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Situating Gender in the Integration of Environmental Justice within Urban Greening

Amalia Calderón Argelich

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Situating Gender in the Integration of Environmental Justice within Urban Greening

Amalia Calderón Argelich

Ph.D. Dissertation submitted for the Program in Environmental and Science Technology. Institut de Ciència i Tecnologia Ambientals (ICTA). Universitat Autònoma de Barcelona (UAB)

September 2023
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BCNUEJ Barcelona Laboratory for Urban Environmental Justice and Sustainability

UAB Universitat Autònoma de Barcelona

ICTA Institut de Ciència i Tecnologia Ambientals ICTA-UAB

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EXCELENCIA MARÍA DE MAEZTU

This Ph.D. research was funded by the AGAUR Catalan governmental agency (FI-AGAUR grant), the UAB and the ICTA "María de Maeztu" Programme for Units of Excellence of the Spanish Ministry of Science and Innovation (CEX2019-000940-M). This work reflects only the author's view; the funding agencies are not responsible for any use that may be made of the information it contains. Amalia Calderón Argelich [amalia.calderon@uab.cat], Universitat Autònoma de Barcelona, 2023. Suggested citation: Calderón-Argelich, A. 2023, Situating Gender in the Integration of Environmental Justice within Urban Greening, Ph.D. Dissertation. Universitat Autònoma de Barcelona.

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Note: U.S. spelling is used in this work

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PREFACE

The dissertation you have in your hands (or screens) is but a small fraction of the so many learnings and experiences I have encountered during my last four years and a half as a predoctoral researcher. And as such, this work encapsulates a particular moment in time and space when I had the chance to address some of my intellectual inquietudes through an academic piece. At the beginning of such process, I was fortunate to be able to choose my research topic and therefore to construct my own research trajectory. In the topics I addressed through my research, I tried to bring together environmentalism, social justice and feminism, which not only gave me personal motivation and inspiration, but which also gave a meaning to my research. By intertwining these themes, I could connect through my work the multiple levels of abstraction from the academic literature to the tangible efforts of improving people's lives. Building from my colleagues at BCNUEJ, I explored the interconnections between research, policy and activism while trying to steer clear of the shadows of the (in)famous impostor syndrome. And through different and stimulating conversations with policymakers, technicians, activists, and researchers, I realized that, indeed, I could add my grain of sand. Tiny, but real.

From the beginning of this journey, I decided to live "intensively" my PhD and I took advantage of the amazing people that surrounded me and all the opportunities and challenges I could encounter. I took every course I could, assisted to many meetings, seminars, webinars, I organized events, wrote policy briefs, and facilitated collaborations. Indeed, Chapter II of this thesis draws on the synergy I found with a predoctoral researcher, Stefania, who arrived to ICTA to conduct a research stay at the same time as I was starting my thesis. We found out that we were both planning to do a literature review on ecosystem services and Environmental Justice, so we decided to merge forces, learn from each other, and became friends in the process. Finally, we compiled a large and robust coded literature review which we split afterwards according to our specific objectives. I believe that such experience was the best way for kicking off my PhD and acquire a bigger picture of some of the literature I engaged with. During Chapter III, I found myself amidst a global pandemic crisis. This circumstance partly influenced my choice to concentrate on Barcelona as a case study and discard other European case studies. As a result of the pandemic, I opted for a research method that was based on policy documents and online participatory processes in planning and managing Barcelona's green spaces, and I also conducted all my interviews through videocalls. Ironically, this virtual approach facilitated my engagement with the city where I

was living, enabling me to better comprehend the efforts of those working to create a greener and more equitable urban environment. Simultaneously, Chapter IV started as a collaboration with my colleagues from BCNUEJ and as a research project funded by the City of Barcelona designed to explore the consequences that the COVID-19 pandemic had left on the use and perception of public space. Once more, I decided to engage in collaboration, embracing the opportunities that arose even amidst challenging circumstances, aiming to see what we could learn from it. In fact, Chapter I and V were finished during a research stay at the City University of New York, an opportunity that appeared in the last stage of the thesis and which provided me with invaluable insights and resources to remove myself from my daily field sites, abstract myself, and theorize some of my findings, while further exploring the complexities of urban planning and Environmental Justice in a North American context.

The past research years gave me the opportunity to cultivate my appreciation for Barcelona, the city where I lived in the last decade of my life. It has been an immense pleasure to experience a transformation in my perception of the city, shaped simultaneously by both my personal development and my academic inquiries. I started the PhD just before the reelection of mayor Ada Colau and I finished it with the end of the Barcelona en Comú leadership in Barcelona. It has been fascinating to witness the transformations of the city itself; a city that was for the first time governed by a female mayor, who built her campaign and political vision around a green, just, and feminist city. Through Colau's mandates, I learned many things about how a government within a democratic framework can (with its pluses and its minuses) bring feminist and care-centered policies to the table at the municipal level, while also building momentum for more livable, accessible, and just cities.

Finally, throughout the past years, I realized what it truly entails to be a researcher and what kind of academic community we create together. When I began my PhD, I had a three-year scholarship contract. However, during that time, the EPIF (Estatuto del Personal Investigador en Formación) was approved, granting us the right to a fourth year of contract (as equivalent to the other predoctoral grants). Only after collective demonstrations and negotiations with the UAB, some of us managed to secure a salary increase and sign a fourth year of contract. However, precarity in Academia is still very real, and some of my peers and subsequent cohorts did not see their rights guaranteed with the same conditions. At the same time, I witnessed different cases of gender harassment and abuse of power in various Catalan Universities, which have been widely reported and commented in the Catalan and Spanish media. Often, such behavior and practices are normalized until brave people, mostly women students, speak up and the media gets involved. Day by day, it has become evident to me

that an integral part of our everyday job also means building an Academia that redefines excellence and guarantees labor rights, gender equity and an ethic of care. And that this is part of doing science and knowledge creation too. And that it takes time and energy. I am grateful for the people and the conditions that allowed me to do this thesis as it stands. And therefore, I am committed to reshaping Academia in our everyday practices. I believe this is not only essential, but urgent. For us and for the ones yet to come.

ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to my supervisors, Francesc, Isabelle, and James, for your invaluable guidance and unwavering support throughout the entire research process. I deeply appreciate the significant time, attention, and care you dedicated to me. Francesc, for your detailed feedback and down-to-earth comments, and especially for accompanying me since the beginning of my master's degree journey. James, for your kindness and insightful comments that led me to those crucial 'aha' moments. Isabelle, for your blend of critical-analytical and creative-inspiring comments, your tireless encouragement, and for always being so authentically caring. I have felt incredibly fortunate to have had you as my supervisors from the first to the last day of this journey. I am also indebted to my tutor, Victoria Reyes-García, for her support with grants and her help and assistance whenever needed. Special thanks to the administration and dissemination team of ICTA for their administrative assistance, access to resources, and continuous support.

Thank you to all my amazing colleagues at BCNUEJ for being the best lab I could ask for. I don't really have the words to thank you for everything I have learned from and with you all. Thanks for building together a research community that is not only excellent but also truly caring and guided by ethical and feminist principles. To my PhD sister Ana Terra, for sharing this journey with me and for being there through the ups and downs of *Ph.D.'ing*. To Austin, Andréanne, Fulvia, Julia, Mel, Panagiota, Carmen, Galia, Filka, Helen, Ita, Valeria, and all others involved, thank you. Special thanks to Helen and Ita for giving me the opportunity to participate in the FEMPUBLICBCN project, to the interns who made the project possible, to Punt 6, and to the vecinas who shared their everyday insights and struggles with us. I extend my heartfelt thanks to all my colleagues at ICTA and Laseg for their camaraderie, intellectual exchange, and collaborative spirit. Their contributions greatly enriched the research experience and fostered a stimulating academic environment. A special thanks to Gemma, Borja, and Giulia at our office Z-148 for everything we shared there. Thanks to all the other predoctoral colleagues I have met in these years and with whom I have found solidarity. Lastly, thanks to the Col·lectius de Doctorands en Lluita for their continuous struggles for the recognition of labor rights for all predoctoral researchers.

I am also thankful to the amazing people I met at the Vrije Universiteit Brussel for welcoming me so warmly, and to the City University of New York for giving me the opportunity to do a research stay at the end of the PhD. Thanks to all the people from the Ajuntament de

Barcelona, as well as the architects and planners who shared their insights and reflections with me about urban greening and beyond.

Finally, I am profoundly indebted to my family and friends for their firm encouragement, understanding, and affection throughout this academic endeavor. Gràcies a tots els meus amics i persones estimades qui desde Tàrrega, Barcelona o arreu m'han recolzat i acompanyat. Gracias Mel, por ser el amor de mi vida. Finalmente, las gracias más sentidas a lo largo de estos años, así como de todos los anteriores, son para mi familia, Carlos, Ma Antonia y Alfonso. Desde Caracas hasta Tàrrega, guiados por el amor al arte y a la ciencia, en continua conversación los cuatro.

SUMMARY

This thesis addresses the pressing need to bridge urban policy and planning strategies over public green and blue spaces with the specific needs and claims of historically marginalized communities, particularly with a focus on women and gender minorities. While global initiatives promote urban greening as part of cities' sustainable agendas, municipalities are still lagging in integrating Environmental Justice objectives into green planning. This thesis critically analyzes the extent to which urban greening research, policy, and planning – traditionally framed as scholarship on Ecosystem Services and Urban Green Infrastructure– address environmental, social, and gender inequities taken together. First, I conduct a systematic review of urban Ecosystem Services assessments to trace and build up Environmental Justice considerations in the literature. Results highlight the increasing operationalization of dimensions justice and greening aspects in ES studies, revealing complementarities, conflicts, confluences, and blind spots, especially as related to gender. Second, I investigate how Environmental Justice, with a focus on gender concerns, is incorporated into urban greening policies and strategies. First through an international overview, and second, through a focus on Barcelona. This study examines how cities translate social and gender equity aspirations embedded into UGI planning into concrete goals and policies, while also considering the limits and challenges of operationalizing equity on the ground, especially when women's needs and identities are concerned. Third, continuing with Barcelona's recent greening experience, I provide empirical insights into changes related to the use and perception of public green and blue spaces by women and non-binary residents in two Barcelona neighborhoods undergoing gentrification and touristification processes during the COVID-19 pandemic. By adopting a feminist participatory approach, this chapter sheds light on the intricate interplay between urban development dynamics, green and blue spaces characteristics, and intersectional use and perceptions of such spaces. All in all, through an examination of international studies and experiences, municipal policies, and local residents' perspectives, this research contributes to a more inclusive and representative approach to urban greening, with the hope to create more equitable and sustainable urban environments, especially concerning gender inequities.

Keywords: urban greening; environmental justice; ecosystem services; urban planning; gender perspective.

RESUMEN

Esta tesis aborda la urgente necesidad de conectar las políticas urbanas y las estrategias de planificación sobre espacios públicos verdes y azules con las necesidades y demandas específicas de las comunidades históricamente marginalizadas, con un enfoque particular en mujeres y minorías de género. Mientras que las iniciativas globales promueven el verde urbano como parte de las agendas sostenibles de las ciudades, los municipios todavía no han integrado objetivos de Justicia Ambiental en la planificación verde. Esta tesis analiza de forma crítica el grado en que la investigación, política y planificación de la vegetación urbana, tradicionalmente enmarcada como estudios sobre Servicios Ecosistémicos e Infraestructura Verde Urbana, abordan conjuntamente las inequidades ambientales, sociales y de género. Primero, realizo una revisión sistemática de las evaluaciones de Servicios Ecosistémicos urbanos para rastrear y desarrollar consideraciones de Justicia Ambiental en la literatura. Los resultados destacan la creciente operacionalización de dimensiones de justicia y aspectos del verde urbano en los estudios de Servicios Ecosistémicos, revelando complementariedades, conflictos, convergencias y puntos ciegos, especialmente en relación al género. Segundo, investigo cómo se incorpora la Justicia Ambiental, con un enfoque en temas de género, en políticas y estrategias de vegetación urbana. Primero a través de una visión general internacional, y segundo, a través de un enfoque en Barcelona. Este estudio examina cómo las ciudades traducen las aspiraciones de equidad social y de género incorporadas en la planificación de la Infraestructura Verde Urbana en metas y políticas concretas, considerando también los límites y desafíos de operacionalizar la equidad a la práctica, especialmente cuando se trata de las necesidades e identidades de las mujeres. Tercero, continuando con la experiencia reciente de iniciativas verdes en Barcelona, proporciono conocimientos empíricos sobre los cambios relacionados con el uso y la percepción de los espacios verdes y azules públicos por parte de mujeres y personas no binarias en dos barrios de Barcelona que están experimentando procesos de gentrificación y turistificación durante la pandemia de COVID-19. Adoptando un enfoque participativo feminista, este capítulo arroja luz sobre la intrincada interacción entre dinámicas de desarrollo urbano, características de espacios verdes y azules, y el uso y percepciones interseccionales de dichos espacios. En resumen, a través del examen de estudios y experiencias internacionales, políticas municipales y perspectivas de residentes locales, esta investigación contribuye a un enfoque más inclusivo y representativo de la vegetación urbana, con la esperanza de crear entornos urbanos más equitativos y sostenibles, especialmente en lo que respecta a las desigualdades de género.

Palabras clave: verde urbano, justicia ambiental, servicios ecosistémicos, planificación urbana, perspectiva de género.

