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Decision-making of municipal urban forest managers through the lens of governance

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Abstract

Awareness of the benefits of urban trees has led many cities to develop ambitious targets to increase tree numbers and canopy cover. Policy instruments that guide the planning of cities recognize the need for new governance arrangements to implement this agenda. Urban forests are greatly influenced by the decisions of municipal managers, but there is currently no clear understanding of how municipal managers find support to implement their decisions via new governance arrangements. To fill this knowledge gap, we collected empirical data through interviews with 23 urban forest municipal managers in 12 local governments in Greater Melbourne and regional Victoria, Australia, and analysed these data using qualitative interpretative methods through a governance lens. The goal of this was to understand the issues and challenges, stakeholders, resources, processes, and rules behind the decision-making of municipal managers. Municipal managers said that urban densification and expansion were making it difficult for them to implement their strategies to increase tree numbers and canopy cover. The coordination of stakeholders was more important for managers to find support to implement their decisions than having a bigger budget. The views of the public or wider community and a municipal government culture of risk aversion were also making it difficult for municipal managers to implement their strategies. Decision-making priorities and processes were not the same across urban centres. Lack of space to grow trees in new developments, excessive tree removal, and public consultation, were ideas more frequently raised in inner urban centres, while urban expansion, increased active use of greenspaces, and lack of data/information about tree assets were concerns for outer and regional centres. Nonetheless, inter-departmental coordination was a common theme shared among all cities. Strengthening coordination processes is an important way for local governments to overcome these barriers and effectively implement their urban forest strategies.

Keywords: municipal government; urban planning; urban greenspace; urban forest management; nature-based solutions

1. Introduction

Policy instruments that guide the planning of cities, such as the new urban agenda within the UN Habitat program, recognize that urban greening can help solve some of the pressing environmental and societal challenges of cities (UN-HABITAT 2018), such as climate change resilience (Doherty et al. 2016) and public health (Shanahan et al. 2015). The agenda also recognizes the importance of establishing new institutional arrangements to assist governments to implement these solutions and strengthen their decision-making (UN-HABITAT 2018).

A dominant aspect of urban greening is the planting and retention of trees (Escobedo et al. 2010; Norton et al. 2015). Urban expansion, densification, and consolidation are challenges facing the greening agenda (Haaland & Konijnendijk 2015; Boulton et al. 2018). The densification of existing inner-city areas creates conditions that make it harder to retain urban greenspaces (Forgione et al. 2016; Nastran & Regina 2016; Meerow & Newell 2017). They also make it difficult to retain and grow healthy urban trees (Vogt et al. 2015), thus impacting net-gain of tree-canopy cover (Kaspar et al. 2017; Guo et al. 2018). Consequently, many cities are actively setting long-term goals to plant and retain more trees, and increase tree-canopy cover (e.g., 202020Vision Australia 2019). The success of this agenda depends largely on the people who make decisions about urban trees and who implement those decisions. For trees in the public realm, this usually means the professionals who work for municipal governments and who make strategic and operational decisions (Pincetl 2010; Lawrence et al. 2013). Here we use social data from interviews with urban forest municipal managers from urban Victoria, Australia, and analyse these data through the lens of governance. We will describe how municipal managers find support for their decision-making to implement their strategies of enhancing tree-canopy cover and tree numbers, and how they are addressing new challenges to deliver sustainable and liveable cities.

2. Theoretical Foundations

The concept of governance can be broadly defined as the rules and processes of decision-making that allow stakeholders to influence and coordinate their needs (Lemos & Agrawal 2006). Governance can help with understanding how people make decisions about what is collectively

owned, such as the environment and natural resources in urban areas (Frantzeskaki et al. 2016), including urban forests and trees (Lawrence et al. 2013). Urban forest decision-making describes the process of what, why, and how decisions are made in relation to urban forests, including how trees are planted, protected, maintained, or removed (Konijnendijk 2000).

Many stakeholders participate in making decisions about urban forests, yet municipal managers play a central role in these decisions. Stakeholders can be broadly defined as those who are affected by the decisions of decision-makers, and who have the power to influence these decision (Reed et al. 2009). Non-government stakeholders are key for taking decisions about what is collectively owned, including the environment and natural resources (Folke et al. 2005; Arnouts et al. 2012), or a city's public infrastructure (Rhodes 1996; Stoker 1998) and natural resources (Borgström et al. 2006; Ernstson et al. 2010; Andersson et al. 2014; Forgione et al. 2016; Frantzeskaki et al. 2016). For instance, residential homeowners make many decisions related to trees that are privately owned (Kendal et al. 2010; Daniel et al. 2016), and community-led greening groups can influence what, why, and how public trees get planted, protected, maintained, or removed (Conway et al. 2011; Connolly et al. 2013) (Figure 1). Yet, given that their resources and norms are vital for governing public assets (Davies, 2002; Bulkeley 2010), the decisions taken by governments about assets that are collectively owned or enjoyed are still key (Kiser & Ostrom 1982). For instance, many of the decisions that influence the strategic direction and day-to-day operations concerning public parks, trees, and greenspaces depend heavily on municipal managers (Sipilä & Tyrväinen, 2005; Mincey et al. 2013). Municipal managers can be highly influential in the decisions related to urban forests and are responsible for resolving the demands being placed on public urban trees.

To understand municipal managers' views on governance we can either look at the formal mandates of the institutions behind them or elicit ideas directly from managers. Institutions can be broadly defined as human constraints or collectives that structure political, economic, and social interaction (North 1991). The formal mandates of these institutions establish discourse, or a shared vision and rationale of a policy action, and rules, or what is allowed and not allowed in the management of what is collectively owned or enjoyed (Ostrom 2005; Arts et al. 2006). Obviously, there is diversity within institutions (Ostrom 2005); even government institutions and

departments may suffer from lack of connectivity and coordination in their discourses (Morrison & Lane, 2005). In urban forests, these discourses can define why and how urban trees are important for municipal governments and the people they represent, and rules define what is allowed and not allowed in their management (Lawrence et al. 2013; Figure 1). These are usually articulated in municipal documents, such as street tree regulations (called ordinances, bylaws, or other terms, depending on context; Mincey et al. 2013), as well as policies, strategies, and management plans (Davies et al. 2017), and can be complemented by other municipal planning instruments, such as zoning and urban growth regulations (Hill et al. 2010; Mincey et al. 2013). However, many of these formal municipal documents, such as management plans (Gibbons & Ryan 2015), are sometimes limited in the information they can provide on urban forest governance, specifically, the stakeholders, resources, processes, and rules behind urban forest decision-making.

