitan Tree Improvement Alliance (METRIA) Conference Lisle, IL.

Saphores, J. D. and W. Li (2012). Estimating the value of urban green areas: A hedonic pricing analysis of the single family housing market in Los Angeles, CA. Landscape and Urban Planning 104(3): 373-387.

Säumel, I., F. Weber, and I. Kowarik (2016). Toward livable and healthy urban streets: Roadside vegetation provides ecosystem services where people live and move. Environmental Science & Policy 62: 24-33.

Schroeder, H., J. Flannigan, and R. Coles (2006). Residents' attitudes toward street trees in the UK and US communities. Arboriculture and Urban Forestry 32(5): 236.

Schroeder, H.W. and S.R. Ruffolo (1996). Householder evaluations of street trees in a Chicago suburb. Journal of Arboriculture 22: 35-43.

Shakeel, T. and T.M. Conway (2014). Individual households and their trees: Fine-scale characteristics shaping urban forests. Urban Forestry & Urban Greening 13(1): 136-144.

Shanahan, D.F., D.T.C. Cox, R.A. Fuller, S. Hancock, B.B. Lin, K. Anderson, R. Bush, and K.J. Gaston (2017). Variation in experiences of nature across gradients of tree cover in compact and sprawling cities. Landscape and Urban Planning 157: 231-238.

Shanahan, D.F., B.B. Lin, K.J. Gaston, R. Bush, and R.A. Fuller (2014). Socio-economic inequalities in access to nature on public and private lands: A case study from Brisbane, Australia. Landscape and Urban Planning 130(0): 14-23.

Silvera Seamans, G. (2013). Mainstreaming the environmental benefits of street trees. Urban Forestry & Urban Greening 12(1): 2-11.

Sjöman, H., J. Morgenroth, J.D. Sjöman, A. Sæbø, and I. Kowarik (2016). Diversification of the urban forest—Can we afford to

exclude exotic tree species? Urban Forestry and Urban Greening 18: 237-241.
Sreetheran, M., M. Adnan, and A.K.K. Azuar (2011). Street tree inventory and tree risk assessment of selected major roads in Kuala Lumpur, Malaysia. Arboriculture and Urban Forestry 37(5): 226-235.
Subburayalu, S. and T.D. Sydnor (2012). Assessing street tree diversity in four Ohio communities using the weighted Simpson index. Landscape and Urban Planning 106(1): 44-50.
Summit, J. and E.G. McPherson (1998). Residential tree planting and care: A study of attitudes and behavior in Sacramento, California. Journal of Arboriculture 24(2): 89-97.
Thaiutsa, B., L. Puangchit, R. Kjelgren, and W. Arunpraparut (2008). Urban green space, street tree and heritage large tree assessment in Bangkok, Thailand. Urban Forestry & Urban Greening 7(3): 219-229.
Todorova, A., S. Asakawa, and T. Aikoh (2004). Preferences for and attitudes towards street flowers and trees in Sapporo, Japan. Landscape and Urban Planning 69(4): 403-416.
Trowbridge, P.J. and N.L. Bassuk (2004). Trees in the Urban Landscape: Site Assessment, Design, and Installation. John Wiley & Sons.
van Dillen, S.M.E., S. de Vries, P.P. Groenewegen, and P. Spreeuwenberg (2012). Greenspace in urban neighbourhoods and residents' health: Adding quality to quantity. Journal of Epidemiology and Community Health 66(6): e8.
Vos, P.E.J., B. Maiheu, J. Vankerkom, and S. Janssen (2013). Improving local air quality in cities: To tree or not to tree? Environmental Pollution 183: 113-122.
Weber, F., I. Kowarik, and I. Säumel (2014). A walk on the wild side: Perceptions of roadside vegetation beyond trees. Urban Forestry & Urban Greening 13(2): 205-212.
Weber, R., J. Schnier, and T. Jacobsen (2008). Aesthetics of streetscapes: Influence of fundamental properties on aesthetic judgments of urban space. Perceptual and Motor Skills 106(1): 128-146.
Williams, K. (2002). Exploring resident preferences for street trees in Melbourne, Australia. Journal of Arboriculture 28(4): 161-170.
Young, R.F. (2011). Planting the living city: Best practices in planning green infrastructure—Results from major U.S. cities. Journal of the American Planning Association 77(4): 368-381.

