

**A survey of attitudes and practices of Australian street tree practitioners.**



**January 2011**

**Martin Ely AILA MPIA  
Registered Landscape Architect  
martin-ely@hotmail.com**

## 1.1 Introduction

Street trees provide cities with a range of social, economic and environmental benefits, with large, mature trees providing the maximum benefits (Geiger 2004). Street trees can in fact be conceptualized as a form of 'green infrastructure', delivering a range of environmental and human services alongside the 'grey infrastructure' of conventional engineering services (Wolf 2003). However street trees face an extremely hostile environment in the city and may struggle to survive and grow (Spirn 1984). These challenges are exacerbated by 'unsustainable' streetscape design and tree planting practices, such as planting trees in undersized tree pits dug in compacted urban soils, and surrounding trees with hard impervious surroundings (Thompson & Sorvig 2008). These practices often result in declining tree health, reduced tree life spans, increased tree mortality, and also conflicts between trees and surrounding infrastructure.

A doctoral research project was undertaken by landscape architect and urban designer Martin Ely at the University of Adelaide, School of Architecture, Landscape Architecture and Urban Design, aimed at developing a more sustainable model for the design of streets and other urban spaces to better accommodate the needs of trees, cities based on the expert opinions of researchers and practitioners in the field (Ely 2010). A mixed-method research strategy was adopted, using both quantitative and qualitative techniques (Creswell 2009). A detailed literature review of current tree planting practices was undertaken covering the following topics: providing space both above and below ground; providing trees with the resources for growth; and minimizing a range of infrastructure conflicts. The views of a variety of professionals across Australia were then collected using various techniques. These included an Australia-wide online survey of local government practitioners to address the 'bigger picture', followed up with in-depth interviews with practitioners in metropolitan Adelaide, to provide a more detailed understanding of the issues. Detailed case studies were also conducted in four Australian capital cities, including interviews with local luminaries, to review current 'best practice' techniques and policies for street tree planting. The outcome of this research was a 'Model for Tree Sensitive Urban Design (TSUD)' which includes a set of 'structural' and 'non-structural' principles and 'best management practices' aimed at better integrating the needs of street trees in the planning and design process.

The following paper presents the results of the quantitative online survey undertaken in 2008/2009 to obtain a 'snapshot' of the attitudes and practices of street tree practitioners throughout Australia.

The survey was targeted primarily at staff working in tree related fields within local government organizations.

## 1.2 Methodology

### Survey research

Questionnaire based survey research is one method of data collection in quantitative correlation research (Crockford & Richardson 2000; Groat & Wang 2002). The aim of survey research is to provide a quantitative or numerical description of some characteristic of a sample of a population, and from that sample make inferences about the wider population (Babbie 1990). Survey data collection can take a number of forms including self administered questionnaires and structured record interviews. Surveys may also be internet based, administered online (Nesbary 2000; Babbie 2001). Advantages of mail or internet based surveys include the ability to conveniently and economically collect a large amount of data from a large number of people in a limited time (Fowler 2002). However convenience and economy may come at the cost of a lack of in-depth understanding of the issues surveyed (Groat & Wang 2002). In this study online survey research was used to establish a broad picture of issues over a wide geographic population, and was then followed up with in-depth interviews to develop a deeper understanding of those issues.

### Online survey

The survey instrument was developed and administered using *Survey Monkey* online software (<http://www.surveymonkey.com/>). The researcher subscribes to the service, and an online questionnaire is developed using standardized questionnaire formats. An invitation and link to the online questionnaire can then be placed on a website, or distributed electronically via email (either by the researcher or by *Survey Monkey*). The software provider also collects survey responses and tabulates the data in spreadsheet and summary format. Advantages of online surveys include the ability of respondents to complete the survey in their own time, or in their workplace, and anonymity (Brace 2004). It is also less expensive and quicker to convey to respondents than paper based mail out surveys. Typically many people will respond within a day of receiving, and there is often a large response on the day the invitation is sent (Yun & Trumbo 2000). Online surveys are also 'dynamic' in that responses can be analyzed statistically on a continuing basis as they are received. Partially completed questionnaires can also be analyzed. Online surveys also allow easier use of 'skip logic' than paper based questionnaires, where respondents can click a 'next' button to go to follow up questions. It is also possible to track responses in terms of who has and has not responded (Sheehan 2001). Disadvantages include time restraints on questionnaire length, and ethical issues of personal intrusion by sending unsolicited emails (Yun & Trumbo 2000). Email messages may

also be rejected as SPAM. *Survey Monkey* has an anti-spamming agreement and an opt-out link field in its email invitation allowing the recipient to opt out of the mailing list. Another concern is the ability of a respondent to fill out multiple questionnaires, including logging on as a different user. This was not considered to be a significant concern for this survey due to the nature of the questions and the targeting of the survey to specific groups. It was not considered that there was a motivation for respondents to attempt to bias the survey results. Respondents were assured of anonymity and confidentiality, however there was an option for the respondent to provide personal details if desired. Of the total respondents 89.5 percent voluntarily provided their name and 96.5 percent the name of their organization, allowing for checking of the validity of responses if required.

### **Survey instrument**

The survey instrument consisted of an online questionnaire. The questionnaire was designed to collect as much information as possible within the time constraints of an online format. Questions were a mix of multiple-choice, rating scale and open-ended formats, and questions were presented in the following sequence:

- Introductory message.
- Part A-Details of individual and organisation.
- Part B-Attitudes to a range of street tree issues.
- Part C-Use of a range of street tree practices.
- Closing message.

Respondents were invited to provide their name and contact details, but this remained optional. When emailed to respondents or placed in an organization's electronic newsletter, the survey link and invitation to respond were accompanied by an explanation of the aims of the research project and contact details for any queries. All questions were optional, and partially completed questionnaires could be submitted, and were included in the data analysis. The questionnaire was first developed in paper form and pilot tested with selected respondents. The online survey was also pretested electronically prior to final posting online.

### **Ethics approval**

Approval of the survey methodology and questionnaire was obtained from the University of Adelaide Ethics Committee. The online questionnaire included University of Adelaide and TREENET letterhead, with TREENET actively supporting the survey. Respondents had the option of providing their names and contact details, and were advised that the survey results would remain anonymous and confidential.



### **Survey distribution**

The survey was administered through a variety of means aimed at the target population of local government arborists and landscape architects, as well as planners, engineers and asset managers. These included:

- Emailing the survey link to potential respondents listed in available data bases, with an invitation to respond to the survey.
- Placing the survey link in online newsletters distributed by professional bodies to their memberships, with an invitation to respond.

Survey links were distributed through the following organizations.

- TREENET data base (222 Local Government members).
- AILA (Australian Institute of Landscape Architects) electronic newsletter and website.
- PIA (Planning Institute of Australia) electronic newsletter.
- ALGA (Australian Local Government Association) electronic newsletter.
- LGMA (Local Government Manager's Association) electronic newsletter.
- ISAAC (International Society of Arborists Australian Chapter) electronic newsletter.
- Engineers Australia electronic newsletter.

The survey provided a means of collecting data from a sample of the wider population, which comprised local government tree managers and others in local government involved with planning for urban trees. As such the total population size was not known. While data bases do exist for certain groups, such as arborists, landscape architects, and planners, these are confidential and do not necessarily identify those working in local government. A 'cluster' sampling approach was adopted which can be used where it is impossible or impractical to compile a list of the wider population, and the population within groups or organizations is sampled (Babbie 2001). Therefore, with the exception of the TREENET data base, the survey link was distributed via each organizations electronic newsletter. This comprises a 'convenience' sample, based on availability of respondents, rather than a completely randomized sample.

### **Survey response**

The highest rates of response occurred in the week immediately following the online distribution of each survey link. Follow up invitations were also contained in subsequent electronic newsletters.

Personal follow up reminders were also sent where non-respondents could be identified, as in the TREENET database. 282 participants began the survey, with 261 completing it (92.6%). It should also be noted that useable data can be obtained from partially completed questionnaires. The *Survey Monkey* software enables identification of responses by the different 'collector' tools. Table 1 summarizes responses from the different 'collectors'. With the exception of the TREENET mail out, the total population being surveyed (potential responses) remained unknown. This was due to the fact that the organizational data-base being surveyed either remained confidential (the organization maintained a database but protected its confidentiality), or was unknown (the organization maintained a membership data-base, but the potential respondent sample could not be identified within that broader data-base). The wide online distribution of the survey also meant that other non-targeted individuals could submit responses if they desired.

**Table 1: Survey response by collector**

Collector	Number of responses	Potential responses
TREENET	136	222
AILA	69	Unknown
Other	77	Unknown
TOTAL	282	Unknown

It is also acknowledged that the survey will tend to have a 'pro tree' bias, being distributed primarily to those dedicated to urban tree planning and management, and with an interest in street tree issues. However the aim of the survey was to assess the attitudes of local government tree managers rather than the wider population. One respondent suggested that it would be of value to administer the survey to a range of other 'non tree' professions and groups.

Data produced by the survey were analysed using simple descriptive statistics including tables and charts generated by the online provider. Initial analysis was based on the total sample of 282 responses (with the actual number of responses varying between questions). Further more detailed analysis could also be undertaken by smaller subgroups of respondents such as by State, or by discipline; however this would involve making inferences based on smaller samples. However a comparison was made between the two groups identified as landscape architects (68) or arborists (98) to identify any possible differences in attitudes between the two disciplines.

### **Response by State**

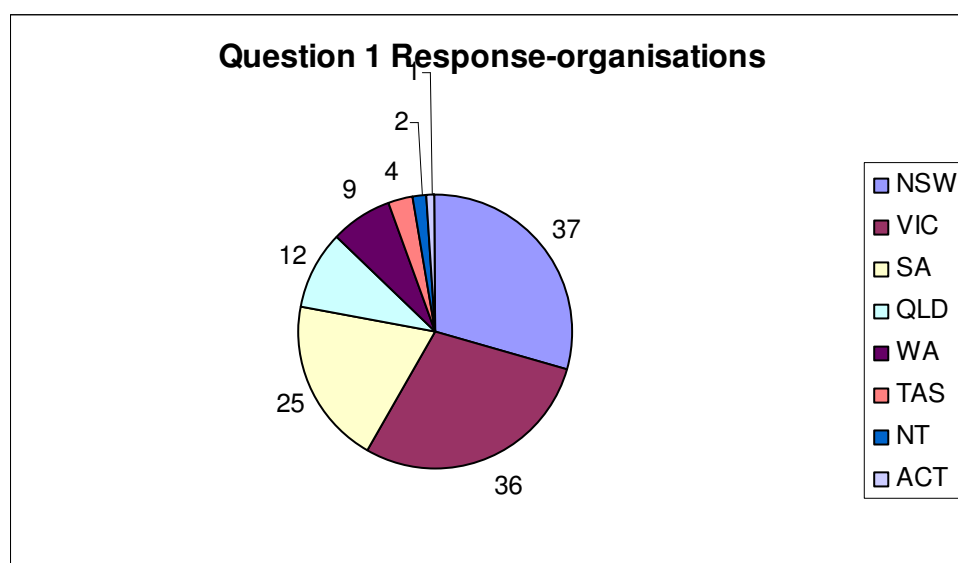
Survey responses were obtained from all Australian States. Table 2, Figure 1 and Figure 2 summarize responses from each State by individuals and by organizations (with some organizations providing responses from more than one individual). It should be noted that although

the survey was anonymous some respondents still did not provide details of their location or organization.

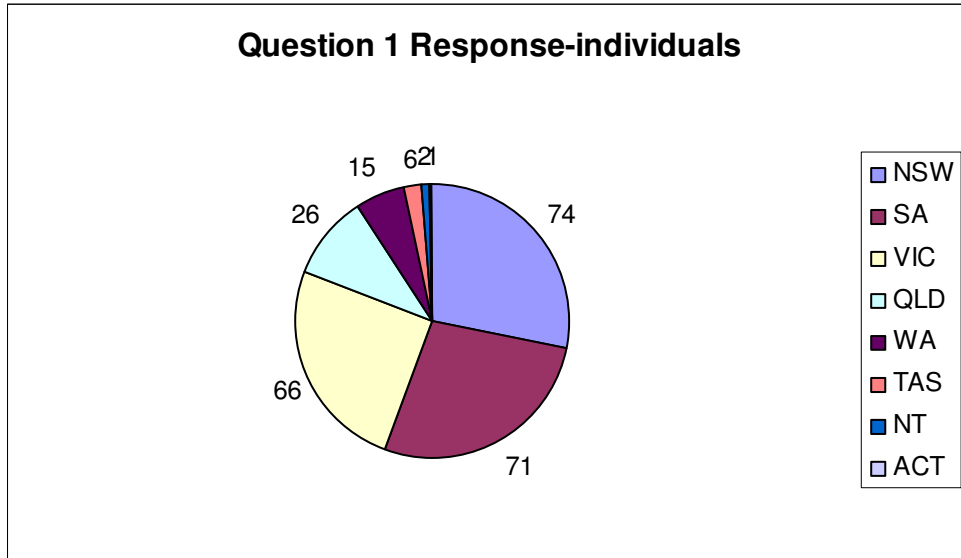
**Table 2: Survey response by State**

State	No. of responses (individuals)	No. of responses (organizations)
NSW	74	36
Vic	66	35
SA	71	26
Qld	26	12
WA	15	9
Tas	6	3
NT	2	2
ACT	1	1
Total	261	109

The highest number of responses was from the two most populous States. The relatively high proportion from South Australia was possibly due to higher local awareness with the survey being South Australian based. Relatively low responses from Queensland may be due to the fact that the whole of the Brisbane metropolitan area is administered by a single 'greater metropolitan' Council (population over one million). Local government amalgamations also occurred in Queensland during the course of the survey. The potential widespread distribution of online surveys was confirmed with several unsolicited responses from overseas (not included in the analysis).



**Figure 1: Survey response by State (organizations)**

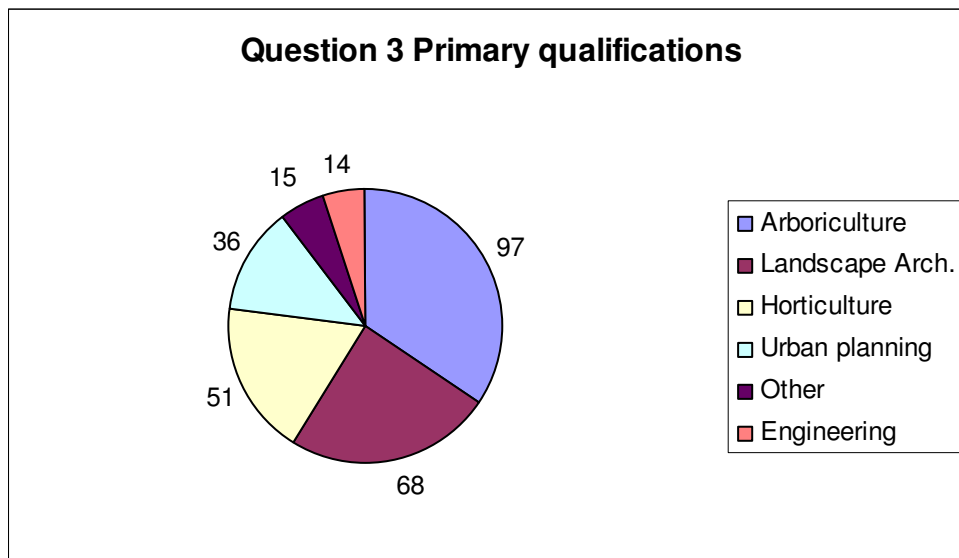


**Figure 2: Survey response by State (individuals)**

It is considered that the organizations responding represented a reasonable geographic coverage in the larger states, including all capital cities and many of the larger urban and regional centres.