Empirical studies on the views of municipal managers can also provide us with insights on these issues. A key question here is how municipal managers are finding support to implement their strategies and address new challenges. The new challenges of urban greening include rapid urbanisation and densification; increased attention to public participation and environmental equity and justice; and changing climate and demographic patterns (Haaland & Konijnendijk 2015; Boulton et al. 2018). In a recent review of existing empirical studies on the views of urban forest municipal managers, Ordóñez et al. (2019) argued that many of these studies are not focused on the processes that could support decision-making – the organizational procedures that help decision-makers govern or manage something effectively and efficiently (Ostrom 2010; Arnouts et al. 2012) –, such as the coordination of stakeholders, but are more focused on issues of operational capacity (i.e., the resources needed to get the job done, including budgets and personnel; see Driscoll et al. 2015), strategic programming (i.e., a pro-active approach to management, including the existence of a strategy or plan; see Davies et al. 2017), public awareness (i.e., educating the public about the benefits of trees to reduce barriers for tree planting and retention; see Young 2013), and the technical aspects of tree selection (i.e., what species of trees are planted; see Vecht & Conway 2015) (Figure 1). While these studies are insightful, they do not explore how municipal managers find support in processes to implement their strategies and address new challenges.

Some of the important processes that could support municipal manager decision-making include stakeholder coordination, partnership creation, and public engagement (Figure 1). Stakeholder coordination is important because not all decisions related to trees and greenspaces are made solely by municipal managers or are the direct result of municipal mandates. Non-governmental greening groups (Conway et al. 2011; Connolly et al. 2013; Varuzzo & Harvey 2017), other municipal units (Young 2013; Driscoll et al. 2015), and land owners and developers can influence decisions about urban greenspace and trees (Newig et al. 2010; Molin & Konijnendijk 2014; Meerow & Newell 2017). However, many greening groups only operate in specific areas, particularly in high-income communities (Conway et al. 2011; Greene et al. 2018). In addition, different stakeholders have different power, or the capacity to influence outcomes in the management process (Newig et al. 2010). The distribution of power among stakeholders may be uneven, with some stakeholders more connected to the higher levels of strategic planning within government and more capable of influencing resource allocation (Campbell 2016). While partnerships can help managers coordinate the input of multiple stakeholders (Brandt et al. 2016; Forgione et al. 2016; Kozová et al. 2018), and address uneven power distributions (Campbell 2016), many cities cannot afford to have a pro-active approach to partnership creation due to lack of resources (Newig et al. 2010; Molin & Konijnendijk 2014). Public engagement receives a lot of attention in urban forestry (e.g., Gulsrud et al. 2018), since the mandate of municipalities is to provide services to the public. While some managers consider public consultation a way to enhance public acceptance of tree-planting programs (Kirkpatrick et al. 2013), most research on the view of municipal managers focuses on their views about raising public awareness rather than improving engagement (Ordóñez et al. 2019). It is still unclear is how public engagement can support the decision-making of municipal managers.

Urban forest governance processes may vary among jurisdictional boundaries and cities, and these differences may reflect differences in the characteristics of urban areas, characteristics that may include level of development, population density, population growth. Many cities contain different urban areas varying from areas of high development and high population density, to areas of low density and high population growth, and everything in between. These characteristics and their variation influence the way we understand a local government as a unit

158 of experience. This idea is reflected in lens of urban-rural gradients, a lens that has been useful
159 for understanding the linkages between the ecological, social, and physical characteristics of
160 cities and urban centres (McDonnell & Pickett 1990; Pickett et al. 2001; Hahs & McDonnell1
161 2006; Dobbs et al. 2013). This lens can allow us to integrate insights from several case studies,
162 helping us understand what is common or different among cities and urban centres, and helping
163 us avoid the local trap (Buijs et al. 2018). Yet, most integrative studies on urban forest
164 governance come from Europe. For example, Lawrence et al. (2013) for the UK, Germany, and
165 Italy; Sipilä & Tyrväinen (2005) for Finland; Molin & Konijnendijk (2014) for Denmark;
166 Kozová et al. (2018) for Slovakia; and Buijs et al. (2018) for several European cities, but mostly
167 on citizen-led greening initiatives. While the urban-rural gradient lens could be useful for
168 understanding urban forests, it has rarely been used to study urban forest governance using
169 empirical data on the perspective of key stakeholders.
170

Governance dimensions	*Themes used in relevant frameworks*	*Themes used in analysis*	*Examples of ideas in themes*
Stakeholders	Actors, Coalitions, Partnerships, Power Analysis	Stakeholders	Other municipal departments/units Developers Residents
Rules of the Game	Ownership, Processes, Regulations, Access & Rights, Participation, Monitoring & Evaluation, Government Style	Processes Regulations Participation	Street tree bylaws or ordinances Coordination of stakeholders Coordination of departmental units Public participation
Resources	Operational Funding, Operational Personnel, Knowledge, Delivery	Operations (Funding/Personnel) Knowledge	Budget Personnel Information/Data
Discourse	Policies, Strategy, Issues & Challenges, Government Style	Policies / Strategies Issues & Challenges	Pro-active management culture Existence of strategy/plan Framing of urban forestry

171

172 *Figure 1:* Urban forest governance framework used in this study, indicating concepts used for
173 data aggregation and interpretation (based on Arts et al. 2006, Frantzeskaki et al. 2016, Buijs et
174 al. 2016, Buijs et al. 2018, Lawrence et al. 2013, and Boulton et al. 2018)

175

3. This study

This study aims to understand the issues and challenges, stakeholders, resources, processes, and rules behind the decision-making of municipal managers in an in-depth and qualitative manner. We focus on how municipal managers find support in processes to facilitate their decision-making. To meet these goals, this study asked the following research questions:

1) What are the priorities/strategies, as well as new issues and challenges, taken into consideration in the decisions made by municipal managers?
2) Who participates in these decisions?
3) What are the resources available for these decisions?
4) What rules and regulations are considered when making these decisions?
5) How is the public or wider community involved in these decisions?
6) How do these vary across urban centres?

This study complements existing literature on urban forest governance and stakeholder decision-making by exploring these topics through the perspective of municipal managers. This makes a significant contribution to the existing literature since most research on urban forest governance has mostly taken a non-government perspective. In addition, most research on the views of urban forest municipal managers provides only a limited understanding of urban forest governance since it is not based on governance frameworks. By this we mean research studies that explore how municipal managers find support in governance processes to implement their strategies and address new challenges, including processes such as stakeholder coordination, partnership creation, and public engagement. While we recognize that this single-actor perspective limits a broader understanding of urban forest governance, particularly on the role of non-government, the purpose of this study is to explore decision-making from the perspective of this pivotal urban-forest stakeholder. In addition, the literature on urban greening governance is usually based on spatially discrete public open space and greenspaces, such as urban parks (see Haaland & Konijnendijk, 2015; Boulton et al. 2018). Focusing on urban forests, defined here broadly as all the trees in a city (Konijnendijk et al. 2006), is important because urban trees are not necessarily confined to discrete public greenspaces and provide the foundation for urban biodiversity in many other areas of a city besides urban parks. Trees can also exist in spaces

surrounded by houses and buildings, and in both public and private lands, providing environmental and social services across different scales (i.e., as individual trees or as urban forest canopy; see Livesley et al. 2016). Therefore, in this study, we do not specifically refer to the urban forest as a publicly owned resource, although we recognize that most decisions that municipal managers make would be about publicly owned trees. This is because administrative boundaries, ownership, and/or tenure specifications for the urban forest are only vaguely addressed in many municipal documents (Ordóñez & Duinker 2013), and in Australia it is common for cities to strategically refer to the urban forest as a continuous resource, spanning both public and private areas (Jones & Instone 2016). These questions are explored in several cities across the state of Victoria, Australia.