RESUM

Aquesta tesi aborda la urgent necessitat de connectar les polítiques urbanes i les estratègies de planificació sobre espais públics verds i blaus amb les necessitats i demandes específiques de les comunitats històricament marginalitzades, amb un enfocament particular en les dones i les minories de gènere. Mentre que les iniciatives globals promouen el verd urbà com a part de les agendes sostenibles de les ciutats, els municipis encara no han integrat objectius de Justícia Ambiental en la planificació verda. Aquesta tesi analitza de forma crítica el grau en què la recerca, política i planificació de la vegetació urbana, tradicionalment emmarcada com a estudis sobre Serveis Ecosistèmics i Infraestructura Verda Urbana, aborden conjuntament les desigualtats ambientals, socials i de gènere. Primer, realitzo una revisió sistemàtica de les avaluacions de Serveis Ecosistèmics urbans per rastrejar i desenvolupar consideracions de Justícia Ambiental en la literatura. Els resultats destaquen la creixent operacionalització de dimensions de justícia i aspectes del verd urbà en els estudis de Serveis Ecosistèmics, revelant complementarietats, conflictes, convergències i punts cecs, especialment en relació al gènere. Segon, investigo com s'incorpora la Justícia Ambiental, amb un enfocament en temes de gènere, en polítiques i estratègies de vegetació urbana. Primer a través d'una visió general internacional, i segon, a través d'un enfocament en Barcelona. Aquest estudi examina com les ciutats tradueixen les aspiracions d'equitat social i de gènere incorporades en la planificació de la Infraestructura Verda Urbana en metes i polítiques concretes, considerant també els límits i reptes d'operacionalitzar l'equitat a la pràctica, especialment quan es tracta de les necessitats i identitats de les dones. Tercer, continuant amb l'experiència recent d'iniciatives verdes a Barcelona, proporciono coneixements empírics sobre els canvis relacionats amb l'ús i la percepció dels espais verds i blaus públics per part de les dones i persones no binàries en dos barris de Barcelona que estan experimentant processos de gentrificació i turistificació durant la pandèmia de COVID-19. Adoptant un enfocament participatiu feminista, aquest capítol aporta llum sobre la intrincada interacció entre dinàmiques de desenvolupament urbà, característiques d'espais verds i blaus, i l'ús i percepcions interseccionals d'aquests espais. En resum, a través de l'examen d'estudis i experiències internacionals, polítiques municipals i perspectives de residents locals, aquesta investigació contribueix a un enfocament més inclusiu i representatiu de la vegetació urbana, amb l'esperança de crear entorns urbans més equitatius i sostenibles, especialment pel que fa a les desigualtats de gènere.

Paraules clau: verd urbà, justícia ambiental, serveis ecosistèmics, planificació urbana, perspectiva de gènere.

STATEMENT OF POSITIONALITY

As a researcher embarking on a thesis that dares to mention big words like social justice and feminism, I find it crucial to begin with a short reflection acknowledging the privileges that have shaped my academic path. While examining the multifaceted dimensions of urban Environmental Justice, I must recognize that my position as a researcher is inherently influenced by various aspects of my identity and background.

As a young, cis, able-bodied woman from a highly educated family, I was given the opportunity to conduct my research in a western University with the means and resources of ICTA/UAB. Additionally, born in Venezuela but mostly raised in Catalunya, I have formal citizenship from a European country, and I speak Spanish, Catalan and English. I am conscious of the privilege that these attributes afford me, granting me the legitimacy and capacity to navigate freely through urban spaces and engage with different communities. With some of my work immersed in gentrification research, there is nothing I can do but endorse Leslie Kern's words in The Feminist City (2020): "I'm very aware that my body reads as a marker of successful 'renewal', signifying that a space is respectable, safe, middle-class, and desirable". However, I am also acutely aware of some of the responsibilities that come with such privileges –to be attentive, empathetic, and to critically assess my multiple roles as a researcher and as an outsider of Barcelona's gentrifying neighborhoods and marginalized communities.

This embodied privilege coexists with, rather than diminishes, some concerns and barriers I faced as a Venezuelan bisexual woman, and as a non-native English speaker in Academia. These experiences have provided me a background that has influenced me and guided me with solidarity tools. By acknowledging my positionality as a researcher with both advantages and limitations, I hope to present my work with transparency, openness, and respect for the diverse voices and experiences that I build from. I am fully committed to giving back to the municipality of Barcelona as what I consider a basic responsibility within my role as researcher. For me, this includes engaging with the policymakers, civil servants, and professionals who contributed with their expertise and insights to my research –which I have done regularly through my PhD, even in specific workshops I helped co-organize with members of the local administration, through teaching courses for/with planners, through policy briefs and reports, or through individual meetings I have set up or been part of to share and engage others with my work. Similarly, I consider it a core responsibility to give time back to the neighbors from Sant Antoni and La Barceloneta, who shared with us their

daily experiences and struggles in their neighborhoods. For this reason, I have been involved in developing different dissemination materials, including audiovisual materials, with and for the residents, as well as meetings to share our results with them.

In conclusion, this positionality statement serves as a modest yet incomplete exercise of reflexivity and self-awareness throughout my research journey. With this, I aspire to contribute meaningfully to the discourse surrounding environmental and feminist justice in Barcelona, while also recognizing that my perspective is just one of many.

LIST OF ABBREVIATIONS AND ACRONYMS

CICES	Common International Classification of Ecosystem Services
COVID-19	Coronavirus Disease 2019
EJ	Environmental Justice
ES	Ecosystem services
FAO	Food and Agriculture Organization
IPBES	Intergovernmental Panel on Biodiversity and Ecosystem Services
IUCN	International Union for Conservation of Nature
MEA	Millenium Ecosystem Assessment
NbS	Nature-based Solutions
PES	Payment for Ecosystem Services
PGBS	Public Green and Blue Spaces
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
TEEB	Economics of Ecosystems and Biodiversity
UGI	Urban Green Infrastructure
UN	United Nations

CHAPTER I. INTRODUCTION

1. Background and motivation

It is no secret that cities are often portrayed as "problematic". They face with issues of pollution, noise, heatwaves, flooding, social inequities, and a dense population. In addition to all of this, cities are major producers of carbon emissions, and they bear responsibility for the extraction of resources and materials from the hinterlands (and beyond) on which they depend (Haberman & Bennett, 2019). Furthermore, many global cities are becoming increasingly unaffordable and exclusive. Recently, citizens have all (re)discovered just how vulnerable densely populated urban areas can be to global pandemics. Nevertheless, more than half of the world's population already resides in cities, and this number is expected to grow.

Conversely, visions of green cities, eco-cities, and sustainable cities are rapidly gaining traction and expanding within strategic urban agendas worldwide. These objectives integrate environmental, social, and economic factors into the frameworks applied to urban development policies. Thus, in the last two decades, enhancing the sustainability, resilience, and livability of cities has become a cornerstone of local government agendas. Through these visions, the perception of cities has evolved from being seen as ecological problems arising from the aftermath of industrial-era urban production processes to being envisioned as integral solutions to environmental challenges. As Angelo & Wachsmuth (2020) ironically put it, everyone started to believe that cities can save the planet.

Numerous global policy initiatives promote the development of green cities, highlighting their significant potential for leadership, innovation, and progress. Examples range from the 11th Sustainable Development Goal, which aims to "Make cities and human settlements inclusive, safe, resilient and sustainable" followed by the "New Urban Agenda" (UN-HABITAT III, 2017; United Nations, 2016), to the European Commission's Biodiversity Strategy for 2030 (European Commission, 2021a, 2021b). Similarly, the Global Covenant of Mayors for Climate and Energy, a global alliance for city climate leadership, and the Food and Agriculture Organization Green Cities Initiative are examples of how the intersection of the green and urban agenda is entering the priorities of global organizations. The latter aims to promote urban greening to "contribute to climate risk mitigation (prevention of floods, reduction of urban heat islands and protection from sandstorms), improved physical and mental health, food and nutrition security, and the creation of green jobs" (FAO, 2020).

Within the scope of the European Union, networks promoting the sharing of innovative ideas between policy-makers and local governments can be found in award initiatives like the European Green Capital Award and the European Green Leaf Award.

In this context, researchers, policy-makers, and practitioners are increasingly capitalizing on the global attention that urban greening has gained and incorporating the planning and management of green spaces as a win-win strategy for building urban resilience and sustainability. During the 2010s, concepts such as Ecosystem Services (ES), Urban Green Infrastructure (UGI), and Nature-based Solutions (NbS) emerged and/or consolidated as interdisciplinary frameworks guiding policy and planning initiatives. This emergence was partially in response to the increased awareness of the conjunction of benefits that can be harnessed from (urban) nature. Among these frameworks, ES serve as the fundamental concept that links biophysical systems and ecological functions to human well-being (E. Andersson et al., 2019).

Urban ES encompass the benefits derived from urban ecosystems, which include all green and blue spaces that may be found in urban and peri-urban areas (Gómez-Baggethun et al., 2013). With the goal of operationalizing the ES framework and serving as practical tools for executing and managing urban greening actions, UGI and NbS concepts have come to the forefront of national and international assessments and urban (re)naturing plans. UGI forms the strategically planned network of urban ecosystems that can deliver multiple ES. Conversely, NbS, a more recent and broad concept, involves the practical and action-oriented application of ES to generate innovative and implementable "solutions" (Pauleit et al., 2017).

Moving to how questions of inequality permeate programs and actions promoting a greater access to green and blue spaces, the Environmental Justice (EJ) movement (and associated literature in geography, sociology, public health, and urban planning) has historically denounced the unequal exposure of impoverished communities and communities of color to environmental toxics, burdens, and risks as well as their limited access to environmental amenities and services, including parks, gardens, and green recreational areas (Agyeman et al., 2016). An EJ concern encompasses more than just the quantity and access to green and blue spaces; it also involves their use, safety, and maintenance (Rivera & Hendricks, 2022). EJ advocacy in urban settings has also long emphasized the need for building healthy communities and engaging in place-remaking and community reconstruction through urban nature projects (Agyeman, 2013; Anguelovski, 2014). Most recently, climate justice activists

and researchers have pointed out the multifaceted climate injustice that historically marginalized groups are facing (Shokry et al., 2020), often due to urban climate change mitigation and adaptation planning failing to tackle inequity and social vulnerability (Hughes, 2015). The quadruple form of environmental injustice manifests through those who have historically contributed the least to climate change and environmental degradation being the most exposed and vulnerable to its impacts (first injustice). These marginalized communities also lack adequate resources and means to adapt (second injustice), while being more susceptible to be neglected or displaced by greening and climate-resilient infrastructure and investments (third injustice) and to pay disproportionately for them (fourth injustice) (Anguelovski et al., 2016). Thus, climate injustices intersect and compound green injustices. At a broader level, official visions of the "Green(est) City" articulated by elected officials and planners as part of an urban green branding, are also criticized for contributing to or worsening green and social inequalities (I. Andersson, 2016; Garcia-Lamarca et al., 2021; Neidig et al., 2022).

In parallel with EJ activism (and sometimes as part of it), feminist movements have also been actively working to address the intersectionality of environmental issues, urban inequalities, and social justice. From Black feminism thoughts on intersectionality (Crenshaw, 1991), to environmental feminism (Sherilyn MacGregor, 2006) and feminist urbanists and geographers (Hayden, 1980; Parker, 2011; Punt 6, 2019; Sánchez de Madariaga & Neuman, 2020), activists and scholars have shed light on the complex ways in which gender, race, class, and other social factors intersect with the (lack of) access to public services and amenities, participation and recognition of rights and needs. Their collective efforts have asserted the different impacts experienced by women and other marginalized groups as well as their agency in the face of urban and environmental challenges, including issues of housing, mobility, health, use of public space, care responsibilities or political participation, among others.

In light of these critiques, it becomes evident that the current policy frameworks for achieving sustainable urban transitions and implementing green initiatives, despite increased support and awareness, still fall short of fully integrating the broader transformative objectives of social justice (Hansen et al., 2022; Li et al., 2021; Raymond et al., 2023). This highlights a significant gap in both academic literature and practical application between green planning and sustainability principles and the lived experiences of local communities utilizing public green spaces and EJ claims. This prompts important questions: Can urban sustainability and EJ find common ground? Is meaningful dialogue possible? Which insights can they share with each other? Where do grassroots initiatives intersect with municipality-

led policies? Can they coexist and provide a confluence and complementarity in our parks and streets? Navigating these intersections presents both a challenge and an opportunity for creating just and sustainable urban transitions. It is also crucial to explore the conditions and implications for truly inclusive greenspaces, and to critically assess the assumed benefits that these spaces provide. This endeavor will ultimately contribute to improving cities, making them more livable, sustainable, and just for all.

For instance, recent municipal greening projects in Barcelona illustrate beautiful renders featuring social diversity, multiple forms of interactions with the green space, and leafy and attractive vegetation (**Fig. 1**). This marketed municipal greening assumes a trickle-down effect of environmental and social benefits following new green interventions (Neidig et al., 2022). Yet, to what degree do these interventions align with the genuine needs, identities, and uses of the city diverse residents? Who gets missed or overlooked? Implementing a new green space in a neighborhood might lose its significance if, for instance, local residents cannot longer afford to live there (Oscilowicz et al., 2023), or if women and girls do not feel comfortable going there. Further, despite parks and public amenities being designed to meet the needs of residents (e.g., women, children, older people) as integral members of society, the lack of participation and barriers in their usage can leave some groups excluded (Rall et al., 2019; Yang et al., 2018). Another example can be found in urban planning participatory processes, which can, in turn, raise mistrust and disaffection among communities if they do not lead to modifications in the original plans (Kotsila et al., 2023).

Figure 1. Render of the Superblock project in Barcelona. This image corresponds to the squares and green axes in Eixample project, specifically the new square that will be created at the junction between Consell de Cent and Rocafort. Source: Ajuntament de Barcelona, 2022.

The primary motivation behind this thesis is to bridge the gap between urban greening policy strategies and the actual needs and claims –those of women and gender minorities in particular– for quality public greenspaces. By identifying and exploring the gaps, misalignments, contradictions, and potential alliances between these two frameworks, this approach can ensure that environmental objectives are synchronized with the specific needs and values of marginalized communities, making it a crucial step towards more equitable and sustainable urban planning. An approach where all the voices can collectively pave the way for a more effective and inclusive urban greening.

