Review

The dimensions of urban green equity: A framework for analysis

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ABSTRACT

Urban vegetation, and in particular urban forests, provide a wide range of ecosystem services to urban societies and may thus be classified as environmental goods. Their status as goods suggests that urban societies' interactions with urban vegetation should be subjected to equity analyses to determine the fairness of such interactions. However, despite good evidence that the distribution and governance of urban vegetation are inequitable in many cases, there is no urban forestry-specific framework for analysis of urban green equity: how we access and govern urban vegetation. To begin to fill this gap, this paper reviews research in the fields of ethics, social and environmental justice, political ecology, and urban forestry research and practice, with a focus on urban forestry, and presents a discussion of the dimensions and sub-dimensions of urban green equity. The principal dimensions that emerged from the analysis were (1) the spatial distribution of urban vegetation, and (2) recognition in urban vegetation decision making, defined here as acknowledgement of participants' difference, existence and validity in decision-making processes, both formal and informal, and the inherent inclusion and power associated with that acknowledgement. Sub-dimensions of spatial distribution included temporality, condition, preference, and ownership, and sub-dimensions of recognition included representation and procedure, and the desire and ability to participate in decision making processes. These dimensions provide a framework for future urban green equity analyses and can help inform public conversations on urban green equity.

1. Introduction

Urban vegetation, and urban trees in particular, provides a wide range of ecosystem services to urban societies, such as mitigating the urban heat island effect (McPherson et al., 2005; Oke, 1973), reducing localized flooding (McPherson et al., 2011; Roy et al., 2012), improving air quality (Escobedo and Nowak, 2009; Nowak et al., 2006), mitigating climate change (Nowak and Crane, 2002), reducing residents' stress levels and improving psychological health outcomes (Annerstedt et al., 2012; Lottrup et al., 2013; Ward Thompson et al., 2012), improving physical health outcomes (Mitchell and Popham, 2008; Ward Thompson and Aspinall, 2011), and increasing property values and commercial activity (Gatrell and Jensen, 2002; Nesbitt et al., 2017). While it is important to acknowledge that urban vegetation can also provide disamenities, such as damage to property, and thus not all urban residents perceive urban vegetation as positive (Fraser and Kenney, 2000; Heynen et al., 2006), much of the literature suggests that urban vegetation is generally a social, economic, and environmental good. Its nature as a good, for which there may be competition in society, indicates that societies' interactions with urban vegetation should

be subjected to an equity analysis to determine the fairness of such interactions.

Despite the clear importance of urban vegetation to various aspects of urban quality of life, research to date suggests that the distribution and governance of urban vegetation are inequitable in many cities around the world (Buijs et al., 2016; City of Vancouver, 2014; Heynen, 2003; Heynen and Lindsey, 2003; Landry and Chakraborty, 2009; McConnachie and Shackleton, 2010; Ogneva-Himmelberger et al., 2009). Urban parks and woodlands are more often located in wealthier neighbourhoods (Poudyal et al., 2009) and require leisure time to enjoy as they can be located some distance from urban residents' homes (Harnik, 2010). The size and abundance of trees on private property are often higher in high-income neighbourhoods (Kirkpatrick et al., 2011) and there is evidence that lower levels of canopy cover across all land ownership types are more often associated with lower-income and racialized neighbourhoods (Landry and Chakraborty, 2009; Nesbitt and Meitner, 2016; Schwarz et al., 2015). In some cases, socioeconomically disadvantaged and racialized urban residents are less likely to engage in urban vegetation stewardship activities, to participate in urban forestry decision making, and to have control over urban vegetation resources

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(Buijs et al., 2016; Heynen, 2003).

While issues of equity in urban forestry are of clear importance in a just society, there is no urban forestry-specific equity framework to guide equity analyses. To begin to address this gap, we present a discussion of the dimensions of urban green equity, broadly defined here as fair access to and governance of urban vegetation regardless of differentiating factors such as socioeconomic status, race, culture, or age (Nesbitt, 2017), drawing from theory in the fields of ethics, social and environmental justice, political theory and political ecology, and urban forestry research and practice. These dimensions may be used to structure urban green equity analyses and help provide a common framework for the social dialogue that accompanies such analyses.

