



Full Length Article

Perceived urban ecosystem services and disservices in gentrifying neighborhoods: Contrasting views between community members and state informants

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ABSTRACT

As assessing urban ecosystem services and disservices is of rapidly growing interest in a context of increasingly urbanized environments, greater scholarly attention needs to be placed on how different informants perceive these services and disservices. Previous research in urban geography and planning has already pointed at the challenges of building inclusive natural outdoor environments such as green and blue spaces in gentrifying neighborhoods, particularly those undergoing green gentrification. In response, we analyze the ecosystem services and disservices identified by community and state respondents in seven cities with gentrifying neighborhoods, pronounced social inequalities, and where natural outdoor environments were created or improved: Amsterdam, Bristol, Cleveland, Lyon, Montreal, Philadelphia, and San Francisco. We found that in cities experiencing green gentrification, interviewees – particularly community informants – reported a wide array of ecosystem services and disservices, and identified some disservices previously under-studied (i.e. physical tiredness, low attractiveness and forced displacement). Our study illustrates how differences in decision making positions can impact perceptions of ecosystem services and disservices. Our study has implications for urban environmental planning decisions that will help maximize the ecosystem services provided by urban natural outdoor environments. Only if all perceived ecosystem services and disservices are considered, will it be possible to design green just cities.

1. Introduction

As the world continues to become rapidly urbanized, securing quality urban natural outdoor environments for people to use, visit and

enjoy has become a particularly important planning goal (Bertram and Rehdanz, 2015; Markevych et al., 2017). Urban natural outdoor environments encompassing parks, tree-lined blocks, greened alleys, community gardens, preserved natural areas, seashores, riverfronts, etc., are

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well known to benefit human health and wellbeing through the provision of ecosystem services (ES) (Bertram and Rehdanz, 2015; de Groot et al., 2010; Haase et al., 2014; Kondo et al., 2020; Reid, 2005; Ribeiro et al., 2021; Yang et al., 2021; Zijlema et al., 2017).

In the last decade, municipal planning policies are placing more emphasis on the development, restoration and protection of natural outdoor environments as a strategy to promote public health, to mitigate climate change impacts, to enhance urban biodiversity or to revitalize deprived neighborhoods, among other societal challenges (Anguelovski et al., 2018a). However, scholars are increasingly pointing to the potential green injustices associated with these interventions (Anguelovski et al., 2020; Cole et al., 2017; Haase et al., 2017; Rigolon et al., 2018). These injustices can be linked to unequal access to high quality natural outdoor environments (Frumkin et al., 2017; Rigolon et al., 2018), or other distributional inequalities (Anguelovski et al., 2020; Finney, 2014). Recent research further indicates that city residents may not receive and perceive the benefits of natural outdoor environments equally due to broader processes of urban development and segregation, including gentrification and green gentrification (Anguelovski et al., 2018a; Cole et al., 2021; O'Neill et al., 2023; Triguero-Mas et al., 2021).

Gentrification can be defined as the socio-cultural, economic and physical transformation of an area towards more privileged people, who can afford high-end housing and exclusive services (Brown-Saracino, 2010; Lees et al., 2015; Smith, 1996, 1982). Meanwhile, green or environmental gentrification is the socio-cultural and physical exclusion and displacement that results from environmental planning agendas and the provision of new green amenities (Gould and Lewis, 2017). As scholars are identifying the growing relevance of gentrification processes in greening cities and neighborhoods (Anguelovski et al., 2021a; Anguelovski et al., 2020; Cole et al., 2019, 2017; Triguero-Mas et al., 2021) there is thus a need to disentangle the nuances between natural outdoor environments' benefits and lack of these benefits for certain population groups in gentrifying neighborhoods and further distill the perceptions of urban ES and ecosystem disservices, here referred to as EDS, from different stakeholders.

ES are generally classified into four main groups: supporting, regulating, provisioning and cultural services (Haines-Young and Potschin-Young, 2018; Millennium Ecosystem Assessment, 2005). All are known to provide *direct* benefits to humans except for "supporting" ES which act as ecological functions which indirectly benefit human's well-being. This broader classification of ES groups is intended to cover all possible benefits that natural outdoor environments can provide to humans (Haines-Young and Potschin-Young, 2018; Millennium Ecosystem Assessment, 2005). All four groups have been reported in cities, being regulating and cultural ES the most frequently highlighted (Jim and Chen, 2006; Palta et al., 2016; Veerkamp et al., 2021a).

Supporting services in urban areas include, for example, habitat provision for urban biodiversity (Felipe-Lucia et al., 2015; Pataki et al., 2011; Ramos et al., 2018). Urban regulating services include air purification, urban cooling, moderation of environmental extremes, and stormwater runoff control, among others (Gómez-Baggethun and Barton, 2013; Reid, 2005). In cities, urban temperature regulation can be extremely important against climate change-exacerbated heat island effects (Bolund and Hunhammar, 1999; Lin et al., 2015; Russo et al., 2017). Provisioning services encompass food production, or water supply, among others (Gómez-Baggethun and Barton, 2013; Reid, 2005). Cultural services comprise recreation, physical activity, restoration, social interactions, cognitive development and more. For example, using green space as a recreational space to take a break from 'city life' has been reported as a valuable ES for urban residents (Bolund and Hunhammar, 1999; Gómez-Baggethun and Barton, 2013; Riechers et al., 2016).

However, natural outdoor environments also produce EDS in cities, defined as negative outcomes that affect human wellbeing through various harmful or even life-threatening pathways (Lyytimäki and Sipilä, 2009). Previously, EDS have been classified into five groups:

ecological, economics, physical hazards, psychological, and general EDS (von Döhren and Haase, 2015). Among others, these EDS include animal disease vectors, tree roots damaging property, allergies, nature-related phobias and plants blocking views (von Döhren and Haase, 2015).

Previous research has attempted to elucidate how different respondents perceive and value urban ES and EDS (Collins et al., 2019; Garrido et al., 2017; Graça et al., 2018; Hofmann et al., 2012; Ramos et al., 2018; Rodríguez-Morales et al., 2020). Considering informants with different views and connections to urban natural outdoor environments (García-Nieto et al., 2015; Lamarque et al., 2011) and exploring their perceptions is paramount to a complete understanding of urban ES and EDS delivery (Bolund and Hunhammar, 1999; Crooks, 2016; Haase et al., 2014; Lyytimäki and Sipilä, 2009; Reed, 2008). Incorporating ES and EDS into (urban) decision-making processes has been found to increase concept awareness and communication as well as enhance participation and collaboration, potentially making greening planning decisions more just in their process and outcome (Dick et al., 2018). Some studies have found that those in different positions of power can have different perceptions of the same natural outdoor environments (Felipe-Lucia et al., 2015; Miller, 2016; Ramos et al., 2018). For example, Ramos et al. (2018) investigated Mexico City respondents' perceptions of ES, focusing on both government officials and landowners. Their study found that landowners perceived a wider range of relevant ES than government officials (Ramos et al., 2018).