### Response by discipline (qualifications)

The primary qualifications of respondents, presented in Figure 3, were taken as an indication of their professional discipline. Some respondents also had a secondary qualification, not included in the diagram). The largest response was from the targeted groups of arboriculture/horticulture (148 or half of respondents) and landscape architecture (68 or one quarter of respondents). There were relatively fewer responses from planners (36), engineers (14) and others (15), despite the survey being distributed through their professional bodies. This may be indicative of a higher level of interest in the topic amongst 'pro-tree' professions such as arborists and landscape architects, with relatively little interest by groups such as engineers. The 'other' category included a predominance of science-based qualifications (10) such as natural resource management.



**Figure 3: Survey response by primary qualifications**

### **1.3 Respondent attitudes and perceptions**

Questions 7-10 investigated respondents attitudes and perceptions on a number of street tree topics. Respondents were asked rate their responses on a scale of 1-5. The following figures present this data in the form of rating averages for each question, for all respondents who answered that question. Provision was also made for open-ended responses, which are summarized in the text. In the following sections the findings from each question are discussed and conclusions drawn. A comparison was also made of the responses of individuals identified in the survey as either landscape architects (68) or arborists (98) to give an insight into any possible differences in perceptions between the two disciplines.

### 1.3.1 Benefits

Current street tree literature emphasizes the many benefits delivered by street trees, especially their human health and well-being benefits, and the more quantifiable ecological services they can provide. Respondents were asked to rate a range of street tree benefits on a scale of 1-5. The intent of the question was to attempt to quantify the priorities given by respondents to the different categories cited in the current literature on urban and street trees benefits. Figure 4 presents rating averages for all 262 respondents who answered the question. Figure 5 presents a more detailed analysis of responses to the question.

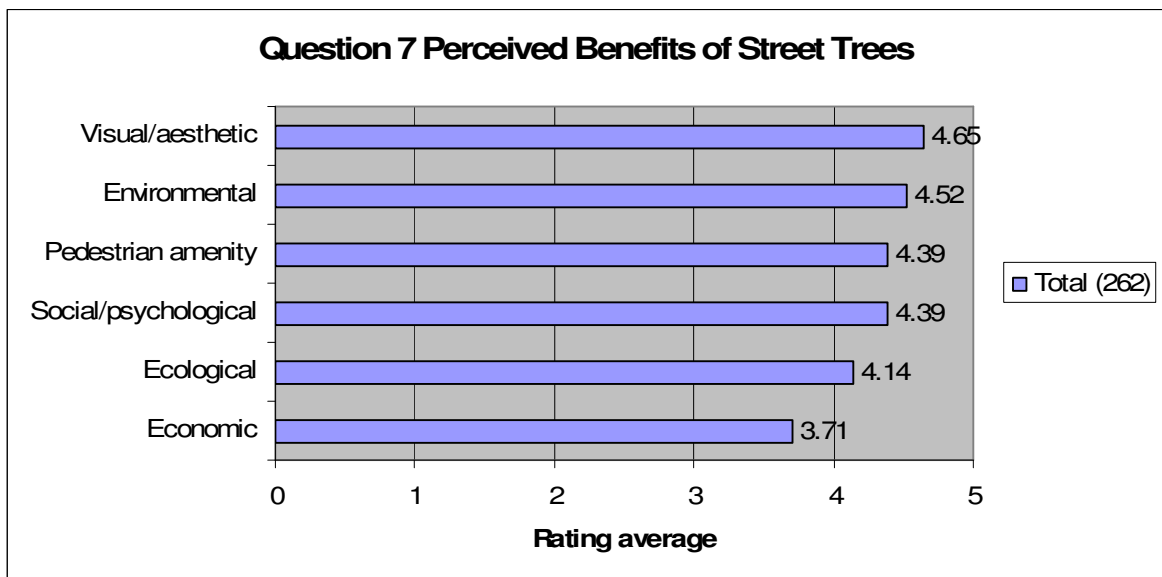


Figure 4: Perceived street tree benefits

**How do you rate each of the following possible benefits of street trees, from least (1) to most (5).**

Answer Options	1	2	3	4	5	Rating Average	Response Count
Environmental	1	8	15	67	<b>169</b>	4.52	260
Ecological	3	17	43	74	<b>123</b>	4.14	260
Pedestrian amenity	3	5	20	90	<b>140</b>	4.39	258
Visual/aesthetic	3	2	8	57	<b>191</b>	4.65	261
Economic	8	29	68	<b>80</b>	74	3.71	259
Social/psychological	4	6	14	80	<b>128</b>	4.39	232
Other(please specify below)							31
<b>answered question</b>							<b>262</b>
<b>skipped question</b>							<b>20</b>

Figure 5: Detailed responses: question 7

**Discussion**

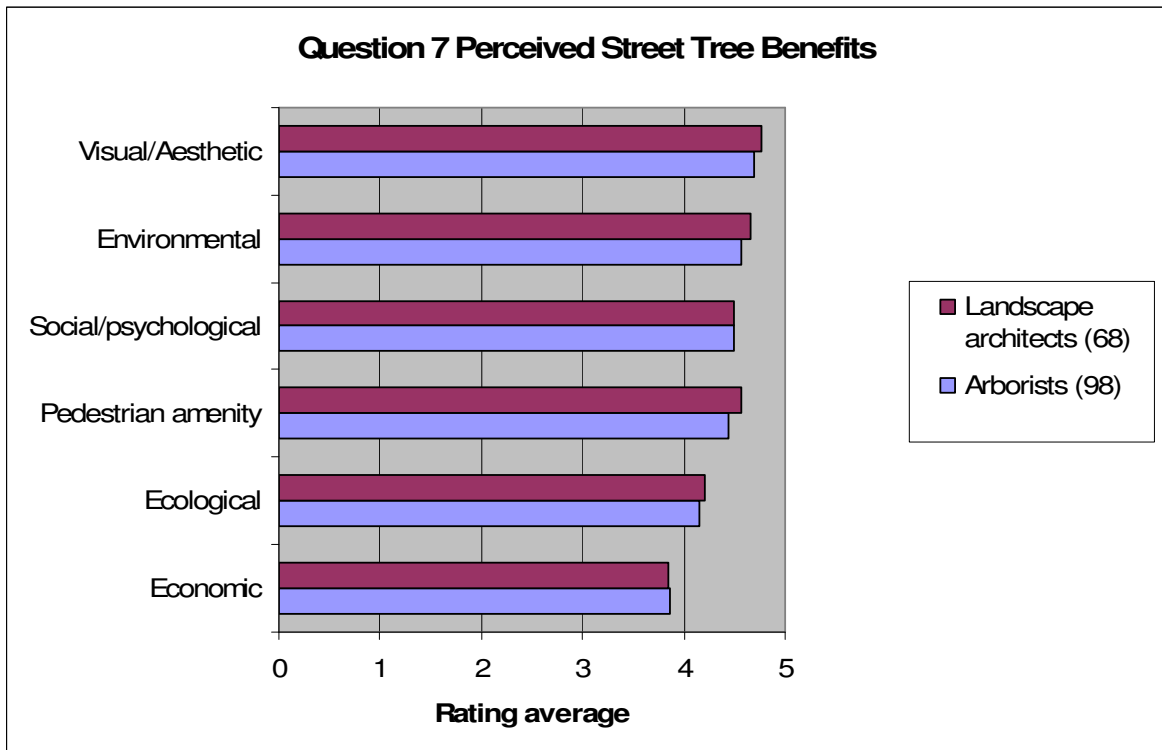
As expected, respondents, being well informed on the topic, gave high ratings to all categories of street tree benefits. Despite recent emphasis on the quantifiable environmental benefits of trees, their less tangible visual and aesthetic roles were still rated highest. Ecological and economic benefits rated lowest (although still high), possibly due to the varying ecological value of urban tree populations, and the less well researched nature of economic benefits.

**Open ended responses (31 responses)**

Respondents referred to the many benefits of urban trees. A key environmental benefit is shade and reduction of the urban heat island effect. Shade is also an important factor in creating urban amenity. Ecological benefits are dependent on species and location. Economic benefits include increased property values. Social and psychological benefits include traffic calming effects. Cultural and heritage values are also significant, and could be included as a separate benefit category in future surveys. The issue of anti-tree attitudes of some residents was also raised, and lack of awareness of benefits by the community.

**Comparison of landscape architects and arborists.**

Figure 6 presents responses of landscape architects (68) and arborists (98) to give an insight into any possible differences in perceptions of street tree benefits between the two disciplines. The ranking of benefits is the same for the two groups, with landscape architects providing a slightly higher rating in all categories except economic benefits.



**Figure 6: Perception of street tree benefits by landscape architects and arborists**

### Conclusion

In recent years a large body of literature has developed on the benefits of street trees and the urban forest (Clark & Matheney 2009). This has emphasized the environmental benefits of trees in terms of quantifying the ecological services they can deliver (Nowak & Dwyer 2007). Most of this has been quantitative research undertaken by arborists and related scientific disciplines (McLean *et al.* 2007) In part this can be seen as an attempt to 'legitimize' the value of trees as urban infrastructure in the eyes of engineers and asset managers, to prove that trees are more than just 'aesthetic decoration' in a street. This also reflects a shift in urban tree management paradigms from creating 'urban amenity' to one of risk and asset management. An interesting outcome of the survey is that, while the environmental benefits of trees are well recognized, the main perceived benefit is their visual/aesthetic role. This aspect is less tangible and less easily quantified, and little research has been undertaken by those well versed in the field of urban aesthetics and 'place making'. However the visual, aesthetic and place making role of trees in cities is very real.

### 1.3.2 Issues

As well as delivering a range of benefits, there are also a number of issues, problems and on-going costs associated with planting and maintaining the urban forest. Respondents were asked to rate a range of issues associated with street trees on a scale of 1-5. The intent of the question was to attempt to quantify respondents perceptions of urban street tree related issues based on the main issues identified in the literature review, and with provision for additional open ended comments. Figure 7 presents rating averages for all 257 respondents who answered the question. Figure 8 presents a more detailed analysis of responses to the question.

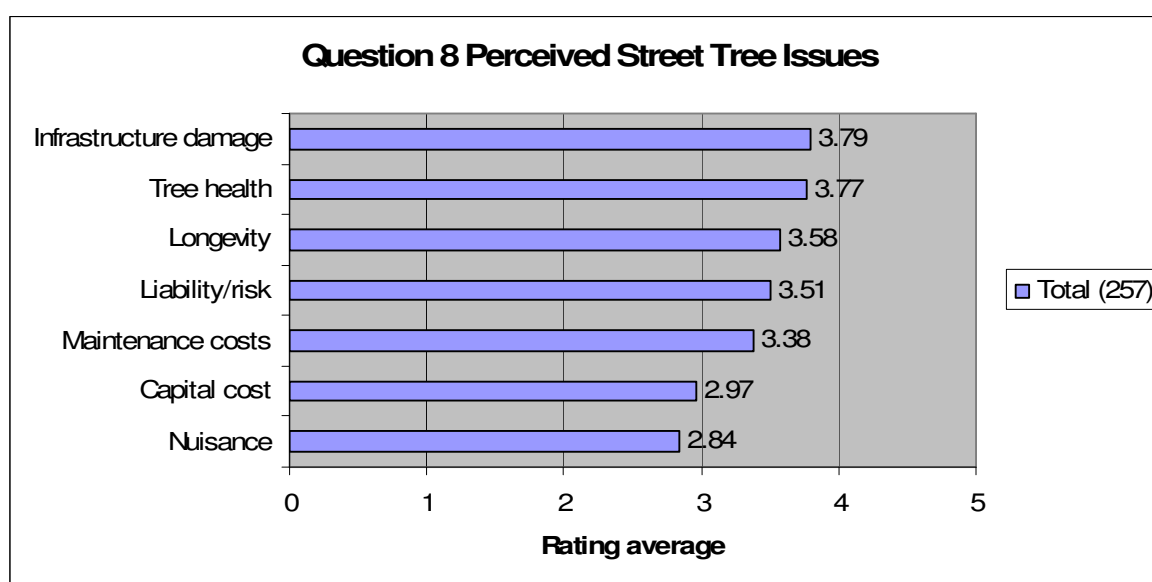


Figure 7: Perceived street tree issues

How do you rate each of the following possible issues or problems involving street trees, from least (1) to most (5)?							
Answer Options	1	2	3	4	5	Rating Average	Response Count
Poor tree health	6	23	56	<b>109</b>	61	3.77	255
Reduced tree longevity	9	28	79	<b>85</b>	55	3.58	256
Infrastructure damage	10	27	54	80	<b>84</b>	3.79	255
Street tree nuisance	41	<b>69</b>	59	56	27	2.84	252
Liability/risk	9	49	64	<b>67</b>	64	3.51	253
Capital costs	23	<b>74</b>	69	65	24	2.97	255
Maintenance costs	12	49	69	<b>81</b>	42	3.36	253
Other (please specify below)							28
<b>answered question</b>							<b>257</b>
<b>skipped question</b>							<b>25</b>

Figure 8: Detailed responses: question 8

## **Discussion**

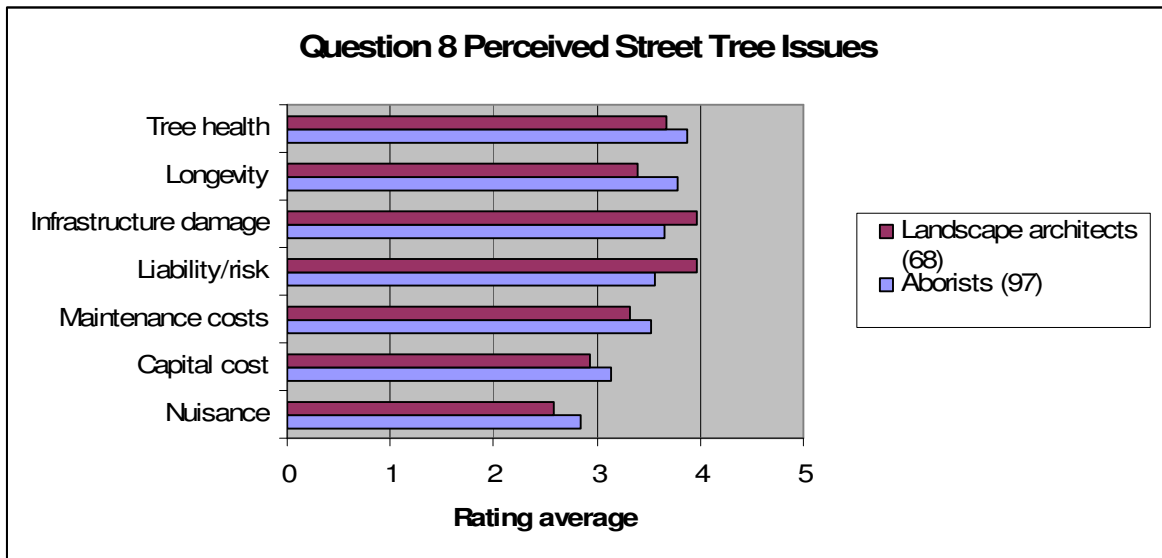
Respondents generally gave street tree issues and problems lower ratings than benefits. Infrastructure damage was rated as the main issue, which also relates to the other significant issues of tree health and longevity. Capital costs and nuisance were seen as the least significant. Liability was rated as a more significant issue than nuisance, with tree managers possibly seeing tree nuisance as a perceived rather than real problem. Ongoing maintenance costs were seen as more significant than capital costs.