1.1. A recent history of social and environmental justice research

Social justice, and environmental justice as an application of social justice in the realm of environmental issues, have historically been concerned with the distribution of social rights and goods (Schlosberg, 2007). Rawls' classic text, *A Theory of Justice*, provides a strong basis for this distributional focus, defining justice as 'a standard whereby the distributive aspects of the basic structure of society are to be assessed' (1999: 9). This definition is based on the liberal ethical conception of freedom and equality as the foundations of equity, applied in such a manner as to promote the wellbeing of the members of a society (Rawls, 1999). These principles are fundamental to the concept of equity but are sometimes in tension with one another. Freedom is focused on the wellbeing of the individual and her/his capacity to behave in a manner that promotes that wellbeing. Equality is focused on the wellbeing of the collective members of society and the behaviours that promote the wellbeing of the collective. According to distributional theories of equity, an equitable society must balance freedom and equality so as to promote the highest wellbeing of the members of a society, and a well-ordered society will do so according to a common understanding of what is just and unjust (Dobson, 1998; Low and Gleeson, 1998; Rawls, 1999). According to the liberal conception of equity, each person's basic entitlement to freedom and rights must be compatible with a system of liberties and rights for all (Rawls, 1999; Rizzotto and Bortoloto, 2011). Individuals are thus required to give up some freedoms in the pursuit of collective wellbeing, the standard by which resource distribution is evaluated. Distributional theories of social equity are applied in contexts where resources are limited, and these limits create the tension between freedom and equality. The freedom to consume resources for the benefit of the individual will reduce the equality of resource use by all members of a society, in the context of limited resources. Theories of justice in this tradition focus on the processes of fair distribution of resources, including the structure and rules guiding just institutions, the principles governing proposed distributions, and the resulting distribution of the resources in question (Rawls, 1999; Schlosberg, 2007).

A central figure in the movement to expand social justice research paradigms beyond the distributional focus is Iris Young with her text *Justice and the Politics of Difference* (1990). Young considers distributional conceptions of social justice to be crucial but incomplete (Schlosberg, 2007; Young, 1990). She argues that distributional injustice arises from social structures, cultural beliefs, and institutional context, and thus focuses her inquiry on the determinants of inequitable distribution. This expands the question 'how should resources be distributed?' to include 'what determines inequitable distributions?' (Young, 1990). Young argues that the roots of inequitable distributions are domination and the oppression that accompanies it. Young includes various practices in the definition of oppression, including marginalization, exploitation, removal of power, cultural imperialism, and violence (Schlosberg, 2007; Young, 1990). She argues that the social and institutional factors that create oppression, and the resulting distributional inequity, are often created by a lack of recognition of identity and difference, and the exclusion from political (i.e., collective

decision-making) processes that this causes (Young, 1990). Taylor has also examined the importance of recognition in social justice theory (1994). He argues that recognition or approval from other people is a fundamental part of human identity and integrity. A lack of recognition, exhibited by insults and devaluation at both the individual and cultural level, inflicts harm that is unjust (Schlosberg, 2007). Recognition is thus a vital human need, and a lack of recognition is as inequitable as the unjust distribution of goods (Taylor, 1994). Gould (1996) uses this definition of equity, that includes recognition, to link equity to political participation. She argues that there is a direct link between a lack of respect and recognition and a decline in a person or group's participation in the wider community, including political processes. Young also argues that political processes can influence both the distribution of goods and the conditions controlling social recognition (Young, 1990). Inclusive decision making is thus both a part of and a condition for social equity.

It is important to note that none of the definitions of equity discussed above seek to define 'the good'. The central role of freedom in liberal philosophy means that a society will contain a plurality of definitions of the good, and the practice of equity in society will look different in different contexts and for different people (Rawls, 1999; Schlosberg, 2007; Young, 1990). For example, the balance point between individual freedom and collective equality will shift according to societal norms and individual experience. The dimensions of equity uncovered in the social justice and ethics literature thus define what should be examined in an investigation of social and environmental equity, and do not lead to a constructed theory of the good.

1.2. Green equity in urban forestry

Urban green equity is a growing area of inquiry in the field of urban forestry, with contributions from spatial analytical approaches and remote sensing, urban vegetation governance and decision making, climate change adaptation, and urban political ecological analyses. Urban forestry research over the past two decades has largely focused on the ecosystem services provided by urban vegetation (Annerstedt et al., 2013; Jenerette et al., 2011; Konijnendijk et al., 2013; McPherson et al., 1997; Nowak et al., 2000; Yamaguchi et al., 2006), reflecting a growing interest in urban vegetation and its societal benefits (Lawrence et al., 2013).

This focus on ecosystem services, a perspective that arguably represents a conceptual commodification of urban vegetation, has given rise to a growing body of literature on the distribution of urban vegetation and its associated ecosystem services. Distributional theories of equity appear to have had a strong influence on urban green equity research in urban forestry, as evidenced by the research focus on urban vegetation distribution and accessibility in the literature (Barbosa et al., 2007; Comber et al., 2008; Germann-Chiari and Seeland, 2004; Lafary et al., 2008; Landry and Chakraborty, 2009; Nesbitt and Meitner, 2016; Schwarz et al., 2015). This body of literature focuses on identifying and understanding spatial relationships between urban vegetation and socioeconomic factors to elucidate patterns of unjust access to urban vegetation and the ecosystem services it provides. It generally assumes that urban vegetation comprises desired or at least innocuous goods or amenities and that a low level of access is an indication of the presence of inequity. Distributional equity also appears to be central to many municipalities' conceptions of urban green equity. For example, when municipalities have codified equity standards or goals, they most often focus on the distance to the nearest park, park area per resident (City of Phoenix, 2009; City of Vancouver, 2017; The Trust for Public Land, 2017), or canopy cover targets by neighbourhood (City of Seattle, 2016; Portland Parks and Recreation, 2015).