One study found that in areas experiencing green gentrification, underprivileged residents lack a physical and emotional connection with natural outdoor environments, so these spaces arise as "disruptive green landscapes" instead of spaces of wellbeing (Triguero-Mas et al., 2021). The authors found that gentrification was seen as a process that impacted all therapeutic dimensions of natural outdoor environments. For example, gentrification was understood to increase the privatization of natural outdoor environments, a phenomenon particularly present when private investors design and finance natural outdoor environments. Gentrification was also associated to the loss of community networks that caused anti-social behavior in public natural outdoor environments, and gentrification was identified as a process enhancing user conflicts and feelings of unwelcomeness in natural outdoor environments. However, to our knowledge, only one study (see Amorim Maia et al., 2020) has explicitly explored urban ES/EDS perceptions and values in the context of complex urban transformation processes such as (green) gentrification (Anguelovski, 2016; Lees et al., 2008).

Besides developing further the theoretical understanding of urban ES and EDS, this paper addresses an empirical gap by examining various informants' perceptions of new or improved natural outdoor environments in cities experiencing (green) gentrification. Using an extensive comparative qualitative study of seven geographically diverse Global North gentrifying cities, we aim to critically identify which ES and EDS are perceived and highlighted by community and state interviewees. We believe this is important in order to design healthier and greener cities for all urban residents.

2. Methods and data

2.1. Case study context

This study was conducted using data from a larger EU-funded international project (GREENLULUS). The project took place in 24 cities across Europe and North-America and aimed to understand how urban greening projects in gentrified cities redistributed the benefits of green spaces for underprivileged residents.

From the 24 cities included in the larger project, we selected seven cities for this study: Amsterdam (the Netherlands), Bristol (UK), Cleveland (Ohio, US), Lyon (France), Montreal (Canada), Philadelphia (Pennsylvania, US), and San Francisco (California, US). Our selection of case studies for this study was designed to reflect the rich diversity of urban development and greening histories as well as natural outdoor

Table 1
Summary of main case cities historical characteristics and green trajectories.

City (State, Country)	Relevant urban development and gentrification characteristics	Main greening strategies	Population (inhabitants in 2021–2022)
<i>Amsterdam (AMS), the Netherlands</i>	<ul style="list-style-type: none"> Postindustrial, multicultural city with a strong focus on technology and design Growing (green) gentrification in some neighborhoods and housing crisis for lower income residents with strong displacement IJ inlet (waterfront) divides the wealthier and poorer sections of the city and has become a symbol for segregation in the city No clear indication of citywide green gentrification according to international comparative study (Anguelovski et al., 2022). 	<ul style="list-style-type: none"> The city aspires to have every person living within a 10-minute walk of a green area Focus has been placed on park expansion and waterfront clean-up and development projects in last 25 years The European leader in cycling network Amsterdam has a high greening policy integration and implementation, with a strong focus on public health benefits. The green rhetoric is intermediate, with a low procedural participation (Anguelovski et al., 2018b). 	903,399 (2022)
<i>Bristol (BRI), UK</i>	<ul style="list-style-type: none"> UK's 8th largest city Contains "deprivation hot spots" where close to 70,000 residents live Home to a multicultural mix of Afro-Caribbean, Indian, Pakistani, and Bangladeshi communities Highly segregated with residents experiencing unequal benefits from city improvements to natural outdoor environments leading to early-stage gentrification in some neighborhoods No clear indication of citywide green gentrification according to international comparative study (Anguelovski et al., 2022). 	<ul style="list-style-type: none"> The city created a 20-year strategy based on 'equal access standard' for vulnerable populations to have access to green areas The city has placed specific attention in addressing social and health inequalities 29 % of city is green space, but much of it is little used due to perceptions of unsafety and inaccessibility. Bristol has a high greening policy integration and implementation, with an intermediate focus on public health benefits. The green rhetoric is very high, with medium procedural participation (Anguelovski et al., 2018b). 	472,465 (2021)
<i>Cleveland (CLE), Ohio, US</i>	<ul style="list-style-type: none"> A post industrial city which has experienced a 6 % population loss in the 2010s decade Considered one of the most segregated cities in the United States Has experienced environmental degradation through river pollution and lead poisoning that disproportionately affects lower income residents Early gentrification pressures in some neighborhoods due to the cleaning up of the Cuyahoga River and Lake Erie in a rebranding effort to make the city a "green city on a blue lake" No clear indication of citywide green gentrification according to international comparative study (Anguelovski et al., 2022). 	<ul style="list-style-type: none"> Cleveland uses greening as a way to reclaim abandoned and unused land plots for the city Has an equal access standard policy to overcome green inequities in the city Cleaning up of river and lakes are a main priority in changing the image of the city and creating new green and blue amenities Cleveland has a medium greening policy integration and implementation, with a high focus on public health benefits. The green rhetoric is high, but with a low procedural participation (Anguelovski et al., 2018b). 	367,991 (2021)
<i>Lyon (LY), France</i>	<ul style="list-style-type: none"> Economy based on the chemical, pharmaceutical- biotech, transport, food and textile industries- Home to one of Europe's largest urban parks The fourth greenest and third largest city of France Gentrification has occurred in some districts, like the Guillotière, that are seeing higher income, whiter residents move in to take advantage of cheaper rents and the renovated riverbank in a central neighbourhood No clear indication of citywide green gentrification according to international comparative study (Anguelovski et al., 2022). 	<ul style="list-style-type: none"> Focus on preserving and promoting local ecological heritage and biodiversity Priorities on managing urban services and cleanup/ redevelopment Greening efforts connected to efforts to improve health Greening focuses on city rebranding and increasing its attractiveness, redeveloping postindustrial neighborhoods, improving permeability and combatting heat-island effect Lyon has a high greening policy integration and implementation, with a high focus on public health benefits. The green rhetoric is intermediate, but with a very high procedural participation (Anguelovski et al., 2018b). 	522,969 (2019)
<i>Montreal (MONT), Canada</i>	<ul style="list-style-type: none"> Second largest city in Canada and historically the commercial capital Home to commerce, tech, tourism, culture Mid-level gentrification present in certain areas like Saint-Henri with the arrival of new green infrastructure (and reopening of the Lachine Canal) and increase in luxury housing and rent prices Short-term citywide green gentrification according to international comparative study (Anguelovski et al., 2022). 	<ul style="list-style-type: none"> Recent efforts of re-naturing have focused on counteracting the heat island effect Its 2005 Tree policy put significant efforts into greening the denser areas of the city Advocating for greening alleys led by residents/activists Montreal has a high greening policy integration and implementation, with a high focus on public health benefits. Both the green rhetoric and procedural participation are intermediate (Anguelovski et al., 2018a). 	2,025,928 (2021)
<i>Philadelphia (PHILLY), Pennsylvania, US</i>	<ul style="list-style-type: none"> A recovering post-industrial city undergoing intense gentrification in central neighborhoods, with especially the displacement of historically marginalized groups. Many areas still with high poverty, unemployment and low educational achievements- High levels of economic segregation Lower income neighborhoods have less access to parks and heat mitigation green infrastructure with early gentrification trends Long-term, sustained citywide green gentrification according to international comparative study (Anguelovski et al., 2022). 	<ul style="list-style-type: none"> Greening has been implemented largely through green stormwater infrastructure or tree-planting, to reduce water pollution from combined sewer overflows and to mitigate urban health island effects. Greening is part of a wider strategy to redevelop neighborhoods, increase the attractiveness of central neighborhoods and improve property values. Philadelphia has a high greening policy integration and very high implementation, with a medium focus on public health benefits. Both the green rhetoric and procedural participation are high (Anguelovski et al., 2018a). 	1,576,251 (2021)
<i>San Francisco (SF), California, US/</i>	<ul style="list-style-type: none"> Former industrial city, now a host for the tech industry History of contamination and toxic waste buildup from years of industrial activity History of residents advocating for cleanup of contaminated areas in poorer neighborhoods Gentrification since the 1990s has intensified with the growing tech industry and influx of new higher income residents Long-term, sustained citywide green gentrification according to international comparative study (Anguelovski et al., 2022). 	<ul style="list-style-type: none"> Greening of waterfronts and neighborhoods Residents face hesitance to advocate for cleanup due to fear of gentrification Community-led community gardens and educational workshops on the benefits of urban greening- San Francisco has a very high greening policy integration implementation, with a medium focus on public health benefits. The green rhetoric is very high and the procedural participation is high (Anguelovski et al., 2018a). 	815,201 (2021)