### **Open ended responses (27 responses)**

Infrastructure conflicts in urban areas included below ground and overhead services and buildings. Soil compaction is also implicated in infrastructure damage and declining tree health. Risk and nuisance are seen as both real and perceived issues. Urban development in general is also an issue. Poor management practices were noted as of more significance than limited budgets. Once again the issue of negative community perceptions of trees was raised. It was suggested that increased awareness of benefits could help offset negative community attitudes to trees. Non-physical issues such management practices and negative community attitudes to trees could be included as separate issue categories in future surveys.

### **Comparison of landscape architects and arborists.**

Figure 9 presents responses of landscape architects (68) and arborists (98) to give an insight into any possible differences in perceptions of street tree issues between the two disciplines. Differences can be observed in the ranking of issues by the two groups. While arborists gave the highest ranking to tree health and longevity, landscape architects ranked infrastructure damage and public liability the highest. This may be due to the landscape architects involvement in the design of the 'hard landscape', with the arborist's main focus on the tree. In all categories except infrastructure damage and liability, landscape architects gave a lower rating to each issue than arborists. This may be due to the fact that landscape architects tends to be less involved with longer term tree issues and street tree management, their role often ending once the tree and streetscape have been installed and established.



**Figure 9: Perception of street tree issues by landscape architects and arborists**

### **Conclusion**

The survey confirmed the findings of the literature review that infrastructure damage is a significant and universal issue for urban tree managers (Costello & Jones 2003), and that tree health and longevity are key concerns in urban settings (Urban 2004). Concerns for liability and risk also reflect the current paradigm of street tree management which has evolved from urban amenity to risk and asset management (Norris 2005).

### 1.3.3 Constraints

The urban environment comprises a hostile environment for the planting and establishment of street trees, which may be exacerbated by unsustainable planting practices. Respondents were asked to rate a range of constraints on street tree establishment, on a scale of 1-5. The intent of the question was to attempt to quantify respondent's perceptions of the constraints on urban street tree planting and establishment identified in the literature review, and with provision for additional open ended comments. Figure 10 presents rating averages for all 260 respondents who answered the question. Figure 11 presents a more detailed analysis of responses to the question.

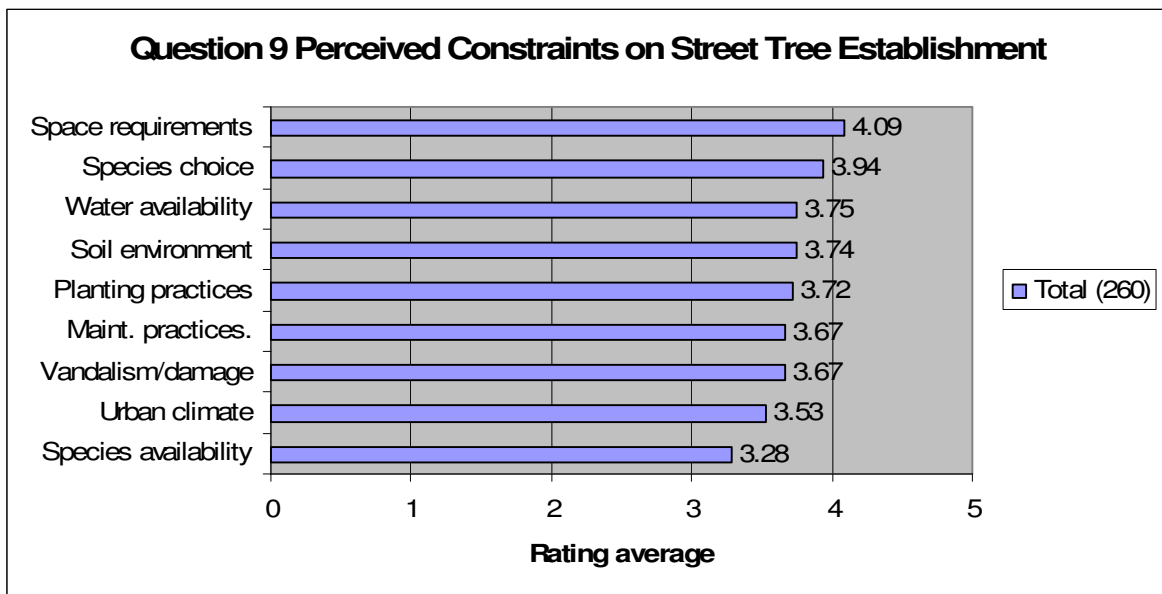


Figure 10: Perceived street tree constraints

<b>How do you rate each of the following possible constraints on the successful establishment of trees in city streets, from least (1) to most (5)?</b>							
<b>Answer Options</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>Rating Average</b>	<b>Response Count</b>
Space requirements	9	19	29	83	<b>116</b>	4.09	256
Soil environment	7	21	65	<b>103</b>	61	3.74	257
Harsh urban climate	7	31	83	<b>90</b>	46	3.53	257
Vandalism and damage	10	33	60	<b>83</b>	71	3.67	257
Planting and estab. practices	11	33	52	<b>83</b>	78	3.72	257
Maintenance practices	7	36	53	<b>96</b>	63	3.67	255
Water availability	9	33	51	<b>83</b>	77	3.74	253
Species choice	13	20	41	74	<b>106</b>	3.94	254
Species availability	22	48	65	<b>69</b>	47	3.28	251
Other (please specify below)							29
						<b>answered question</b>	<b>260</b>
						<b>skipped question</b>	<b>22</b>

**Figure 11: Detailed responses: question 9**

### **Discussion**

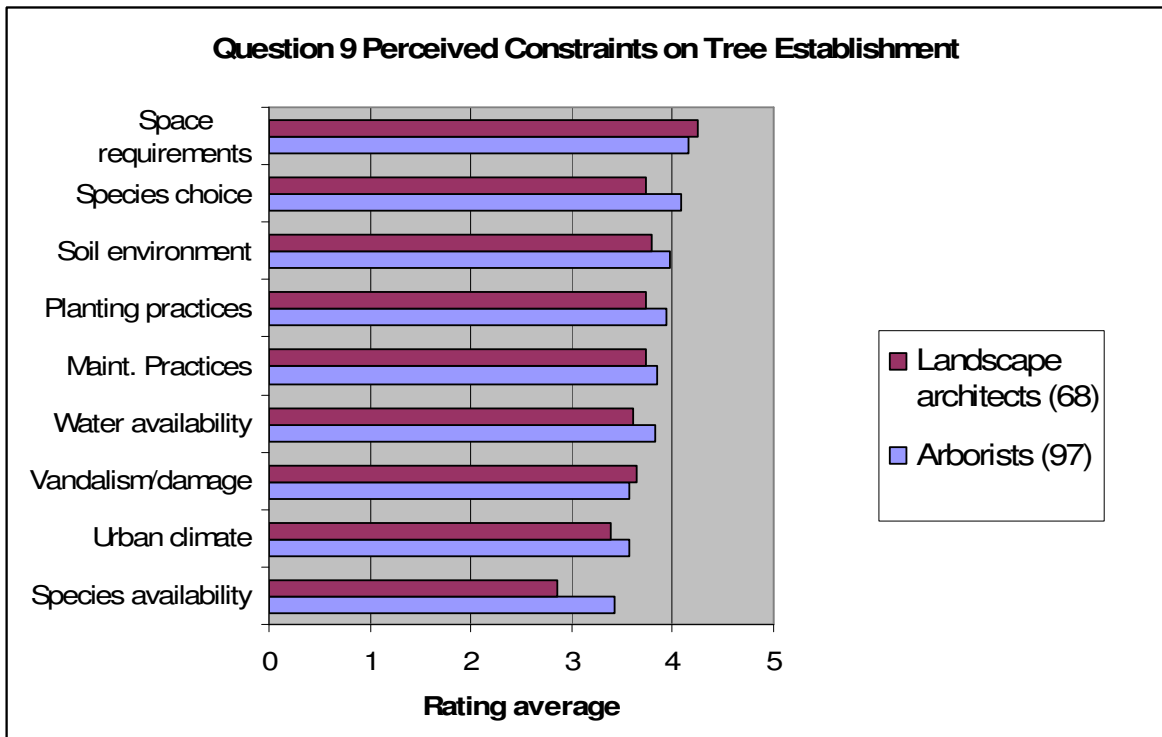
A wide range of factors were considered to be constraints. Lack of space was rated as the main constraint. Limited species choice rated second. Both of these rated higher than water availability and a range of other physical constraints.

### **Open ended responses (28 responses)**

It was noted that many street tree constraints can be overcome with appropriate species selection. Soils are a physical constraint in some areas. A wide range of organizational factors were also raised as constraints, including lack of knowledge, policies and support. Availability of appropriate tree stock was also identified as a constraint. Other concerns raised included the constraints imposed by the nature of recent urban development and associated services. These factors could be included as separate constraint categories in future surveys.

### **Comparison of landscape architects and arborists.**

Figure 12 presents responses of landscape architects (68) and arborists (98) to give an insight into any possible differences between the two disciplines in perceptions of constraints on street tree establishment. Both groups had a similar ranking of constraint factors, with the most important factor being space requirements. However arborists gave a consistently higher rating in all categories except space requirements, indicating that arborists may perceive more constraints on tree establishment. One hypothesis may be that this is due to a greater knowledge by arborists of biological tree requirements and related constraints. Another may be the arborists more extended involvement with the tree life cycle and awareness of longer term failure due to poor planting practices.



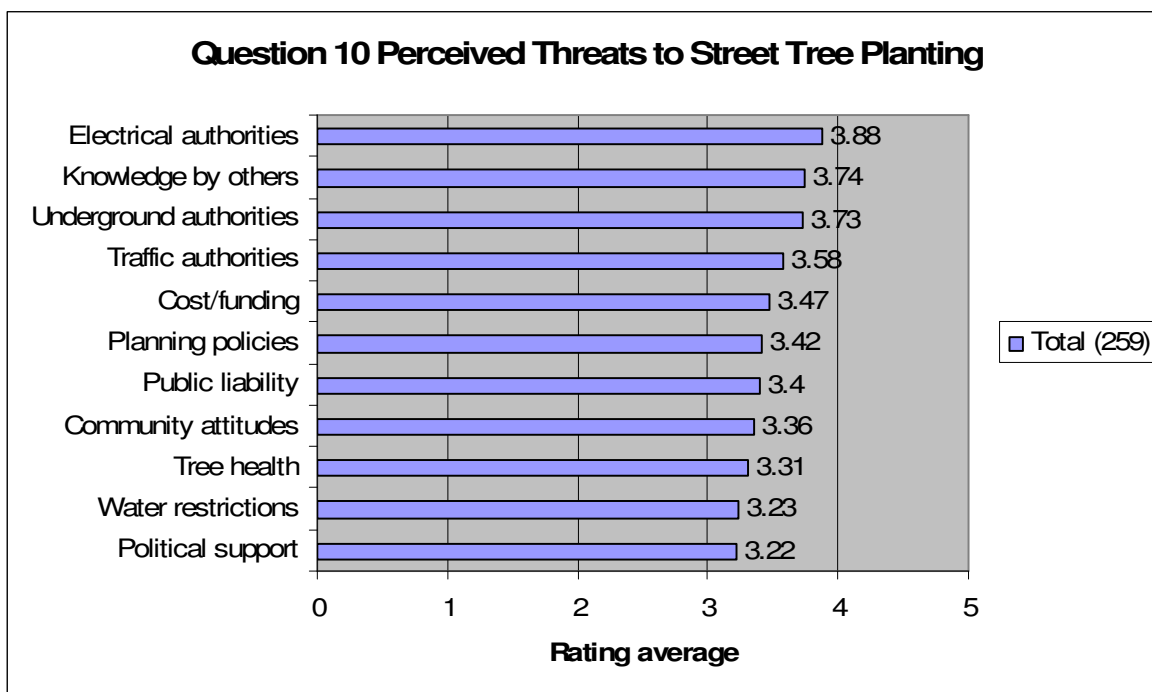
**Figure 12: Perception of street tree constraints by landscape architects and arborists**

### Conclusion

The survey confirmed the findings of the literature review, that lack of space is the key constraint in urban street tree planting (Urban 1992). Lack of species choice also emerged as a significant factor, which was not highlighted in the literature review. Interestingly the issue of water availability was seen as of less significance than would be expected from the literature (Connellan 2008).

### 1.3.4 Threats

Individual street trees, and the wider urban forest, are subject to a number of current and potential threats. These include both direct physical threats, and threats created by the wider social and institutional context. Respondents were asked to rate a range of future threats to street tree planting, on a scale of 1-5. The intent of the question was to attempt to quantify respondent's perceptions of the threats to urban street trees, using categories identified in the literature review, and with provision for additional open ended comments. Figure 13 presents rating averages for all 253 respondents who answered the question. Figure 14 presents a more detailed analysis of responses to the question.



**Figure 13: Perceived threats to street trees**

<b>How do you rate each of the following possible threats to street tree planting in your city, from least (1) to most (5)?</b>							
<b>Answer Options</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>Rating Average</b>	<b>Response Count</b>
Electrical service authorities	7	27	53	74	<b>97</b>	3.88	258
Underground svc. authorities	6	33	56	<b>89</b>	72	3.73	256
Traffic authorities	5	38	65	<b>99</b>	49	3.58	256
Planning policies	14	42	71	<b>78</b>	50	3.42	255
Public liability	13	51	<b>68</b>	<b>68</b>	56	3.40	256
Cost/funding	13	40	71	<b>77</b>	55	3.47	256
Water restrictions	22	59	58	<b>71</b>	46	3.23	256
Community attitudes	20	45	63	<b>78</b>	50	3.36	256
Tree health	15	49	74	<b>75</b>	41	3.31	254
Lack of political support	29	52	58	<b>67</b>	50	3.22	256
Lack of knowledge by others	11	32	51	81	<b>81</b>	3.74	256
Other (please specify below)							21
						<b>answered question</b>	<b>259</b>
						<b>skipped question</b>	<b>23</b>

**Figure 14: Detailed analysis of responses: question 10**

### **Discussion**

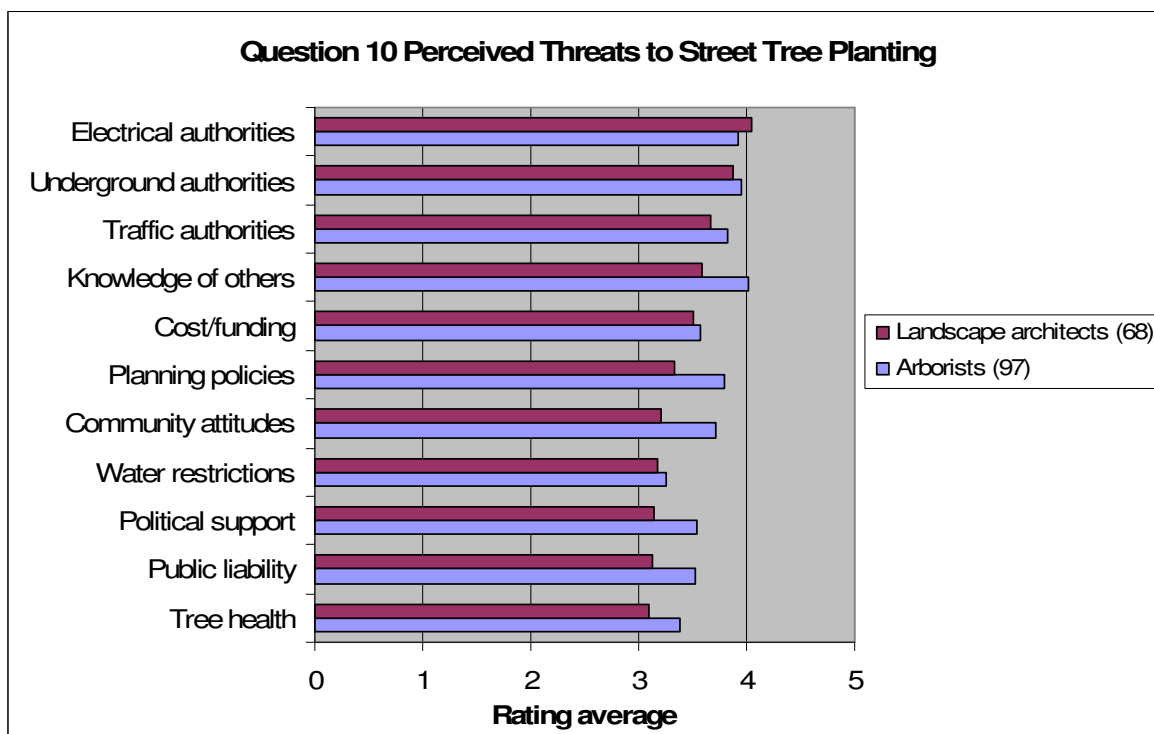
The main threats were identified as the policies of other authorities, especially electrical service authorities (and their tree pruning activities), and lack of arboricultural knowledge by others involved with street trees. Lack of political support, and water restrictions, were rated as the least severe threats.