A field of inquiry that has received less attention is urban vegetation governance. Nonetheless, the field of urban vegetation governance has made important contributions to the urban green equity literature in recent years and is a growing area of research. Urban vegetation

governance refers to the processes, interactions, actors, and decisions that lead to the establishment and maintenance of urban vegetation resources and control over those resources, with a particular focus on urban forests (Lawrence et al., 2013). The contributions of this literature to urban green equity are in the area of equitable governance processes. Recent research in urban vegetation governance examines and proposes unique and inclusive multi-stakeholder governance processes that encourage citizens to engage in co-created stewardship and decision making at the local level and that allow for flexible, bottom-up approaches to decision making (Adger et al., 2005; Brink et al., 2016; Buijs et al., 2016; Gulsrud et al., 2018; McLain et al., 2012). The concept of place-based or mosaic governance clearly articulates this focus. Mosaic governance allows for a mosaic of governance approaches to exist simultaneously in the landscape and evolve to meet citizens' needs and interests (Buijs et al., 2016). Research suggests that this approach to governance may be more inclusive and more appropriate in socio-culturally and bio-culturally diverse societies (Buizer et al., 2016). There is also evidence that inclusive governance approaches can foster active citizenship, community-building, and democracy (Fisher et al., 2015; Svendsen and Campbell, 2008).

It appears that some municipalities are beginning to understand urban green equity from the perspective of stewardship and recognition in decision making, as evidenced by urban vegetation stewardship programming in underserved or low-canopy neighbourhoods and opportunities to engage in stewardship as a 'citizen forester' (City of Melbourne, 2017a; Gulsrud et al., 2018; NYC Parks, 2017; Portland Parks and Recreation, 2015). While these programs are not always officially framed as increasing inclusion in decision making, they partially serve that function. Some cities, such as the City of Melbourne, are facilitating forms of mosaic governance in their urban forests by engaging residents in local values mapping and by creating local urban forest plans by precinct (City of Melbourne, 2017b; Gulsrud et al., 2018; Kendal, 2014). Outside the realm of urban forestry but within the environmental management sphere, the acknowledgement of power in decision making has been institutionalized in some cases, as in, for example, the US Environmental Protection Agency's (EPA) definition of environmental justice as:

…the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. EPA has this goal for all communities and persons across this nation. It will be achieved when everyone enjoys: the same degree of protection from environmental and health hazards, and equal access to the decision-making process to have a healthy environment in which to live, learn, and work (US Environmental Protection Agency, 2017, p. 1).

Political ecology is another field of research in urban forestry that is closely related to urban green equity. The field of urban political ecology seeks to bring together distributional and governance-focused conceptions of equity in urban forestry using a Marxist political lens (Anders Sandberg et al., 2015; Heynen et al., 2006; Swyngedouw and Heynen, 2003). This body of literature posits that urban vegetation, and the communities living alongside it, are primarily shaped by the capitalist drive for growth and the accompanying destruction of place and commodification of public goods (Anders Sandberg et al., 2015; Swyngedouw and Heynen, 2003). Urban political ecology sees urban spaces, and thus urban vegetation, as places of struggle, where societal power relationships play out over the competition for goods and services, and seeks to uncover the role of social and cultural norms and power structures in the production of inequity in urban forestry (Heynen, 2003). Political ecology considers multiple forms of power and its influence over urban vegetation, including political, economic, social, and discursive power (Anders Sandberg et al., 2015; Boone et al., 2009; Swyngedouw et al., 2002). This approach to urban green equity grows out of social justice research such as Young's analysis of domination and oppression (Young, 1990), while applying a specific

political lens to the analysis of power relationships linked to urban vegetation.

2. Methods

2.1. Study screening

Research was selected for inclusion in this analysis using a systematic and iterative screening protocol developed by the study authors. Articles were collected using keyword searches in a variety of databases and search engines (e.g., Google Scholar, Web of Science, JSTOR) and 'snowballing' from citations within collected articles (Konijnendijk et al., 2013; Wolf et al., 2015). Articles were selected for review, evaluated, and culled based on the following criteria: (1) reporting on an original scientific study or reviewing and summarizing reports of original scientific study; (2) presenting research related to social and environmental justice and green equity; and (3) presenting research related to urban environments, particularly within the field of urban forestry. Highly-cited research was preferentially selected, where appropriate, without excluding recent research. This selection system ensured that our review considered both current and influential research. Periodic consultations among the authors on whether to include a study generated a final list of 62 studies, including 45 peer-reviewed articles, 9 studies published in books, and 8 professional reports. The review is current to June 2018.