environments interventions themselves encountered during our fieldwork. Moreover, this selection allowed us to analyze qualitatively the study cases with enough detail in only one manuscript.

Data on urban greening trajectories, urban development history, and gentrification characteristics of each of the seven cities included was compiled from various sources (Anguelovski, 2016). In summary, data for developing case context included newspaper and other media articles, fact sheets, reports, or policy and planning documents produced by a variety of local organizations, including city planning and environmental agencies. Data that discussed or addressed health and well-being or social equity in said documents were also considered by the researchers. Based on this diverse data, we report a summary of specific characteristics for each city, focusing on urban development and gentrification, greening strategy, core demographic and natural outdoor environments characteristics (Table 1).

Source: own elaboration based on different sources (Anguelovski, 2016; Anguelovski et al., 2018b; Anguelovski and Connolly, 2021; Anguelovski et al., 2022; Brinkhoff, 2022).

2.2. Research design and data collection

We draw from a subset of pretested questions and modified and selected them to build a final semi-structured interview guide based on the overall aim of the parent project, which also covered the goal of our study. Fieldwork was conducted in all cities during summer of 2019 (except for Montreal in 2018). A variety of informants were interviewed about the greening strategies of their city as well as their connections to different dimensions of gentrification, health, and environmental justice.

The research team identified and interviewed a broad diversity of key public, private, and civic informants. For the purpose of this paper, we focus on two main categories: (i) community members including those in an informal capacity (neighborhood leaders/activists) and those in a formal capacity who belong to a nonprofit coalition or work in spaces like a community botanical garden, a park forum, a nature school, or a land conservancy who were or worked with socially underprivileged residents (i.e. those experiencing the impacts of green gentrification processes); and (ii) state informants from city and supra-municipal administration members, including staff (technicians), planners and politicians working in various areas such as urban planning, green space management or city water management. In line with previous research, we separated informants into categories based on the understanding that state administration members have a stronger impact on environmental policy and management in comparison to community members (Felipe-Lucia et al., 2015; Ramos et al., 2018). For each type of informant, we developed a specific semi-structured interview guide (see Supplemental material pages 3–7). All of the respondents were considered local experts in the fields of housing, green spaces, sustainability, environment, infrastructure, health, social issues, and/or economic (real estate) development and provided information reflecting on their work or activist experience in relation to city greening projects.

Interviewees were identified either through internet searches, review of local media and policy reports, and/or by snowball sampling until reaching theoretical saturation. In total, the research team interviewed 105 community and 48 state respondents in the cities part of this study (Table 2).

2.3. Qualitative analysis

For the analysis, the research team first used a thematic approach in order to create a detailed coding scheme based on the main conceptual and analytical themes of interest to the parent project (see Supplemental material, page 8). The whole research team coded all the interviews using this detailed coding scheme in NVivo, with meetings regularly conducted to ensure intercoder reliability. Nearly all interviews were

recorded and transcribed, so we were able to analyze participants' verbatim responses. For the small number of interviews that were not recorded, extensive notes were collected during the interview, which were then also analyzed and coded.

Upon the completion of this full interview coding, the lead author used a grounded theory approach (Glaser and Strauss, 1999) to sub-code data from seven of the initial codes from the thematic coding scheme: (i) regulating ES, (ii) provisioning ES, (iii) cultural ES, (iv) disservices, (v) health benefits of greening: mechanisms, (vi) green space that meets residents' needs, and (vii) access to green space. A total of 19 new codes emerged, including, for example, improved air quality, climate regulation, and stormwater management (see Supplemental material, page 19). Our analysis focused on exploring and interpreting the richness and complexity of perceptions. For that reason, we analyzed our data according to what codes emerged in each city and which ones were reported by each stakeholder type, independently of the frequency of reporting.