2. Theoretical framework and key concepts

2.1 Green planning for human well-being

Responding to the challenges of urbanization and climate change has become a central concern for governments at all levels. As we have seen previously, there is an increasing recognition of the potential to deploy urban greening to address social challenges and simultaneously attain climate and biodiversity goals. The strategic use of greenspaces to address urban challenges is conceptualized and operationalized in a variety of ways. These approaches include the framework of ES, which emphasizes how ecosystem processes and ecological functions contribute to human well-being. In addition, the concepts of UGI and NbS have played crucial roles in operationalizing the ES framework, especially since the early 2000s (Matsler et al., 2021).

ES has become one of the most prominent concepts and frameworks in both the academic and policy-making spheres, particularly in the fields of environmental management, sustainable development and biodiversity conservation. The term emerged in the late 1970s and steadily gained prominence in the subsequent decades. The Millenium Ecosystem Assessment (MEA, 2005) defines ES as the benefits people obtain from ecosystems, underlining the relationships between nature and human well-being and the multidisciplinary approach required to understand these benefits. ES encompasses a wide array of benefits that humans derive from ecosystems. Although its initial purpose was to promote awareness for biodiversity conservation (Pauleit et al., 2017) the concept has significantly expanded in its operationalization scope and relevance, sparking debates ranging from the methods for assessments and valuation to its implications for justice (Schröter et al., 2014; Sikor, 2013). International initiatives like the Economics of Ecosystems and Biodiversity (TEEB) and the Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES) have contributed to its dissemination and promotion in the planning and policy-making spheres.

Moving to the urban realm, urban ecology scholarship has increasingly applied the ES framework in cities. There is an interest in overcoming the nature-city divide and integrating environmental science with insights from urban planning and other social disciplines to understand cities as complex social-ecological systems (Alberti, 2008; Forman, 2014; Niemelä, 2011). Following the widely established classification frameworks of MEA, TEEB and the Common International Classification of Ecosystem Services (CICES) (urban) ES are categorized into four main groups (Elmqvist et al., 2018): *Provisioning ES*, including food and

water supply; *Regulating ES*, encompassing urban temperature regulation, air purification, global climate regulation, moderation of extreme events, runoff mitigation, pollination and seed dispersal, waste treatment, and noise reduction; *Supporting ES*, which includes biodiversity conservation and habitat provision; and *Cultural ES*, covering recreation and relaxation, environmental learning, sense of place, and social cohesion.

The ES framework has become widely integrated within urban sustainability and resilience agendas in the last decade, particularly in the European context (Gómez-Baggethun & Barton, 2013; Haase, Frantzeskaki, & Elmqvist, 2014; Raymond et al., 2017). Research on urban ES has rapidly progressed towards practical applications in policy-making and governance (Haase, Frantzeskaki, et al., 2014; Stange et al., 2022). These applications aim to guide urban plans and policies for the integration and management of urban areas, improving resilience and livability. Examples include the IUCN (IUCN, 2020) and the European Commission (European Commission, 2021a, 2021b), which have adopted its framework along with the UGI and NbS concepts for the effective operationalization of environmental, social, and economic objectives.

The European Commission (2013, p. 7) first prioritized UGI as a tool to deliver ES, defining it as a "Strategically planned network of green and blue spaces in urban areas, designed and managed to deliver a wide range of ES and other benefits at various spatial scales". This definition underscores the importance of an integrated approach that envisions the urban landscape with interconnected green and blue spaces, encompassing a variety of elements such as urban parks, forests, gardens, green roofs and façades, green corridors, street trees, waterways, and coastlines, among others (Hansen et al., 2017; Taylor & Hochuli, 2017). More recently, the concept of NbS has emerged as a dynamic applied approach that builds upon the ES framework to address the pressing climate and other broader socio-ecological, and even economic, challenges of cities. According to the European Commission (2021, p. 17), NbS are "Solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social, and economic benefits, and help build resilience." Additionally, NbS has recently become a focal point in research and innovation agendas, with the Commission advocating for the development and investment in NbS projects and interventions. This emphasis aims to enhance cities' ability to adapt to and mitigate the adverse impacts of climate change and urbanization (European Commission, 2021). With this, one can see a shift from traditional hard engineering practices and toward strategic and spatial planning approaches guided by a more integrated, multifunctional

performance of the instruments, projects, and concrete actions deployed in urban environments (Sekulova et al., 2020).

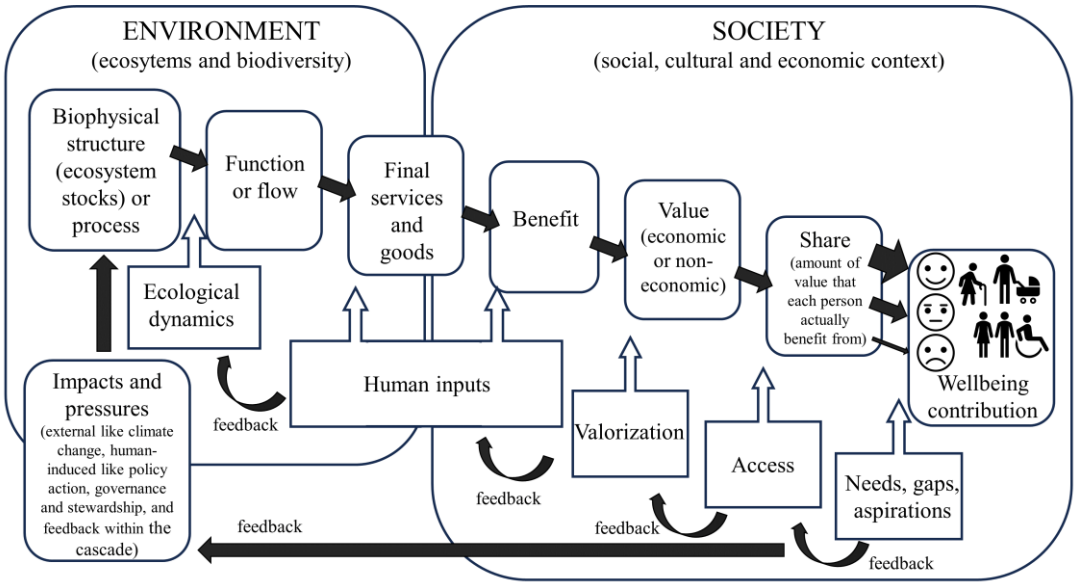

Figure 2. Ecosystem Services cascade model adapted from Potschin-Young et al. (2018) with elements of the Ecosystem Services and Well-being chain from Daw et al. (2016).

As previously stated, ES encompass the contributions of ecosystems to human well-being. However, the mechanisms by which ES are produced and eventually translated into benefits to people are not straightforward. For this reason, this thesis draws from the ES cascade model as a conceptual framework that illustrates the key steps by which UGI delivers ES and how this flow eventually translates into human well-being. (**Fig. 2**). The ES cascade is a widely cited and adapted model originally suggested by Potschin-Young et al., (2018). It approaches human-nature connections by recognizing the functional attributes of ecosystems that lead to services, as well as the benefits and values they uphold. According to this model, alterations in benefits and values influence how individuals respond to the different factors driving ecosystem change.

Additionally, the adapted version of the ES cascade model used in this thesis incorporates elements from the ES-Well-being chain from Daw et al. (2016) and as adapted in Fortnam et al. (2019). The chain model disaggregates the assumption of society as a homogenous category that benefits equally from ES, instead acknowledging the unequal allocation of benefits among various groups and individuals (T. Daw et al., 2011). This model allows for a contextualized analysis of ES that can be applied to different social groups and examines how socio-demographic aspects, such as income (T. Daw et al., 2011) or gender (Fortnam et al., 2019) can determine unequal ES flows and benefits. Analyzing the different steps by

which these benefits are produced is fundamental to a better understanding of how the UGI can be designed and maintained, how access and distribution of benefits may be unequal, and what role values attached to the social, cultural, and economic context play. Therefore, the chain model can also serve as a conceptual tool for a more detailed EJ analysis of ES. This is the reason it is merged with the ES cascade in the conceptual framework, used to develop the studies presented here. Another relevant framework for the incorporation of EJ in ES research is the one proposed by Langemeyer & Connolly (2020), which has also influenced this thesis and is expanded upon in the following chapter.

The ES cascade model used in this thesis (**Fig. 3**) starts with the biophysical elements or processes (which can also be understood as ecosystem stocks or elements from the UGI) that carry out specific ecological functions, providing services. For example, an urban tree (biophysical structure) retains rainwater through its canopy and roots in permeable surfaces (function), preventing excess runoff (service), thereby preventing urban areas from flooding and contributing to the well-being, safety, and health of its residents (benefit). The value of this service can be, for instance, indirectly reflected in the economic value of a residential unit surrounded by trees, which can limit access for low socioeconomic groups to such an area, thereby potentially excluding them from these well-being contributions. All the elements of the cascade can, in turn, generate feedback to the other components. In this case, we can argue that the valorization of flood control can influence the design of new residential units with abundant permeable surfaces and trees in their surroundings. In this case, the well-being and value assigned to an ES determine decisions regarding the planning of the UGI. However, external pressures like climate change can also influence the value assigned to this service, for instance, if flooding events are expected to increase. Similarly, policy action can prevent and manage (potential) socioeconomic segregation. For example, by applying housing policies or other governance programs.

In this thesis, I chose to use the ES framework as a starting point in the analysis of greenspace planning in urban agendas. As previously mentioned, the ES concept has become mainstreamed in the international and institutional agendas for urban sustainability and resilience. In Chapter II, I outlined the state of knowledge through a systematic literature review of ES assessments and how such assessments operationalize EJ concerns. However, when I focused on the specific planning and design of greenspaces in Barcelona (Chapter III), I decided to adopt a general approach of ES without delving into further classifications and quantifications of different groups of benefits. Instead, I opted for focusing on UGI as an ES-based planning approach, examining the pressures and impacts driving green planning

and policy. This is because, even though Barcelona stands out with a green planning department explicitly using the ES framework as a guiding principle, there was limited actual integration of concrete ES goals and metrics into local urban plans and policies. Policy documents and plans tend to most often refer to UGI terms. Evidence has indeed indicated that ES concepts, even when integrated, do not necessarily align with day-to-day decisions executed by municipal planners and routine choices made by local government agencies (Ruhl et al., 2021).

In addition, as indicated in the findings presented in Chapter II, ES assessments frequently narrow their focus to the examination of a single type or category of ES, which this thesis attempts to overcome. This trend is also suggested by Ziter (2016), which shows that urban ES scholarship tends to concentrate on quantifying individual services. This can be explained by the fact that holistic assessments of urban ES are challenging and time/resource-consuming.

Considering the above, in Chapters III and IV, I chose to adopt a holistic perspective of the ES framework and progressively incorporate framings referring to the (public) spaces, infrastructures, and planning processes that frame them. Consequently, I strategically employ the terms "public greenspaces" or UGI in Chapter III to contextualize discussions on the practical implementation of green planning within specific planning contexts. Moreover, in Chapter IV I make use of the terms public green and blue spaces (PGBS) as a crucial element of urban public space, and to better represent the local study context of the two case studies in this thesis, as perceived by its proximate residents. Therefore, in Chapter IV, I chose to focus on the general use, needs, and perceptions of PGBS (which provide multiple ES to residents), with an emphasis on such spaces and infrastructures. By doing so, the goal of this thesis is not to quantify, value, or assess a particular group of ES. Instead, I chose not to treat ES as the central unit of analysis in the research, but rather as an overarching conceptual framework that guides my research direction.

2.2 Urban Environmental Justice

EJ encompasses both a social movement and an academic field of study, and is considered a fundamental goal of environmental planning in itself (Schlosberg, 2013). I position this thesis around this assertion. EJ involves achieving fair resource distribution, inclusive political processes, and institutional recognition of communities, all contributing to the promotion of full human flourishing, regardless of race, gender, sexuality, ethnicity, or socioeconomic status. It focuses on identifying, measuring, and addressing the historic inequalities

experienced by historically marginalized groups in access to environmental goods and services, as well as toxics and hazards. EJ in the context of urban planning, that is, focusing on the built environment and community-led projects greening initiatives, is also known as Green Justice.

Marginalized communities can be defined in various ways depending on the context. Generally, they are characterized as underprivileged individuals who lack economic, political, and cultural influence due to the marginalizing impact of intersectional factors such as classism, racism, sexism, ageism, and ableism. These factors often hinder the full capacity and flourishing of both communities and individuals (Schlosberg, 2007) particularly in terms of access to economic opportunities and political representation. In this thesis, I refer mostly to working-class individuals, minority racial/ethnic groups, migrants, women and gender minorities, LGTBIQ+, children, older people, and people with disabilities or other health conditions. It is important to note that by identifying these groups, I do not subscribe to the assumption that essentializing the above-mentioned social groups makes them intrinsically more vulnerable or any other form of generalization. Instead, I adopt a systemic perspective recognizing the intricate and evolving interplay of relationships, norms, and processes.

Traditionally, EJ scholarship has predominantly examined justice through three key dimensions (Schlosberg, 2007, 2013). Firstly, *distributional justice* involves the fair allocation and accessibility of environmental goods and services for all social groups, across different spatial and temporal scales. Secondly, *procedural justice* concerns the legitimacy of decision-making processes, which involves transparency and citizen involvement. Lastly, *recognitional/interactional justice* revolves around interpersonal interactions, the provision and access to information, and perceptions of fair treatment and respect for specific identities and needs, particularly those of historically marginalized communities.

