



Research paper

Assessing residents' reactions to urban forest disservices: A case study of a major storm event



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HIGHLIGHTS

- A 2013 ice storm caused widespread damage to and by the urban forest in Toronto.
- The ice storm created a number of ecosystem disservices experienced by residents.
- Residents are more likely to be pruning their trees as a result of the ice storm.
- Some residents have responded by removing healthy trees to reduce risk.
- Residents' negative experiences with trees must be addressed in management plans.

ARTICLE INFO

Article history:

Received 14 October 2015

Received in revised form 12 April 2016

Accepted 28 April 2016

Keywords:

Ecosystem disservices

Residential landscapes

Urban trees

Ice storm

ABSTRACT

Ecosystem services associated with urban forests have received significant consideration in the last decade, but less attention has been given to disservices. In the urban forest, examples of common disservices include air pollution, allergens and physical damage to property. The way perceived and experienced urban forest disservices influence residents' tree management is unclear yet important to understand when developing management goals and strategies. This study's objective is to examine residents' experiences, attitudes, and actions related to an ice storm, which created a set of urban forest disservices, to better understand the role of disservices in residential tree management. To address the objective, residents from the Greater Toronto Area were surveyed six months after the December 2013 ice storm. The survey responses indicated that the majority of participants had multiple small and large branches fall on their property as a result of the storm, although few lost trees. As a result of their ice storm experiences, many survey participants altered their tree plans, including deciding to remove healthy trees on their property to reduce future risks. Most respondents want their municipality to continue street tree plantings, but utilize more structurally sound trees and take better care of existing trees. The case study highlights the ways disservices can influence the attitudes and actions of residents, thus, illustrating the importance of documenting disservices, along with ecosystem services, in order to develop successful management strategies and better understand socio-ecological interactions in the urban forest.

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1. Introduction

The ecosystem services produced by urban forests have received significant attention in recent years, including the documentation of a long list of social, cultural, economic, health, and environmental benefits that arise from such services (Jim & Chen, 2009; Ostoić & Konijnendijk van den Bosch, 2015). Research in urban forestry parallels broader efforts to better link ecosystem functions with

human well-being through the identification of positive services provided by ecosystems (MEA, 2005; TEEB, 2011). As a result of the emphasis on ecosystem services, urban forest management in North America has largely shifted from goals of beautification to ones related to maximizing ecosystem service provision (Silvera Seamans, 2013); the potential of ecosystem service provision is then often used to justify the large investments many municipalities are currently making to grow their urban forest (e.g. City of Toronto, 2013).

Absent from many ecosystem service discussions are the disservices produced by ecosystems. In the context of urban forests, examples of disservices include the financial costs of maintaining the urban forest, allergens, pest outbreaks, air pollution,

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personal safety concerns and physical damage (Escobedo, Kroeger, & Wagner, 2011). Several authors have recently argued for the importance of examining not only the ‘goods’ but also the ‘bads’ produced by ecosystems to create a more balanced starting point for management action (Delshammar, Östberg, & Öxell, 2015; Lyytimäki, Petersen, Normander, & Bezák, 2008; Shapiro & Báldi, 2014). Ecosystem disservices should be managed alongside services to maintain local support for management actions, which is particularly important in cities given the many actors involved in managing urban ecosystems (Sandbrook & Burgess, 2015). Furthermore, exploration of disservices in urban forests should also include residents’ negative experiences with urban trees to fully understand residents’ tree management decisions (Kirkpatrick, Davison, & Daniels, 2013), develop strategies to support management goals, and/or modify management to better reflect residents’ reaction to disservices.

This study examines residents’ experiences, attitudes and actions related to a major storm event that highlighted a set of urban forest disservices. In particular, we were interested in addressing three questions: (1) what type of damage to and by trees as a result of the storm did residents identify on their property; (2) if and how the storm impacted residents’ planting, pruning and removal of trees of their own property, beyond immediate clean-up; and (3) what types of municipal responses do residents support to minimize tree-related disservices associated with future storm events? These questions were explored through a case study of the December 2013 ice storm in the Greater Toronto Area (Ontario, Canada) using survey responses from residents in five neighborhoods across the region. The following sections explore the concept of ecosystem disservices, present the case study methods and results, and discuss the impacts urban forest disservices have on residents’ urban tree management and support.

2. Ecosystem disservices

The ecosystem services framework has been critiqued for only accounting for the benefits of ecosystem functions, with recent calls for integrated assessments that consider both ecosystem services and disservices (Dunn, 2010; Lyytimäki & Sipilä, 2009). There is not, however, universal agreement about what disservices are (von Döhren & Haase, 2015). While a variety of definitions are also used to define ecosystem services, there is greater similarity among them: typically a focus on goods or services provided by ecosystems that contribute to human well-being (MEA, 2005; TEEB, 2011). On the other hand, the term disservices is sometimes used to represent an absence or reduction of ecosystems services (Chapin et al., 2000; Harrison et al., 2014), loss of economic value associated with an ecosystem (Villa et al., 2014), or impacts from changes in an ecosystem (Balmford & Bond, 2005).