3. Results

The study findings reflected key themes linked to urban ES and EDS in gentrifying neighborhoods. We built our qualitative results based on full coding work and data analysis, and provide a limited (due to space limitations) selection of quotes to illustrate findings. For each quote, a superscript indicates the case site (i.e. "AMS" for Amsterdam, "BRI" for Bristol, "CLE" for Cleveland, "LY" for Lyon, "MONT" for Montreal, "PHILLY" for Philadelphia, and "SF" for San Francisco) and the type of respondent (i.e. "comm." for community members and "state" for state informants).

In general terms, our findings show that community respondents are more aware of and report a broader diversity of disservices than state informants. This broader diversity presented by community members include EDS that have been scarcely studied such as forced displacement. Both groups reported the little studied EDS of physical tiredness, and low attractiveness. Overall, we found that differences in informants type influence how ES and EDS are perceived.

3.1. Perceived ecosystem services in gentrifying areas

Delving now into the details of the analysis, in gentrifying areas benefiting from new or improved natural outdoor environments, the ES perceived by the different interviewees pertained to all main groups of ES (see Table 3): habitat for species (supporting ES); improved air quality, climate regulation/urban cooling, stormwater regulation (regulating ES); food production (provisioning ES); outdoor recreation, social interactions, connection with nature, positive aesthetic experiences, and mental restoration (cultural ES).

The only supporting ES revealed in our study was habitat for species. Community and state informants in Amsterdam, Lyon, and Montreal spoke about how greening is able to "help connectivity and biodiversity conservation"^{MONT/comm.} and provide habitats for species. A City of Lyon employee and a community civic member from Amsterdam both spoke about the "routes for different kinds of animals"^{AMS/comm.} and a way to increase "biodiversity [as] there are more animals"^{AMS/state}.

In Lyon, Amsterdam, Philadelphia, Bristol, San Francisco and Cleveland, community and state respondents highlighted the role of greenspaces in improving air quality, particularly focusing on traffic-borne air pollution such as nitrogen dioxide and particulate matter. For example, a Bristol parks nonprofit member mentioned that "to mitigate pollution effects on schools close to polluted roads, you plant trees or hedges, thick hedges, along there and that has all sorts of mitigating effects"^{BRI/comm.}. In San Francisco, a nonprofit member spoke of the benefit of tree upkeep because trees have a role in "absorbing carbon"^{SF/comm} so they help mitigate pollution. Furthermore, climate regulation benefits, specifically the impact of greenspaces or specific vegetation features on mitigating high temperatures and heat stress,

Table 2
Summary of the number of interviewees by category and city.

City	Informant category		TOTAL
	Community	State	
Amsterdam	9	11	20
Bristol	17	5	22
Cleveland	33	8	41
Lyon	6	10	16
Montreal	13	4	17
Philadelphia	16	8	24
San Francisco	11	2	13
TOTAL	105	48	

were also praised by municipal administration and community interviewees in Amsterdam, Philadelphia, Lyon and Montreal. For example, a Philadelphia public health professional used temperature measurements to show the difference greening makes in the city, saying that when comparing a specific park (i.e. Fairmount Park) to other city areas, “there can be substantial differences in quite a few degrees”^{PHILLY/state}. In Amsterdam, natural outdoor environments contribute to multiple challenges, as one respondent explained: “the things from the climate get better, so the rain gets more processed, there’s no heat stress and more”^{AMS/state}. State and community members in Cleveland, Lyon, Amsterdam, Bristol and Philadelphia also emphasized stormwater runoff regulation amongst other benefits from greenspaces. For example, a city water employee from Lyon explained the impact that even small greenspaces can have in managing stormwater runoff, while pointing out design details such as “below the knots and depressions from the forecourt there are stormwater management structures”^{LY/state}.

Last, food production was the only provisioning service mentioned by interviewees, reported by both categories of respondents in Cleveland and Montreal. A Cleveland city planning commission member spoke about using land to grow vegetables and give access to residents to healthy food, and a Montreal nonprofit member spoke of a similar suggestion, stating that “people would use the space because they’d be out there to grow their vegetables”^{MONT/comm}.

Both types of informants interviewed in Lyon, Philadelphia, Cleveland and Amsterdam described how greenspaces provided outdoor recreation. They noted that greenspaces were places for events, “community celebration”^{CLE/state} and “family cookouts”^{PHILLY/comm}, where food, music and drinks can be shared and sports such as “volleyball”^{CLE/state}, “flying kites”^{CLE/state}, “boules”^{LY/comm}, walking, trekking or “working out”^{LY/state} can take place, thanks to specific amenities such as playgrounds promoting children’s physical activity. Respondents reported the importance of these spaces to encourage active commuting and for people to “enjoy themselves”^{PHILLY/comm}.

Community members from Cleveland, Lyon, Montreal, Philadelphia and Bristol indicated that greenspaces supply spaces for social interaction. Neighborhood residents, community-based organizations and neighborhood resident leaders exposed the importance of greenspaces as spaces to meet a diversity of other people – including a diversity of ages and walks of life. They also highlighted that natural outdoor environments were a place “to come together and work together”^{PHI/comm} (particularly in gardening), “hang out with (...) friends and family”^{BRI/comm} and neighbors (both those living across town but also those living in close proximity), chat and enjoy company, explaining the importance of these activities to provide an intangible benefit such as improving social networks.

In regard to “feeling connected to nature”, an urban ecology health employee from the City of Lyon highlighted this ES and stated that “it promotes closer links between urban life and wildlife”^{LY/state} and can possibly lead to residents feeling more curious about nature. Meanwhile, community informants in Lyon, Philadelphia and Bristol also pointed out that natural outdoor environments provided “connection with nature”^{BRI/comm}. Visual appreciation and positive aesthetic experiences were reported in Lyon, as a result of “looking at the flowers, the birds”^{LY/}

^{comm} and enjoying parks as a whole in general. Both community and state respondents in Amsterdam, Cleveland, Philadelphia and Lyon reported various mental restoration services of greenspaces, by means of “reducing stress levels”^{AMS/state}, their role in giving people “respite from the rest of the city,”^{CLE/state} and feeling recharged after a whole day of work. One resident reported that green space gives “...this ability to regenerate, to recharge...”^{LY/comm} and that could be an option in replacement of meditation indoors. A nonprofit member from Philadelphia also noted people can “... go and just hang out and sit on benches and chill out...”^{PHI/comm} in these spaces.