3. The dimensions of urban green equity: spatial distribution and recognition

Building on the literature presented above, we propose that two principal dimensions exist within the theory and practice of urban green equity, with additional sub-dimensions associated with each. We identified and defined the dimensions based on the most representative themes in the reviewed literature. The principal dimensions are: (1) the spatial distribution of urban vegetation (Fig. 1), and (2) recognition in urban vegetation decision making, defined here as acknowledgement of participants' existence and validity in decision-making processes, both formal and informal, and the inherent inclusion and power associated with that acknowledgement (Fig. 2). These two dimensions are discussed below, along with a discussion of their sub-dimensions. Table 1 lists the number of articles, books, and reports included under each dimension and sub-dimension. Where a source commented on more than one dimension or sub-dimension, it was counted twice.

3.1. Spatial distribution of urban vegetation

The distribution of urban vegetation is clearly a principal dimension of urban green equity, based on the social justice, environmental justice and urban forestry literature, and municipal policy and practice. The spatial distribution of urban vegetation in relation to residents' homes and places of work influences whether residents have opportunities to access urban vegetation and how often that access occurs. Many ecosystem services, such as air quality improvements (Nowak et al., 2006; Yang et al., 2004), improved microclimates (Lafortezza et al., 2009; McPherson et al., 2005), psychological health benefits (Ulrich et al., 1991; Ward Thompson et al., 2012), and physical health benefits (Lovasi et al., 2011; Ward Thompson and Aspinall, 2011) may only be experienced in close proximity to urban vegetation. For example, residents may experience improved air quality while walking near urban trees or may feel reduced stress and higher levels of wellbeing when recreating in an urban park or woodland. The distribution dimension contains four principal sub-dimensions presented here (1) temporality, (2) condition, (3) preference, and (4) ownership (Fig. 1). Condition and preference are presented together below, in reflection of their close relationship to each other.
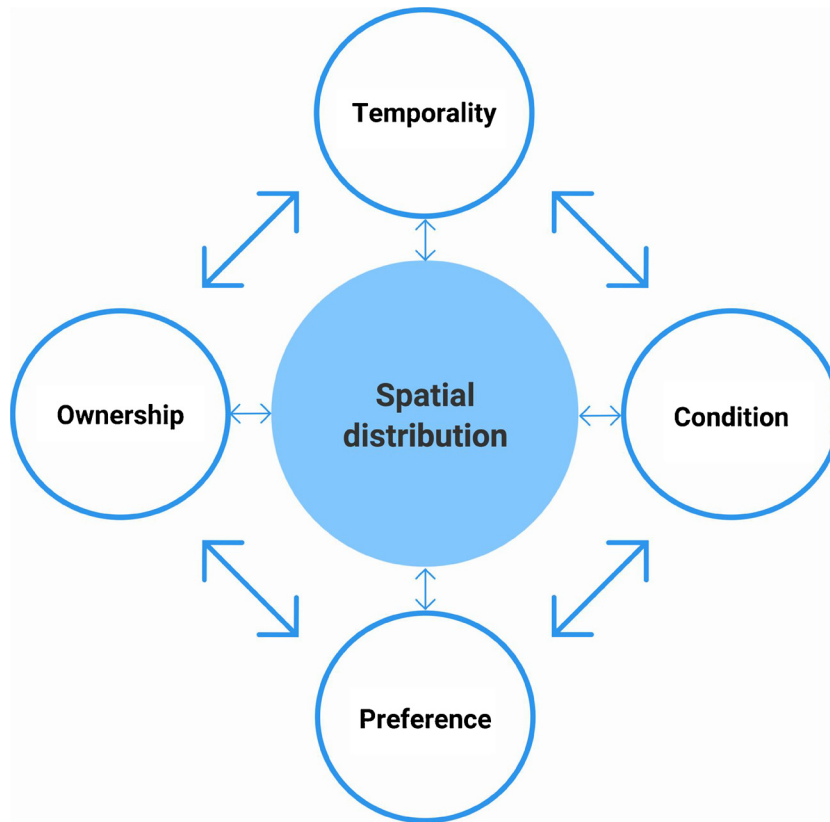
Fig. 1. Conceptual diagram of the spatial distribution of urban vegetation and its sub-dimensions.
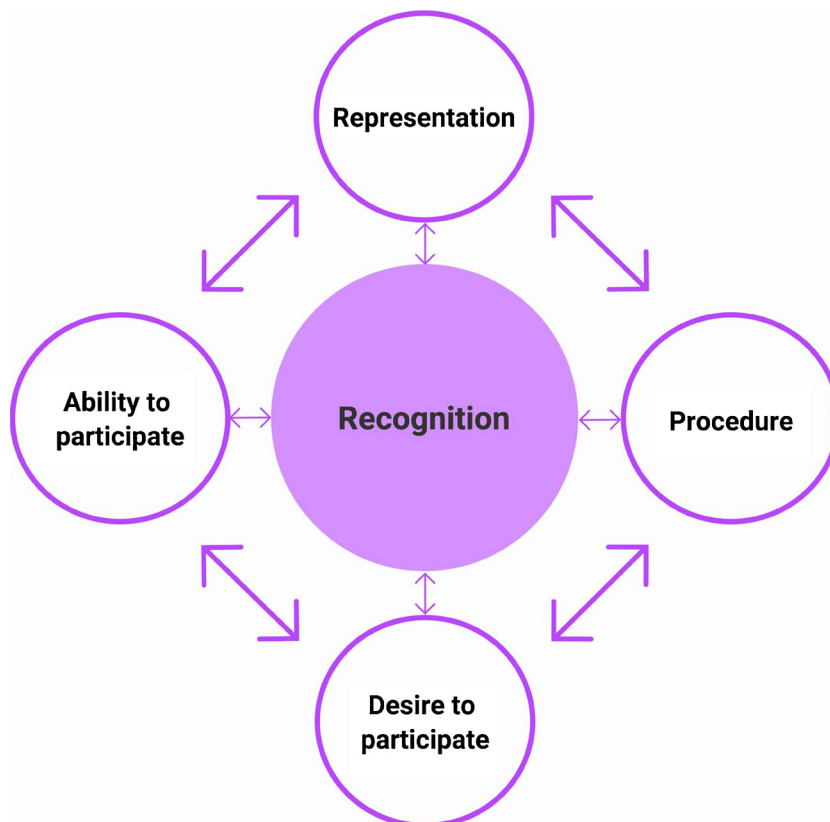