Zooming in on greening, despite the envisioned trickle-down effect and win-win solutions that UGI implementation is meant to activate, the application of the ES framework within cities has not thoroughly examined the social implications arising from inequities in access and planning of UGI, particularly in terms of potential injustices that may emerge. However, an extensive body of literature in urban EJ scholarship has extensively investigated and uncovered the historically unequal distribution of green spaces, wherein disadvantaged communities historically faced limitations in access to fewer and lower-quality green amenities (Heynen et al., 2006; McDonald et al., 2021; Nardone et al., 2021). Recent research has also provided evidence of how urban green planning can exacerbate trade-offs and

potential social, racial, and health inequities in access to ES (Anguelovski et al., 2018; Wolch et al., 2014). Such inequities can lead to processes of social exclusion, like green gentrification, defined as the implementation or redevelopment of public and/or private green amenities that contribute to rising real estate values, entrepreneurial investments, and demographic changes in the local area (Anguelovski et al., 2022). With race and income historically examined as central social determinants in the field of EJ (Coolsaet, 2020; Safransky, 2014), although the inclusion of women and LGTBIQ+ communities within the scope of environmental (in)justices is currently gaining traction in the literature (Bell, 2016; Goldsmith & Bell, 2022), research on gender still remains limited. This thesis thus gives particular attention to women and gender minorities (and their intersecting identities) and focuses on their needs, uses and barriers in relationship to urban greening.

Although the three dimensions of justice have traditionally served as a frame for justice analyses and approaches within the EJ field (Campbell et al., 2022; Fitzgerald, 2022; Mullenbach et al., 2022), there is a growing body of recent research advocating for an expansion of these justice dimensions towards a more comprehensive and inclusive approach, one that can also be more gender-sensitive. This approach incorporates emancipatory, anti-subordination, intersectional, and relational perspectives on justice (Anguelovski et al., 2020), giving due consideration to the unique, overlapping needs, capabilities, identities, and everyday experiences of marginalized groups in the context of urban greening (e.g., Amorim-Maia et al., 2022; Pérez del Pulgar et al., 2019). Furthermore, it calls for the historic recognition of processes of land loss and theft, segregation, colonization, and trauma that have shaped the unequal access to green goods, especially nature, for historically marginalized groups (Anguelovski et al., 2021).

In sum, there is an increasing recognition of the significance of urban greenspaces in tackling the social and environmental challenges of cities, and their integration into research and policy through advanced greening concepts and practices (E. Andersson et al., 2019; McPhearson et al., 2022). However, urban ecology and the operationalization of the ES framework retain a limited perspective for addressing the interrelated processes involved with environmental, social, economic, and gender inequities in cities (Langemeyer & Connolly, 2020; Marshall & Gonzalez-Meler, 2016). In fact, this perspective is often nascent or, in some cases, entirely absent from the discourse.

As a side-note, this introductory chapter intentionally offers a concise theoretical discussion of concepts from urban greening and justice inquiries, serving as a foundational platform for

more extensive theoretical explorations in the second chapter. Specifically, a more detailed review of the ES-based literature and its gaps is conducted in Chapter II, where I delve into the particular intersections between the ES framework and the EJ scholarship, providing a deeper discussion of the subject. In the subsequent chapters, certain aspects of these theoretical discussions are further elaborated.

2.3 Gender and feminist urbanism

In the exploration of urban green and blue space and the ways in which marginalization shape its use and perceptions, it becomes evident that gender is an essential and significant –yet overlooked– factor. Although gender can determine the use and benefit of (and exclusion from) urban amenities and services, it is often an understudied aspect of urban life and remains invisible in many aspects of the public discourse (Fernández Núñez et al., 2022; Kern, 2021; Sánchez de Madariaga & Neuman, 2020; Sánchez de Madariaga & Roberts, 2016; Sillman et al., 2022; Yang et al., 2018).

Throughout the academic literature, urban geographers, planners, and sociologists have found that women's experiences, perceptions, and use of the urban environment differ from those of men, with important justice implications (Fainstein & Servon, 2005; Hayden, 1980; Heynen, 2018; Kern, 2021; Parker, 2011). Women and girls have been shown to prioritize various urban services and infrastructure such as transportation, housing, and public spaces differently (Brownlow, 2006; Buckingham, 2016; Curran, 2017; Sánchez de Madariaga & Roberts, 2016; Spain, 2014). For example, since women have often tended to assume the burden of caregiving activities (e.g., bringing kids to school, shopping, visiting relatives), their transport patterns reflect different uses which are more complex than the linear home-work commuting (De Madariaga, 2016; Knoll & Schwaninger, 2020; Loukaitou-Sideris, 2020; Maciejewska et al., 2019). Moreover, contemporary scholars in feminist urban planning have urged their fields to seek a deeper understanding of gender dynamics within urban environments, challenging the concept of gender binarism and progressively acknowledging the disparities experienced by gender and sexual minorities (Beebeejaun, 2017; Heynen, 2018). Further evidence shows how the LGTBIQ+ community (i.e., lesbian, gay, trans, bisexual, intersex, queer, non-binary, and all other identities and sexual orientations) face particular forms of discrimination and violence due to their gender and sexual identity in urban (green) areas (Davis & Edge, 2022; Goldsmith & Bell, 2022).

Feminist urbanism scholarship places a strong emphasis on recognizing the significance of care activities, which encompass unpaid reproductive work. It critiques the hierarchical

treatment of these activities in the utilization and planning of both public and private spaces (Chinchilla, 2020; Gabauer et al., 2021; Punt 6, 2019). Much of this discourse highlights the historical trend of cities being designed to prioritize production and consumption over care (Punt 6, 2019; Valdivia, 2018). Besides this larger societal critique, feminist scholars also highlight the safety concerns, violence, and harassment that women and gender minorities face in urban public spaces, particularly at nighttime (Sánchez de Madariaga & Roberts, 2016).

In response, feminist urbanism promotes an inclusive city by enhancing social cohesion through the creation of spaces that encourage interaction and coexistence for all social groups, especially those from historically marginalized groups (Punt 6, 2019). For example, the incorporation of resting areas is meant to diversify the functions of urban space, promoting the creation of specific facilities in parks, recreational areas, and playgrounds. Such facilities allow people to engage in caring activities with their family and friends, as well as self-care, and become spaces of encounter and conviviality (Jennings & Bamkole, 2019). These elements are crucial in the development of a more inclusive public space that facilitates care-related activities like playing with children, meeting with relatives, and engaging in sports or walking in a safe and healthy environment (Gabauer et al., 2021). In this context, an UGI planned and evaluated with inclusivity and gender in mind can play a significant role as part of an infrastructure that can contribute to the enhancement of caregiving and self-care.

In Barcelona and beyond, the feminist urbanism group, Col·lectiu Punt 6, has been at the forefront of this work and proposed a framework to include gender and everyday life perspectives in the planning, design, and management of urban spaces through a system of five urban qualities (Col·lectiu Punt 6, 2014). These five urban qualities are considered necessary characteristics to account for the experience of everyday life and integrate a comprehensive gender equity perspective. The five urban qualities are: 1) *Spatial proximity,* measured in distance and transportation time, should be walkable by anyone and connected to other urban amenities such as services, public transport, shops, and dwellings; 2) *Diversity* encompasses social, physical, and functional mixture, allowing for multiple communities, activities, and uses in urban space. It responds to different needs based on gender, sex, age, race, socio-economic profile, and culture; 3) *Autonomy* refers to spaces perceived as accessible, safe, and reliable for people with different socio-economic and functional diversities. Those include dependent people, the elderly, or people with baby strollers; 4) *Vitality* entails the continuous and simultaneous presence of people with a high density and diversity of activities and uses in the street. 5) *Representativeness* involves the real and symbolic

visibility and recognition of the entire community. This ensures that memory, social and cultural heritage are valued with equity, as well as people's participation in urban decisions.

Combining elements of feminist urbanism and a care perspective enhances our understanding of how green planning can effectively advance urban greenspaces that benefit socially vulnerable residents and meet their daily uses and needs. In my thesis, I use these qualities as guiding principles for the evaluation of urban greening with a gender perspective.

Throughout the interdisciplinary inquiries of this thesis, gender-related concepts are examined to varying degrees of depth. Gender serves as the primary lens through which I chose to analyze intersectional forms of inclusion and justice. However, the use of gender has different implications in different areas of discourse, which I will outline below. Therefore, it is necessary to establish a conceptual delimitation to provide clarity in this regard and address any potential ambiguities.

A *gender perspective*, or *research with a gender perspective*, implies that gender is integrated into research design and consistently accounted for throughout the research process, even if it is not necessarily the primary focus of analysis. In contrast, *feminist research* places gender at the center of inquiry and the research process (Hesse-Biber, 2013), privileging women and gender minorities' issues, voices, and experiences (Brannelly & Barnes, 2022). Unlike research with a gender perspective, feminist research is value-driven, with the main goal being to support social justice and transformation, often creating links between research, activism, and policy (Hesse-Biber, 2011). Feminist research frequently analyzes gender within the intersectionality of other identity standpoints, such as sexual orientation, ethnicity, class, or nationality. Furthermore, feminist research praxis emphasizes the relationship between the researcher and the researched person or group in order to balance power dynamics (Hesse-Biber, 2013), and critically attempts to acknowledge and reflect upon such imbalances.

Feminist urban researchers have further refined existing methods to explore socio-spatial dynamics of interest within the urban space. Many integrate qualitative and mixed methods in their research to better understand and illuminate women's experiences in the city. This includes techniques such as focus groups, exploratory walks, photovoice, and participatory action research (Ortiz Escalante & Gutiérrez Valdivia, 2015). Additionally, feminist urbanism scholars have delved into effective practices and strategies to increase the presence of women and other underrepresented groups in urban planning (S. Hesse-Biber, 2012; Kindon, 2003; McIntyre, 2003).

In this thesis, I employ both gender and feminist research approaches. In Chapter II, I apply the gender perspective by considering gender as a social variable in the assessment of justice perspectives in urban ES studies. In Chapter III, I conduct an assessment with a more in depth gender perspective on greenspaces, examining how gender is integrated into urban greening. Finally, in Chapter IV, I position myself within a feminist approach by employing feminist methods and expanding the scope to include women and non-binary individuals as research participants and community advisory board.

As previously mentioned, feminist research often centers on intersectional analyses. *Intersectionality*, first coined by Kimberlé Crenshaw (1989) builds on critical race theory and the black feminist movement. Since this initial introduction, intersectionality has proven to be a prolific concept with significant theoretical and methodological engagement among feminist and antiracist scholars (Cho et al., 2013). The intersectionality approach recognizes the interconnectedness of social characteristics such as gender, race, class, age, disability, and sexual orientation, among many others. This interplay can lead to privilege, discrimination, and oppression, depending on the context and the different axis at play (Rodó-Zárate, 2021). Intersectionality goes beyond identity categories; it encompasses the intricacies crucial for understanding deeply rooted social, political, and structural inequalities (Cho et al., 2013). More importantly, it transcends overlapping or summatory forms of oppression, towards a holistic understanding of the mutual co-constitution of each identity and experience, and how this translates into a particular form of (in)justice (Rodó-Zárate, 2021). In this thesis, I use an intersectional approach to comprehensively explore how different axes of power are expressed in the use and perceptions of public green and blue spaces, and how specific communities are affected in their daily urban life.

3. Research questions

This section outlines the formulation of research questions that guided this investigation. The research questions were crafted to provide a clear and structured framework for the subsequent analysis, ensuring that each article addresses specific aspects of the overall research goals.

Through the ES framework, municipal greening agendas are increasingly embracing integrative, government-based approaches to the creation and management of urban green infrastructures that simultaneously address environmental, economic, and social challenges. While a substantial body of literature exists on the topic of urban green planning and implementation, it is not clear whether the environmental and social benefits derived from

such greenspaces are equally shared among different communities. Furthermore, it remains uncertain to what extent this consideration is integrated into urban greening research and policy.

More specifically, the overarching research questions that this thesis aims to address are inspired by the fact that there is still a significant gap in our knowledge regarding 1) the extent to which urban greening research and policy takes into consideration the pursuit of justice in planning processes and outcomes, and 2) the ways in which uneven access, use and perceptions of the benefits of UGI manifest and take root, as mediated by social categories –particularly gender– and by urban development processes experienced by residents –that is, gentrification, touristification, and the COVID-19 pandemic. In view of these gaps, the research questions I try to answer are the following:

- **Chapter II**: Which EJ perspectives and dimensions have been incorporated into urban ES assessments? How do these two fields of research interact with each other in the academic literature?
- **Chapter III**: To what extent do leading examples of urban green planning incorporate social justice in general, and gender equity in particular? What considerations related to justice and gender equity do cities incorporate as guiding goals for their green strategies and practices?
- **Chapter I**V: What changes have women and non-binary people experienced in the use and perception of PGBS during the COVID-19 pandemic? How have those uses and perceptions been shaped by concurrent perceptions of gentrification and touristification?

The process of formulating each research question was neither simultaneous nor straightforward; it progressed gradually during the development of the thesis. Addressing each article along with its guiding research question led to the emergence of new insights and perspectives. These revelations uncovered further avenues for investigation, prompting the formulation of subsequent questions and identifying gaps to address. This iterative approach enabled a continuous refinement of the research scope and objectives, ultimately fostering a deeper understanding of the literature. Consequently, answering each research question played a pivotal role in propelling the research forward, aiding in the formulation and delimitation of subsequent questions and steps in the thesis.

As illustrated in Table 2, Chapter II started with a comprehensive global review aimed at establishing the current state of knowledge in how EJ is being addressed and integrated

within research on urban ES. However, while delving into the specific inquiries of Chapter II, I encountered emerging questions and identified gaps related to the various social groups considered in ES assessments. Notably, the omission of gender as a significant social factor in EJ examinations was particularly striking. Additionally, I observed that a considerable portion of ES analyses primarily focused on distributional assessments. Meanwhile, procedural and recognitional analyses remained relatively scarce. This observation led to my decision to focus the subsequent empirical chapters on the procedural and recognitional justice aspects of urban greening, with a particular emphasis on gender inequities.