4. Methods

4.1 Context

The state of Victoria (34 – 39 S, 141 – 150 E), Australia, covers approximately 227,600 km^2, and is the country's second smallest state. With 6.4 million people, it is also the second most populous state (ABS 2018). Climate across the state varies widely, but most of it is in a warm, temperate region, characterized by warm and dry summers, and cool and wet winters. Summer temperatures range 14 – 23°C in the coast, 16 – 31°C inland, and 11 – 20°C in the mountains, and winter temperatures 7 – 14°C, 5 – 16°C, and 0 – 5°C, respectively. Some areas receive rainfalls of more than 1,000 mm per year, while others average as little as 327 mm per year (BMO 2019). This varied but mild climate manifests in a diverse vegetation (Figure 2).

The capital and most important urban area of the state is the Greater Metropolitan Area (GMA) of Melbourne (37.49 S, 144.58 E). Other urban centres across the state include regional city centres, such as Mildura, Shepparton, Wangaratta, Ballarat, Bendigo, and Geelong, the last three being the largest regional cities, all located within 150 km of the Melbourne GMA. Regional cities are important historical and economic areas, and some are becoming residential locations for people working in the Melbourne GMA (VPA 2018; Figure 2).

The Melbourne GMA, also known as Greater Melbourne, covers 9,992.5 km^2 and has the second biggest (approximately 4.9 million; City of Melbourne 2018) and fastest growing (2.7% growth from 2016-2017; ABS 2018) urban population of Australia. It is characterized by a Mediterranean oceanic climate (Köppen classification; BMO 2019) with a daily mean temperature of 9 – 15°C, and a mean annual rainfall of 600 – 1100 mm (BMO 2019). The GMA is divided into 32 local government authorities (LGAs; henceforth, local governments). Greater Melbourne is a rapidly urbanizing area, with clear policies aimed at urban densification and avoiding urban sprawl. Urban planning in Victoria is based on a hierarchical system of government, with the Victorian State government setting the strategic planning direction for cities, and local governments making decisions about locally significant matters (Infrastructure Victoria 2016). Local government budgets are currently subject to rate capping (MAV 2017).

Urban forests are important in urban planning in Victoria. For example, the City of Melbourne is a world leader in urban forestry (Gulsrud et al. 2018). Many other cities have recently developed urban forest strategies (e.g., City of Moreland 2017) and currently participate in creating a metropolitan urban forest strategy for Greater Melbourne to coordinate the urban forest agenda efforts across city councils (Resilient Melbourne 2019). Issues of priority in this agenda include the multifunctionality of urban greenspaces (Ives et al. 2013; Phelan et al. 2018) and having enough space for growing trees within intensified urban development (Kaspar et al. 2017).

The urban forest of Greater Melbourne has some important characteristics. Its uneven tree-canopy distribution varies according to neighbourhood age, income, and education level (Kendal et al. 2012; Dobbs et al. 2013). Low tree diversity is a concern in Greater Melbourne. Local governments have a long history of planting exotic European tree species in parks and streets, such as English elms (*Ulmus procera* and/or *minor*) and London planes (*Platanus x acerifolia).* To maintain the European heritage of their central districts, some cities only allow exotic trees in these areas (e.g., City of Ballarat 2018). More natural areas contain more native and/or indigenous tree species, such as river red gum (*Eucalyptus camaldulensis*; City of Moreland 2017). Climate change is a major challenge, with significant droughts, heatwaves and flooding causing various impacts to urban trees in recent decades (May et al. 2013; Nitschke et al. 2017).

4.2 Design & Methodology

This study used qualitative research methods to elicit and analyse the views of municipal managers from a sample of cities across Greater Melbourne and regional Victoria. Qualitative research is an exploratory, descriptive, and explanatory approach that seeks to understand the experiences and opinions of individuals or collectives, while relying heavily on their views to generate this knowledge (Creswell 2018). The method of Grounded Theory, a strategy of inquiry based on interpretative procedures, was used here to discover concepts, generate theory, reveal the underpinnings of social phenomena, and build a model for understanding an issue from the perspective of our participants (Glaser & Strauss 1967). Rather than relying on lengthy descriptions, Grounded Theory generates results in terms of the frequency and hierarchical structure of ideas (Corbin & Strauss 2015).

Because the intention was for municipal managers to elaborate on the research questions in this study (i.e., questions 1 to 5 above, section 3 "This Study") with some context, participants in the study were asked to think about specific instances of urban forest decision-making, specifically, events of tree planting, removal, or retention. This approach brought the decision-making process to life from the perspective of those making or participating in decisions. It connected the strategic direction and day-to-day operations of a city's urban forest activities with events that illustrated change in the urban forest.

An adapted urban-rural gradient approach was used to understand the unique experience of a city or urban centre, relying on similar approaches in Greater Melbourne (see Theoretical Framework; also Dobbs et al. 2013; Hahs & McDonnell 2006). Cities representing four local government types were used: 1) a state capital city centre and central business district (centre); 2) local governments surrounding the city centre (inner); 3) local governments in the outskirts of Greater Melbourne (outer); and 4) several regional state cities (regional). These local government types range from areas of high development and population density (centre, inner), to areas of low density and high population growth (outer), and everything in between. While there are variations in the way cities are classified in different state government departments, with different typologies referring to different characteristics, such as intensity of development, age of area, residential patterns, and population growth, the classification used here responded to

the planning guidelines of the Victoria Planning Authority (2018; Figure 2). The urban-rural gradient lens was not used to generalize results for all local governments in Victoria, as this assumes representativeness. Rather, the lens allowed the exploration of the research questions in cities that share similar characteristics and represent units of experience.