Others have used definitions of ecosystem disservices that more fully separates them from loss of benefits, with disservices interpreted as functions or end-products of ecosystems that are perceived as negative for human well-being (Escobedo et al., 2011; Lyytimäki & Sipilä, 2009). Through this definition, disservices can occur alongside ecosystem services and be experienced differently by individuals and communities in ways that may or may not mirror ecosystem service provision distributions (Escobedo et al., 2011). In this paper, ecosystem disservices will be used in reference to the more robust definition: functions or end products of ecosystems that are perceived as negative for human well-being.

Several types of ecosystem disservices have been identified, such as financial, including land, labour, and capital; social nuisances; and environmental, including pollution and energy use associated with ecosystems and management activities (Escobedo et al., 2011). Focusing on urban areas, Lyytimäki et al. (2008)

described examples of aesthetics, safety, personal security, health, economic, and mobility impacts created by ecosystem disservices.

Within the urban forestry literature, few studies have empirically considered ecosystem disservices as more than just a reduction in ecosystem services. One exception is an analysis of both services and disservices in Melbourne (Australia), with allergen and infrastructure damage potential representing urban forest disservices (Dobbs, Kendal, & Nitscke, 2014). The authors found that the examined disservices were lower in public greenspaces, but higher for street trees, while the spatial patterns of specific services and disservices varied. However, even in this study many more ecosystem services were accounted for (nine), while commonly identified urban forest disservices (e.g. air pollution, maintenance costs, obscured sightlines) were excluded. The other studies examining urban forest disservices primarily include air pollution disservices related to urban forests, with a focus on tree emissions and the energy and emissions associated with forest management (Baró et al., 2014; McPherson, Scott, & Simpson, 1998; Nowak, Stevens, Sisinni, Luley, & 2002; Nowak & Dwyer, 2007), and those studies identifying perceived harms and nuisances associated with urban trees (Camacho-Cervantes, Schondube, Castillo, & MacGregor-Fors, 2014; Flannigan, 2005). However, in most of these cases the term disservices is not used.

While the term ecosystem disservices is increasingly used in the literature, particularly in the context of cities (von Döhren & Haase, 2015), there is an on-going debate about the usefulness of identifying and accounting for ecosystem disservices alongside beneficial services (e.g. Lyytimäki, 2015; Shapiro & Báldi, 2014; Villa et al., 2014). Opponents suggest that the current focus on ecosystems services is needed to rectify the traditional imbalance towards risks or nuisances, with nature historically framed as scary and needing to be tamed (Shapiro & Báldi, 2014). For example, there are robust literatures examining nuisance species and fear related to greenspace, both of which can be classified as disservices (Lyytimäki et al., 2008).

Additionally, Villa et al. (2014) argues that inclusion of disservices adds unnecessary confusion, takes away attention from provisioning and preventative benefits, and simplifies complex interactions between humans and nature. Finally, the role of people in creating disservices is debated, with Shapiro and Báldi (2014) suggesting that most ecosystem disservices are a result of human actions (e.g. pest outbreaks due to human-aided invasions) and not products of undisturbed ecosystems.

In urban forests, many species are already not considered for planting because of their potential disservices, often related to tree debris produced, pest vulnerability, or the size of the space they occupy (Kendal, Dobbs, & Lohr, 2014; Sæbø, Benedikz, & Randrup, 2003). Thus, one could argue that the current focus on urban forest ecosystem services is needed to encourage management away from traditional decision-making that emphasizes ‘bads’ and a very limited set of ‘goods’ (i.e. aesthetics) towards recognition of the broader set of services produced by urban forests.

On the other hand, proponents argue that disservices are also associated with relatively undisturbed ecosystems, not just heavily managed or degraded systems, so disservices are not simply a product of humans (Lyytimäki, 2015). Additionally, disservices are necessary to determine if ecosystems are an efficient way of addressing a problem (Escobedo et al., 2011), and must be examined to develop strategies to address the disservices people regular face and hear about through the media (Lyytimäki, 2014). This last point is particularly relevant in the context of urban forests, where residents manage much of the existing forest and future planting sites (McPherson, 1998; Pearce, Kirkpatrick, & Davison, 2013).

While Dunn (2010) argues for a separation of perceived disservices from actual disservices, exploring residents’ perceptions of ecosystem services and disservices is needed to understand their

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