#### **Open ended responses (27 responses)**

Service and other authorities were identified as external threats. Negative community attitudes were also identified as a significant threat. Other threat factors raised included water and climate.

#### **Comparison of landscape architects and arborists.**

Figure 15 presents responses of landscape architects (68) and arborists (98) to give an insight into any possible differences between the two disciplines in perceptions of future threats to street trees. Both groups had a similar ranking of threat factors; however the highest ranking for arborists was knowledge by others, which was given a lower priority by landscape architects. Arborists rated all threat categories higher than landscape architects, with the exception of the role of service authorities. This indicates that arborists may perceive more threats to trees due to their greater involvement in long term tree management.



**Figure 15: Perception of threats to street trees by landscape architects and arborists**

### Conclusion

The literature review identified a number of areas in which conflicts arose between street trees and urban infrastructure. This included hardscapes (Costello & Jones 2003), overhead services (Fakes 2000), underground services (Mattheck & Bethge 2000), buildings (Cameron *et al.* 2006) and traffic engineering requirements (Wolf & Bratton 2006). In each of these areas trees are given lesser status and priority than the engineering infrastructure. This reflects a potential area of conflict between arborists and engineers/asset managers. Solutions to such conflicts tend to be tree based, involving tree pruning, tree removal, restrictions on tree species or increased planting setbacks (Harris *et al.* 2004). The alternative would be an engineering based approach in which the infrastructure is designed to allow both trees and infrastructure to co-exist (Hitchmough 1994). The survey confirmed this in terms of an emphasis on the threats posed by the role of service and other authorities, especially electrical service authorities. The other significant perceived threat was lack of knowledge by others, which also emerged in the literature review in terms of the need for 'tree literate design' based on knowledge of the biological needs of trees (Coder 1998). Interestingly water restrictions were not viewed as significant a threat as the above factors.

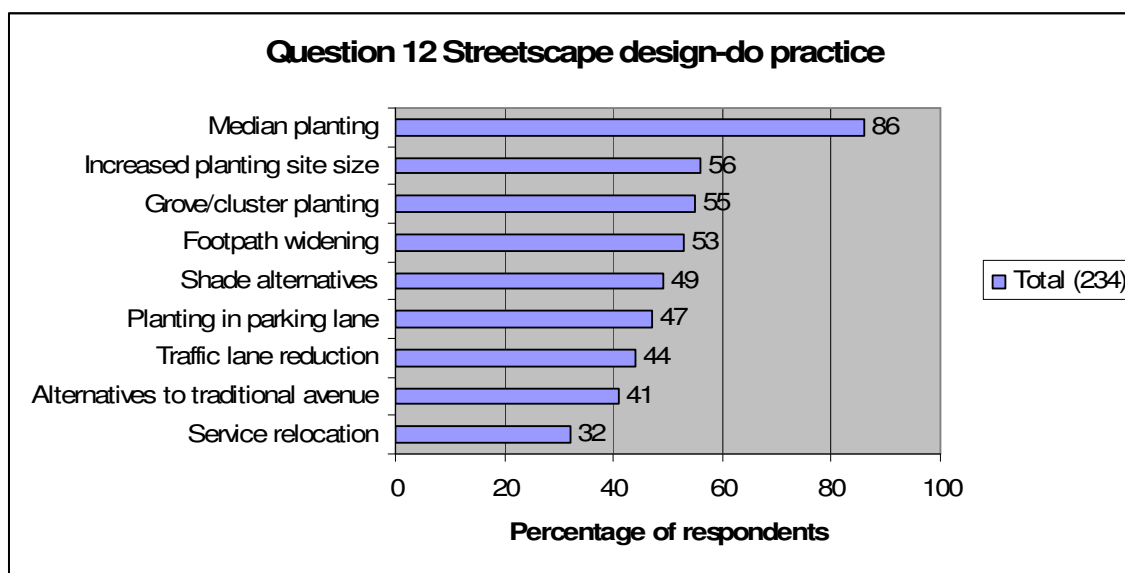
## 1.4 Uptake of practices

Questions 12-16 asked respondents about their uptake of a range of street tree related practices. Respondents were asked if they practiced, did not practice, or intended to practice a range of practices. The following Figures present these data in the form of the percentage of respondents who reported that they did utilize a practice, for all respondents who answered that question. Provision was also made for open-ended responses, which are summarized in the text. A full tabulation of open-ended responses is also contained in Appendix A. In the following sections the findings from each question are discussed and conclusions drawn.

It should be noted that these practice related questions provide a very simplified picture of the real world situation, necessitated by the need for brevity and simplicity in an online survey tool. The adoption of a practice may vary from widespread use, to occasional use, to use only in certain locations or situations. Similarly intention to adopt a practice can vary from a realistic short term intention to a long term 'should do' or 'like to'. These issues were explored in greater depth in follow up in-depth interviews (Ely 2009a).

### 1.4.1 Streetscape design

Appropriate streetscape design is seen as a key starting point to successful street tree planting and establishment. Respondents were asked if they currently practice, or intend to practice, a range of streetscape design practices. The intent of the question was to obtain a 'snapshot' of respondent's uptake of a number of streetscape design practices identified in the literature review, with provision for additional open ended comments. Figure 16 presents the percentage of respondents reporting that they do undertake certain practices (of all 234 respondents who answered the question). Figure 17 presents a more detailed analysis of responses to the question.



**Figure 16: Rate of adoption of streetscape design practices**

<b>What is your Council's use of the following streetscape design practices?</b>				
<b>Answer Options</b>	<b>Don't practice</b>	<b>Do practice</b>	<b>Intend to practice</b>	<b>Response Count</b>
Footpath widening	93	<b>127</b>	19	237
Traffic lane/width reduction	<b>110</b>	103	24	233
Service relocation to accommodate trees	<b>136</b>	75	29	237
Planting in parking lane	106	<b>110</b>	25	236
Median planting	29	<b>204</b>	6	237
Increased planting site size	74	<b>132</b>	36	234
Use of shade alternatives to trees	113	<b>116</b>	13	238
Grove or cluster planting	83	<b>130</b>	26	236
Alternatives to traditional avenue design	<b>102</b>	92	38	229
Other (please specify below)				30
		<i><b>answered question</b></i>		<b>239</b>
		<i><b>skipped question</b></i>		<b>43</b>

Figure 17: Detailed responses: question 12

### Discussion

Median planting was the most common practice, with most Council's undertaking it in some form. This was followed by attempts to create more space for trees including larger planting sites, cluster planting and footpath widening. The least adopted practice was (costly) service relocation.

### Open ended responses (30 responses)

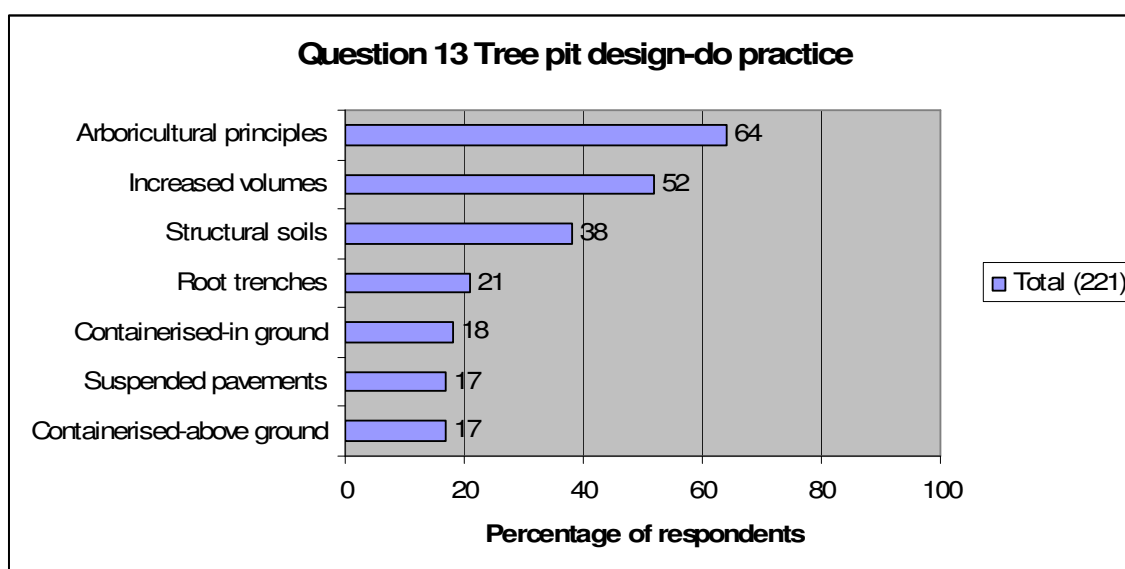
Resistance to innovative practices, by engineers and others was mentioned. More stringent constraints on tree planting in medians planting was raised, as was the option in some situation of 'no trees'. Space available for tree planting was seen to vary between localities. Resistance to planting trees in the parking lanes was also noted. Other streetscape design initiatives raised included aerial bundled cable and WSUD installations with street trees.

### Conclusion

The literature review identified a number of strategies for the design of streets to better accommodate trees (Urban 2007). The survey showed that a number of these practices have already been adopted by some Councils, primarily increasing space for trees through measures such as footpath widening. Other desirable practices such as service relocations are less widely adopted, primarily due to cost factors.

### 1.4.2 Tree pit design

In recent years a better understanding has developed regarding the 'landscape below ground' and the need to improve the design of the below-ground space to grow healthy, long lived trees. Respondents were asked if they currently undertake a range of tree pit design practices. The intent of the question was to obtain a 'snapshot' of respondent's uptake of a number of tree pit design practices identified in the literature review, with provision for additional open ended comments. Figure presents the percentage of respondents reporting that they do undertake certain practices (of all 221 respondents who answered the question). Figure 19 presents a more detailed analysis of responses to the question.



**Figure 18: Rate of adoption of tree pit design practices**

<b>What is your Council's use of the following tree pit design practices?</b>				
<b>Answer Options</b>	<b>Don't practice</b>	<b>Do practice</b>	<b>Intend to practice</b>	<b>Response Count</b>
Increased tree pit volumes	82	<b>118</b>	34	226
Design based on arboricultural principles	57	<b>144</b>	30	224
Continuous tree root trenches	<b>141</b>	48	40	223
Structural soils	<b>105</b>	84	40	221
Suspended pavements	<b>152</b>	39	33	222
Containerized trees-above ground	<b>172</b>	41	13	223
Containerized trees-in ground	<b>171</b>	41	9	221
Other (please specify below)				37
		<b>answered question</b>		<b>226</b>
		<b>skipped question</b>		<b>56</b>

**Figure 19: Detailed responses: question 13**

### **Discussion**

The most widely adopted practices were the tree pit design based on arboricultural, including increased soil volumes. There was also a higher uptake of structural soils than other innovations such as root trenches and suspended pavements.

### **Open ended responses (35 responses)**

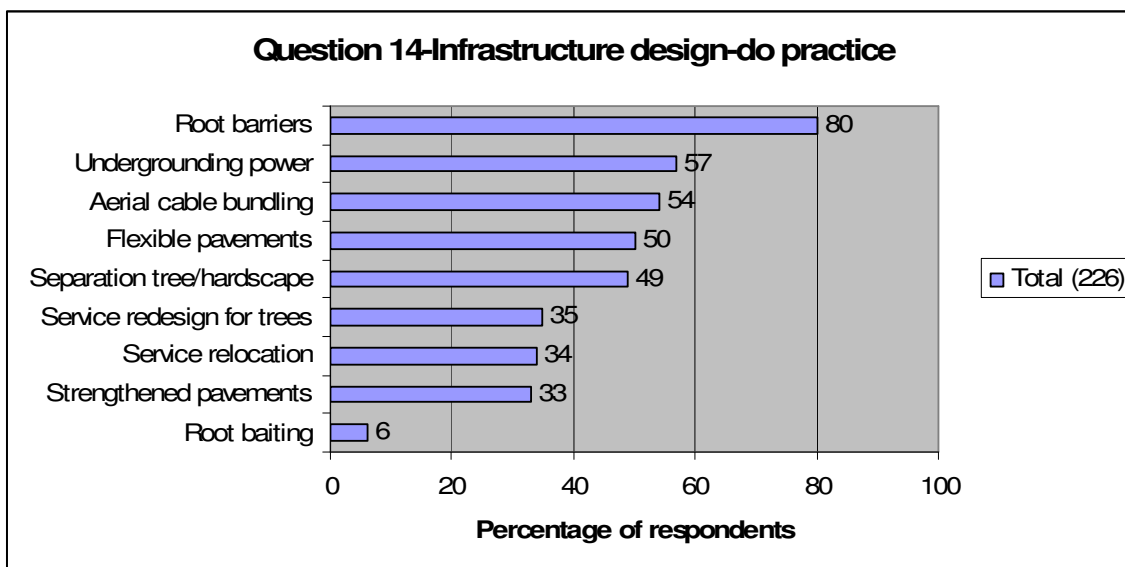
A number of respondents mentioned a low uptake of improved practices, despite recognition of their desirability. Innovations such as structural soils and root trenches are used only occasionally. Root barriers were also mentioned as a below ground practice.

### **Conclusion**

The literature review identified the need for increased rootable soil volumes as a key to growing healthy, long lived street trees (Craul & Craul 2006). It also identified a wide range of below ground technical innovations aimed at increasing soil volumes in the urban landscape (Thompson & Sorvig 2008). However it also recognized the need, first of all, to get the basics of tree planting and establishment correct (Harris *et al.* 2004). The survey confirmed this emphasis on adopting sound arboricultural practices. More technical below ground innovations, although highlighted in the literature, have been less widely adopted, although there is an expressed interest in pursuing innovative practices such as structural soils and root trenches, in appropriate situations.

### 1.4.3 Infrastructure design

Conflicts with surrounding urban infrastructure are a key consideration in urban tree planting, but practices to reduce conflicts are often engineering-driven and of detriment to trees. Respondents were asked if they currently undertake a range of infrastructure design practices. The intent of the question was to obtain a 'snapshot' of respondent's uptake of a number of infrastructure design practices identified in the literature review, with provision for additional open ended comments. Figure 20 presents the percentage of respondents reporting that they do undertake certain practices (of all 226 respondents who answered the question). Figure 21 presents a more detailed analysis of responses to the question.