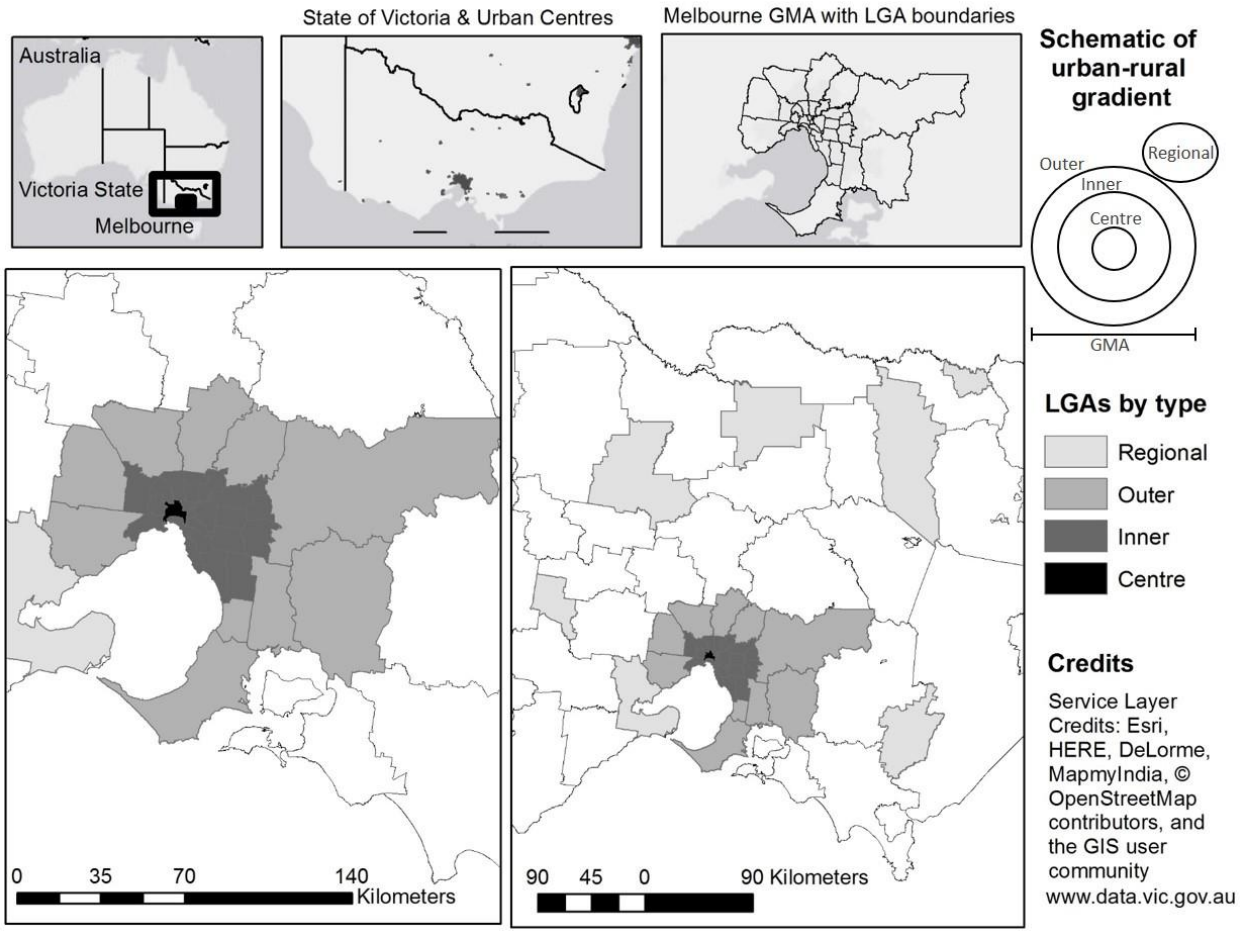


Figure 2: Urban centres and types of local governments (LGAs) in the state of Victoria and the Greater Metropolitan Area (GMA) of Melbourne, Australia, including central, inner, outer, and regional cities (non-shaded areas are not considered in the classification or the study)

A common misconception of the method of Grounded Theory is that it ignores existing theory, but instead we share the perspective that the method can expand and/or build on previous theory (Suddaby 2006). The framework adapted from urban greenspace and urban forest governance

311 studies that was presented in Section 2 (Figure 1), was used to aggregate ideas generated by the
312 data analysis.
313
314 *4.3 Data Collection*

315 In-depth, semi-structured, interviews were conducted by the lead author with urban forest
316 municipal managers during April to July 2018. Participant recruitment followed sampling
317 procedures typical to the Grounded Theory method (Corbin & Strauss 2015), based on
318 willingness to participate and open to any adult professional. Participants working in an urban
319 forest management capacity in a local government were approached and invited to participate in
320 the interview via email, using stratified snowballing techniques to connect with other participants
321 from the different local governments (Figure 2). The study aimed for at least 20 participants,
322 which is the median of participants in qualitative research studies on the views of urban forest
323 managers (Ordóñez et al. 2019). The following recruitment protocol was followed: 1) at least
324 two cities representing one local government type (except centre, which included only one city)
325 were contacted; 2) at least two people in each city were contacted; and 3) one-to-one interviews
326 were scheduled wherever possible. Some of these parameters were not met due to lack of
327 participant availability. For example, four cities only had one participant; three cities had three
328 participants; and three interviews were carried out with two participants at the same time. All
329 other local governments had two participants each and most interviews were carried out one-to-
330 one. The local governments in the study represented a population of 1.77 million, or
331 approximately 28% of Victoria's population of 6.4 million, with a wide range of socio-economic
332 characteristics (Table 1). Interviews were carried out in English, and were audio recorded to
333 capture the direct voice of participants. These audio-recordings were all transcribed. Ethics
334 approval for research with human subjects was obtained from the University involved (Ethics ID
335 Number: 1750430), and informed consent was obtained from all participants. In order to adhere
336 to the privacy policy in the Ethics with human subjects guidelines, and because some contact
337 information for urban forest managers in the participating local governments is publicly
338 available, we do not openly reveal the local governments studied to ensure participant anonymity
339 and confidentiality.
340
341

342 *Table 1:* Characteristics of the local governments studied

Characteristic	*Categories*	*Number of cases*
Local Government Types [a]	centre	1
	inner	6
	outer	2
	regional	3
Population [b]	<99,999	1
	100-149,999	6
	150-199,99	4
	>200,000	1
Median Weekly Household Income ($ AUD) [b]	<$999	0
	$1,000 – $1,499	8
	$1,500 – $1,999	3
	>$2,000	1
% of population with University as highest education [b]	<9%	0
	10%-19%	6
	20%-29%	0
	30%-39%	2
	>40%	4
Index of Relative Socio-Economic Disadvantage (IRSD) Quantiles [c]	1	1
	2	1
	3	2
	4	5
	5	3
% of population born in Australia [b]	<49%	2
	50%-64%	6
	65%-79%	2
	80%-94%	2
	>95%	0
Existing Urban Forest Strategy [d]	Yes	10
	No	2