Fig. 2. Conceptual diagram of recognition in urban vegetation decision making and its sub-dimensions.

Table 1
Number of articles, books and reports included in the analysis under each dimension and sub-dimension.

Dimension	Articles	Books	Grey literature
Spatial distribution	14	5	5
Temporality	9	1	0
Condition and preference	6	0	0
Ownership	2	1	0
Recognition	21	5	5
Representation	11	1	0
Procedure	11	0	0
Desire to participate	3	0	0
Ability to participate	4	1	0

3.1.1. Temporality

Temporality is a key aspect of spatial distribution and its principal sub-dimension. Temporality in this context includes 1) social and biophysical legacies, 2) the availability of leisure time in which to access urban vegetation, and (3) the availability of urban vegetation related to seasonality. Social and biophysical legacies have been shown to account for the current distribution of urban vegetation and the social patterns of land tenure and residence that influence access to that vegetation (Boone et al., 2009; Grove et al., 2006). Histories of segregation and policies, such as redlining, that systematically denied financial and social services to racialized and ethnic communities, have been shown to influence current distributions of urban vegetation and residents' access to it, particularly in the United States and South Africa (Boone et al., 2009; McConnachie and Shackleton, 2010). Residents that were historically denied access to financial services were less able to invest in urban vegetation such as trees, resulting in lower-canopy neighbourhoods to this day (Boone et al., 2009; McConnachie and Shackleton, 2010). Similarly, biophysical legacies can determine current urban vegetation distribution, given the typical life cycle of urban trees. Historical waves of planting, followed by natural growth and mortality have been found to predict the current distribution of urban trees in some contexts (Grove et al., 2006).

Given the importance of physical proximity to receiving benefits from ecosystem services (spatial access), the availability of leisure time in which to access urban vegetation and the temporal availability of urban vegetation related to seasonality are also important aspects of distributional equity that relate to temporality. Leisure time allows urban residents to spend time close to urban vegetation, recreating in nearby parks, hiking through urban woodlands, or walking beside street trees (Taylor, 2012). Without this leisure time, the physical experience of proximity to urban vegetation is necessarily diminished, and residents consequently receive fewer ecosystem services from urban vegetation. There is evidence that those with more restricted leisure time, often as a result of lower socioeconomic status and longer working hours, are less able to spend time accessing urban vegetation, even if they live in close proximity to it, representing a distributional inequity that goes beyond spatial distribution (Rishbeth, 2001).

The responses of urban vegetation ecosystems to seasonality can also raise distributional equity issues in some climatic contexts. Many of the services provided by urban vegetation are produced by plant leaves, which may or may not be present in winter months in temperate regions. For example, the psychological benefits provided by urban vegetation often relate to green views (Kaplan, 2001; Lottrup et al., 2015) and the positive associations between urban vegetation exposure and some physical health outcomes are based on exposure to greenness, which is often a measure of exposure to spring or summer vegetation (Dadvand et al., 2012a, 2012b; Donovan et al., 2011). Urban plant species, and their seasonal responses such as leaf loss, can thus influence the distribution of urban vegetation ecosystem services by season. Those urban residents who live and work near deciduous trees in temperate climates, for example, may thus receive fewer winter-time

benefits than those who live near coniferous trees, while receiving greater summer-time benefits such as shading. While the above topics are the principal ways in which temporality relates to the spatial distributional equity of urban vegetation, it is important to note that temporality influences all the sub-dimensions in some way.