**Figure 20: Rate of adoption of infrastructure design practices**

<b>What is your Council's use of the following infrastructure design practices?</b>				
<b>Answer Options</b>	<b>Don't practice</b>	<b>Do practice</b>	<b>Intend to practice</b>	<b>Response Count</b>
Separation of tree/hardscape	101	<b>108</b>	13	219
Root barriers	40	<b>181</b>	8	226
Root baiting	<b>197</b>	15	10	221
Strengthened pavements	<b>134</b>	75	18	223
Flexible pavements	87	<b>117</b>	27	228
Relocation of services	<b>124</b>	78	27	227
Undergrounding of power	71	<b>131</b>	29	228
Redesign of services to accommodate trees	<b>114</b>	86	33	228
Aerial cable bundling	82	<b>118</b>	25	220
Other (please describe below)				32
		<b>answered question</b>		<b>231</b>
		<b>skipped question</b>		<b>51</b>

Figure 21: Survey data question 14

### Discussion

Root barriers appear to be an almost universal practice, and the main strategy to reduce infrastructure conflicts, despite qualifications about their value. Other more widely adopted service related practices include undergrounding power, and aerial bundled cabling, both of which reduce tree pruning impacts. Popular hardscape practices include the use of more flexible pavements, and increased separation between trees and hardscape. Less popular were costly service relocations, and strengthened pavements (which may also have a detrimental effect on trees). The least adopted practice was root baiting (control of tree root growth by soil water management) due either to its difficulty, or lack of awareness by respondents of the meaning of the term.

### Open ended responses (32 responses)

Once again improved practices appear be limited in uptake, despite their desirability.

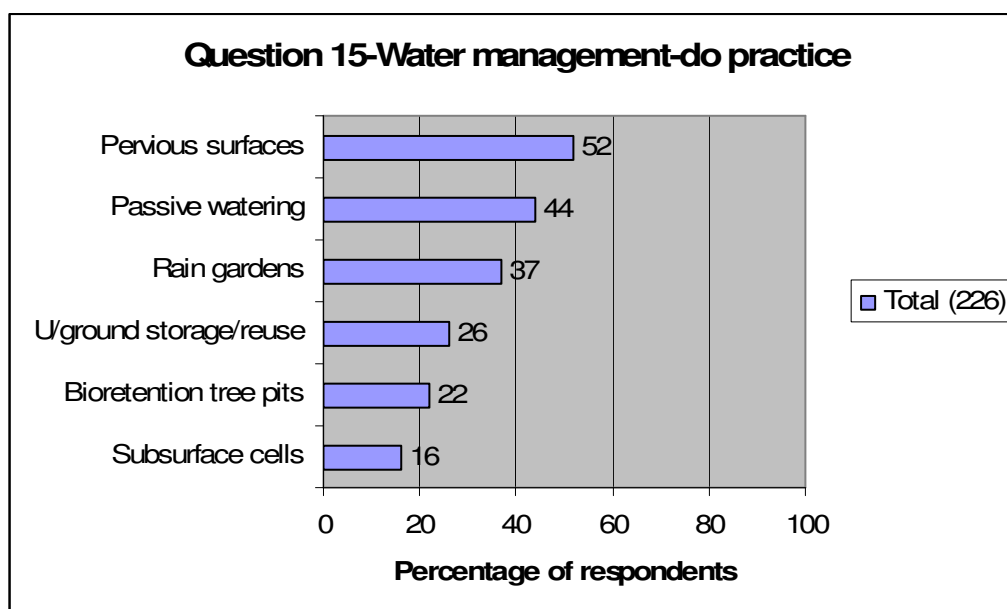
Undergrounding of power may be limited by cost. In some areas aerial bundled cabling is the responsibility of service authorities rather than Council. The cost of service redesign or relocation was also considered be prohibitive in most cases.

### Conclusion

The survey confirmed a finding of the literature review, that root barriers are the main tool for dealing with tree/infrastructure conflicts, despite uncertainties as to their effectiveness (Gilman 2006). Undergrounding of power and aerial bundled cabling are also widely adopted practices (Fakes 2000). In terms of hardscapes, the main emphasis apart from root barriers is on more flexible pavements (Costello & Jones 2003) and increased tree/hardscape separation (Gilman 1997). Service resign or relocation, although desirable, is not widely adopted, due to costs.

#### 1.4.4 Water management

Providing the appropriate conditions for growth, especially an adequate water supply, is a key consideration in street tree planting and management. The issue is likely to be exacerbated in the future due to drought and climate change. Respondents were asked if they currently undertake a range of water management practices. The intent of the question was to obtain a 'snapshot' of respondent's uptake of a number of water management practices identified in the literature review, with provision for additional open ended comments. Figure 22 presents the percentage of respondents reporting that they do undertake certain practices (of all 226 respondents who answered the question). Figure 23 presents a more detailed analysis of responses to the question.



**Figure 22: Rate of adoption of water management practices**

<b>What is your Council's use of the following street tree water management practices?</b>				
<b>Answer Options</b>	<b>Don't practice</b>	<b>Do practice</b>	<b>Intend to practice</b>	<b>Response Count</b>
Increased pervious surfaces	82	<b>121</b>	36	231
Passive watering with stormwater runoff	91	<b>101</b>	44	230
Rain gardens/bioretention basins	<b>111</b>	84	35	228
Bioretention tree pits	<b>126</b>	50	53	225
Underground storage and reuse	<b>128</b>	57	46	225
Subsurface "cells"	<b>145</b>	36	48	224
Other (please specify below)				34
		<b>answered question</b>		<b>231</b>
		<b>skipped question</b>		<b>51</b>

**Figure 23: Detailed responses: question 15**

### **Discussion**

Use of pervious surfaces was the most widely adopted practice, followed by the use of stormwater for passive irrigation and raingardens. Other WSUD practices have been less widely adopted, and are have yet to be recognized as mandatory 'best practices'.

### **Open ended responses (33 responses)**

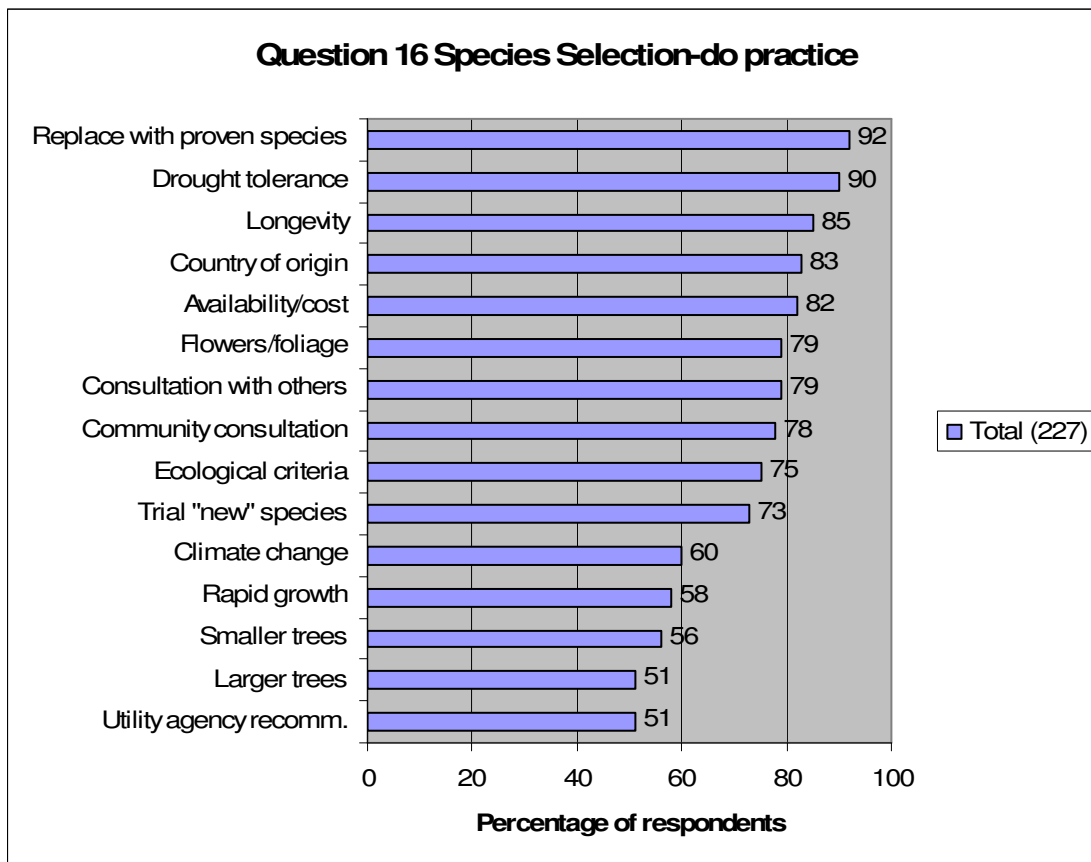
The extent of adoption of WSUD practices appears to be limited to occasional or experimental use. In some areas WSUD may be the responsibility of subdivision developers, with Council possibly imposing conditions on approvals. Several respondents have been using recycled water on street trees and parks, which could be included as a separate practice category in future surveys.

### **Conclusion**

The literature review identified water management as a key strategy for maintaining a sustainable urban forest, especially in times of drought, water restrictions and climate change (Connellan 2008). Water Sensitive Urban Design was also identified as an emerging strategy with direct and indirect benefits to urban trees (Day & Dickinson 2008). The survey identified a relatively low uptake of WSUD practices, but interest in adopting innovations such as bioretention systems (Breen *et al.* 2004). The main practices adopted are the less 'technical' ones of porous surfaces (Ferguson 2005) and passive watering with stormwater runoff (Lawry 2008).

### 1.4.5 Tree species selection

Selecting the 'right tree for the right place' is considered to be key strategy which addresses a range of street tree related issues, such as available space, potential infrastructure conflicts and climatic constraints. Respondents were asked if they currently undertake a range of street tree species selection practices. The intent of the question was to obtain a 'snapshot' of respondent's adoption of different tree species practices or criteria identified in the literature review, with provision for additional open ended comments. Figure 24 presents the percentage of respondents reporting that they do undertake certain practices, (of all 227 respondents who answered the question). Figure 25 presents a more detailed analysis of responses to the question.



**Figure 24: Rate of adoption of tree species selection practices-**

<b>What is your Council's use of the following tree species selection practices/criteria?</b>				
<b>Answer Options</b>	<b>Don't practice</b>	<b>Do practice</b>	<b>Intend to practice</b>	<b>Response Count</b>
Location/country of origin	35	<b>191</b>	4	230
Plant fewer larger trees	107	<b>116</b>	6	226
Plant more smaller trees	96	<b>127</b>	8	227
Availability and cost	42	<b>185</b>	1	227
Attractive flowers or foliage	46	<b>181</b>	4	229
Rapid growth	93	<b>134</b>	2	228
Longevity	28	<b>197</b>	7	230
Changing climate	69	<b>137</b>	25	228
Ecological criteria	45	<b>171</b>	12	228
Drought tolerance	13	<b>205</b>	13	228
Consultation with community	40	<b>179</b>	12	227
Consultation with others	38	<b>180</b>	10	227
Replace with existing proven species	14	<b>208</b>	5	225
Opportunity to trial "new" species	41	<b>165</b>	26	227
Recommendations by utility agencies	103	<b>113</b>	8	222
Other (please specify below)				31
		<b>answered question</b>		<b>232</b>
		<b>skipped question</b>		<b>50</b>

**Figure 25: Detailed responses: question 16**

### **Discussion**

Tree species selection still appears to be the main tool used by arborists to improve street tree planting outcomes. The most highly rated selection criteria are the practical ones of replacing trees with proven species, and selecting for drought tolerance. The least favoured practice was adopting utility agency recommendations.

### **Open ended responses (31 responses)**

Some respondents promote the use of local or indigenous planting. Preferred tree size is dependent on location. Consultation may be undertaken with others, but the recommendations of arborists are considered preferable to those of service authorities.

### **Conclusion**

Tree species selection was not addressed as a separate topic in the literature review, but rather it emerged as a significant consideration under a number of topics (Harris *et al.* 2004). The survey identified a strong preference for planting proven species, and selecting for drought tolerance and longevity. There was little support for selecting trees on the basis of utility agency recommendations. Interestingly selection for climate change was not rated as significantly as expected.

## **1.5 Additional survey comments**

Respondents were also invited to provide any additional comments (Question 17), with 51 respondents doing so. A full tabulation of comments is contained in Appendix A. Comments focussed on Council organizational and management factors, rather than physical considerations. These included negative community attitudes to trees and the need for education regarding street tree benefits. Some respondents promoted the need for an urban forestry approach to street tree management. Some Council's have also prepared detailed street tree strategies. Physical factors raised included lack of planting space in recent urban developments, water restrictions and tree species selection issues including drought tolerance and the need for an 'ideal' street tree.

## 1.6 Conclusion

A quantitative study was undertaken to obtain a 'snapshot' of the attitudes and practices of local government street tree practitioners and managers throughout Australia. A web based survey was developed using the services of an online service provider, with an online link distributed to local government arborists and landscape architects, and also to local government planners, engineers and asset managers. 261 respondents completed the survey, from all Australian states, representing 109 Councils and related bodies. Approximately half of respondents were arborists/horticulturists, and one quarter landscape architects. The survey explored the attitudes and perceptions of respondents in terms of street tree benefits, street tree issues, constraints on street tree planting, and future threats to urban trees. Uptake of a range of practices was also explored, including streetscape design, design below ground, infrastructure design, water management and tree species selection. Survey results were presented in tables and simple graphic form. While the survey provided a valuable 'big picture', methodological constraints did not allow for a detailed understanding of many issues. The survey was therefore followed up with in depth interviews to gain a deeper understanding of the topics addressed in the survey (Ely 2009a).

A number of final conclusions have been drawn from the survey results.

- There is a high level of recognition of the benefits of street trees, including their environmental benefits. But the highest rating was given to the more intangible and less widely researched visual and aesthetic benefits of street trees.
- The key street tree issue was infrastructure damage, followed by tree health/longevity and liability/risk.
- The main constraint on street tree planting was lack of space, followed by lack of species choice.
- The key threat to future street tree planting was seen to be the role of various external authorities, especially electrical service authorities, but also other service providers and road traffic authorities. Lack of knowledge by others was also seen as a significant threat. However water availability was not rated as highly as expected.

- The main streetscape design practices adopted were increasing planting site sizes, through strategies such as footpath widening.
- The main approach to tree pit design was design based on sound arboricultural principles, and increasing soil volumes where possible. There was also limited uptake of technical innovations such as structural soils.
- The key strategy for managing tree/infrastructure conflicts remains root barriers. Undergrounding of power and aerial bundled cable are also widely adopted, however strategies such as service relocations to accommodate trees appear to be prohibitive in many cases. With respect to hardscapes, the main strategies are more flexible pavements and increased tree/hardscape separation.
- There has been limited adoption of recent WSUD innovations, due to a range of factors, but interest in adopting practices such as bioretention tree pits. The main practices adopted comprise porous surfaces and passive watering with stormwater runoff.
- Tree species selection practices emphasize maintaining a sustainable urban forest, and include planting proven species, and planting long lived, drought tolerant species. There is little support for planting based on utility authority recommendations.
- Both landscape architects and arborists recognize the benefits of street trees. However there are differences in attitudes and perceptions in street tree issues and threats, possibly due to arborists longer term involvement with the tree beyond the initial planting phase.