In Chapter III, I directed my attention towards UGI as an ES-based planning approach. I sought to scrutinize how cities translate broad equity aspirations into tangible objectives and policies. Consequently, I embarked on a detailed examination of justice operationalization within cities, achieved through the analysis and comparison of urban greening plans and strategies. However, during this process, I recognized the importance of contrasting institutional goals with the actual needs and perceptions of city residents. This investigation aimed to gauge the extent to which these goals are effectively communicated to the end-users of the UGI.

This realization prompted the focus of Chapter IV on the utilization and perceptions of PGBS. Moreover, I adopted a feminist participatory approach to gain deeper insights into the perspectives and needs of women and non-binary individuals. By including non-binary individuals, I aimed to foster a more inclusive approach, challenging gender binarism and providing opportunities to learn from LGTBIQ+ experiences, a subject that remains relatively unexplored in urban greening and EJ research. Moreover, in Chapter IV, I chose to narrow the focus to the neighborhood scale. This approach allowed for a more in-depth examination of the factors influencing the unique local environment and the constraints imposed by urban dynamics, which have a broad impact on public space in general, and particularly on PGBS. By scrutinizing La Barceloneta beach as a blue space experiencing pressures from tourism, and the Sant Antoni superblock as a public greenspace undergoing gentrification, this neighborhood-centric perspective also provided valuable insights into the determinants that influence the characteristics of green planning. It shed light on their intricate interplay with processes of gentrification and touristification. Lastly, the advent of the COVID-19 pandemic introduced new questions and avenues for research. This included an exploration of the shifts in the use of PGBS, and related policy implications.

Table 2. Summary table with the perspectives, research gaps, key concepts and contributions for each chapter.

	Chapter II	**Chapter III**	**Chapter IV**
Perspective from the overall goal	What does the scientific literature on ES say about justice? What is missing from current analyses?	What do the policies, strategic plans and city planners and decision-makers say about applying justice in UGI planning?	What do the women and non-binary residents say about their evolving perceptions on the use of PGBS? How do those connect with broader justice considerations?
Research gap addressed	Theoretical gap: Need for EJ theory to be applied to ES research issues (and vice-versa) in order to generate new insights and push new theory	Practical-Knowledge gap: Lack of understanding of how urban planning professionals implement gender and social justice in greenspace planning and what constraints their work	Knowledge Gap: research on the evolving perception and use by women and non-binary people of PGBS when affected by the COVID-19 pandemic, and in the broader context of gentrification and touristification
Key concepts	ES framework and EJ	UGI planning, with particular focus on its publicly accessible green and blue elements. Social equity and inclusivity	PGBS as part of the public space. Displacement and sense of community
Main scientific contribution	To provide the first complete, systematic and critical examination of how urban ES assessments have conceptualized and operationalized justice.	To provide a structured analysis of the conceptualization and operationalization of EJ and gender equity within urban and environmental departments and provide recommendations to policy and practitioners.	To evaluate the changes in the use and perceptions of women and non-binary residents in PGBS in relationship with other simultaneous urban processes including the COVID-19 pandemic, gentrification and touristification.

4. Transversal research goals

More broadly, building upon the preceding theoretical framework and research questions, the overarching goal of this thesis is to critically analyze the extent to which urban greening research, policy and planning, drawing on ES and UGI concepts, address environmental, social and gender inequities. To comprehensively investigate this overarching goal, this thesis addresses the following transversal research goals:

- To advance the conceptual understanding and operationalization of the ES framework under the perspective of environmental, social, and gender inequities.
- To build upon the concepts and tools developed by the EJ scholarship and the feminist urbanism perspective, and apply them to urban greening research to expand

the theoretical boundaries of how justice is perceived, applied, and operationalized at the local level and across different social groups.

- To illustrate the state of knowledge and practices related to urban greening with regard for environmental, social, and gender inequities. This involves analyzing empirical evidence from the international context of research, policy focused on the municipal level, and neighborhood residents' perceptions.
- To develop and expand methodological approaches to studying urban greening, bringing together quantitative, qualitative, and participatory methods and tools, examining various data sources including scientific literature, policy documents, interviews with key stakeholders, and residents using PGBS.
- To provide practical lessons and recommendations to policy and practice in the planning and management of urban green infrastructure and its interactions with other urban processes.

These goals are interwoven across various chapters of this manuscript. The goals and contribution of this thesis are considered by each of the core II-IV Chapters in the context of the following specific objectives:

- **Chapter II** systematically reviews the extent to which urban ES assessments have incorporated EJ perspectives, considering the operationalization of different justice and greening aspects, and pointing out their complementarities, knowledge gaps, points of conflict, and areas of confluence.
- **Chapter III** identifies how social justice and gender equity are being considered and incorporated into urban greening policies and strategies, with a focus on the case study of Barcelona, Spain.
- **Chapter IV** determines the changes in the use and perception of PGBS by women and non-binary residents of two neighborhoods undergoing gentrification and touristification processes amidst the COVID-19 pandemic in Barcelona, Spain.

Table 1. Summary table of research chapters.

	Chapter II	**Chapter III**	**Chapter IV**
Title	Tracing and building up environmental justice considerations in the urban ecosystem services literature: A systematic review	Greening plans as (re)presentation of the city: toward an inclusive and gender-sensitive approach to urban greenspaces	Gendered use and perceptions of public green and blue spaces in gentrifying neighborhoods during the COVID-19 pandemic

Geographical scope	Global review and analysis of published academic articles and reviews	Local case study (Barcelona) and international contextualization (Europe and North America)	Two neighborhoods as case studies: Sant Antoni and La Barceloneta (Barcelona)
Type of objective	Theoretical-descriptive: critical analysis of the state of knowledge and further theorization	Empirical-Analytical	Empirical-Analytical
Publication stage	Published in *Landscape and Urban Planning*	Published in *Urban Forestry and Urban Greening*	Submitted to *People and Nature*

5. Methodological framework

This section provides an overview of the research methodology adopted in this thesis to effectively address the research questions and attain the study's defined objectives. Certain parts of this section may exhibit partial overlap or repetition with the methodological sections of the Chapters II-IV. To ensure the coherence and integrity of each chapter as stand-alone research papers, I have maintained its original format. Here, I present a common methodological framework that unifies all chapters, aiming to build a cohesive research narrative throughout the thesis. This approach allows for an integrated overview of methods while preserving the individuality of each chapter's contribution to the overall study.

Table 3 provides a comprehensive overview of the methodological and research design choices employed in each chapter of the study. I outline the research approaches and their contributions. Additionally, I highlight the diverse data sources, collection techniques, data analysis methods, and ethical considerations pertinent to each chapter. This overview emphasizes the research efforts of the doctoral thesis and its contribution to the broader academic community to which I aim to contribute. In Chapter II, I developed a quantitative literature review approach, using a systematic standardized protocol (PRISMA). In Chapter III, I adopted a qualitative case study method, building from a qualitative comparison of international greening plans of cities to then focus into the Barcelona case through documents analysis and semi-structured interviews. Last, in Chapter IV I employed a mixed methods with a feminist intersectional participatory approach and a community advisory board, combining a quantitative survey and qualitative focus groups, exploratory walks, and semi-structured interviews.

Table 3. Methodological and research design from each chapter.

	Chapter II	**Chapter III**	**Chapter IV**

Methodological research approach	Deductive: quantitative	Inductive: qualitative	Deductive-inductive: mixed methods
Contribution to the Literature	Urban ES, EJ	Green justice (EJ area focused on greenspaces), gender-sensitive planning and policy	Green justice, gentrification studies, public health (COVID-19) and feminist urban studies
Research approach	Dimensions and manifestation of environmental (in)justice	Gender perspective to green planning	Intersectionality, feminist research, community-engaged participatory research
Data source	Quantitative data extracted from coding peer-reviewed published articles and reviews available at Scopus and Web of Science academic databases	Strategic policies and plans of 6 Global North cities, Barcelona official reports, and key stakeholder interviews	Community advisory board meetings, qualitative/quantitative data from women and non-binary residents of the two neighborhoods as case study.
Data collection	Systematic literature review through a standardized assessment (PRISMA) protocol-based criteria of inclusion and predefined coding categories	Narrative and analytical review of key policy documents, semi-structured interviews through snowball sampling	Street intercept surveys, focus groups with participatory mapping and exploratory walks, semi-structured interviews through snowball sampling, and social media dissemination
Data Analysis	Quantitative content analysis of code frequencies and conceptual analysis	Qualitative content analysis of documents, qualitative analysis of interviews' transcripts with deductive thematic, and grounded theory coding using NVivo software	Descriptive statistical analysis of survey results, qualitative analysis of focus groups and interviews' transcripts with deductive thematic, and grounded theory coding using Atlas.ti software
Ethical Considerations	No need for ethical approvals.	Ethical approval by university committee. Informed consent form and signatures collected.	Ethical approval by university committee. Informed consent form and signatures collected. Monetary compensation to participants

6. Case study description

This thesis takes the city of Barcelona as main empirical case study in Chapters III and IV. The Barcelona municipality is the capital of the Catalonia region, located on the Mediterranean coast of North-East Spain. It holds a total population of 1.66 million of inhabitants as of 2021, spread across its 10 districts and 73 neighborhoods (Ajuntament de

Barcelona, 2021a). When accounting for the broader metropolitan area, this figure increases to 3.30 million residents.

Barcelona city comprises an area of 10,135 hectares, with its boundaries mostly delineated by biophysical elements: the Mediterranean coastline on the East side, and the Collserola Mountain on the West. Collserola has been a protected park since 1987 and is mostly covered by a Mediterranean forest ecosystem (Parc de Collserola, 2023). Barcelona reached its maximum urban expansion within its natural boundaries and the nearby municipalities on each size of the rivers: the Llobregat river on the South, the Besòs river on the North.

While the city contains a dense population with 16,325 inhabitants per km^2, this density displays significant variations across different districts. The most densely inhabited district records approximately 36,000 inhabitants per km^2 (Eixample district), in contrast to the least densely populated one (Sarrià-Sant Gervasi), which registers a figure of 7,492 inhabitants per km^2 (Ajuntament de Barcelona, 2021a).

This variation is also reflected in the distribution of greenspaces. Given its compact urban layout, Barcelona exhibits a comparatively low proportion of urban green spaces per resident (7 m^2) in contrast to its European counterparts (Fuller & Gaston, 2009). However, if we consider the forested area of Collserola, it increases to 17.2 m^2 per capita. Furthermore, the distribution of the urban greening is not homogeneous across the city, ranging from 2 m^2/resident in the district of Eixample to 17.5 m^2 in Sants-Montjuïc (Ajuntament de Barcelona, 2021b).

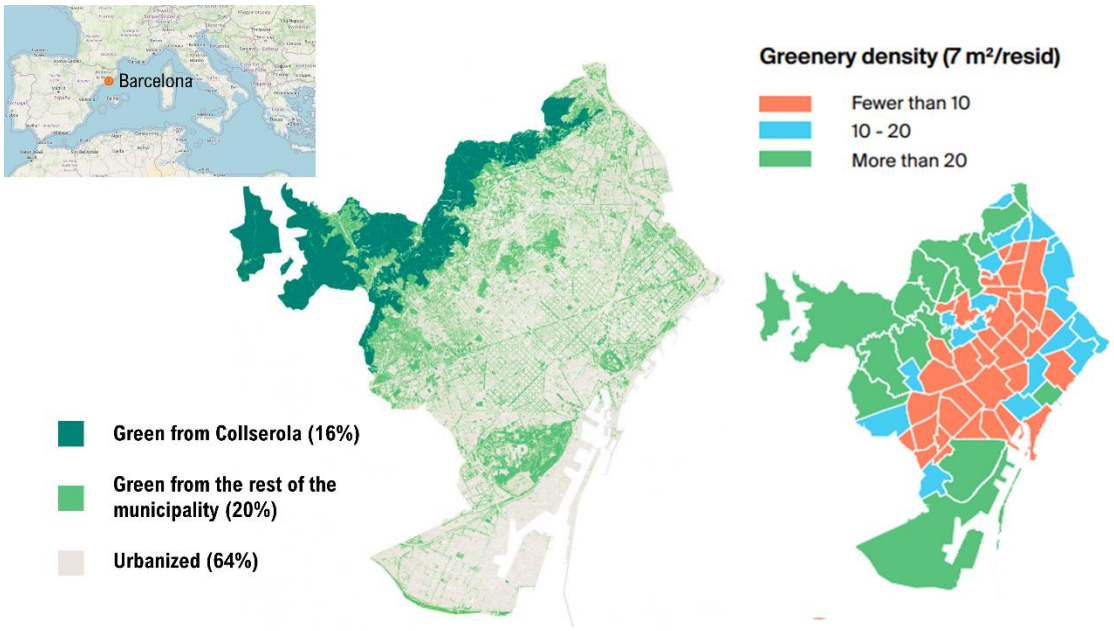

Figure 3. Map of Barcelona situation and its green canopy cover surface and density. Greenery density in the right excludes the forested area of Collserola. Sources: Pla Natura 2030, Ajuntament de Barcelona; Open Street Map.

Nevertheless, if we consider different UGI components, Barcelona comprises a relatively high ratio of street trees (with more than 120 trees per 1000 inhabitants) compared to the average range of 50-80 trees in other European cities (Pauleit et al., 2002). With the aim to increase the total surface of green canopy, the City Council is currently putting efforts in implementing small-scale UGI components such as green roofs, green façades, and the Superblock program (Ajuntament de Barcelona, 2017). The Superblock program is an extensive planning initiative aimed at transforming streets design driven by a vision of urban regeneration that emphasizes greener and healthier surroundings while addressing social concerns, climate mitigation, improved livability, and economic stimulation (Ajuntament de Barcelona, 2022; Eggimann, 2022; Mueller et al., 2020). The plan also seeks to enhance street accessibility and inclusivity. The program encompasses various street transformations for pacification and urban greening, like creating green pedestrianized avenues, establishing urban parks, and forming new green axes and squares (Ajuntament de Barcelona, 2022).