[a] Based on Victoria Planning Authority (2018); see Figure 2
[b] Based on 2016 Census, see http://www.abs.gov.au/websitedbs/D3310114.nsf/home/census
[c] Index of Relative Socio-Economic Disadvantage (IRSD), where 1 = very disadvantaged, and 5 = not disadvantaged, based on Socio-Economic Indexes for Areas (SEIFA), see http://www.abs.gov.au/websitedbs/censushome.nsf/home/seifa
[d] Based on publicly available documents available through participating local government websites

343

344

Table 2: Selected participant characteristics

Characteristic	*Details*	*Number of cases / Details*
Gender	Female	6
	Male	17
	Other	0
Number of years in urban forests/greening	Average number of years working in the field of urban forestry or urban greening	17.5 ± 1.8 years
Number of years in local government	Average number of years working with local government	8.9 ± 1.9 years
Education	Post-graduate degree	9
	Bachelor's degree	11

4.4 Data Analysis

All transcribed and audio data were imported into NVivo 12 Pro (developed by QSR International 2018). Codes were assigned to ideas that emerged from the transcribed text, rather than being forced upon the data (i.e., inductive interpretation; see Kelle 2007). Coding in grounded theory is done via the interpretation of participant responses and by assigning words that convey ideas that densify or simplify the meaning that the participants are trying to communicate. These ideas are then grouped into ideas of a higher hierarchy, also called code clusters, themes, or theme clusters in grounded theory studies. This hierarchical grouping adds structure to the coding system and allows researchers to related ideas to one another. Coding is carried out until saturation is reached (i.e., until no more information can be extracted from the data; also called premature closure or theoretical saturation in grounded theory; see Corbin & Strauss 2015). Codes in this study were aggregated into hierarchical groupings that related to the themes in our analytical frameworks (Figure 1). Only codes mentioned more than twice, and in more than two interviews were used for this aggregation (Table 2). Sources were classified by government type (Figure 2; "cases" in Table 2). Once the coding was finalized, we classified areas of text according to the specific instances of urban forest decision-making, chiefly, events of tree planting, removal, or retention, mentioned by the participants ("types of events" in Table 2). The query and relationships functions of NVivo 12 aided the exploration of codes across local government types and types of events (Table 2). The data analysis was carried out by the lead

366 author. The researcher had 10 years of experience in urban forest research but not in Australia.
367 This meant that knowledge about urban forest governance had not been acquired through an
368 immersion in the experience of the case studies. This meant that the researcher did not rely on
369 previous professional relationships to recruit participants, or in assumptions about context to
370 interpret data. During interviews, participants shared a lot of context when responding to the
371 questions. This meant a stronger reliance on code emergence and the pre-established governance
372 framework (Figure 1) for data interpretation.
373
374 The number of cities for each local government type was not the same (Table 1). Therefore,
375 additional data analysis procedures were developed to facilitate comparison of coding patterns
376 across cities. A weight was applied to the total number of mentions of a code to normalise the
377 data for direct comparison. The weighted number of mentions of a code for each local
378 government type was calculated as a fraction following the equation:
379
380 $$R_w = R_{LGA\ type} \times \left(\frac{N}{N_{LGA\ type}}\right) \qquad \text{(Equation 1),}$$

381 where R_w is weighed number of mentions for a code for any given local government type, $R_{LGA\ type}$
382 is the original number of mentions for a code in any given local government type, $N_{LGA\ type}$ is
383 the number of local governments of that type (e.g., 5 for inner; see Table 2), and N is the total
384 number of local governments (12; see Table 2). Therefore, the relative contribution of any local
385 government type to the number of mentions of a code is:
386 $$\frac{R_w}{Sum\ of\ all\ R_w} \qquad \text{(Equation 2; expressed as \%).}$$

387 This weighted number of code references per local government type was a more reliable measure
388 to enable comparison across cities than the original number of mentions of a code. These two
389 measures were used to visualize coding patterns in the results section.
390

391 *Table 3:* Selected coding examples, indicating case (local government type), assigned code(s),
392 themes (see Figure 1), and reference (participant number, internal to study)
393

Example	*Verbatim data*	*Case*	*Assigned code(s)*	*Themes* *	*Reference*
1	"That's one of the issues we are finding quite often in terms of state government and that between local government, it's the different agendas that people are driving. And obviously, you know our responsibility is to the community, to the local people"	Inner	State Actors Coordination: state policy	Stakeholders Processes	P4
2	"We need to provide clearance of the street trees for the overhead electrical powerlines because of risk of fire and damage to the electrical asset. That's really the number one reason why the state legislation exists. And yeah, the regulatory body [name of state body], has been increasing the pressure for council to do audits"	Inner	Increased infrastructure conflicts Coordination: state policy	Issues & Challenges Processes	P23
3	"We do have a parks department who looks after purely the parks, but we need to persist very heavily. None of the park guys are tree specialists. So, we often come and help them, or lend them our contractors. We assist them in master plans, give key advice for the strategies and policies and things like that, and they can take our advice or not, of course"	Inner	Departmental units Coordination: inter-departmental	Stakeholders Processes	P13
4	"So, there were these 100yr old trees that had to be removed (…). And we had near misses in terms of large branches falling and almost hitting people (…). We did an assessment of all the trees, and some trees were better than others, but some people in council take the view that is a risk, we got to get rid of them all"	Regional	Culture of risk aversion Coordination: inter-departmental Removal of ageing trees	Strategy Processes Type of event	P1
5	"Another thing is resources right (…). And sometimes greenery and landscaping fall off the agenda (…). "*the budget ran out, sorry, we're not going to be able to deliver*", right? (…) And we have a healthy budget, right, is not that, but we gain new areas and trees every year, and we may not be able to maintain them, especially in new developments"	Outer	Lack of budget Increasing maintenance costs	Operations Issues & Challenges	P7
6	"People ring me all the time, but they never ring me to say they love their trees (…) they only ring council about their tree because there's something wrong with it. So, I hope there's sort of that silent majority out there that don't ever ring"	Outer	Community views Increased Infrastructure conflicts	Issues & challenges	P11

Ellipses (…) are added to indicate deleted indicate deleted text, so focus is given to the essence of the idea
Brackets [ ] are used to not disclose private information of individual or institutional names
* These relate to analysis themes in Figure 1