## References

- Babbie, E. (1990). Survey Research Methods. Belmont, CA., Wadsworth.
- Babbie, E. (2001). The Practice of Social Research. Belmont, CA., Wadsworth.
- Brace, I. (2004). Questionnaire Design: How to Plan, Structure and Write Survey Material for Effective Market Research. London, Market Research in Practice Series.
- Breen, P., L. Denman, P. May and S. Leinster (2004). Street trees as stormwater treatment measures. WSUD2004.
- Cameron, D. A., M. B. Jaksa, W. Potter and A. O'Malley (2006). The Influence of Trees on Expansive Soils in Southern Australia. Expansive Soils: Recent Advances in Characterization and Treatment. A. A. Al-Rawas and M. F. A. Goosen, Taylor and Francis (UK): 295-314.
- Clark, J. and N. Matheney (2009). "The benefits of trees." Arborist News **18**(3): 12-19.
- Coder, K. D. (1998). Root Growth Control: Managing perceptions and realities. The Landscape Below Ground II, San Francisco, California, International Society of Arboriculture.
- Connellan, G. (2008). "Water efficiency strategies in our cities: Their impact on urban trees." The Bark. The newsletter of the International Society of Arboriculture, Australia Chapter. **9**(3): 3-8.
- Costello, L. R. and K. S. Jones (2003). Reducing Infrastructure Damage to Trees: A compendium of strategies. Cohasset, CA, Western Chapter of the International Society of Arboriculture.
- Craul, T. A. and P. J. Craul (2006). Soil Design Protocols for Landscape Architects and Contractors. Hoboken, New Jersey, John Wiley & Sons Inc.
- Creswell, J. W. (2009). Research design : qualitative, quantitative, and mixed methods approaches. Los Angeles, SAGE Publications.
- Crockford, R. H. and D. P. Richardson (2000). "Partitioning of rainfall into throughfall, stemflow and interception: effect of forest type, ground cover and climate." Hydrological Processes **14**: 2903-2920.
- Day, S. D. and S. B. Dickinson, Eds. (2008). Managing Stormwater for Urban Sustainability using Trees and Structural Soils. Blacksburg, VA., Virginia Polytechnic Institute and State University.
- Ely, M. E. (2009a). Planning for trees in urban environments. . TREENET Proceedings of the 10th National Street Tree Symposium 3rd and 4th September 2009. , Adelaide.
- Ely, M. E. (2010). Integrating trees into the design of the city. School of Architecture, Landscape Architecture and Urban Design. Adelaide, University of Adelaide. **PhD**: 464pp.
- Fakes, J. (2000). Practical issues in line clearance and street trees. TREENET Proceedings of the Inaugural Street Tree Symposium: 7th and 8th September 2000, Adelaide, TREENET Inc.
- Ferguson, B. K. (2005). Porous Pavements. Boca Raton, Florida, Taylor and Francis.
- Fowler, F. J. (2002). Survey research methods. Thousand Oaks, CA., Sage.
- Geiger, J. R. (2004). " The Large Tree Argument: The Case for Large Trees vs. Small Trees." Western Arborist **30**(1): 14-15.
- Gilman, E. F. (1997). Trees for Urban and Suburban Landscapes, Delmar Publishers.
- Gilman, E. F. (2006). "Deflecting roots near sidewalks." Arboriculture and Urban Forestry **32**(1): 18-23.
- Groat, L. and D. Wang (2002). Architectural Research Methods. New York, John Wiley & Sons, Inc.
- Harris, R. W., J. R. Clark and N. P. Matheney (2004). Arboriculture: Integrated Management of Landscape Trees, Shrubs and Vines. Upper Saddle River, NJ, Prentice Hall.
- Hitchmough, J. D. (1994). Urban Landscape Management. Sydney, Inkata Press.
- Lawry, D. (2008). From the gutter to the stomata by closest "root". TREENET Proceedings of the 9th National Street Tree Symposium 4th and 5th September 2008, Adelaide.

- Mattheck, C. and K. A. Bethge (2000). "Biomechanical study of the interactions of roots with gas and water pipelines for the evaluation of tree sites." Arboricultural Journal **26**: 43-54.
- McLean, D. D., R. R. Jensen and A. R. Hurd (2007). "Seeing the forest through the trees: building depth through qualitative research." Arboriculture and Urban Forestry **33**(5): 304-308.
- Nesbary, D. K. (2000). Survey Research and the World Wide Web. Boston, Allyn and Bacon.
- Norris, M. (2005). Managing and Assessing Aging Urban Trees. TREENET Proceedings of the 6th National Street Tree Symposium:1st and 2nd September 2005, Adelaide, TREENET Inc.
- Nowak, D. J. and J. F. Dwyer (2007). Understanding the benefits and costs of urban forest ecosystems. Urban and Community Forestry in the Northeast. J. Kruser. Newtown Square, PA., U.S.D.A. Forest Service, North Eastern Research Station, : 25-46.
- Sheehan, K. (2001). "E-mail survey response rates:a review." Journal of Computer Mediated Communication **6**(2).
- Spirn, A. W. (1984). The Granite Garden. New York, Basic Books,Inc.
- Thompson, I. H. and K. Sorvig (2008). Sustainable Landscape Construction: A guide to green building outdoors. Washington D.C., Island Press.
- Urban, J. (1992). "Bringing Order to the Technical Dysfunction within the Urban Forest." Journal of Arboriculture **18**(2): 85-90.
- Urban, J. (2004). Growing the Urban Forest. Healthy Trees for a Beautiful City, City of Toronto.
- Urban, J. (2007). Tree planting in urban areas. Landscape Architecture Graphic Standards. L. J. Hooper. Hoboken, New Jersey, John Wiley & Sons, Inc.: 361-363.
- Wolf, K. L. (2003). Ergonomics of the City: Green Infrastructure and Social Benefits. Engineering Green: Proceedings of the 2003 National Urban Forest Conference, Washington D. C., American Forests.
- Wolf, K. L. and N. Bratton (2006). "Urban trees and traffic safety: considering US roadside policy and crash data." Arboriculture and Urban Forestry **32**(4): 170-179.
- Yun, G. W. and C. W. Trumbo (2000). "Comparative response to a survey administered by post, E-mail and Web form." Journal of Computer Mediated Communications **6**(2).

## Appendix A-Open-ended responses

The following section provides a compilation of verbatim open ended responses provided for each survey question. Comments have been coded in terms of key response categories that emerged from the data.

### Question 7 Perceived street tree benefits (31 responses)

#### General

*I personally rate all very highly but the environmental, ecological and economic benefits are generally ignored for projects.*

*Predominantly street trees in inner suburbs.*

*Too numerous to mention!*

*There are numerous other positive benefits.*

*I think street trees confer enormous benefits.*

#### Environmental

*Point-of-source water treatment potential in built-up streets.*

*Reduced Heat Island Effect - Climatic benefit depends on the species.*

*some trees contribute negatively to the environment through leaf fall, phenolics, invasiveness etc. - need to be local native species biological as it creates shade and prevents skin cancers.*

#### Ecological

*I would like to mention that I don't feel enough street trees are planted in regard to their ecological benefit for providing food and habitat for indigenous animals. Many Street Trees proposed by some developers and councils are considered noxious weeds in other states and I also don't like the recent proposal in I think it is "Melbourne 2030".*

*It states that streets should be planted with single species in order to achieve "grand avenues" or for some similar reason. It is counterproductive to producing streets with biodiversity and a range of food/habitat trees for local wildlife.*

*Can't always satisfy ecological objective because the system is so disturbed; sometimes we just need trees that can survive.*

*Ecological - it depends on where that ecology is located.*

*Only some species have high habitat values.*

*While I love Australian eucalypts, I'm not sure about them as street trees; deciduous less risky?*

*Street trees can be a way of educating residents about endemic species and improve awareness and appreciation of endemic species.*

#### Amenity

*Farmers like to come into a green cool environment to feel better than they do on drought stricken lands.*

*Providing shade over parked cars is important in our hot climate.*

*Sun protection is a big priority as we have the highest rate of skin cancers in the country.*

*Improve microclimate.*

#### Shade

*Physical shade / shelter (micro environmental- i.e. alternative for shade sails).*

*I rate street trees very highly as an investment in shade, comfort, beauty and contribution to amenity of the city.*

#### Economic

*Trees equal amenity equals property value equals suburb amenity equals higher suburb desirability equals higher prices equals higher investment in amenic infrastructure like trees (on private land).*

*It's a pity Councils don't seek to enhance suburb amenity by accepting that higher infrastructure repair costs from planting more larger trees (not under powerlines) is the price for higher suburb amenity equals more rate*

return to pay for higher costs. Imagine a world with big trees everywhere in suburbia and no or minor infrastructure repair costs. Underground power lines NOW. Consumers will contribute to the enhancement of their public amenic environment, if they get a return from higher property prices. They did it in Perth and doubled the population in 20 years without any tree protection legislation.

### **Social/psychological**

*Traffic Safety - slow traffic speeds.*

*Can have positive effects on vehicle traffic calming.*

*Physical wellbeing (e.g. some relates to psych; economic) but more to it ... like contribution to preventive health; community well being etc. (rate at 5).*

### **Cultural/heritage**

*Heritage values Tree size.*

*Heritage value 5.*

*Some remnant trees have heritage significance (e.g. Aboriginal Scar trees). Historical/memorial (links to psychological) (rate at 4) Cultural-e.g. Avenue of Honour.*

*Other values include heritage/character of an area can be determined by type, size etc of verge trees.*

### **Other benefits**

*Food.*

### **Issues**

*Agree strongly on all the above being subject to; the fundamentals of 'right tree in right place' appropriate maintenance practices suitably applied and; is sustainable or; has sustainability planning woven into regime....stakeholders support typically required to achieve success.*

*My experience has been that the general population actually hate trees with a passion as they drop leaves etc and people have to clean up the mess.*

*I believe in street trees. I grew up in Kuringai Municipality in urban Sydney, - very conscious of street trees.*

*Here, there is nervousness about risk I think.*

*It is distressing that so many residents are now allowed to have the tree on their verge removed at whim.*

## **Question 8 Perceived street tree issues (27 responses)**

### **General**

*All of these problems can be minimized if the correct planning, design and tree selection decisions are made prior to the planting and construction work being done. Problems are typical of established trees in older streets.*

*All of the above depend on the age and type of tree, width of street, sidewalk etc.*

### **Tree health/longevity**

*Difficult to answer. The LGA is relatively young, so longevity has not yet become an issue. Tree health generally ok (sandy soils, many open verges, not highly polluted).*

*Aging tree population combined with drought and salt is causing a massive decline in tree population.*

### **Infrastructure conflicts**

*Being an inner city council consisting predominantly of 19th century infrastructure and the demand for greening causes conflict.*

### **Below ground services**

*Existing utility regulations for sewer and water keep us from planting many street trees in Adelaide.*

### **Powerlines**

*Powerline clearance impinges greatly on the benefits of street trees.*

### **Buildings**

*Infrastructure in Yarra is old and most houses are Victorian era built with little or no foundations on very reactive clay. Doesn't mix with trees planted in the past-Planes, Melaleucas etc.*

## **Compaction**

*Infrastructure damage i.e. compaction of rooted soils/ root damage and the like, during upgrading/ land development constructions etc; are widely known to be the leading causal agents in decline of urban trees. The components of tree health, reduced longevity, capital/ other costs would be typically brought about by the tree damages or constraints handed out at some previous time; if a street tree was deemed a nuisance; then perhaps the planners or managers of that tree should be taking a closer look at what they've planted and maintained respectively; before handing out 'nuisance' notices!! Damage to trees that causes most of the fatalities is root damage from other government services, road widening by Council operations and redevelopment of property in the older areas.*

*Poor growth rates due to soil compaction (i.e. a bonsai effect) rates as a significant issue at VicRoads.*

## **Risk**

*Tree risk is a real issue and the reality is that the probability of risk (of tree) eventuating is so minute compared to other 'everyday exposures to household and work-place risk' however; I'm sure the vast majority of asset managers whether assets be trees or other; would consider and act upon minimizing any risk surrounding; a sound method for measuring and managing tree risk may be provided by tree appraisers separately yet certainly; should form component of any worthwhile tree management program.*

## **Nuisance**

*Street tree "nuisance" problem is largely dealt with by application of consistent policies:*

*I would add to this list -views screening properties- (particularly in coastal and river foreshore areas, or any long attractive views, where the general public does not support trees).*

*Not sure what street tree nuisance is and how it differs from infrastructure damage. Does it relate to autumn leaves and messy fruits?*

## **Urban development**

*Lack of balance re trees and development (due lack of understanding and conflict with short term returns) would rate a 5.*

*Also developers can be very difficult on matters of species selection with developers seeking to achieve a certain 'image' with the street trees that may not be compatible with the environment and conditions (e.g. deciduous European trees which cause problems with seed dispersal, leaf drop and root penetration)*

*And the greatest threat (and potential blessing) is man's influence and urbanization.*

## **Costs**

*Rate return for street tree infrastructure investment. Councils want ongoing income for less outlay so we get smaller trees, less amenity, reductions in suburb values (or less capital appreciation comparative to leafier suburbs). I don't see any positive ideas or reasonable changes to suburban infrastructure provision. Just same old crap. It almost makes me want to work for Council as an employee. Perish the thought! I make a living assisting people/developers to get better outcomes from belligerent Council bureaucracy (as long as they listen to me and agree to do what I tell them).*

*Luckily there is sufficient budget to cover costs required to manage trees to a professional standard.*

*Capital costs met under budgets.*

## **Management, maintenance**

*Proactive tree maintenance has never occurred in this town.*

*Trees are not the issue; their poor management is of primary concern.*

*Maintenance should be done by a qualified arboriculturist. This doesn't happen. Rather let's say the energy authority comes along, has its "policy" prunes accordingly, leaves a tree unbalanced, prey to disease and insects etc. So a problem created.*

*Proper street tree planning would require a co-ordinated approach. Doesn't happen here.*

*Our council has a cyclic street tree replacement/infill program which caters for replacement of many aged street trees or trees which should be replaced due to declining health or aesthetics.*

*Lack of quality stock limited knowledge of trees / urban landscape by contractors / developers Poor post establishment practices Poor understanding of trees / soil relationships.*

## **Other**

### **Climate/water**

*Climate change would rate a 5.*

*High water use to maintain deciduous trees.*

### **Public perceptions**

*Unfortunately the true value of trees is not relayed to the community.*

*Poor public perception of street trees is a major issue for us, i.e. people fear trees will damage property & create nuisance.*

*Lack of awareness of tree benefits amongst the community would rate a 5.*

*Another problem is community perception of 'danger' versus the other benefits of large street trees.*

*The question is not formulated clearly. I am guessing its intention and I am confirming that all the above contribute to the common, often very negative, attitude towards urban trees.*

### **Car parking**

*Loss of car parking.*

### **Vandalism**

*Vandalism (especially when first planted).*

### **Tree protection**

*Insufficient protection of trees, require greater recognition and weight under the law.*

### **Space**

*Not enough room to grow canopy trees-too many competing demands and conflicting interests.*

### **Biodiversity**

*Planting of environmental weed species; reduced biodiversity and gene pool pollution of indigenous species;*

*Biggest problem is inappropriate tree plantings and failure to maintain natural trees - replace them with exotic species which cause all the problems above.*

## **Question 9 Perceived constraints on street tree establishment (28 responses)**

### **General**

*Again answers to this section depend on type of tree chosen, width of street, and most importantly the degree of climate change that is occurring quickly, (i.e. water and rainfall regimes.)*

### **Space**

*Our footpath specifications for new infrastructure allow space for trees. We have 'set-outs' that require trees to be certain distances from utilities etc.*