3.1.2. Condition and preference

Additional sub-dimensions that influence the distributional equity of urban vegetation are physical condition and residents' preferences in accessing urban vegetation. Urban trees and parks in poor condition cannot be expected to provide the same level of ecosystem services as those in good condition. Urban parks with damaged facilities cannot provide the full range of recreational benefits provided by parks in good condition, and trees in poor condition may not provide high levels of services such as shading or stress relief (Hernández-Morcillo et al., 2013; Maco and McPherson, 2003). Although a high-level analysis of the spatial arrangement of urban vegetation may suggest that they are equitably distributed using spatial accessibility metrics, variability in urban vegetation condition can influence its ability to provide ecosystem services and thus the spatial distribution of those services.

A related sub-dimension is residents' preferences for urban vegetation characteristics. Unsurprisingly, urban residents demonstrate strong and widespread preference for urban vegetation in good condition, including healthy trees and well-maintained park spaces (Rishbeth, 2004). However, beyond those basic conditions, residents of different sociocultural backgrounds have been shown to have sometimes divergent preferences for urban vegetation elements (Buijs et al., 2009; Fraser and Kenney, 2000; Rishbeth, 2004, 2001). For example, while residents of Western European cultural backgrounds have expressed preferences for large trees and more 'natural' looking landscapes, those residents of Mediterranean background have shown preferences for food-producing urban trees and spaces and those of middle-eastern origin have shown preferences for more manicured urban green spaces (Buijs et al., 2009; Fraser and Kenney, 2000; Rishbeth, 2004). These preferences may influence residents' choices to access urban vegetation and their experiences while accessing it, thereby influencing residents' experiences of distributional equity.

3.1.3. Ownership

Finally, urban vegetation ownership is an important sub-dimension of distributional equity that influences whether residents can access and benefit from urban vegetation near their home or work. Urban vegetation occurs on public, private, and public-private land. While urban vegetation on private land may be spatially located near urban residents, those residents may not be able to physically access those spaces. For example, private gardens and private golf courses are generally closed to the public or require payment to access. While such spaces may offer some ecosystem services to the wider urban public via microclimatic regulation (Escobedo et al., 2011; Nowak et al., 2006) or long-distance green views (Lottrup et al., 2015), the ability of these spaces to offer a wide range of ecosystem services to multiple urban residents may be restricted if those residents are unable to come into close physical proximity with these urban green spaces (Swyngedouw and Heynen, 2003). Additional complexity arises from the distinction between de facto and de jure land ownership that allows private land to be used informally as public land by some members of society, and public land to be used more heavily by some members of society as a result of sociocultural power dynamics (Anders Sandberg et al., 2015). It may thus be difficult to determine the accessibility and distributional equity of urban green spaces simply by observing them at a point in time or via an analysis of land ownership.

3.2. Recognition in urban vegetation decision making

Recognition in urban vegetation decision making is another key dimension of urban green equity that emerges from the relevant

literature presented above. The term recognition implies both access to and power within formal and informal decision-making processes. Recognition in urban vegetation decision making determines residents' ability to influence the management of urban vegetation for their personal benefit and the benefit of society (Heynen, 2003). The ability to influence urban vegetation decisions may thus equate to influence on urban vegetation outcomes such as species selection, tree maintenance and condition, and the design of urban green spaces, thereby affecting the ecosystem services residents may derive from urban vegetation (Conway and Vander Vecht, 2015). In addition, residents may derive benefits through the process of participating and having power in decision-making processes, such as increased community cohesion and sense of place in the community (Buijs et al., 2016; Fisher et al., 2015). Recognition within urban vegetation decision making is thus a key dimension of urban green equity. The recognition dimension contains four principal sub-dimensions presented here (1) representation, (2) procedure, (3) desire to participate, and (4) ability to participate (Fig. 2). The four sub-dimensions are presented in two sections below, in reflection of their respective relationships.

3.2.1. Representation and procedure

Representation or inclusion in decision making is a fundamental sub-dimension of recognition and urban green equity, based on the premise that an actor must be present and have power within the decision-making process in order to influence the process and its outcomes (Chan et al., 2012; Rishbeth, 2004). Once they are present, a process must fairly consider and respect the voices of participants in order to achieve procedural equity and thus recognition for all participants, rather than perpetuating or increasing inequity by excluding or failing to recognize, understand, and respect certain voices in the process (Boone, 2002; Boone et al., 2009; Newig and Fritsch, 2009). Representation and procedure are important sub-dimensions in that they help ensure that the diversity of voices and perspectives on urban vegetation management are included in decisions that affect that management. This can help ensure that the resulting urban green spaces provide equitably distributed ecosystem services, including cultural services such as sense of place and community identity (Nesbitt et al., 2017). As mentioned above, representation and fair procedures can also ensure that decision-making spaces are welcoming to diverse participants and provide opportunities for empowerment and community-building (Buijs et al., 2016).