394

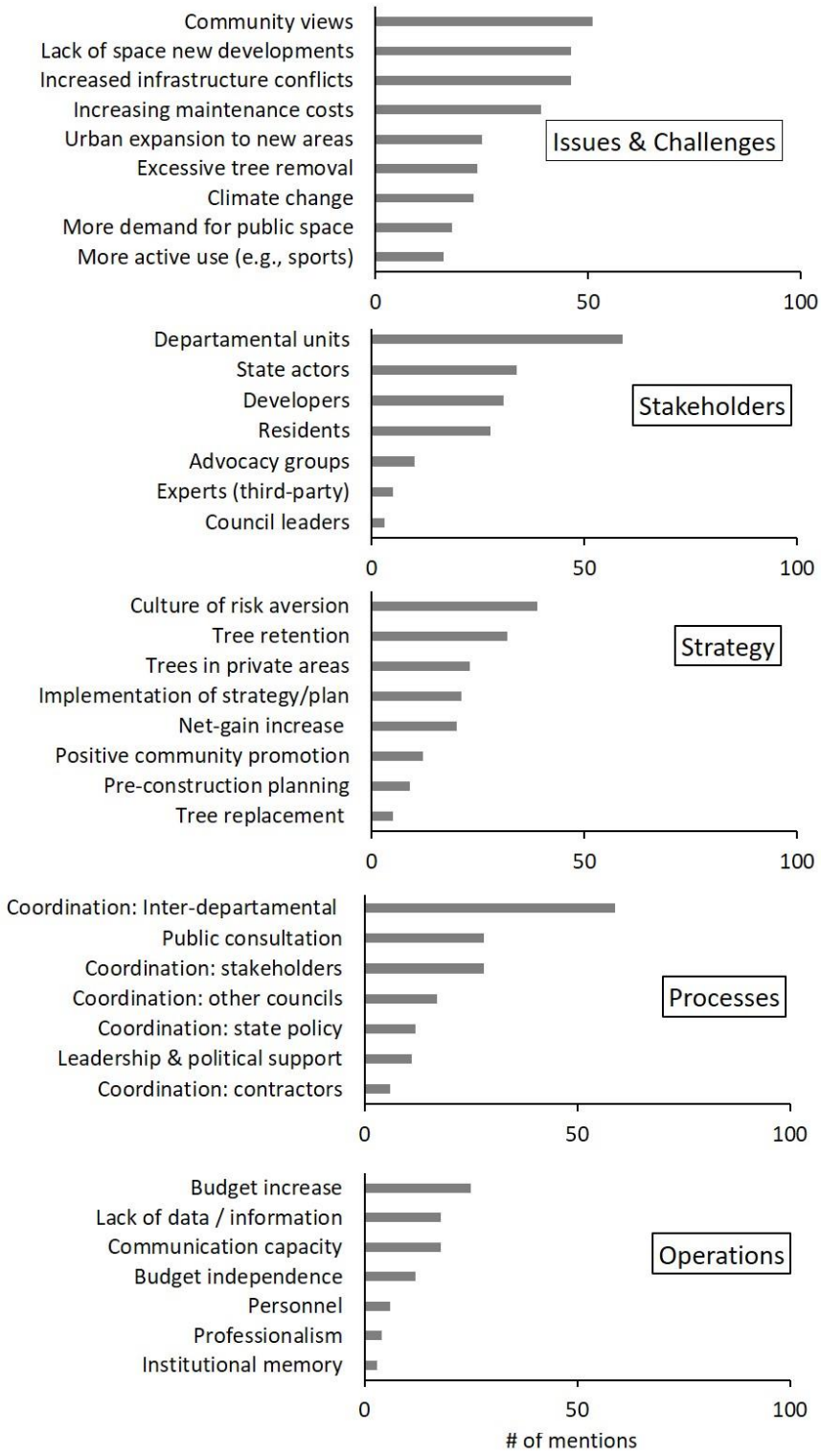
5. Results

Data were collected in 20 interviews involving 23 participants (Table 3) from 12 local governments representing four different local government types, as based on our classification (i.e., centre, inner, outer, and regional). The data represented a total of 24 hours of audio recordings with an average of 62.1 ± 2.4 min per interview. The coding analysis resulted in an average of 99.9 ± 5.2 codes per interview. Results are presented in terms of the frequency of ideas and their aggregation, or clustering (Figure 3); the relationship of these ideas, viewed from the perspective of events triggering a decision (Figure 4), and coding patterns of ideas across local government types (Figure 5).

First, urbanization processes, particularly those related to urban expansion and densification, are frequently mentioned as issues that make it difficult for municipal managers to implement their strategies. These processes have brought stakeholders, such as state actors, other municipal departments, and developers, into the decision-making process of managers (Figures 3 and 4). The coordination of departments and stakeholders were frequently mentioned as important processes for managers to support their decision-making, more so than some operational issues, such as bigger budgets (Figures 3 and 4). However, implementing these coordination processes depended on key capacities, such as the capacity to communicate strategies to stakeholders (Figures 3 and 4). The effect of urbanization processes on tree retention and removal was very evident given that participants were mostly thinking of tree removal events as specific instances of their decision-making (Figure 5).

Second, the public or wider community was mentioned frequently by municipal managers. Community views, a culture of risk aversion, increased demand for active use of greenspaces or parks (e.g., for sports), and increased infrastructure conflicts, were frequently mentioned as issues that make it difficult for municipal managers to implement their strategies. Strategies of tree retention, trees in private lands, and positive promotion of urban trees were frequently mentioned as ways to counterbalance the loss of trees in public and private spaces (Figures 3 and 4).

Finally, the issues affecting decision-making in urban forests is not the same across the types of local government. Unsurprisingly, urban expansion, increased active use of greenspaces, lack of data/information about tree assets, and infrastructure conflicts were more frequently referenced in outer and regional local governments. Lack of space to grow trees in new developments, excessive tree removal, public consultation, community views, stakeholder coordination, strategies for trees in private land, political leader support, and climate change, were ideas more frequently raised in centre and inner local governments. Nonetheless, a culture of risk aversion, strategy/plan implementation, inter-departmental coordination, and budgets, were shared ideas among all local government types (Figure 5).