*Maintenance and space critical factors.*

### **Species choice**

*It's selecting the right species for the area to take on all of obstacles it has to grow in.*

*Species selection in Bendigo rarely involves endemic species; suitability is paramount in health/longevity of trees.*

*Climate, space and water availability problems can be minimized by selecting the most appropriate species.*

*Things you have control over are not an issue i.e. species selection for the right location. Changing clay soils that waterlog even in summer is difficult.*

*As old tree stock is removed we assess each planting area to ensure that replacement species are suitable to the area.*

### **Soils**

*Clay soils make establishment of trees difficult. Can be very dry to saturated.*

*Coastal Plains and salt zones combined are very difficult for street tree options and establishment.*

*Shallow soils and sandstone geology mean that there are many failures when traditional 600mm square pits are dug. There is a lack of recognition of the need to invest in tree pit infrastructure.*

### **Water**

*Water an issue only for establishment phase, with time for truck to travel from site to site.*

*Poor representation of examples (at least currently) promoting creative stormwater designs where trees are sequestering nutrients from stormwater.*

*Lack of firm regulations encouraging using water sensitive urban design (advice notes on development approvals don't have enough legal weight); should this come from state governments?*

## **Management**

### **Budget**

*Maintenance Budget 1.*

### **Political support**

*Political unwillingness.*

### **Understanding, knowledge**

*Actual understanding.*

*Inadequate arboricultural knowledge/understanding.*

## **Innovation**

*Lack of Council staff progressive /proactive thinking. Are they just complacent or are they just too tired to bother? Are they paid not to think or do political forces and management discourage enthusiasm and creativity.*

## **Policies**

*Inadequate policy framework – 5.*

*The biggest vandal is the council, which is obsessed with public liability and committed to inappropriate species.*

*Lack of urban trees management and replacement plans.*

*Lack of strong policies protecting street/verge trees.*

## **Maintenance**

*Maintenance and space critical factors.*

## **Stock/availability**

*Quality of trees planted - especially rootstock.*

*The City of Greater Bendigo has an in-house plant nursery where we can propagate and grow-on trees. There is space there for 1000 advanced trees. The greatest% of plants propagated are native, many others are grown on for purchased tubes etc.*

*Supply of species quantities, even species that nurseries supply sell out quickly in March / April or end up with inferior stock.*

*Availability of sizes (most Australian trees establish better, live longer in the given location when planted as a small seedling; push to produce advanced stock reduces the species choice).*

*Species availability is not a problem if several options are available for selection. Council also operates a Community Nursery which can provide many locally endemic species in bulk amounts.*

## **Other**

### **Community attitudes**

*A major constraint is attitude of ratepayers to the variety of tree on their verge (problem in city is strong dislike to existing Qld. Box trees). Some residents just don't want a tree; Council is unwilling to over-rule this.*

## **Urban development**

*Urban consolidation through subdivision of existing house lots is reducing the existing stock as well as the opportunities for new planting. With the smaller lot sizes street trees are becoming more important and are the only area left where good sized trees can be planted other than parks. With the trend to reduce road widths, include cycle ways and include the services within the footway, tree choice is becoming more restricted. Tree planting could be built in at the subdivision stage but this doesn't seem to happen.*

*Establishment and maintenance are the responsibility of the developer in accordance with conditions of consent until an acceptable time frame e.g. one year from planting.*

## **Other**

The items under 9 above 'successful establishment' for us here in Singapore refers to a time period of 2-3mths; in Australia this may be 1-2yrs subject to regional climate / conditions etc. If an establishing tree were to find constraint influenced by soil space in this early period, it could never have been expected to sustain beyond establishment in the first instance; planting medium qualities and volumes adequacy can be issue to succeed establishment; this responsibility usually rests with planting specified and/or contractor; similarly for maintenance. A suitably selected tree species for location/ conditions, pre-grown by professional grower with its end use in mind and planted & maintained properly succeed.

### **Infrastructure**

Infrastructure constraints e.g. overhead power lines.

Include destructive treatments by utilities companies -above and below ground - as vandalism & damage!).

Interaction with infrastructure below ground needs to be well managed.

Another issue is the conflict with vehicles, particularly waste collection and the requirements of electricity providers to keep trees clear of wires in areas without underground power have resulted in 'butchering' of trees in some cases. Recent adoption of Australian Standards has improved the manner of pruning in most areas.

### **Question 10 Perceived threats to street tree planting (20 responses)**

#### **Service authorities**

Power being undergrounded, authorities use horizontal boring, little damage incurred

What we want and we get are two different things. We want leafy suburbs and high amenity enjoyment and we get shrub plantings under power lines, noisy unsafe roads where they remove street trees because someone pranged into one which Council never replaced. Get rid of power poles which kill a lot more people. Take on ETSA and Councils today! .well maybe tomorrow.

Policies of utility services can be designed for because the standards and construction methods do not vary and can be accommodated.

I'd phrase my threats a little clear zone requirements for road safety combined with little or no expenditure on safety barriers (5) electrical line clearance requirements combined with no expenditure on undergrounding of power lines (5) These are the 2 most significant threats to tree planting on new arterial roads across Victoria. Note the combination of a legal or policy requirement is a problem when capital is not available to manage that requirement in a way that permits.

#### **Knowledge**

Lack of balance in compromises between the professions ... e.g. comment from a young graduate civil engineer "horticulture is what you do when we've finished the real work."

Managers with no arboricultural expertise.

Traffic authorities.

I'd phrase my threats a little clear zone requirements for road safety combined with little or no expenditure on safety barriers (5) electrical line clearance requirements combined with no expenditure on undergrounding of power lines (5) These are the 2 most significant threats to tree planting on new arterial roads across Victoria. Note the combination of a legal or policy requirement is a problem when capital is not available to manage that requirement in a way that permits.

#### **Funding**

Biggest issue is lack of funding for a street tree planting program.

The attitudes of key staff in the organization means there is a lack of political support.

Planning and development.

Planning and development policies need to be improved to increase the importance of designing for street trees and clearly notifying developers up front of the requirements to provide street trees and the design specifications required.

#### **Community attitudes**

Societal values and the culture of egoism and rampant consumerism within western society.

Two comments. I love trees but everyone thinks they are experts on trees.

Public acceptance of street trees can be negative in some areas with certain members of the public preferring a green lawn and no tree as it interferes with parking.

Community attitude is the biggest threat in relation to trees. It is often the 'NIMBY' syndrome, "I Love Trees - just don't plant them outside my house! People complain about leave/berries/flowers/caterpillars/bees/nuts etc

*and it takes a hard line from our politicians to say the tree stays. There is a need to keep the community informed of how important trees are to the environment and also the aesthetic/economic realities of trees. Community attitudes would vary greatly in this municipality from those who don't seem to mind living with vertical and horizontal concrete as their environment to their opposite; the latter would welcome trees and want those trees that are here retained. We seem to be in the older age groups. The majority of the public think everyone loves trees; it is not the case or yes but not in front of my house. The old adage "I love trees, but!" Planting generally supported politically but opposed by individual residents.*

### **Water, climate**

*No water restrictions in the township area.*

### **Climate change**

*We have storm water retention for tree watering. Tree health is current as we have no depth in soil moisture for the past 3+ years.*

### **Other**

#### **Vandalism**

*Vandalism is a big threat in the City.*

*Poisoning and midnight pruning of park trees and street trees for "improved" sea views is rife. Vandalism is also high in certain areas.*

#### **Management**

*Lack of clear policy directions and inconsistent approach and applications where there is policy.*

#### **Species selection**

*I believe some of the issues above can be overcome with prudent species selection.*

### **Other**

*None of the above; not relevant to Singapore; urban greenery generation and conservation supported & instigated through government planning policy and....dedicated arborists too!*

## **Question 12 Streetscape design practices (30 responses)**

### **General**

*Response as consultant observing emerging trends.*

*Mostly resisted by designers/engineers.*

*On a project basis - e.g. Lochiel Park, Playford, Northgate, Golden Grove.*

*Councils employ consultants to produce quality design and generally only offer guidance/comment on the finished product. Council produces basic urban design responses to minor engineered road repairs and don't design outside the square. It's not their business. They don't seek areas for large tree plantings in new housing schemes. Everyone calls them environmental marvels (like Mawson Lakes) but what a load of underwhelming hype all round.*

*Council is preparing a new Development control plan which is intended to contain guidelines and specifications for street tree planting which will hopefully include a variety of instructions and measures as listed above to improve long term maintenance.*

*We strive to implement all of the above. It can be difficult persuading other internal depts. E.g. typically, asphalt roads take priority over 'green stuff'. But we keep trying and make small victories.*

*Tree planting such as suggested simply NOT on the agenda..... If only.*

*The council has not thought about any of these things.*

*State Highway authority (NSW Roads and Traffic Authority) practice some of the above better practices in Highway upgrading work. Council invests very little in landscaping outside Parks and shopping centres.*

### **Medians**

*Median planting- only if there is 4m or more median width a root control barrier to protect the road and enough soil volume to support the selected tree species at maturity.*

*Answers for VicRoads. Additional notes: Median planting - yes, but not trees. Alternatives to traditional avenue design - yes we do practice the alternative of no planting!!!*

*Trees used to be planted in central medians but in response to new guidelines from the state govt. road authority this will no longer occur.*

### **Space**

*Council is working with the Growth Centre's Commission to ensure that there is room for street trees in its release areas. The State Government has mandated road widths and left little room for trees however we will ensure there is some room left!*

*Very little space to plant trees except in parking bays, no medians and narrow footpaths in narrow roads. Footpaths are a standard 1.5 m wide unless they are shared paths (hike/bike) in which case they are 2.5 m. We got big old roads here. Nature strip?*

### **Footpath widening**

*Kerb extensions in narrow streets and shopping precincts.*

*Shade structures.*

*Council has used umbrella structures in some town centre sites, where funding permits. There has been resistance by the engineers to use trees in parking lanes unless part of footpath widening/blister proposals.*

### **Parking lane**

*Planting in parking lane- this has been done in the past but we don't like it and are no longer approving this type of design.*

*Informal planting.*

*Informal planting on streets is associated with Water Sensitive Urban Design treatments otherwise a formal avenue approach is used.*

### **Other**

#### **Services**

*Fund for aerial bundle cabling in nominated streets - less costly than undergrounding*

*Relocation is minimal.*

*Interested in changing to ABC cable to prevent 'V' pruning of tree canopies. While electricity companies want council to ensure services a clear will not help by subsidizing ABC cable installation.*

### **WSUD**

*Behind kerb SW cells for street tree irrigation has been investigated. Currently, Caloundra has never had any water restrictions as our dam averages 85% capacity. This will change shortly when Brisbane connects to our dam. This will change our water use structure considerably.*

*WSUD measures.*

*Water sensitive urban design with street tree planting.*

### **Species selection**

*Drought tolerant plants where suitable. The aim is to plant a tree of an appropriate type in the right location.*

## **Question 13 Tree pit design practices (35 responses)**

### **Extent of adoption**

*Want to/should practice.*

*Those "do practice"; items are only in very small numbers, in certain areas of the CBD only. City wide, almost non existent.*

*Mostly resisted by designers/engineers.*

*Still pretty standard planting techniques.*

*All of the above are in the experimental stage.s*

*Council engineers have primary control over streetscape works but have not supported innovative use of structural soils, tree planting in parking lanes or relocation of services due to funding constraints.*

### **Volumes**

*Limited application of increased tree pit volumes in major projects but not minor street tree planting projects.*

### **Arboricultural principles**

*Council follows the planting specification recommended by Craul (1992).*

### **Trenches**

*Continuous trenches and structural soils occasionally.*

*Continuous trenches often in rural road circumstances.*

*We have trialed with continuous tree root trenches on a reserve constructed by a developer within our council area. Generally this is difficult to attempt in the streetscape due to extensive service present.*

### **Structural soils**

*Structural soils have been used but not in association with suspended pavements.*

*Feedback from landscape contractors + soil suppliers is that there is a lot of ignorance regarding what structural soils actually are and how they should best be installed. It is also apparently difficult and can be costly to supply structural soils to projects outside of the major Metropolitan areas.*

*Structural soils only used in urban environments where funding permits sometimes use.*

*Structural soils- has been used this in clay soil by others, did not work at all, are considering for sandy soil.*

### **Containerized**

*Portrush Road Median has containerized plantings.*

*Comments relate to the streets within South Bank not BCC In relation to the last two points we do have some podium type tree planting at ground level with very generous root zones.*

*Above ground containers-not often.*

### **Other**

#### **Subsurface cells**

*Arboreen root cells as an alternative to structural soils.*

### **Soil improvement**

*Mass ripping and mulching, with a view to using compost as well. In many of our cases, our limitations don't involve a small available root volume. As long as we can get air into the soil (and water) we should be right. Our specification also requires cultivation, but we rarely see it undertaken.*

### **Root barriers**

*Root barriers are still practiced, although the arboricultural seminars are teaching us that the use of blue metal/gravel instead of yellow sand under pavement within the tree drip line should be used to discourage roots from shallow growth under the pavement.*

*Council requires root barriers rather than containerized trees in the ground.*

*Use of root control structures on planting.*

*Council are now using Root directors supplied from Woodchuck Landscape Systems in Mount Barker.*

### **WSUD**

*Implemented Water sensitive urban design effectively container growing.*

## **Question 14 Infrastructure design practices (32 responses)**

### **Extent of adoption.**

*As above, very small quantity of "do practice" items.*

*Council engineers have primary control over streetscape works but have not supported innovative use of structural soils, tree planting in parking lanes or relocation of services due to funding constraints*

*We try all of the above. Depends on project and budget and site.*

*Unfortunately the infrastructure unit (engineers) work separately from tree design team. Difficult to change long held beliefs. However, are starting to get them on board with WSUD.*

*No-one bothers with this stuff in my Council as this is called thinking outside the managers parameters.*

*Remember, incompetency is promoted the hell away from good blokes.*

### **Root barriers**

*Root barriers used as reactive not proactive, strengthened pavements, relocation/redesign of services sometimes.*

*We only occasionally use root barriers. We have much research inside VR on root barriers, but there are varying opinions within regarding whether they work or whether they are useful.*

### **Undergrounding power**

*Western Power runs a program of retrofitting nominated suburbs with underground power lines*

*Underground power and bundling are cost prohibitive at this stage.*

*Street light wire removal is also cheap, funded in partnership with our electricity distributor and gains considerable additional tree growth space under other overhead conductors.*

*Much of the council area is in the urban growth corridor and all new services are undergrounded.*

*Undergrounding existing overhead power lines is too cost prohibitive for council.*

*We encourage undergrounding of power in new developments, however the idea is most often rejected due to high costs.*

*Undergrounding performed for heritage not tree purposes. Undergrounding of power in new developments*

*Comments relate to the streets within South Bank not BCC Not sure what is meant by first point Power is already underground - no above ground cables.*

*Undergrounding-a couple.*

### **Aerial cable bundling.**

*Cable bundling does not change pruning regulations, so ineffective.*

*Some aerial cable bundling has occurred - but no ongoing program.*

*ACB less now.*

*Aerial bundling is undertaken by the responsible authorities.*

*Aerial bundling and overhead power lines not within their jurisdiction. Camden Council does not provide electricity services however it does encourage cable bundling in area with above ground services. Council follows the Road Openings Conference standards in relation to service locations within the footway.*

*ETSA funding needs to increase to support more aerial bundling.*

*Would like to see aerial bundling practiced but this is the responsibility of the service authority.*

*Not cost effective to replace i.e. one span e.g. ABC cable can cost \$15,000.*

*Extensive overhead cable bundling due to initial provisions by State when legislation introduced in 1980s, little since.*