Lyndal Plant (corresponding author)
Casual Research Staff
School of Agriculture and Food Sciences
University of Queensland
QLD. 4072, Australia

Dave Kendal
Senior Lecturer
School of Technology, Environments and Design
University of Tasmania
TAS, 7005, Australia

Résumé. Les villes établissent des cibles visant à accroitre la diversité des espèces chez les arbres d'alignement afin d'améliorer leur résilience et amplifier l'apport de la forêt urbaine sur le plan des services écosystémiques. L'évaluation de la composition et de la structure des alignements d'arbres et leur vulnérabilité conséquente aux stress des changements climatiques, des ravageurs et des maladies, offrent des orientations en vue de l'atteinte de ces cibles. Cependant, prendre en compte les préférences des résidents locaux en lien avec la diversité des espèces dans les alignements est également important afin de rencontrer ces cibles. L'essentiel de la recherche sur les préférences citoyennes pour les arbres d'alignements a porté jusqu'à maintenant sur les caractéristiques recherchées pour un arbre individuel, sans référence à des caractéristiques contextuelles ou collectives comme la diversité des espèces. Nous avons supputé les préférences de résidents pour des particularités d'ensembles d'arbres de rue, incluant une abondance d'espèces, à partir du prix de vente de maisons dans la ville de Brisbane, Australie. Bien que les acheteurs soient disposés à payer une prime pour des maisons situées sur des rues plantées d'arbres matures et âgés, leur tolérance envers une diversité d'espèces était limitée à un maximum de six espèces dans leur voisinage. La tolérance variait également dans la ville, avec une plus grande sensibilité aux mélanges d'espèces pour des emplacements présentant un meilleur avantage socio-économique. Ces résultats suggèrent qu'une diversité accrue ne sera pas automatiquement acceptée par la communauté. Les villes doivent être prudentes dans leur approche visant à augmenter la diversité des espèces d'arbres à plus fine échelle comme pour l'aménagement de rues boisées, au sein de la forêturbaine.

Zusammenfassung. Verwaltungen setzen Ziele zur Erhöhung der Straßenbaumdiversität, um die Widerstandsfähigkeit zu unterstützen und die Ökosystemleistungen aus den urbanen Wäldern zu erhöhen. Untersuchungen der Straßenbaumzusammensetzung und der Struktur und nachfolgend auch deren Anfälligkeit gegenüber Stressfaktoren des urbanen Klimawechsels, Schädlingen und Krankheiten liefern Richtlinien für solche Ziele. Dennoch ist auch die Untersuchung von Präferenzen der lokal Ansässigen bezüglich der Charakteristika der individuellen Straßenbäume wichtig für die Erreichung dieser Ziele. Viel von der gegenwärtigen Forschung zur Präferenz von Straßenbäumen fokussierte bislang auf der Präferenz der Anwohner, ohne eine Referenz zu kollektiven/kontextabhängigen Charakteristika wie Artenvielfalt. Wir leiteten die Vorlieben der Anwohner für kollektive Straßenbaummerkmale, einschließlich Artenreichtum aus benachbarten Hausverkaufspreisen in der Stadt Brisbane, Australien ab. Während Hauskäufer bereit waren, mehr für Häuser in Straßen mit ausgewachsenen und alten Bäumen zu zahlen, war ihre Toleranz für eine Mischung von Arten begrenzt auf nicht mehr als sechs Arten in der Nähe. Die Toleranz variierte auch innerhalb der Stadt mit größerer Sensitivität für Mischungen von Arten an Standorten mit größerem sozio-ökonomischen Vorteil. Diese Ergebnisse verdeutlichen, dass wachsende Artenvielfalt nicht automatisch von der Kommune akzeptiert wird. Verwaltungen müssen vorsichtig sein bei ihrem Versuch, die Artenvielfalt im Feinbereich, wie Straßenzügen und innerhalb von urbanen Wäldern zu erhöhen.

Resumen. Los municipios están estableciendo objetivos para aumentar la diversidad de especies de árboles urbanos y así apoyar la resiliencia y mejorar la oferta de servicios ecosistémicos del

bosque urbano. Las evaluaciones de la composición y la estructura de los árboles de la calle y la consiguiente vulnerabilidad al estrés del cambio climático urbano, las plagas y las enfermedades, ofrecen orientación para tales objetivos. Sin embargo, la evaluación de las preferencias de los residentes locales hacia la diversidad de especies también es importante para lograr dichos objetivos. Gran parte de la investigación sobre la selección de árboles hasta la fecha se ha centrado en las preferencias de los residentes por las características individuales de los árboles, sin hacer referencia a características colectivas / contextuales como la diversidad de especies.

Inferimos las preferencias de los residentes por las características colectivas de árboles, incluida la riqueza de especies, de los precios de venta de casas cercanas en la ciudad de Brisbane, Australia. Si bien los compradores de casas estaban dispuestos a pagar una prima por las casas en las calles con árboles maduros, su tolerancia a las mezclas de especies se limitaba a no más de seis especies cercanas. La tolerancia también varió dentro de la ciudad con mayor sensibilidad a las mezclas de especies en lugares de mayor ventaja socioeconómica. Estos hallazgos sugieren que la comunidad no aceptará automáticamente una mayor diversidad. Los municipios deben ser cautelosos en su enfoque para aumentar la diversidad de especies de árboles en escalas más finas, como los paisajes urbanos, dentro del bosque urbano.