3.2. Perceived ecosystem disservices (EDS) in gentrifying areas

The perceived EDS were (see Table 4): economic (e.g., damage to infrastructure and its related green space maintenance costs), physical hazards (physical tiredness, physical risks), psychological (feeling excluded, experiencing fear/insecurity), and broader social impacts (such as low attractiveness and forced displacement). All EDS were consistently identified by community informants, while none of the state members interviewed mentioned feeling excluded or forced socio-cultural and/or physical displacement.

Economic ecosystem disservices associated with urban natural outdoor environments emerged in Montreal, Cleveland and Philadelphia, with comments from both state and community informants. For example, the maintenance of trees or greenspaces was understood to be high in cost. A city councilor in Montreal found that adding more ash trees turned into having to use more “funding towards treating and replacing”^{MONT/state} those trees when infected by emerald ash borer disease. In Cleveland and Philadelphia, community respondents were most concerned about the damages caused by trees and inadequate maintenance of greenspaces (including vacant lots). In order to avoid the risk of falling limbs, those interviewees reported that they would have to pay directly for the cost of managing those “limb trees that die while hanging over a house or a car”^{CLE/comm}, or to solve the fact that “trees [are] damaging pipes”^{CLE/comm} or “roots ruining sidewalks”^{PHILLY/comm}.

Physical hazard disservices that resulted from physical tiredness

Table 3
Summary of perceived urban ES and EDS.

	Community respondents	State respondents
Ecosystem Services perceived		
Supporting ES:		
Habitat provision [AMS, LY, MONT]	✓	✓
Regulating ES:		
Air purification [LY, AMS, PHILLY, BRI, SF, CLE]	✓.....	✓
Climate regulation (urban cooling) [AMS, PHILLY, LY, MONT]	✓	✓
Stormwater regulation [CLE, LY, AMS, BRI, PHILLY]	✓	✓
Provisioning ES:		
Food production [CLE, MONT]	✓	✓
Cultural ES:		
Outdoor recreation [LY, PHILLY, CLE, AMS]	✓	✓
Social interaction [CLE, LY, MONT, PHILLY, BRI]	✓	×
Connection with nature [LY, PHILLY, BRI]	✓	✓
Positive Aesthetic experiences [LY]	✓	×
Mental restoration [AMS, CLE, LY, PHILLY]	✓	✓

were reported in Montreal, Cleveland, and Lyon by both community and state respondents. Residents (or municipal staff) having to perform the maintenance of natural outdoor environments, such as picking up falling leaves, were seen as discouraging factors for adding new greenness, according to the interviewees. A city water employee spoke of one situation in which it was difficult to convince people of adding more trees because “it’s creating extra work for them”^{LY/state}. The same person also mentioned that gardeners and other employees who clean up parks complain about picking up waste in the park, more so than general maintenance. While an increase in physical activity was interpreted as a positive outcome of contact with greenspaces by some of the interviewees of our study, our results show that physical tiredness related with greenspace maintenance work was also reported as a concern by other informants. In addition, risks to physical health were perceived in Lyon, Montreal, and Cleveland. These risks were posed by fallen branches and fruits that could create “slip and fall”^{MONT//comm.} situations, especially dangerous for older residents. Also, a city green spaces manager in Lyon acknowledged that greenspaces could end up increasing noise and air pollution due to the use of mowers during maintenance.

Feeling excluded was a psychological disservice mentioned by interviewees in Cleveland, Montreal, and San Francisco, but only reported by community informants. A community civic group member in San Francisco saw the improvements and greening of an area as not intended for lower income people but rather to entice the arrival of higher income groups. Community groups felt that it was “about cleaning it just enough so that millionaires who want to buy a vacation home and [will] only be here for a month buy in”^{SF/comm.}. The city added “porch swings and kayaks”^{SF/comm.} in natural outdoor urban areas while not addressing the cleanup of toxic land in these areas, nor catering to the long term underprivileged residents. In Cleveland, a similar worry of possible exclusion arose with community respondents questioning “What is all this development happening? What does it mean?”^{CLE/comm.}. Lastly, key community interviewees in Montreal were afraid a park would become an arena for dog owners who live in the condos nearby, and “people who want to bring their kids or whatever then they’re no longer able to do that”^{MONT/comm.}. These changes in public space use left parents feeling alienated and excluded from the cultural ES of the park, including potential health benefits.

State respondents and community interviewees in Lyon, Cleveland and Montreal spoke of insecurity and fear in relationship to natural outdoor environments. Some described concerns about “homeless”^{MONT/comm.} and “indigenous”^{MONT/comm.} people considered by some as “unwanted”^{MONT/comm.} users whose presence had increased since greenspace improvement. These users were “people who live in the neighborhood [but that before were] never seen”^{MONT/comm.}. Community non-profits exposed that these users “came to sleep and do all their needs in the alley. They [also] leave cans of beer and other stuff”^{MONT/comm.}. Community informants were also seen as more fearful of greenspace used for “illegal activities”^{MONT/comm.} and of high bushes where people “could be hiding”^{CLE/comm.}. One Montreal city councilor referenced how a resident needed street tree branches trimmed because of “...the way they move at night with the wind created shadows of light and [he/she] gets scared.”^{MONT/state} Unwanted wild animals (skunks and raccoons) or ‘vermin’ often associated with disease or potential attacks to residents were also mentioned as a concern brought to a city planning commissioner in Cleveland.

Low perceived attractiveness was a disservice indicated by both categories of informants in Lyon and Cleveland. Respondents expressed that greenspaces were perceived by some community members to be “not very pretty”^{LY/state} or even “ugly”^{CLE/comm.} or messy. In some cases, these negative images were further exacerbated by overgrown shrubs and bushes that surrounded it. Also, the lack of maintenance of vacant lots, such as in some districts of Lyon, made green spaces less attractive. For some community informants, depending on the aesthetics and type of maintenance for a new green space, natural outdoor

environments might not be perceived as assets or as a welcoming area. Adding natural outdoor environments was not always perceived as addressing the prevalent social and health injustices faced by specific residents’ groups, making natural outdoor environments not a top priority for community informants, particularly in Bristol, Montreal, Lyon, San Francisco, and Philadelphia. For example, community members showed a preference for “shops and facilities you can find in cities”^{BRI/comm} over adding more trees. They also felt that adding green space was “depriving them of somewhere to park [their car]”^{BRI/comm.}. In San Francisco, when residents were presented with options of creating a ‘Green benefit district’ coalition, they eventually selected the Arts and Cultural District option because, as those involved reported, the cultural district was a greater priority than greening the district. The rejection of new greenspace seems to puzzle and frustrate (some) city officers. In Philadelphia, a city public health employee emphasized how much they would like to bring new green spaces to neighborhoods for residents, but it is “...a question of whether neighborhoods want that [green spaces] and not everybody does...”^{PHILLY/state}. A city urban planning employee from Lyon expressed frustration because even when green spaces are made, residents do not choose to use them and “we cannot force them to go”^{LY/state}. Similarly in Montreal, the city green space management director saw that “...generally wealthy neighborhoods want more green spaces and working class neighborhoods couldn’t care less [because they have other priorities and worries]”^{MONT/state}.