437

438 *Figure 3:* Frequency of mention of codes classified by code clusters, which reflect the themes in

439 the framework (Figure 1), based on data elicited from the municipal managers

440

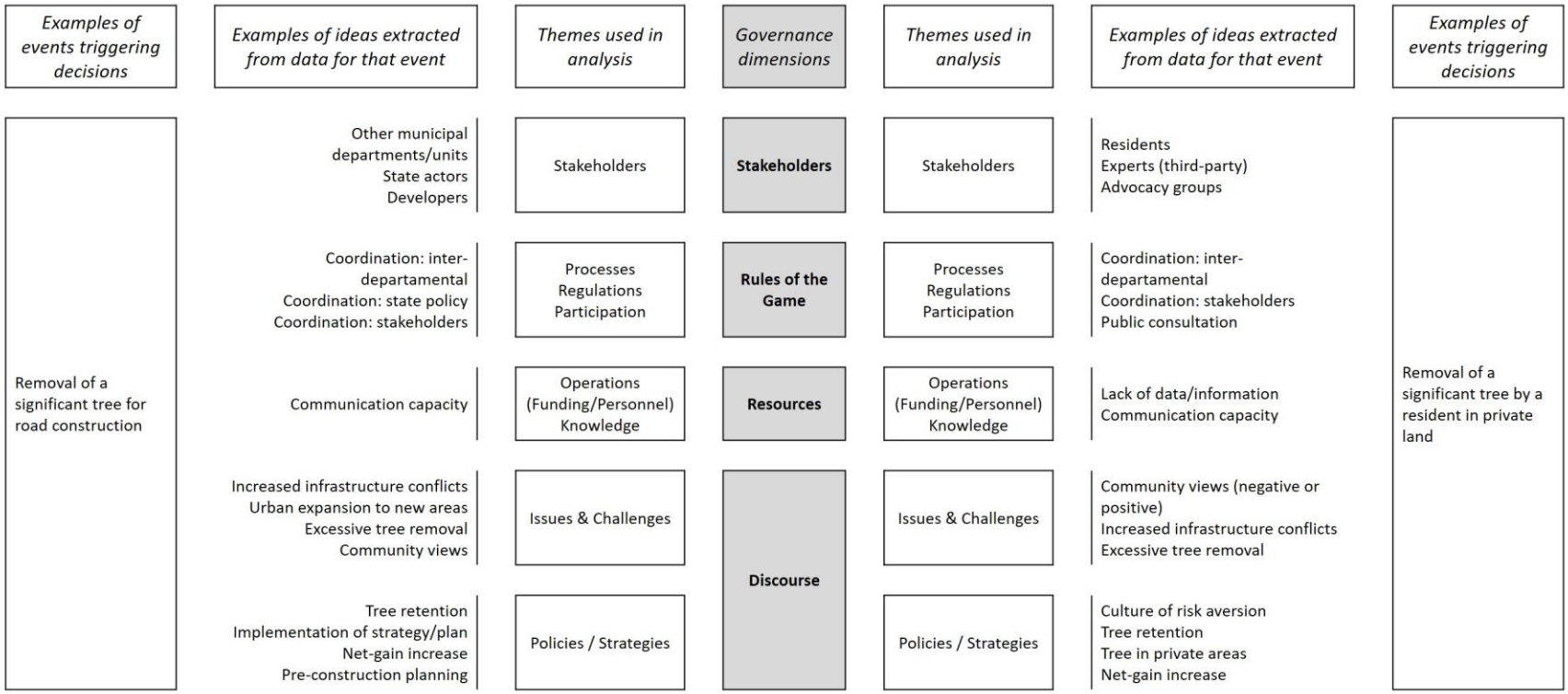


*Figure 4:*Illustration of relationship of codes using examples of events triggering a decision, indicating code clusters that reflect the themes in the framework (Figure 1), based on data elicited from municipal managers

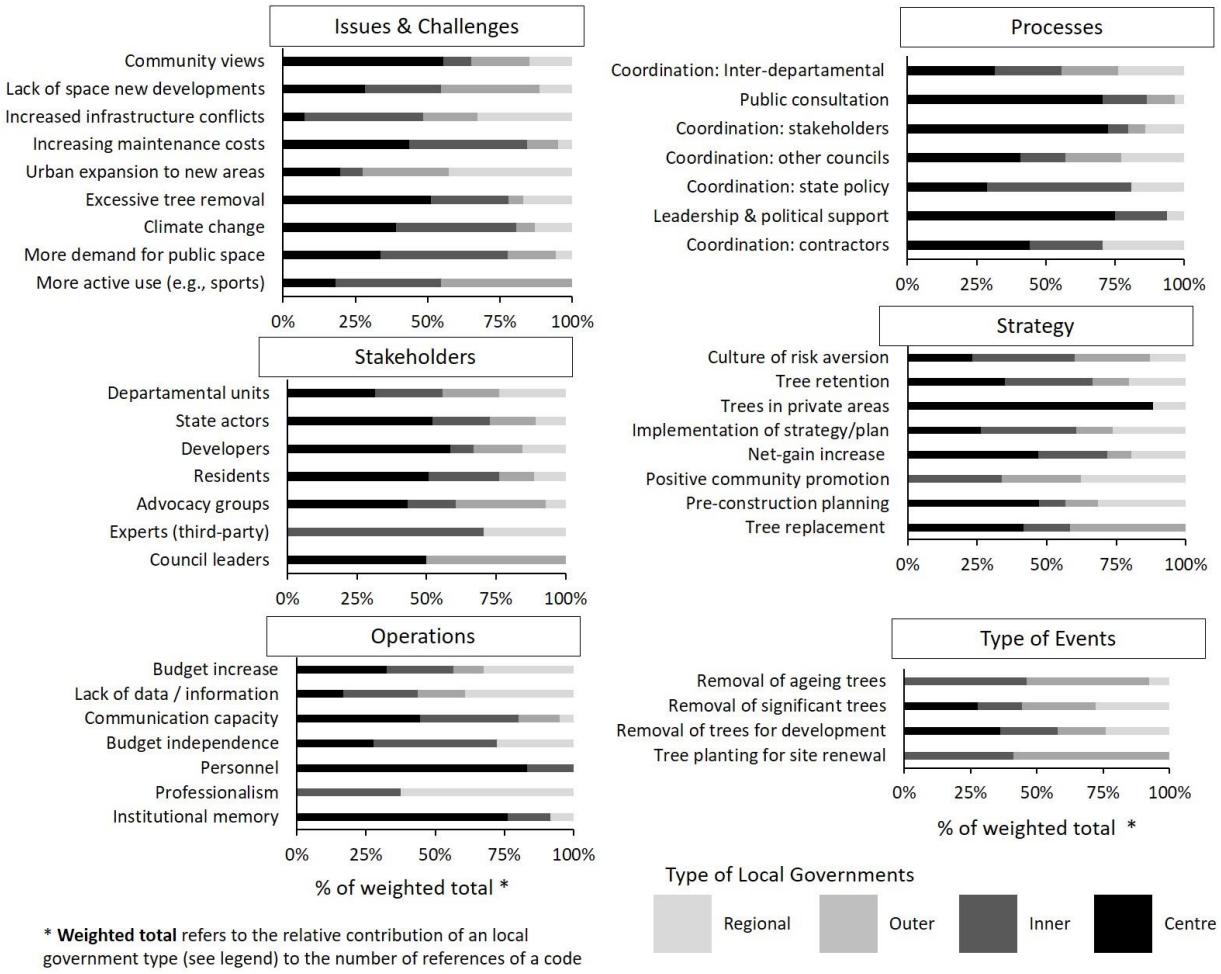


Figure 5: Frequency of a code by percentage contribution of a local government type (see Figure 2) using weighted totals (based on Equations 1 and 2), classified by code clusters that reflect the themes in the framework (see Figure 1) with added panel indicating frequency of types of events triggering a decision visualized by percentage contribution of a local government type (see Figure 4), based on data elicited from the municipal managers