The City Council of Barcelona endorsed its first strategic document on the urban green infrastructure in 2013, named the "Barcelona Green Infrastructure and Biodiversity Plan" (Ajuntament de Barcelona, 2017). This plan was designed to amplify and enhance the city's urban green infrastructure. Subsequently, a new version of this strategic policy was launched under the name of "Pla Natura Barcelona 2021-2030", aiming to sustain and advance the UGI and biodiversity of the city. Complementing these greening strategies, the City approved the "Pla Clima 2018-2030", a climate action plan outlining mitigation and adaptation

strategies to counteract climate change impacts in the city. Notably, this plan prioritizes augmenting green spaces as a pivotal adaptation strategy to climate change's impacts and to improve citizen well-being. This document was reinforced with the "Declaració d'Emergència Climàtica" a climate emergency declaration in January 2020, propelling a series of measures expanding previous commitments and goals (Ajuntament de Barcelona, 2020).

For this thesis, I chose Barcelona as a case study for several reasons. First, it serves as an example of a compact Mediterranean city with a relatively low proportion of green space, which distinguishes it from previous studies conducted in Northern European cities (Haase, Larondelle, et al., 2014). In Barcelona, a city known for its high population density and limited availability of open spaces, the importance of public green and blue areas becomes particularly pronounced due to historical scarcity and the current and projected impacts of climate change. The Barcelona "Pla Clima 2018-2030" identifies four primary climate change challenges facing the city: rising temperatures, diminished water resources, increased risk of flooding, and coastal erosion due to rising sea levels. Additionally, Barcelona has grappled with significant air quality issues in recent decades, primarily stemming from traffic emissions (Moreno-Jiménez et al., 2016).

Second, Barcelona is characterized by its rich cultural and social diversity, and it offers a range of green public spaces that have evolved to suit local conditions. These spaces include the beach, the peri-urban forest of Collserola, as well as various public gardens and parks (Honey-Rosés, 2022). Conversely, neighborhood social transformations, including social inequities, gentrification, and the influx of tourism, have had significant implications for how Barcelona's residents perceive their local surroundings and communal areas (Anguelovski et al., 2017; Oscilowicz et al., 2020; Pérez del Pulgar et al., 2019). Moreover, low-income and migrant communities from the Global South in Barcelona tend to experience higher levels of segregation compared to other social groups, and they often face more adverse socioeconomic and environmental conditions (Anguelovski, 2013; Baró et al., 2019; Lagonigro et al., 2018; Moreno-Jiménez et al., 2016).

Third, Barcelona stands out as a compelling case study showcasing the implementation of transformative urban sustainability and justice principles, notably under the governance of the Barcelona en Comú party since 2015. The City Council's ambitious discourse has spearheaded the incorporation of social economy, citizen participation, feminism, urbanism, and ecology, resulting in initiatives that have gained global recognition within municipal

policies (see, for instance, Borge et al., 2022; C40 Women4Climate, 2019; Kussy et al., 2022; Mueller et al., 2020; Satorras et al., 2020; Villarroya & Casals-Balaguer, 2022).

7. Structure of the dissertation

This dissertation is structured around three original research papers, presented in Chapters II-IV. The introductory chapter (Chapter I) sets out the overall objectives and establishes a common theoretical and methodological framework. Following these papers, Chapter V integrates a general discussion and key conclusions, providing a comprehensive overview of the research. All the scientific articles have been led by me with collaborative contributions from other co-authors at different stages of the research process. As specified on the first page of each respective chapter, at the time of submitting this thesis, two research articles had already been published (Chapters II and III), while the third has been submitted for publication (Chapter IV).

In Chapter II, I conducted a systematic literature review to explore the key factors for effectively integrating an EJ perspective into evaluations of urban ES. Specifically, I quantitatively analyzed the treatment of distributional, procedural, and recognitional dimensions of EJ and their correlation with various categories of urban ES, including UGI elements and types of ES. Through this, I gained a global overview of how research on urban ES understands and executes justice and equity assessments, as well as identifying their main gaps and strengths.

In Chapter III, building on the findings from Chapter II, I conducted a case study analysis at the municipal level to examine how greening policy strategies incorporate considerations of justice and gender. To provide international context and justify the choice of case study, I began with a comparative analysis of five different strategic greening plans in Europe and North America. Subsequently, I selected Barcelona as the primary case study due to its pioneering efforts in enacting comprehensive equity and gender policies within the municipal realm, particularly in relation to its greening objectives. Through the use of qualitative methods, including semi-structured interviews with key stakeholders and a review of policy documents, I identified three areas of action—closely related to the three dimensions of EJ—by which the Barcelona municipality is integrating equity and inclusivity concerns in its greenspace design and implementation.

In Chapter IV, my intention was to complement Chapter III by examining the actual use and perceptions of greenspaces by city residents, zooming in at the neighborhood scale. In Barcelona, neighborhoods function as distinct entities with their own historical and

geographical attributes, making them a significant scale for analysis to gain deeper insights into the local dynamics of various urban processes that influence the lives of their inhabitants. I chose to focus on the impacts of gentrification, touristification, and the COVID-19 pandemic, as these have notably shaped the everyday routines and utilization of public spaces for Barcelona's residents in recent years. Building upon feminist urbanism principles and the qualitative groundwork laid out in Chapter III, I adopted an intersectional feminist approach combined with community-engaged participatory methods to identify the different barriers and needs that women and non-binary people perceive in their daily use of greenspaces.

Chapter V synthesizes and discusses the main findings and theoretical contributions to the academic fields of green planning, ES, EJ, and gender equity. Additionally, this chapter outlines potential areas for further research, highlights the main conceptual and methodological limitations, and offers recommendations for policy and practice, emphasizing the key implications of this thesis for the planning, management, and decision-making spheres.

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CHAPTER II. TRACING AND BUILDING UP ENVIRONMENTAL JUSTICE CONSIDERATIONS IN THE URBAN ECOSYSTEM SERVICE LITERATURE: A SYSTEMATIC REVIEW

Abstract

The concept of ecosystem services (ES) has mainstreamed as an interdisciplinary framework in the urban sustainability and resilience agenda. While the uptake of ES in urban areas is deeply entangled with multiple values, trade-offs, institutions, management and planning approaches, there is still a lack of a comprehensive and systematic framework to address environmental justice (EJ) in urban ES assessments. This article presents a systematic literature review to examine what factors are critical for the effective inclusion of an EJ lens in urban ES appraisals. More specifically, we assessed how distributional, procedural and recognitional EJ dimensions have been addressed, and in relation to which types of urban ES. Our results reveal that EJ considerations are currently focused on the (un)equal distribution of ES and the associated green and blue infrastructure with regard to socioeconomic groups, with special attention to income and race/ethnicity as the main mechanisms of social stratification. There is also a predominant focus on regulating and cultural ES, analyzing their role on resilience and adaptive capacity on one hand, and recreational values, social cohesion and place-making on the other. In this review, we also evaluate the interconnected dimensions of justice and their constraints, and lay out pathways for new research into intersectional and restorative approaches to justice in ES assessments. Finally, we interrogate what the role of urban ES-based planning might be in making more inclusive and just cities and explore its implications for policy and practice.

Keywords: Green spaces; Urban green infrastructure; Cities; Trade-offs; Equity; Environmental benefits.

This chapter corresponds to the following published article:

Calderón-Argelich, A., Benetti, S., Anguelovski, I., Connolly, J. J. T., Langemeyer, J., & Baró, F. (2021). Tracing and building up environmental justice considerations in the urban ecosystem service literature: A systematic review. Landscape and Urban Planning, 214, 104130. https://doi.org/10.1016/j.landurbplan.2021.104130

1. Introduction

Over the last decade, the concept of Ecosystem Services (ES) has been mainstreamed as an interdisciplinary guiding framework in urban sustainability and resilience agendas (Gómez-Baggethun and Barton, 2013, Haase et al., 2014, Raymond et al., 2017). Cities worldwide are increasingly incorporating ES-based approaches to inform decisions over green and blue infrastructure (see Box 1) planning and management (Demuzere et al., 2014, Hansen et al., 2015) with the aim to become inclusive, safe, resilient and sustainable (UN, 2015). Nevertheless, the development of urban ES assessments has so far not fully integrated an Environmental Justice (EJ) perspective (cf. Ernstson, 2013, Langemeyer and Connolly, 2020, Enssle and Kabisch, 2020). As a result, decisions and interventions that do not include a broad range of urban EJ issues might perpetuate or even exacerbate environmental inequalities around benefits from nature and ES among economically, socially and racially disadvantaged groups (Haase et al., 2017, Wolch et al., 2014).

The ES framework has recently been criticized for reflecting an anthropocentric understanding of human-nature relationships and for privileging economic valuation approaches (Schröter et al., 2014, Sikor, 2013), which may lead to the commodification of ecosystem processes and structures. This is already illustrated by the green branding tools that cities tend to increasingly incorporate in their greening projects (Garcia-Lamarca et al., 2021, McDermott et al., 2013). Furthermore, ES assessments are often underpinned by prescriptive and normative assumptions (Kotsila et al., 2020) expressed in broad claims like, for example, that all social groups will derive equal health and well-being benefits from the ES provision of a new greening intervention. These aspects may neglect values embedded in social structures and perpetuate the unidimensional and techno-economic framing of ES approaches (Lele et al., 2018, Lele, 2013). At the same time, researchers increasingly acknowledge that the translation of ES into human benefits is deeply entangled with multiple perceptions, institutions, and infrastructures, especially in urban areas (Andersson et al., 2019, Elmqvist et al., 2018, Ernstson, 2013). These factors intervene in the co-production of ES benefits and therefore need to be carefully dissected in order to avoid unequal distribution of and access to ES for marginalized groups, their exclusion from the decision-making processes and the disregard of their specific needs, values, demands and identities (Anguelovski et al., 2020).

We acknowledge that some of the literature on ES has considered questions previously examined by the longstanding EJ scholarship (Dawson et al., 2017, Mohai et al., 2009,

Walker, 2011), such as concerns over unequal access to environmental resources and decision-making power (Costanza, 2003; Heynen and Lindsey, 2003, McAfee, 1999, Tschakert, 2007, Wilson and Howarth, 2002). These early ES analyses broadly explored the links between ES, well-being, poverty alleviation and sustainable environmental management, mainly in rural livelihoods and natural reserves. For instance, Payment for Ecosystem Services (PES) —a policy of compensatory market-based tools for ecosystem protection— has been widely critiqued in communities of the Global South for their inability to give proper acknowledgement to issues of inclusion and poverty alleviation while creating conflicts of land use (Chaudhary and McGregor, 2018, Chaudhary et al., 2018, Kosoy and Corbera, 2010, Pascual et al., 2014, Schreckenberg et al., 2018, Sikor, 2013). On a similar line, the current IPBES framework has integrated different worldviews and types of knowledge into its assessments through the Nature's Contribution to People approach, emphasizing the need for a combination of generalized understandings and localized, context-specific perspectives of nature's benefits vis-à-vis conservation policies (Díaz et al., 2018, Kadykalo et al., 2019, Martin et al., 2016). However, while these efforts demonstrate a greater incorporation of plural views of nature in decision-making, ES research regarding processes of urbanization and development remains relatively new, and there is still a lack of systematic incorporation of urban EJ concerns (Haase et al., 2017; F. Marshall et al., 2018).

Recently, researchers have been calling for a greater focus on EJ in the urban ES scholarship in order to integrate broader conceptions of justice (See Box 1) into a better diagnosis of urban environmental and health inequalities (Aragão et al., 2016, Berbés-Blázquez et al., 2016, Ernstson, 2013, Langemeyer and Connolly, 2020, Marshall and Gonzalez-Meler, 2016) while fostering more representative and legitimate decision-making processes (Andersson et al., 2019, Langemeyer et al., 2015, Maes et al., 2018). Furthermore, some urban ES researchers are increasingly incorporating social dimensions within their assessments, which opens new terrain for EJ analysis, including novel socio-economic and non-monetary valuations of ES (Amorim Maia et al., 2020, Camps-Calvet et al., 2016, Depietri et al., 2016, Langemeyer et al., 2018), analyses of ecosystems trade-offs (Turkelboom et al., 2018), ecosystem disservices (Escobedo et al., 2011, Von Döhren and Haase, 2015), and broad recognition of the diverse socio-cultural values held by different groups (Bertram and Rehdanz, 2015, Fischer et al., 2018, Jacobs et al., 2016, Swapan et al., 2017).

These efforts towards a more comprehensive urban ES-based application framework that systematically incorporates justice in the urban greening governance partially originates in the recent EJ scholarship which has traditionally highlighted existing inequities in access to

ES provision as part of green infrastructure interventions (Byrne and Wolch, 2009, Meerow, 2020, Shokry et al., 2020, Wolch et al., 2014). Put differently, environmental amenities and greening policies in urban planning are not exempt from trade-offs and potential social and racial inequities in the way new green infrastructure is being deployed (Connolly, 2019, Nesbitt, Meitner, Sheppard, & Girling, 2018). They can intensify social-spatial inequities by triggering processes of social exclusion while leaving historical grievances untouched (Anguelovski et al., 2018, Connolly and Anguelovski, 2021, Gould and Lewis, 2017, Rigolon and Németh, 2019, Safransky, 2018, Schlosberg, 2013, Wolch et al., 2014)

Consequently, there is a scholarly need for a greater confluence —both conceptual and practical— between EJ and urban ES. Such an endeavor is needed to bring new light to our understanding of the diverse environmental relations of different population groups, regarding questions of unequal access, perceptions, and responsibilities vis-à-vis urban ES-based agendas. This agreement would also serve as the foundation for ensuring that plural values and demands are recognized in the political and institutional schemes that shape the ES-based environmental governance model. In turn, such ES research that bridges interdisciplinary EJ concepts and methods can challenge the vision of EJ as a static and idealistic concept rather than a dynamic and pluralistic one, which urban communities actively construct in their specific contexts (Brand, 2015). Thus, expanding the conception of urban green and blue infrastructure in this way is required to account not only for (un)equal material distribution but also for the actual delivery of benefits and embedded values, and the participation of different social groups in the co-production of ES —or lack thereof (Andersson et al., 2019, Anguelovski et al., 2020, Safransky, 2018).