Community members also shared concerns around forced displacement in San Francisco, Montreal, Cleveland, and Amsterdam. Interviewees stated that new or improved greenspaces were directly linked to increased property values, for example because “when [community organizations] green, a lot of promoters use that as a way to sell and to increase the value of their property”^{MONT/comm.}. However, community informants exposed feeling generally confused about “all that development that’s happening” in their city^{CLE/comm.} and how the neighborhood will look like in the future and for whom. Even when green spaces are planned with residents’ needs in mind, by attempting to co-create a space that “has value and a sense of purpose”^{CLE/comm} for them, community respondents were preoccupied with socio-cultural and physical displacement due to the exclusion felt in greenspace. For example, a community member from San Francisco spoke extensively about how development areas were only cleaned up with the intention of attracting higher economic class people and how “it didn’t even take a decade for the Dogpatch power plant to be removed before it was fully gentrified [i. e. socio-culturally and/or physically displaced]”^{SF/comm}. In Amsterdam, one interviewee reflected on how people almost always support more

Table 4
Summary of perceived urban EDS.

	Community respondents	State respondents
Ecosystem Disservices perceived		
Economic EDS:		
Damage to infrastructure and costs [MONT, CLE, PHILLY]	✓	✓
Physical hazards EDS:		
Physical tiredness [MONT, CLE, LY]	✓	✓
Physical risks [LY, MONT, CLE]	✓	✓
Psychological EDS:		
Feeling excluded [CLE, MONT, SF]	✓	×
Experiencing fear/insecurity [LY, CLE, MONT]	✓	✓
Other social impacts:		
Low attractiveness [LY, CLE, BRI, MONT, LY, SF, PHILLY]	✓	✓
Forced displacement [SF, MONT, CLE, AMS]	✓	×

green space and enjoy the benefits but "...[this] makes the house prices here even go up higher". *AMS/comm*.

In reference to our chosen cities, we found that the North American cities reported a wider diversity of EDS than European cities. Amsterdam and Bristol both had higher variability of ES reported than EDS, and for Lyon there was a similar number of ES and EDS categories disclosed. Interestingly, although EDS were less virulently reported by European cities, both Lyon and Bristol reported the disservice of low attractiveness of green urban spaces. In North American cities we found that Cleveland and Montreal reported the highest diversity of EDS including low attractiveness, and feelings of fear and exclusion.

4. Discussion

Our study shows that, in cities undergoing gentrification, informants report a wide array of ecosystem disservices (and services) in relation to new and improved natural outdoor environments. Generally, community respondents are able to more clearly and richly identify ecosystem services and disservices, probably because they are in closer contact and have greater experience of community life, needs and dynamics. Our results enrich existing scholarly understandings of ES and EDS (Haines-Young and Potschin-Young, 2018; von Döhren and Haase, 2015), highlighting that informants from cities experiencing green gentrification (particularly community respondents) can offer rich and nuanced descriptions of EDS that extend well beyond what has been studied until now. These may include forced displacement, physical tiredness, and low attractiveness of urban spaces, illustrating their importance in the context of cities experiencing green gentrification.

In sum, our study illustrates how differences in decision making positions (those with greater administrative capacity and decision-making power vs. those in community roles with often stronger community relations and connections) can impact the perception of ES and EDS: community respondents tend to perceive a greater number and diversity of EDS in comparison with administration members from city and supramunicipal institutions. In addition, some specific services (social interaction, positive aesthetic experiences) and disservices (feeling of exclusion and forced socio-cultural and/or physical displacement) are only reported by community members (Fig. 1).

4.1. The particular importance of cultural services for community members, while other ecosystem services are relevant for all respondents

From all the reported cultural ES, social interactions and positive aesthetic experiences were only stated by community informants. This result highlights how, in gentrifying neighborhoods, those respondents use and value natural outdoor environments to be able to keep a sense of community and maintain social relations in the midst of the demographic and broader social change that tend to occur in gentrifying neighborhoods. Other studies also focusing on residents' needs had already found that aesthetic pleasure and social interaction were important for urban residents in Porto, Portugal and Guangzhou, China (Graça et al., 2018; Jim and Chen, 2006) although those studies were not particularly focused on areas experiencing gentrification. In Barcelona, the one study that did link ES with green gentrification found social relations to be one of the differentiators between parks associated with green gentrification and parks that were not (Amorim Maia et al., 2020). Our results are also in line with recent research highlighting that aesthetic appreciation along with recreation tend to be the most prevalent cultural ES in cities (Veerkamp et al., 2021b), followed by connection with nature, having a sense of place in nature, or getting inspiration through nature (Bertram and Rehdanz, 2015; Riechers et al., 2016). According to respondents, recreation is also a highly effective ES offered by natural outdoor environments, especially for physical activity benefits. Since gentrifying neighborhoods tend to be formerly more marginalized, grey, and/or postindustrial environments and landscapes (Gould and Lewis, 2017), it seems valuable for new green amenities to

be offering aesthetic value and physical activity opportunities to more socially vulnerable residents.

In terms of regulating ES, air purification, urban temperature regulation, and stormwater runoff regulation benefits were reported by both community and state informants. Our findings are in line with empirical research showing that urban vegetation, particularly trees, are commonly associated with these ES (Collins et al., 2019; Drillet et al., 2020; Gómez-Baggethun and Barton, 2013). For urban temperature regulation, most respondents highlighted the cooling effects of adding green space to urban areas, in line with recent studies on the role of trees and vegetation in helping mitigate heat wave risks (Baró et al., 2015; Graça et al., 2018; Lin et al., 2015; Wangchuk et al., 2021). Since both groups of respondents perceived all regulating services, it seems that the tangible, physical benefits of having cooler and cleaner air are of particular importance for the environmental quality of residents within gentrifying neighborhoods, especially since many of them are in post-industrial landscapes, such as San Francisco, Cleveland, and, to some extent, Amsterdam.