6. Discussion

The results of this study have helped us answer our question about the priorities/strategies, and new issues and challenges, being taken into consideration by municipal managers in their decisions. These results support the findings of recent reviews on the challenges of urban greening and urban forestry, particularly urban expansion and densification (Haaland & Konijnendijk 2015; Boulton et al. 2018). We extend this literature by using empirical data to elaborate on the consequences of these challenges for manager decision-making. A consequence of these new challenges is that multiple stakeholders are participating more in the decisions of municipal managers, including state actors, developers, and residents. Co-governance (Ostrom 2010; Arnouts et al. 2012; UN-HABITAT 2018), also termed in other contexts as network or polycentric governance, can better engage multiple stakeholders in the decisions related to urban greenspace (Frantzeskaki et al. 2016; Forgione et al. 2016; Buijs et al.; 2016; 2018). Our results show that implementing co-governance depends heavily on the coordination of departments within municipal government and the coordination of other stakeholders. These involve two key processes: how municipal managers coordinate the inputs of other departments and stakeholders; and how municipal managers communicate their strategies to other departments and stakeholders. Our results also show that local governments are responding to these pressures by developing new strategies not focused on increasing canopy cover and the number of trees, such as strategies of tree-retention and trees in private lands.

Our results confirm the findings of studies that suggest that processes, such as inter-departmental coordination (Young 2013), are critical for urban forest managers to make decisions. Here we contextualize the importance of these processes alongside other factors, particularly issues related to the resources and regulations available to municipal managers. Many other past studies on the views of municipal managers that have focused heavily on the importance of resources, such as size of budgets and personnel (Ordóñez et al., 2019). This has generated a dichotomy as to whether good governance emerges from having enough resources or from effective coordination. Clearly, both are needed, but for local governments with healthy budgets, such as those studied here, effective coordination is becoming more and more important to implement strategies and address new challenges. In this study, the frequency of mention of ideas related to maintenance costs, budgets, and personnel mean that local governments are required to invest

485 more personnel time and budget to maintain trees. This relates to research that shows that it is
486 difficult to grow healthy trees in denser urban environments (Vogt et al. 2015). Nonetheless, the
487 higher frequency of mention of ideas related to coordination processes also shows that local
488 governments are not monolithic institutions (Ostrom 2005), where policies and intentions are
489 perfectly aligned across departments (Mincey et al. 2013). Activities such as the development of
490 an urban forest strategy or plan (Driscoll et al. 2015; Gibbons & Ryan 2015; Davies et al. 2017)
491 can serve to align the policies and intentions of different local government departments, but the
492 long-term implementation of this strategy or plan still depends heavily on coordinating decisions
493 across departments. Improving the coordination of municipal departments and stakeholders is
494 then a critical aspect of urban forest governance.
495
496 Our research question related to how the public or wider community is involved in the decisions
497 of municipal managers has helped us elicit important ideas about public engagement. To
498 successfully implement an urban forest agenda, local governments must successfully engage
499 with the public (Sipilä & Tyrväinen 2005; Nastran & Regina 2016; Kozová et al. 2018), not only
500 for reducing barriers of public acceptance (Kirkpatrick et al. 2013; Young 2013; Haaland &
501 Konijnendijk 2015) or to add more greenspace and trees, but to increase community stewardship
502 of the urban forest (Connolly et al. 2013; Buijs et al. 2018). Yet, our results show that
503 community views and a culture of risk aversion of local governments can make it difficult for
504 municipal managers to implement their strategies. Our results show that implementing public
505 engagement depends heavily on capacities related to how municipal managers coordinate the
506 inputs of the public, and how they communicate their strategies. Implementing strategies
507 currently being entertained by local governments about influencing the decisions about privately
508 owned trees may be an opportunity for these governments to successfully engage the public.
509 However, these strategies need to be aligned with equity considerations, given that many areas
510 with an abundance of privately-owned trees usually represent high income residents (Conway et
511 al., 2011; Varuzzo & Harvey 2017; Greene et al., 2018). This means that only engaging the
512 communities located in areas with privately-owned trees to implement retention strategies may
513 over-represent the views of high-income residents in engagement processes.
514

Our final question was about how all these issues above vary across urban centres. Our results show that not all urban centres are affected by the same issues or prioritize strategies in the same way. For example, only central and inner-urban centres were interested in public participation, and this could be related to the fact that they are dealing with a more engaged public, or that these cities have the resources to undertake extensive public consultation, or because they see benefit of engaging the public in their decisions (Gulsrud, 2018). In contrast, outer and regional centres find issues of urban expansion, increased active use of greenspaces, and lack of data/information about tree assets as more important in the decisions they make. Nonetheless, all urban centres considered coordination and a culture of risk aversion as important issues. It is difficult to discuss these results in the context of the research on the views of municipal managers, since most of this research focuses only on how personnel and budget sizes, among other operational issues, differ among urban centres (Ordóñez et al. 2019). Efforts to create metropolitan-wide strategies that integrate the diverse needs of a wide range of local governments will likely fail if they focus solely on increasing tree numbers and urban tree-canopy, and do not address issues of coordination, risk aversion, and public engagement.

7. Conclusion

Understanding urban forest governance and decision-making from a local government perspective can complement non-government perspectives. Urban expansion and densification in urban areas facing population growth and intensifying development are challenging the implementation of the urban forest strategies designed by local governments. But allocating more resources on the more tangible aspects of urban forests, particularly urban tree planting and urban tree maintenance, will not by itself improve the implementation of these strategies. Facilitating stakeholder coordination, partnership creation, and public engagement, may be more important for some local governments. No two municipalities are the same, and central and inner urban centres face very different challenges and prioritize issues differently than outer and regional centres. Future research could focus on assessing how coordination processes influence urban forest management objectives, such as increase in tree-canopy cover and tree numbers, which are becoming key performance measures for delivering sustainable and liveable cities. Finding ways to quantify these relationships, and quantifying how municipal managers prioritize these issues, are also worth exploring. The empirical qualitative social science data presented

here can help build quantitative data collection instruments, such as surveys or questionnaires. It is still unclear how the style of local government (e.g., authoritative government, etc.) can influence urban forest governance. This was not an issue mentioned by the participants of this study as an important issue. Also, capturing information about government styles is nuanced, since representative governments can be transient; government style typologies (e.g., populist or authoritarian) may not be applicable in some contexts; and eliciting this type of information directly from research participants raises issues about the effectiveness of social science research, since it is difficult to ask these questions without priming respondents and influencing the answers.

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