Box 1. Glossary of major terms relevant to the key topics of discussion of this review.

Urban Ecosystem Services (UES) — Benefits that humans obtain from urban ecosystems and their components (Gómez-Baggethun and Barton, 2013, Mader et al., 2011, Millennium Ecosystem Assessment, 2003).

Green and Blue Infrastructure (GBI) — A strategically planned network of green and blue spaces in urban areas, designed and managed to deliver a wide range of ES and other benefits at various spatial scales (Hansen, Rall, Chapman, Rolf, & Pauleit, 2017).

Environmental Justice (EJ) — Plural set of conditions related to the fair distribution of resources, inclusive political processes, and institutionalized recognition of communities that allow for full human flourishing (Schlosberg, 2013).

Equity — Used here as the just distribution of environmental goods and burdens.

Fairness — Used here as individuals' perceptions of justice arising from a judgment process (Graham et al., 2015).

Distributional Justice — Also known as distributive justice, it refers to the equitable allocation of and access to material costs and benefits for all social groups in both spatial and temporal terms (Schlosberg, 2013).

Procedural Justice — Also known as participatory justice, it refers to participatory and inclusive decision-making processes and it is linked with transparent and meaningful citizen involvement (Schlosberg, 2013).

Recognitional Justice — Also known as interactional justice, it is related to interpersonal interactions that allow people to express themselves in their own way, provision and access to information, and respect for different needs, values, preferences and identities (Langemeyer & Connolly, 2020).

Restorative Justice — Also known as reparative justice, it is based on acknowledging histories of social trauma and taking recovery measures (Aragão et al., 2016, Draus et al., 2019, Draus et al., 2019).

This systematic review paper takes a step toward a combined ES-EJ perspective by examining how questions of EJ are currently being incorporated into urban ES studies and proposes new directions to bring urban EJ and ES together in ways that can foster more inclusive, sustainable, resilient and healthy cities. Our goal is to identify potential intellectual alliances through the incorporation of the EJ lens into the assessment of urban ES and to highlight the two fields' complementarities, knowledge gaps, points of conflict, and areas of confluence.

2. Material and methods

In order to identify and analyze the scientific literature relevant to our research objectives, we carried out a quantitative systematic review, similarly to prior ES reviews on factors of urban greenspace provision and governance (Boulton et al., 2018, Breen et al., 2020), biodiversity and ecosystem functioning in cities (Haase et al., 2014), ES and human-well-being (Cruz-Garcia et al., 2017) and the conceptualization and involvement of stakeholders in urban ES research (Luederitz et al., 2015). The novel contribution of our review is that it interrogates the operationalization of EJ within urban ES assessments, which has not been previously completed nor addressed in the literature. The process of data gathering, screening and analysis followed the widely used protocols of the PRISMA Statement for systematic reviews (Moher et al., 2009), as depicted in Fig. 1. We first gathered potentially relevant

papers using the ISI Web of Science and Scopus, two well-recognized and widely deployed databases. We performed a search of peer-reviewed articles and reviews published in English. The search string used is available in Table S1 of the Supplementary data. We obtained (on 8th January 2020) 136 records from the Scopus database and 189 from the ISI Web of Science. Following the database search, 15 additional papers that referred to urban ES and EJ but not as the main part of their analysis (and thus were not identified in our search string) were suggested by authors with expertise in this area and, after confirmation of relevant content, added to our list. We finally obtained a merged database of 241 identified unique records. From these initial search results, we screened the abstracts for their relevance to the research goal, using the following criteria: 1) Explicit mention and examination of ES; 2) Explicit relation of the ES framework to EJ, social equity or perceptions of fairness; 3) Focus on the urban context, including also rural-urban gradient and peri-urban studies. During the screening of abstracts, we discarded non-relevant papers that did not meet these criteria. Examples of excluded papers include those that broadly mention justice or equity implications of ES but without further analysis, papers only mentioning ES as a potential indicator of environmental sustainability, and other articles obtained due to identification errors from database algorithms. Abstracts of the retrieved articles were examined by the first two authors, and doubts regarding the inclusion or exclusion of studies were discussed by all co-authors until an agreement was reached. After the first selection, the first author reviewed the full-text to confirm eligibility and proceed to the analysis.

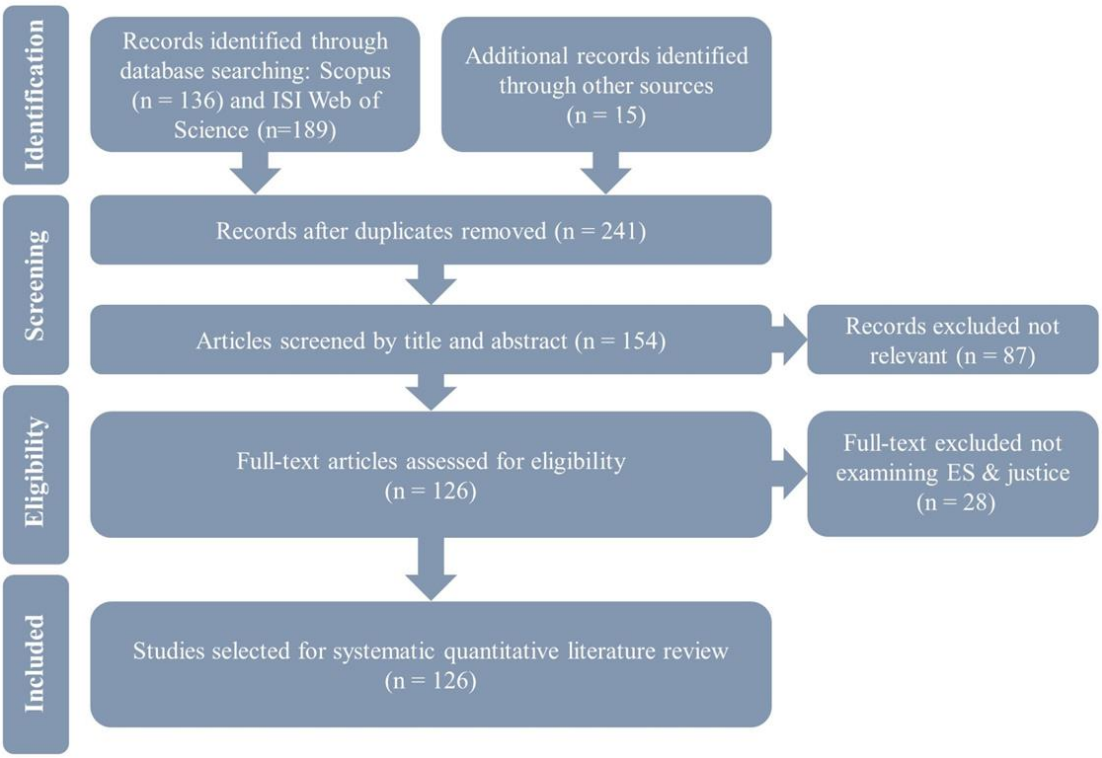

Figure 1. Diagram of search and data selection based in PRISMA Statement steps.

We eventually included 126 relevant papers and carried out an in-depth analysis of these papers following a codification protocol of predefined possible entries, shown in Table 1. The final review categories were obtained iteratively by clustering closely related concepts to avoid redundancy and by dividing categories to avoid ambiguity. This classification facilitated the subsequent analysis and data visualization and was agreed upon in consensus with all co-authors. We selected categories that allowed us to obtain the bibliographic information and scope of the article (i.e. authors, title, keywords, abstract, journal, year of publication, category of article, country, continent). We then included information about the nature of ES analyzed, by groups (i.e. provisioning, regulating, supporting and cultural), and by the ecological structures (e.g. allotments, parks, blue spaces, etc.) that produce them. We dissected the types of urban ES to better examine the benefits provided relative to how they are operationalized in relation to an EJ perspective, following well-established classification frameworks used in previous research (see Elmqvist et al., 2018, Gómez-Baggethun and Barton, 2013), such as those from the Millennium Ecosystem Assessment (MA), The Economics of Ecosystems and Biodiversity (TEEB) and the Common International Classification of Ecosystem Services (CICES). We also included ecosystem disservices because trade-offs and negative outcomes can have potential EJ ramifications and are especially relevant in urban areas (Von Döhren & Haase, 2015). Although we did not code the specific disservices considered in our sample, we contend that a holistic approach of ES

should include the wide range of disservices derived from urban green infrastructure, including for instance, tree pollen allergy, damage to infrastructure, and lack of perceived safety and harassment (Langemeyer & Gómez-Baggethun, 2018). We also identified the EJ approach or dimension used by relevant articles, the social stratifications at stake in the production of (in)justices, and the types of stakeholders responsible for addressing or producing injustices. We selected the social stratification variable to account for the social mechanisms of power that have historically privileged some social groups among others (i.e. by income, educational attainment, age, gender or race/ethnicity) in the access and vulnerability to environmental benefits and hazards.

Table 1. Review categories and possible entries for each one. These variables served to code the 126 analyzed papers.

Review categories	Possible entries	References
Category of article	Case study, review, conceptual paper.	
Country	Name of the country of the study, multiple, not applicable.	
Continent	Name of the continent of the study, not applicable.	
Ecological structure	Allotments and community gardens, parks, blue spaces (rivers, lakes, coast, wetlands), agricultural land, forests, other peri-urban lands (including peri-urban areas and urban-rural gradient), brownfields, green space connected to grey infrastructure (green roofs, street trees and façades), not specified (when talking of urban green infrastructure in general).	Modified from Haase et al., (2014); and Hansen et al., (2017)
Groups of ES	Provisioning, regulating, supporting, cultural, not specified (when talking of ES in general terms).	Mader et al., (2011)
ES examined	Provisioning: food supply, water supply, raw materials. Regulating: runoff mitigation, air purification, global climate regulation, urban temperature regulation, noise reduction, waste treatment, moderation of extreme events, erosion prevention and maintenance of soil fertility. Supporting: habitat provision for biodiversity. Cultural: aesthetic benefits, recreational and mental and physical health, sense of place and social cohesion, tourism. Ecosystem disservices (if mentioned). Not specified.	Based on Elmqvist et al., (2018); and Mader et al., (2011)
EJ dimension examined	Distributional, procedural/participatory, recognitional/interactional, not specified.	Schlosberg, (2007, 2013)
Social stratification related to EJ	Income, educational attainment, age, gender, race/ethnicity, not specified.	Agyeman et al., (2016); Martínez-Alier et al., (2014)
Stakeholders involved	Policy makers (including EU-policy makers and analysts), NGOs, land owner/landlords, scientists, firms/industry, farmers, foresters, public/residents, tourists, various-local public authorities (including city council and municipal agencies and administrators), various-regional public authorities (including regional and national agencies and administrators and government), no (when there is no stakeholder involved in the research process of the article).	

We acknowledge that our review has likely omitted some relevant literature as it has been limited to peer-reviewed articles already published and written in English and available in the search databases. Additionally, our search terms greatly delimit the bounds of the studies we examine, as the ES framework is often not used by (urban) EJ researchers and vice versa. ES

research often addresses poverty alleviation, distribution of resources, governing systems (Sjöstedt, 2012, Suich et al., 2015) and trade-offs in human well-being (Daw et al., 2015) but may not be self-identified or labelled as research related to EJ. On the other hand, there is a large body of literature on EJ, encompassing disciplines such as political ecology and critical geography, which addresses the topic of urban greening without referring to the ES framework (Heynen et al., 2006, Ranganathan and Bratman, 2019, Tzaninis et al., 2020, Wachsmuth and Angelo, 2018). However, the objective of this review was to identify the state of the field in terms of the explicit intersection between ES and EJ in urban areas among the afore-mentioned bodies of literature with an approach that could be transparent and repeatable. For this reason, despite the bias and limitations expected in systematic reviews, we are confident that the number and diversity of the articles we have reviewed here is representative of the emerging EJ trends within the urban ES literature and therefore provides a rigorous picture of the state-of-the-art.

3. Results

A detailed list of the final reviewed articles is available as Supplementary data. The 126 articles identified and analyzed covered the time period 2009–2020 with a consistent increase, especially in the last 4 years (Fig. 2). Despite the fact that the seminal paper on urban ES dates back to 1999 (Bolund & Hunhammar, 1999), the earliest articles included in this review were not published until 2009 (Byrne & Wolch, 2009). From the 126 papers in our analysis, 14 were theoretical/conceptual articles, 12 were literature reviews and 101 were empirical case studies. Review articles focused on a particular geographical scope or ecological structure (e.g. Davies and Lafortezza, 2017, Dobbs et al., 2019, du Toit et al., 2018, Ordóñez-Barona et al., 2019), on a specific ES group (e.g. Chen et al., 2019) or on other emerging aspects related to urban green spaces such as human health, ecosystem-based adaptation, and factors affecting the value of urban NbS and greenspace provision (e.g. Boulton et al., 2018, Brink et al., 2016, Jennings et al., 2017, Keeler et al., 2019). However, none of these reviews systematically addressed EJ aspects in urban ES assessments as an overarching topic. The most frequent journals of publication of the reviewed articles were Landscape and Urban Planning (15 articles), Urban Forestry and Urban Greening, Ecological Economics, Ecology and Society, and Urban Ecosystems (6 articles each). The majority of analyzed articles were case studies with a geographical scope focusing on the Global North (Fig. 3). Nevertheless, 19 conceptual and review articles did not focus on any country/continent in particular and are therefore not represented in the map.