Our findings on the provisioning service of healthy food production (via community and allotment gardens) aligns with previous evidence (Bolund and Hunhammar, 1999; Haase et al., 2017; Russo et al., 2017), as well as those ES services related with habitat provision, an intermediate supporting service (de Groot et al., 2010; Dobbs et al., 2014; Gómez-Baggethun and Barton, 2013; Lundy and Wade, 2011) that residents in historically marginalized neighborhoods particularly value. Both groups of informants in our study tie habitat provision to urban biodiversity and to creating connections between urban life and wildlife. However, the mention of those ES were rather rare, implying that those seemed to be of lower value by residents living in gentrifying neighborhoods according to both state and community respondents.

4.2. Wider diversity of ecosystem disservices perceived by community members, while no reference is made to ecological disservices

Our study findings indicate a broad set of perceived EDS – economic costs, physical hazards, psychological impacts, and other social impacts. However, ecological disservices, such as biogenic emissions or bio-invasive species, were not mentioned.

In our study, a wider diversity of disservices was mentioned by community members and some were even only reported by community interviewees, including feelings of exclusion in the context of green gentrifying neighborhoods and socio-cultural and/or physical displacement. These negative perceptions are more commonly experienced by underprivileged residents, as other studies report (Anguelovski et al., 2021b), that is by people whom community respondents tend to be in closer contact with, for example through their participation in neighborhood community gardens or urban greenspace stewardship activities, in comparison with city planning staff. It could also be that responses from state informants reflect an institutional vision rather than individual perception or experience (Scholte et al., 2015).

Feeling excluded, experiencing fear, and experiencing insecurity were the psychological EDS that respondents reported. Feelings of anxiety/discomfort, insecurity, fear, disgust, scariness, and unpleasantness have been identified in similar research on urban green space, especially in gentrifying neighborhoods (Anguelovski et al., 2020; Finney, 2014; Rigolon et al., 2018; Rodríguez-Morales et al., 2020; Roy et al., 2012; von Döhren and Haase, 2015), and are generally related to overgrown vacant lots, unmaintained hedges/shrubs (wildness), darkness (Andersson et al., 2015; Gómez-Baggethun and Barton, 2013; Jim and Chen, 2006; Lyytimäki and Sipilä, 2009) and increased crime in those contexts (Barton, 2016). In our study, those feelings were also linked to green spaces being used by homeless or indigenous residents. In Montreal, for example, community respondents reported feeling afraid and insecure due to possibility of illegal activities taking place there by unhomed or indigenous residents, and of people hiding in overgrown plants.

In our study, feelings of exclusion and fears of forced displacement are exclusively reported by community respondents, in relation to the natural outdoor environments built in the neighborhoods under study, including in San Francisco, Cleveland, Montreal, and Amsterdam. In those cities, respondents did not identify new green space as a new valuable amenity for long-term residents but rather perceived it as a possible contributor or sign of gentrification and displacement. Green gentrification can stem from the fact that natural outdoor environments generally increase real estate values around these spaces (Lyytimäki and Sipilä, 2009; Miller, 2016; Ramos et al., 2018; Villegas-Palacio et al., 2016) and can compromise access to more affordable housing, as in the case of San Francisco, or contribute to the privatized access to a new green amenity, as in Montreal next to the Lachine Canal. Since community respondents are likely more in contact with vulnerable neighborhood residents, their direct neighborhood presence and experience

might thus explain their ability to perceive those social impacts.

Participants of our study identified the low attractiveness of new green areas and their aesthetics as an EDS, including displeasing infrastructure, overgrown plants, undermaintained spaces or lost car park sites. This perception has been documented in literature and is most often associated with lack of maintenance or trash in natural outdoor environments (Lyytimäki et al., 2008; Lyytimäki and Sipilä, 2009; Roy et al., 2012; Triguero-Mas et al., 2021). Here, it might also be linked to the fact that gentrifying neighborhoods are still lagging behind wealthier areas in relation to access to many core city service investments as well as funding allocated to natural outdoor environments budgets. These findings might echo recent research showing that the quality (over the quantity) of the green space is most relevant (Russo and Cirella, 2018) in explaining green space perception.