Achieving representational and procedural equity in decision making is a complex task, particularly in complex, culturally-diverse urban environments. While formal decision making may be guided by institutional policies designed to promote both representational and procedural equity, applying those policies in practice comes with some challenges. First, formal urban vegetation decision making involves multiple actors and alliances that exist among them. Municipalities often work with external agencies, such as other government agencies, private corporations, and NGOs, to conduct urban vegetation management activities, and most cities will have formal and informal channels through which public and private actors may influence urban vegetation decisions (Lawrence et al., 2013). Second, uneven power dynamics may work to undermine equity policies in practice, particularly in light of the complex ways in which human differences such as gender, race, income, and colonial relations interact and intersect in urban environments (Doshi, 2017; Heynen, 2018, 2016; Heynen et al., 2006; Mollett and Faria, 2013). For example, equity policies and procedures, particularly those of formal institutions, are often created by colonial cultures within the structures of a colonial society. These policies may thus perpetuate inequity by continuing to impose colonial cultures and processes on indigenous and racialized communities who must participate in those processes when seeking to achieve recognitional equity (Heynen, 2016). Once participants are included in a process, additional variables such as gender identity and racialized status can influence micro-scale interactions as participants struggle to understand one

another and work toward collective decisions in an egalitarian way that meets participants' needs. Third, truly participatory decision making takes time that many formal urban forestry actors do not believe they have (Newig and Fritsch, 2009). And fourth, formal decision making is only one part of the complex governance reality of urban vegetation. Urban vegetation exists in a wide variety of urban land types along a public-private gradient (Konijnendijk et al., 2006). It is thus governed by a range of actors with interests in and power over urban vegetation resources, from private citizens, who play a key role on private land, to non-governmental organizations (NGOs), to municipal governments, who often play a central role in policy making and urban vegetation management (Ferrini et al., 2017; Konijnendijk et al., 2006). Intersectional axes of power related to gender, race, income and colonial relationships have particular influence over the exercise of power in this wider context of urban vegetation governance (Heynen, 2018, 2016; Mollett and Faria, 2013).

3.2.2. Desire and ability to participate

Once urban vegetation decision making is structured to encourage representational and procedural equity, urban residents must participate in the process if it is to achieve recognitional equity. Two relevant sub-dimensions that influence participation are the desire to participate and the ability to participate in decision making. Local governance often suffers from a lack of citizen engagement (Buijs et al., 2016), undermining attempts at equitable governance and inclusive decision making. It appears that it is not enough to simply open the doors – residents must somehow be motivated to walk through them and offer their time and energy. Municipalities and other urban forestry actors are thus seeking ways to encourage residents to engage with urban green spaces through culturally-relevant stewardship, tree planting programs and giveaways, or public consultation (McLain et al., 2012). Political ecological theories of intersectional identity are particularly important in this context. Urban residents must see their identities and priorities reflected in urban vegetation decision making in order to desire to participate. If communities that have traditionally been marginalized in urban environments are called upon to perpetuate their marginalization via urban vegetation decision processes, it is not in their interest to participate (Heynen, 2016). This reality has led to calls for an abolitionist ecology that seeks to understand and practice urban green relationships and decision making in such as way as to dismantle traditional power structures in the process (Heynen, 2016).

Once motivated to participate, either in mainstream or resistance-based processes, residents must also have the ability to participate. Stewardship opportunities, public meetings, community advisory bodies, or resistance-based action must be structured in such a way as to allow for residents of variable incomes, schedules, language abilities, and cultural backgrounds to participate. Lower-income urban residents are particularly vulnerable to exclusion for this reason, due to long or unconventional work hours, lack of childcare, or lack of private transportation to attend events outside their immediate neighbourhood (Anders Sandberg et al., 2015; Heynen, 2003; Heynen et al., 2006). Intersectional identities can additionally influence how and whether residents are able to behave and thus participate in decision processes via, for example, perceptions of safety (Doshi, 2017). Such voices are thus less likely to be included in urban vegetation decisions and urban vegetation is less likely to reflect their unique viewpoints and meet their unique needs.

3.3. Interaction

The two principal dimensions of urban green equity interact with and influence one another in practice. The distribution of urban vegetation influences the power that individuals and groups have over urban vegetation decision processes and thus modifies the decision processes. For example, those residents with greater ownership of or control over urban land will de facto enjoy greater power in the control

of that land and thus its urban vegetation. Those residents may also enjoy greater perceived legitimacy in urban vegetation decision making due to their control of urban vegetation resources and may be given preferential treatment in decision processes. Urban residents that hold greater social and economic power are also better able to participate in decision-making processes that are not structured to ensure recognition and inclusion of diverse viewpoints and abilities to participate (Buijs et al., 2016; Heynen, 2018). The relative power of actors involved in urban vegetation decisions then influences the outcome of those decisions and thus the distribution of urban vegetation resources. This may result in decisions that cause urban vegetation and parks, and their maintenance, to be preferentially distributed to those more powerful members of urban society, perpetuating both distributional and recognitional inequity.