### **Service relocation**

*Working with power company to redesign infrastructure.*

*Redesign of services &; relocation of services is minimal.*

*Second last item, service relocation - only where significant ecological or amenity.*

*Relocation of services prohibited by cost.*

### **Root baiting**

*Root baiting-?*

## **Question 15 Water management practices (33 responses)**

### **Extent of adoption.**

*Pervious surfaces and passive watering occasional.y*

*Rain gardens, bioregion tree pits?*

*Only apply WUSD in appropriate locations.*

*This is the tropics; we get rain events of up to 1m in a week!*

*City of Perth in the infancy of water management practices!*

*Limited exploration of these innovations due to budget constraints.*

*Again, try to do all of the above. Depends on budget, timeframes, etc.*

*When I say 'intend to practice', it is the sort of intent that will require 5-10 years to change organizational behavior. Council relies on Mother Nature and tree selection for street trees to survive the harsh climate after requiring the developer to maintain the trees during their establishment phase which would include manual watering.*

*Over the last few years we have ventured into adopting some of these practices I have been trying to implement WSUD principles in the City of Marion since arriving here after working in Brisbane where I was heavily involved in these practices.*

*WSUD services outside Council's control.*

*Development approvals.*

*Mostly undertaken by Developers.*

*Development Assessment unit does condition bioretention, biofiltration etc.*

*When I say we practice some of these, it is primarily by conditioning a DA, we don't have a lot of control over the actual installation.*

*New developments generally address most of these items as a development requirement.*

### **Passive watering**

*The passive watering would potentially include bioretention tree pits.*

### **Underground storage**

*Underground storage not useable from first tests done.*

### **Subsurface cells**

*Subsurface "cells" are new (in one park) still under the control of the developer, bus yes, it was encouraged by the City and approved by the WA Planning Commission. The adoption of the rest of the water management practices is slow.*

*"Cells" = aggregate filled trenches.*

*Storage cells are just coming onto the radar now that water restrictions are imminent.*

### **Other**

#### **Recycled water**

*We use treated effluent water on the street trees the city plants.*

*Street Trees are now watered with recycled water at the City of Salisbury.*

*Use of reclaimed water.*

*Use recycled water for Parks.*

*Use of treated effluent.*

#### **Soil additives**

*Use TerraCottem soil condition to reduce watering.*

#### **Water trucks**

*Water Trucks for street plantings.*

#### **Wetlands**

*Development of water catchments as wetlands for water holding and irrigation.*

## **Question 16 Tree species selection practices (31 responses)**

### **General criteria**

*Visibility-single trunk, amenity to pruning, tree vigor, environmental weeds, flower irritants, not too vigorous roots.*

*Manageable root systems, weed/invasiveness potential, litter abundance, liability e.g. berries/trip/slip hazards Indigenous/exotic.*

*On the use of indigenous species and avoidance of species regarded as potential weeds in locations close to areas of natural vegetation.*

*More emphasis on native street trees & mixed species for ecological corridors, better biodiversity and food for bats, birds and possums.*

*Council plants mostly natives originating from coastal communities ranging from Northern New Sales Wales to South East Queensland and North Queensland. And to a lesser extent exotics from a similar geographic range/climate.*

*Council actively encourages seed collection of endemic species for use on development sites. It works with agencies such as the Mt Annan Botanic Gardens to propagate the seedlings at the cost of the developers of the release areas.*

### **Size**

*Due to confined spaces use of smaller species.*

*Trend is to go larger Availability/cost-grow in-house.*

*Depends on site and response from residence.*

*The answer above about tree size is this in relation to mature specimen size or installation size.*

*We plant the largest trees possible for the planting site - hence in many locations there are fewer larger trees, and in other locations there are smaller trees where the utilities cannot be re-designed for the next 15-20 years.*

*We plant small trees under overhead power lines and larger trees.*

*Choice of large/small tree is determined given consideration to available footpath width, scale of street and set back of adjoining buildings - no active decision to plant more big or more smaller trees.*

*Should be plant fewer, larger trees - not fewer larger trees?*

*Plant indigenous tube stock in WSUD treatments otherwise minimum size street tree is 2.5 m.*

*While everyone wants large trees to look at no one wants them near their property as they may cause problems, roots, leaves, shadowing etc.*

*Size location dependant.*

*Larger or smaller trees-depends on location.*

*Plant fewer but advanced trees within streetscape/ town centre environments, but within suburban streets we will plant more smaller trees.*

*Smaller trees-depends on area.*

### **Availability**

*The main problem we have is the availability of the select few species we are able to use*

### **Consultation with others.**

*Consultation only occurs with developers who seek to understand what the minimum requirements are to achieve Council approval. So we get new tree plantings into rubble in car parks and compacted verges in new streets. The architects tend to do the urban design (you know real fast with rubber stamps and all botanic names miss-spelt) and tender out the landscaping expertise to a contractor. Landscape architects, who are you kidding!*

*Consultation with others for major programs.*

*Believe arborist has better idea than utility services regarding tree selection.*

*Consultation with others- occasionally.*

*Utility agencies.*

*Recommendations by utility agencies - has proven very difficult and limiting in South Australia. To give an example, the largest tree allowed (without specific permission) to be planted around power lines is a Callistemon...*

*Recommendations by utility agencies depends on the species and its proven record in the area.*

### **Other**

#### **Street Tree Policy**

*We have a street tree planting policy which details species, planting requirements etc*

*Council has adopted a street tree planting strategy so it not necessary to continually consult the community about species selection.*

*Tree species is usually dictated by Councillors.*

### **Question 17 Any additional comments (51 responses)**

#### **Values, benefits, support**

*Council take trees in town for granted and put a higher value on sealing road shoulders (over large tree roots) than on carrying best practice or exploring new practices to achieve the same results.*

*This council has not changed its approach to tree planting for years. Trees are generally treated as a liability. Staff do not appear to be interested, are not qualified and do not pro-actively manage trees.*

*Street trees will only ever be valued equally among the other resources and structures located in the road reserve if their status as plants is heightened to elevate them to utilities that provide beneficial and monetary worth as other utilities do. For trees such values per tree per species need to be calculated for carbon sequestration, incipient water storage, reduced drainage and drainage infrastructure costs, sociological worth, shade, prolonged pavement life contribution by shading, value as harvestable timber etc. Then as a utility the funding required to maintain the resource over its expected lifespan can be more accurately allocated and the worth of the tree as a utility that is more than aesthetic could be better communicated and their importance*

better understood by the broader community. At this time more appropriate funding for staff, maintenance and research may be easier to achieve.

Councilor support for trees in general appears to be dwindling due to increasing tree complaints from the community. However, it is also noted that when trees are removed from the community, it is only then that the community is as much for trees, as against.

We have presented to the Councilor's the statistics and triple bottom line benefits of street tree planting, specifically the effects of climate change and amenity. Unfortunately the point was not really accepted. They were more concerned with potential problems and local issues to understand bigger picture  
Would love to see more research done regarding the benefits of trees especially relating to human health and other cost benefits.

One of the single biggest issues is that generally people don't appreciate trees, the time, effort and how difficult it is to grow a tree to maturity in the public arena, as stated earlier most people are unhappy with the mess that they create.

Street trees will be the most important trees in our new release areas as lot sizes become smaller and people don't have the room for backyard planting - yes, even in Camden! For this reason, Council continues to explore means of educating its community on the importance of these trees and 'ownership' of the trees by the residents.

Political and public perception of the real benefits are the prime stumbling blocks. Lack of open collaboration with service engineers is the second problem and the lack of can do attitude.

Council attitudes are influenced by policy, staff involved, etc as well as traditions within the area. The approach to landscaping also differs depending on the ecological or amenity values of an area.

Trees are a high priority for us at Ipswich City Council.

Vandalism, theft, and "don't get me wrong I love trees but ..." are the biggest issues. Followed closely by "my house is cracking and the engineer said that tree ..." whilst ignoring the climatic conditions over the past ten years.

### **Council organization, management**

Planting is carried across different sections of Council, and there are a number of different approaches. In new capital works we usually have the luxury of being able to design for and specify our needs to create environments that are a bit 'special', and can therefore use trees that may be larger, and with sub-surface conditions provided for the longer term. Day-to-day tree management practices and decisions relating to street tree planting are usually maintenance and budget driven - and there is never enough money

Too many to note. Call me on \*\*\*\*\* if you wish to discuss further.

Local area is covered by five different Councils (a rural environment). Procedures are generally behind that of the larger metropolitan centres (behind the times). Generally trees suffer e.g. Catchment Management Authority can override TPO's and VMO's re tree removal. These sort of anomalies are a cause of concern.

Wagga Council is moving forward with changes to their tree management, however budgets restrict works.

Working towards proactive management of urban trees as we have started auditing all our city trees with Homewood Consulting Services Vic.

We are currently reviewing our street tree and urban forest practices. The main impediment to implementing good tree practices seems to be the lack of any dedicated person to be a "tree advocate". Until Council creates this position, we will continue with the present ad hoc process of doing what we can when we can. We are making progress though; we are working an Urban Forest Management Plan and reviewing our DCP to make it more tree friendly.

Council has recently engaged an arborist who will provide standards and recommendations on tree maintenance practices.

### **Budgets**

Budgets are tight and there is limited support towards street tree planting programs anywhere. Planting tends to occur in limited scope, mostly in association with major capital infrastructure works, with a very small recurrent tree planting program. A lot of resource is focused on the tree assessment task, a large portion of which deals with private property. There is limited survey or knowledge of the condition of the tree assets overall.

Maybe this is the real face of development- South Australian rustbelt style. All talk and hype, little substance. I think the problem is that Councils are reluctant to publicly talk about rate revenue or claim to seek higher rate returns in exchange for higher quality/cost amenic infrastructure such as plentiful large tree establishment and undergrounding of power lines. There are some great potential initiatives (as listed in this survey) available to Council's that would reduce annual operating costs but seemingly there is no incentive to make a leap or even trial into the great unknown of capital expenditure on items that are not roads or drains. Perhaps this a real

*problem for Council's who can't see the link between amenic expenditure and rate return on investment. Perhaps the problem lies with the people who spin Council under-achievement and the public who have been trained to expect it. I solve development problems with regards trees by engaging these initiatives and Councils love it, but they don't practice it. I would like to see Landscape Design a mandatory requirement of new development within the Development Act in the same manner as significant tree protection has been incorporated. Better outcomes, better quality urban design, guaranteed industry base. You beauty. While we're on that topic, why shouldn't tree planning and planting require development approval?*

### **Maintenance**

*This survey didn't have reference to the use of trained/skilled/qualified/knowledgeable tree maintenance staff. I believe this is an important part of tree development/establishment/management. We as a council are struggling to find suitably qualified and skilled staff.*

### **Strategies**

*I would encourage you to read our AILA Award winning Greening Footscray Strategy (see link). The Strategy was developed to respond to the issues of Footscray's urban environment. It first outlines the desired tree 'effect' based on existing strategic positioning, then selects a preferred species that meet the criteria for the effect, meaning the trees can achieve a whole lot of social, economic and environmental goals.*

*[http://www.maribyrnong.vic.gov.au/Page/page.asp?Page\\_Id=2949&h=0](http://www.maribyrnong.vic.gov.au/Page/page.asp?Page_Id=2949&h=0).*

*We also have several "rules", "laws" and other development standards/requirements which are critical to optimizing positive street tree outcomes/management and minimizing liabilities. E.g. Street Tree Policy Standards for Tree Planting/Establishment; Tree Removal/Community notification; and Tree Valuation: Tree Protection during construction City Plan- Subdivision standard conditions for street tree contributions and Natural Asset Local Law and detailed survey of 10% of estimated street tree population, and other asset data from satellite imagery; stratified random sampling; community attitude surveys etc. and several strategic documents approved by Council- e.g. Subtropical Boulevard Strategy and Neighbourhood Shadeway initiative New to this Council so not up with past practice. Council just releasing new 'Tree Policy' for public comment, looks promising and will embrace 'best practice'.*

*Council is currently undertaking an Undesirable tree removal program which incorporates a replanting process of desirable trees and shrubs at new safe distances with root directors. please contact me if you would like some photographs or information.*

#### **Innovation**

*Very difficult to get landscape consultants who are keen to try innovative and sustainable techniques including run off into gardens & tree pits, and who will focus on native species selection - the nursery industry has been very slow to develop and market native species for urban and street tree use. Street trees could make huge improvements to roads, particularly around the edges of towns - often "suburbs" or peripheries suffer from poor quality landscapes which could easily accommodate large trees alongside roads*

*As we use qualified consultants we think we get the current best practice advice - consultants have trouble designing to a price and delivering on time.*

#### **Urban development**

*The most important aspect is getting trees back into the residential areas where they have been lost through increasing densities. As areas are not available on private land due to this intensive redevelopment, the only alternative is within the road reserves. This also has many benefits in improving the environment we live in and also making it a better place.*

*Many Council's UNDERESTIMATE the willingness of developers to invest more in new landscape planting in return for relaxing non-viable retention of large trees. Too many trees forced to be retained don't make it to 10 years.*

### **Space**

*I believe that we could improve our street trees by creating wider nature strips. There seems to be such a demand to "cram" trees, public utilities, footpaths into such a narrow strip of land? To the point that it's not sustainable? Correct species selection and planting location (i.e. Don't plant trees in front of lamp post or just next to or above domestic sewer junctions) at the development stage will also minimize long-term issues. To a large degree many of the issues relating to street trees could be minimized by correct planning process and the understanding of how trees grow within the urban environment. Another key point is aftercare correct tree training / proactive pruning programs to correct tree growth at a young stage.*

*The most significant barrier to provision of successful street trees that I have experienced is space, both above and below ground, and the very substantial costs of creating this space if it does not already exist.*

**Soil**

*Soil condition is generally clay, avoid changed profiles and choose trees that will grow in existing conditions - more long term sustainable.*

**Services**

*We are currently developing an agreement in principle with the electricity supplier regarding tree planting under power lines and species selection.*

*Services are everywhere, cannot be governed by these.*

**Water**

*Water restrictions have the potential to have a huge affect on the urban forest. At Unley we have concerns with our street tree asset in particular from the lack of water. Furthermore, we have had to introduce strategies within our parks and reserves to save our trees of importance. This has occurred due to having to in many cases having to 'turn off' our park/reserve watering systems.*

*We live in a Wet Dry climate with no water restrictions. One of the biggest issues we face is old planting techniques which see large mature trees fall in cyclonic winds.*

**Species selection**

*The Council wishes to decrease the use of exotic species to retain/re-create the sense of local identity and reduce the nutrients load on the waterways causing nitrification of our lakes.*

*I have been researching an alternative to the box tree, which in Nedlands arouses strong opinions, mostly anti. Still no one tree species ticks all the boxes on suitability to climate, soil, leaf drop. There must be something better than London Plane trees which are going in now.*

*Trialing alternative/new species and planting techniques is often limited to successful negotiations with developers of new residential estates due to the limited resources of Council.*

*I am prepared to trial species unusual or not known to grow in our area. I have been doing trials on different trees for over 10 years with varied success. Trees that do well in local gardens do not necessarily do well in streetscapes. I am not a qualified arborist, I do have a good grasp and understanding of what species do well with frost, alkaline soils and a rainfall of less than 350mm.*

*Using drought proofing tree planting techniques (Soil Conditioners) and drought tolerant species*

*We try to stay with drought tolerant species that grow quick and can withstand a certain amount of abuse.*

**Other**

*Could this survey be conducted across related professions & industries too e.g. development, natural resources, landscape architecture.*