Our results also indicate that community and municipal

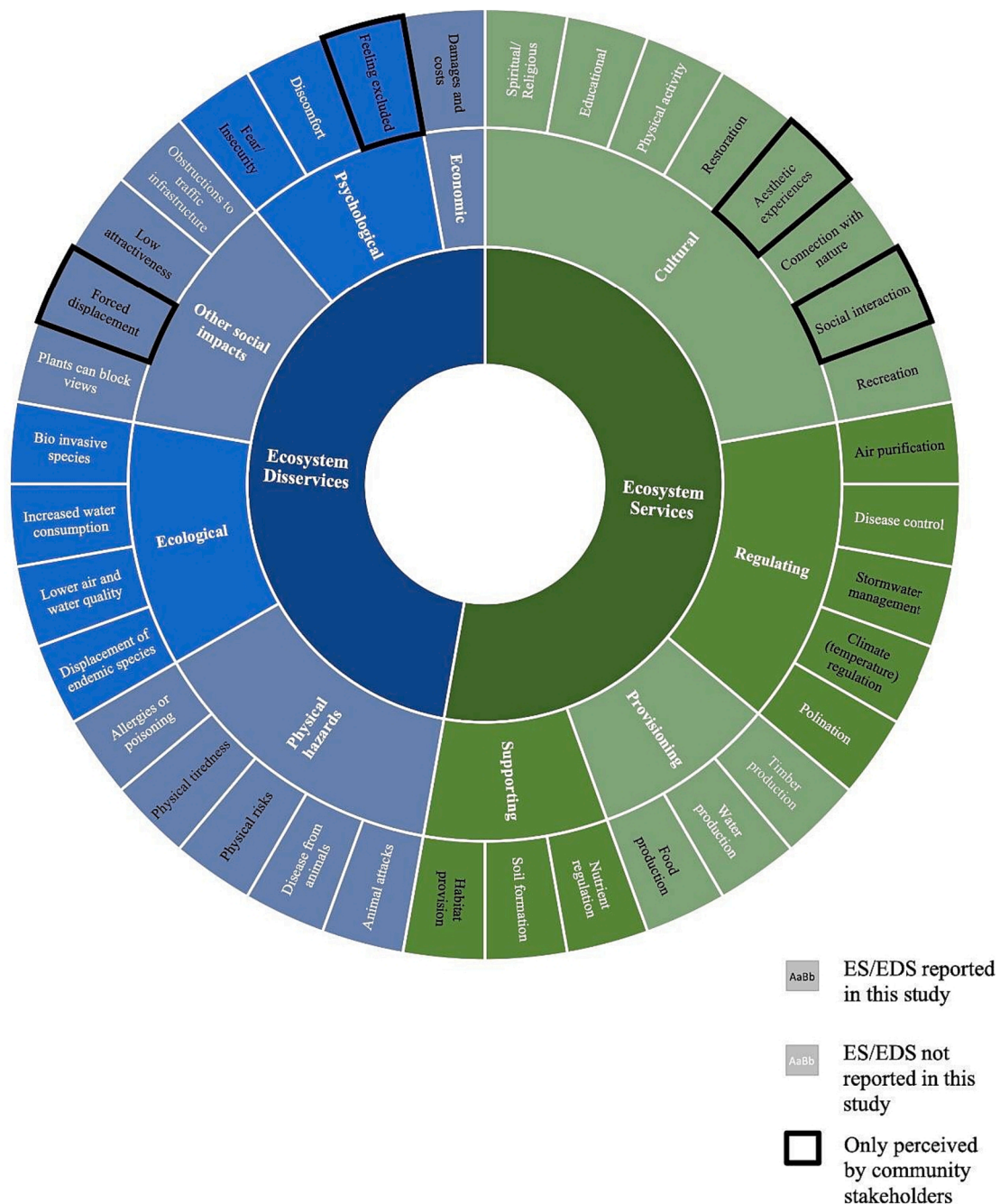


Fig. 1. Different ecosystem services and disservices, showing those reported in detail by our interviewees and those that only community members stated.

administration informants from cities undergoing green gentrification perceived physical hazard-related risks associated to new natural outdoor environments. Community respondents perceived that either the lack of upkeep of green areas created unsafe conditions due to increased falling risk or to the use of dangerous pesticides. These findings thus add to previous research that had focused more on health risks such as allergies caused by increased pollen, the increased odds of attacks by insects or animals, or increased probability to get an infectious disease transmitted by animals acting as vectors (Roy et al., 2012; von Döhren and Haase, 2015). Furthermore, physical hazard is a disservice that our study respondents mentioned in the context of natural outdoor environments maintenance (falling limbs, leaves, fruits or trimming shrubs and bushes) and waste pickup in gentrifying neighborhoods. This disservice has received little attention so far, but complements existing research on the physical damage and maintenance costs of new green infrastructure (Gómez-Baggethun and Barton, 2013; Lyytimäki et al., 2008; Roy et al., 2012; von Döhren and Haase, 2015). Respondents particularly highlighted the increased physical effort for older residents and park employees in areas requiring maintenance. Rather than bringing new benefits for community members, green space might thus create new physical and labor burdens.

The economic disservices that respondents reported were nearly all related to damage caused by new green spaces. These results add to the current evidence on the role of plant growth in property damage and the costs of removing unwanted species (Gómez-Baggethun and Barton, 2013; Lyytimäki et al., 2008; Roy et al., 2012; von Döhren and Haase, 2015). Our study found that community respondents were concerned about who would take responsibility over maintenance costs. Some residents feared it would fall on them and the city would not step up and take care of damage, or that it would take several complaints for the city to become involved. This fear explains why disadvantaged communities are often against street tree-planting programs, especially in the US (Carmichael and McDonough, 2019; Riedman et al., 2022). This economic concern could be also a direct result of gentrification, which tends to increase cost of living and worsen socioeconomic segregation.

In general, our findings illustrate that ecosystem disservices are broadly recognized by community members, which may indicate that ecosystem disservices play a significant role in people's perceptions of natural outdoor environments. Our study did not provide information on the potential outperformance of ecosystem disservices over the ecosystem services. However, previous research demonstrates that natural outdoor environments can be considered greenLULUs (Locally Unwanted Land Uses) or "disruptive green landscapes" for underprivileged residents (Anguelovski, 2016; Triguero-Mas et al., 2021), which may be a relevant consideration in future research on ecosystem services and disservices, particularly in contexts of green gentrification.

4.3. Strengths & limitations

In this analysis, we presented respondents perceptions of the ES and EDS provided by natural outdoor environments in different cities. While gender, geographical location, position in society, and age have been documented as influencing how services and disservices are perceived (García-Nieto et al., 2015; Moutouama et al., 2019; Ramos et al., 2018), we did not collect information on these characteristics because our study goals were more directly focused on contrasting perceptions among interviewees types than on those characteristics. However, we cannot rule out the potential impact that sociodemographic characteristics of our interviewees could have in our results. Further, as perceptions are subjective, each ES and EDS may be interpreted differently by each interviewee (von Döhren and Haase, 2015). Despite having interviewed a diversity of local community organizations and municipal planning agencies, in some of the cities we only managed to collect data from a small number of city administration members (i.e. Montreal and San Francisco), which could have impacted the heterogeneity of information we collected (Saunders et al., 2018).

Apart from these limitations, our study has several strengths. We were able to differentiate perceptions by type of informant and include respondents in a diversity of community and administrative positions, which allowed us to identify a wide range of EDS and ES in gentrifying cities, and identify those that community respondents perceive due to their close contact with residents. Moreover, this study provided a novel cross-city perspective to previous research into urban ES and EDS by focusing in several cities located both in North America and Europe. Lastly, our study highlighted disservices in regard to psychological, physical hazards, economic and social impacts and provided insights into disservices sparsely studied so far.

5. Conclusions

Cities around the world have been creating an identity around greening, branding themselves as "green cities" and attracting capital and investors. These investors take advantage on the potential of green projects and environments, capturing for themselves the social and health benefits of green (García-Lamarca et al., 2022). Taking our findings and this context into account, we believe our study is a step forward in nuancing and further building the ES and EDS scholarship, showing the importance of further refining the ES and EDS framework to better understand how urban natural outdoor environments are usually purely conceptualized as solutions to anthropocentric needs.

Our study findings further refine the conceptualization and diversity of urban ES and EDS and provide an understanding and contextualization of how they are perceived differently by informants holding different types of positions and connections to neighborhood residents and to gentrification processes involving unequal urban change and development in those neighborhoods. Thus, our research presents a wider set of EDS that have to be considered, particularly if equity and environmental justice lenses are applied. Our results have clear policy and planning implications, calling for the recognition of the wider benefits but also social, economic, physical and psychological negative effects of new green space projects to ensure designing healthy green just cities.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ecoser.2023.101571>.

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