Although the dimensions are presented as interacting with one another, it is important to note that the magnitude and specific outcomes of these interactions remain unclear. There is a lack of empirical evaluations of the role of urban vegetation distribution in establishing relative power and recognition in urban vegetation decisions, and the specific influences of urban vegetation decision processes on the distribution of urban vegetation resources for different people and contexts, (Bengston et al., 2004; Briassoulis, 2001; Fisher et al., 2009; Mincey et al., 2013). Despite the recent interest in inclusive, participatory decision making (e.g., Hendricks et al., 2017), the results of inclusive policy and practice have yet to be empirically evaluated in urban forestry. Likewise, although management decisions are designed to produce desired outcomes, there is little evidence that unpacks how urban vegetation decisions influence specific outcomes in urban vegetation, particularly in the context of involving multiple objectives and interested stakeholders, and complex urban ecological interactions (Bengston et al., 2004; Briassoulis, 2001; Fisher et al., 2009). Further research is needed to clarify these relationships and create a more robust framework for urban green equity research and practice.

3.4. Applying the dimensions

As discussed above, the roles of freedom and equality in liberal philosophy mean that a society will contain *both* common understandings of the good (Rawls, 1999) and multiple definitions of the good (Young, 1990). Thus, there is no ideal level of equity in practice, and equity will look different in different contexts – the balance point between collective equality and individual freedom may shift according to societal norms and a plurality of definitions of what is good and what is fair. The potential for tension between (1) equality, expressed as equal opportunity to benefit from and influence society, and (2) freedom, expressed as divergent identities and views, and the recognition of those identities in society, requires that equity analyses acknowledge local contexts and the role of cultural and institutional inequity in real policy issues. We thus propose that the dimensions of equity described above be employed in urban green equity analysis with the understanding that the practice of equity is different from the theory and philosophy of equity. Urban green equity analysis can deconstruct and interpret local equity conditions according to the two dimensions and can provide benchmarks for societal consideration but cannot prescribe generalized solutions – that exercise is for the societies that experience and live with the realities of urban green inequity.

4. Conclusion

The two dimensions of urban green equity described above, (1) the spatial distribution of urban vegetation, and (2) recognition in urban vegetation decision making, are based on historical and more recent definitions of social equity in the liberal philosophical tradition (Rawls, 1999; Schlosberg, 2007; Taylor, 1994; Young, 1990) and the treatment of environmental justice and equity in the field of urban forestry (Buijs et al., 2016; Heynen, 2003; Heynen et al., 2006; Landry and

Chakraborty, 2009; Schwarz et al., 2015). Importantly, they also reflect the discourses of social movements of the late twentieth and early twenty-first centuries (Schlosberg, 2007). Social movements for civil rights and multiculturalism, for example, have simultaneously demanded equitable access to resources in society, and recognition in decision making. Modern definitions of social and environmental justice often contain these two dimensions (Schlosberg, 2007).

Although research on recognitional equity has developed a strong body of knowledge in the social and environmental justice fields, research on recognitional equity in the field of urban forestry is more limited, with most contributions coming from fields that are external or tangentially related to urban forestry (Buijs et al., 2016; Heynen, 2003; Young, 1990). The conceptual representation of recognition and its subdimensions presented here should be interpreted in this context. They are presented as a way of conceiving of recognitional urban green equity that may provide a framework for future research. However, this conceptualization of recognitional green equity has not been tested and will likely require further development and/or refinement in the future.

This clear area of weakness in the literature points to the need for examinations of urban vegetation governance and decision making, with a focus on recognitional equity. Green equity in diverse urban societies demands equitable recognition in governance and decision-making processes that shape access to and management of urban vegetation. Urban residents have multiple, sometimes competing goals for urban vegetation management that must be balanced via recognitional equity, and urban forestry practitioners will need to understand and use both dimensions of equity in their professional practice if they are to achieve increased urban green equity in their municipalities or neighbourhoods (Buijs et al., 2016). Equitable urban vegetation governance is a key ingredient in shaping more equitable, greener futures in cities around the world but has yet to be analyzed using empirical approaches that tie urban vegetation decisions to urban vegetation outcomes, such as distributional equity. In fact, recognitional equity standards are currently unclear, preventing a robust recognitional equity analysis. This is a key area for future research that would do much to advance both our theoretical knowledge of urban green equity and its application in practice.

While the urban forestry literature has begun to consider both dimensions of urban green equity, research in each dimension appears to be somewhat isolated from the other dimension, although they are sometimes integrated in the political ecology field (Anders Sandberg et al., 2015). There thus appears to be a solid foundation on which to build future urban green equity research that considers both dimensions of equity, where possible. Such an approach to the issue will likely yield deeper analyses that will align with the dimensions of current social and environmental justice movements and that will have utility for local actors that seek to address urban green inequities in their societies.

Conflicts of interest

The authors have no conflicts of interest to declare.

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