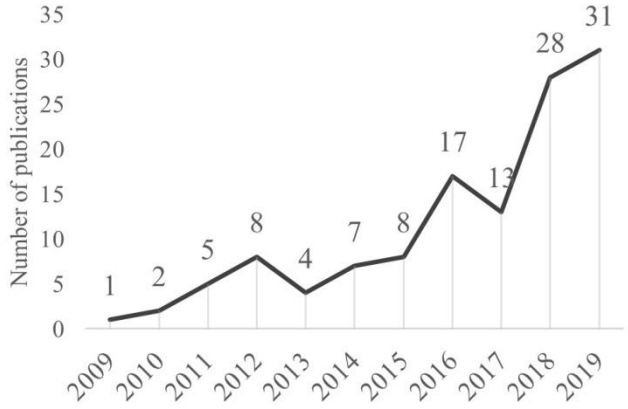

Fig. 2. Number of publications analyzed from 2009 to 2019.

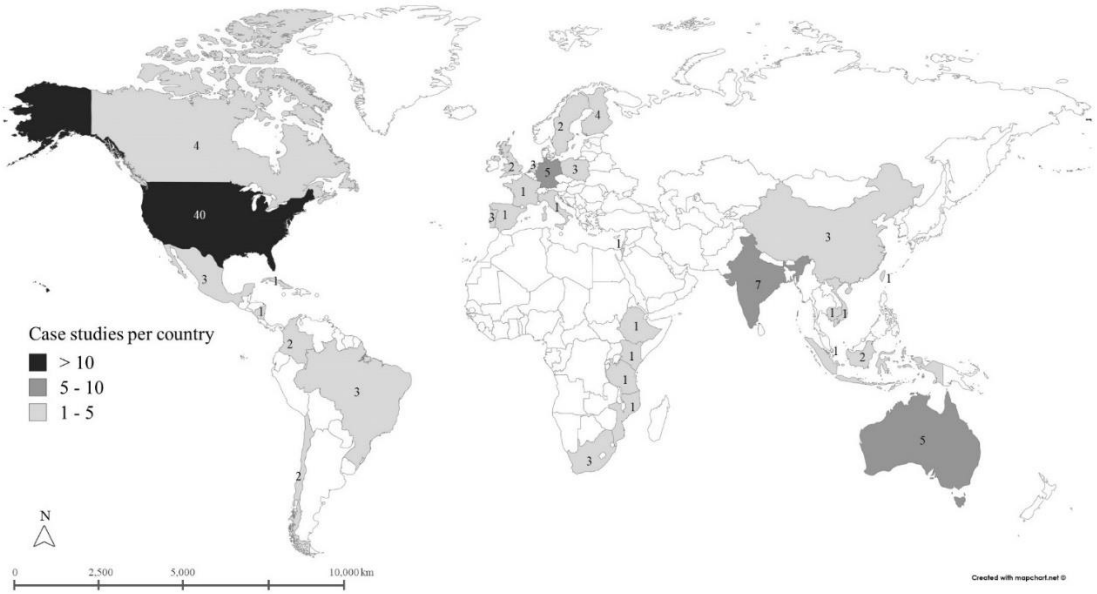

Fig. 3. Geographical distribution of the reviewed articles with specific case study areas (n=107).

Almost half of the reviewed papers addressed regulating ES (60 out of 126), closely followed by cultural ES (Fig. 4). However, 18 articles considered exclusively cultural ES in their analysis, while regulating and provisioning ES were more often examined in combination with the rest of the groups of ES. Supporting ES were the focus in only 21 articles and 30 articles did not highlight any group of ES, but rather addressed the concept in broader terms, without a specific examination or quantification of a certain group. Note that some ES classifications such as CICES (Roy Haines-Young, by, & Potschin, 2018) do not include supporting ES as these are considered as ecological functions.

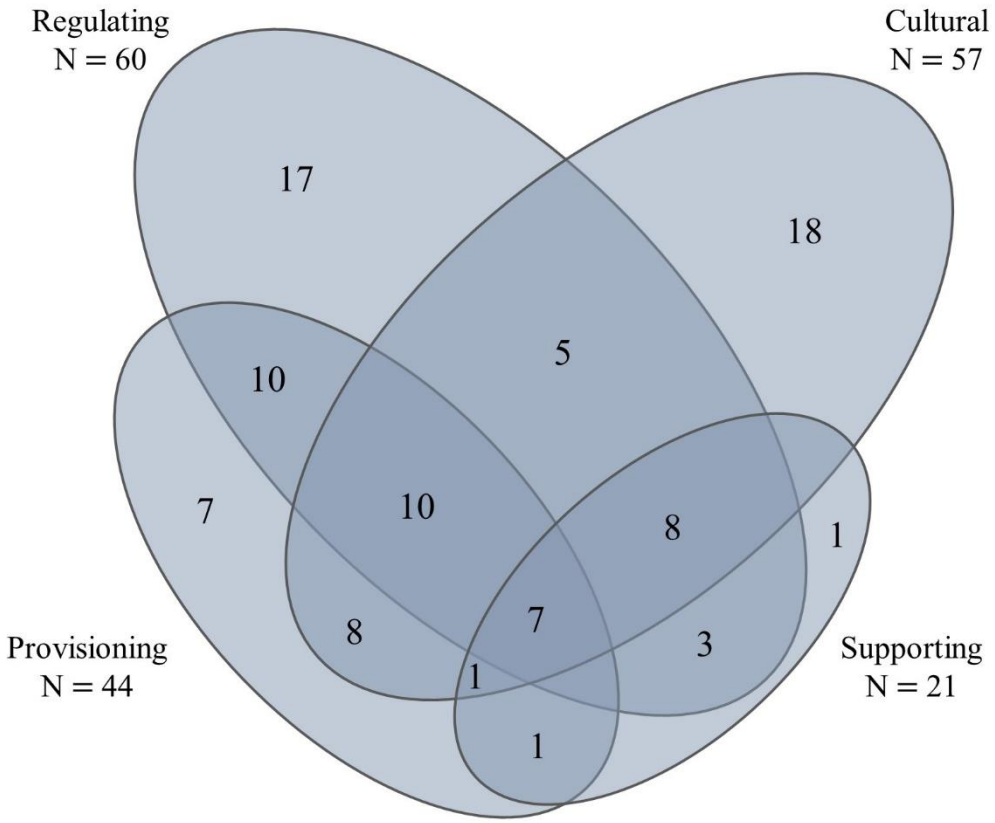

Fig. 4. Venn diagram with overlapping bubbles representing the four groups of Ecosystem Services (i.e., Regulating, Provisioning, Cultural, Supporting) considered in the reviewed articles (N = 126). Each number within the figure represents the number of articles that have examined one or more groups of Ecosystem Services simultaneously. Additionally, 30 articles did not examine any group of Ecosystem Services in particular but rather employed a general approach to the topic.

Fig. 5 displays the specific ES analyzed in the articles in percentages. Note that data source categories are not mutually exclusive, as one article might have analyzed more than one ES. Percentages in the following bar graphs have been quantified in the same way. Cultural ES such as outdoor recreation and contribution to mental and physical health are by far the most frequently assessed ES (45.2%). Beyond cultural ES, regulating ES are analyzed in our articles mainly through runoff mitigation (27%) and articles addressing provisioning ES focus mostly on food supply (24.6%). However, 28.6% of our articles considered some of the previous ES groups but did not fully examine nor quantify any specific ES type. Additionally, 17.4% of the articles mentioned ecosystem disservices but with an uneven degree of detail, alluding for instance to spread of diseases, safety perception, social exclusion and green gentrification.

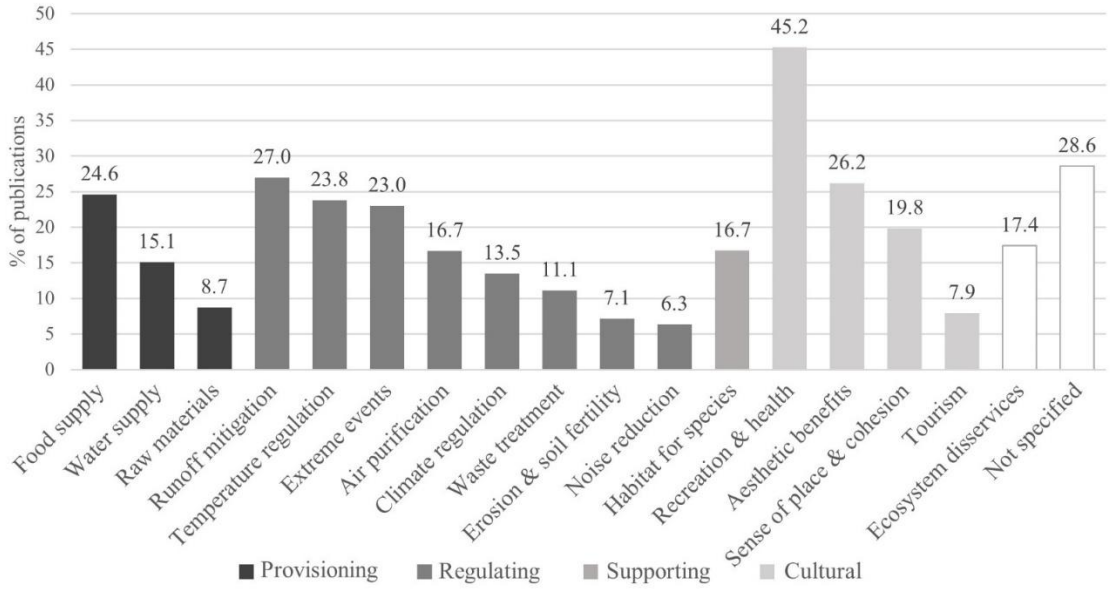

Fig. 5. Types of ES examined sorted by frequency and clustered by ES group (% of 126 articles). Data categories are not mutually exclusive.

The provision of urban ES derives from the institutional arrangements and implementations of the ecological structures of the green and blue infrastructure and their interconnection with the grey infrastructure (Andersson et al., 2019, Kontogianni et al., 2010, Luederitz et al., 2015). Our results show (see Fig. 6) that most studies (46.8%) did not focus on a specific ecological structure. The category "not specified" was applied to articles framing an ecological domain of analysis in terms of green infrastructure, green spaces, or canopy cover in general. This does not mean that the authors did not refer to specific urban green spaces, but that they aggregated different components of the green infrastructure indistinctively. On the other hand, blue spaces are the ecological structure that has received the most attention within our articles (40.5%), followed by urban forests (23.8%) and parks (16.7%).

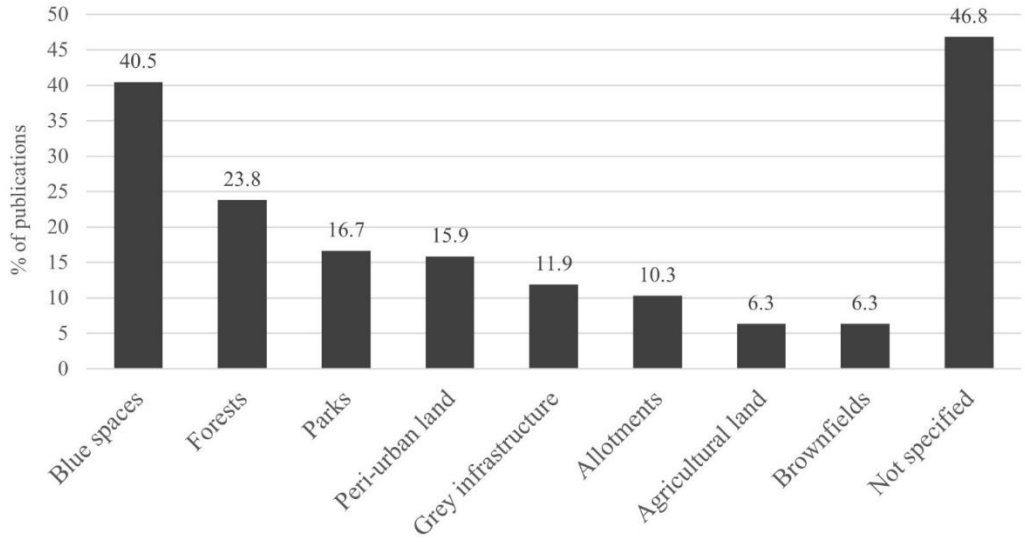

Fig. 6. Ecological structures considered in the articles sorted by frequency (% of 126 entries).

Distributional justice clearly dominates the EJ approach in urban ES studies, with most articles analyzing this one aspect of justice exclusively (65 out of 126 articles) and others in combination with other dimensions (Fig. 7). Distributional considerations included spatial distribution of ES provision, often in comparison with the distribution of income and/or racial segregation, and also the distribution of intergenerational and intragenerational justice, in the sense of temporal justice as characterized in Langemeyer & Connolly, 2020. Such examples of temporal justice include future generations facing climate change-related hazards and historical legacies derived from prior patterns of inequities. Fewer articles focused on the procedural aspects of justice, examining participatory processes, stakeholders and policy-making. Recognitional and interactional dimensions of EJ are an emerging issue and were only considered in 25 articles, where the emphasis was on the different needs, values, and preferences of diverse social groups. A few articles (10) did not focus on any one dimension of justice, instead using the concept as a broad concern without going deeper into how environmental inequalities are specifically manifested.

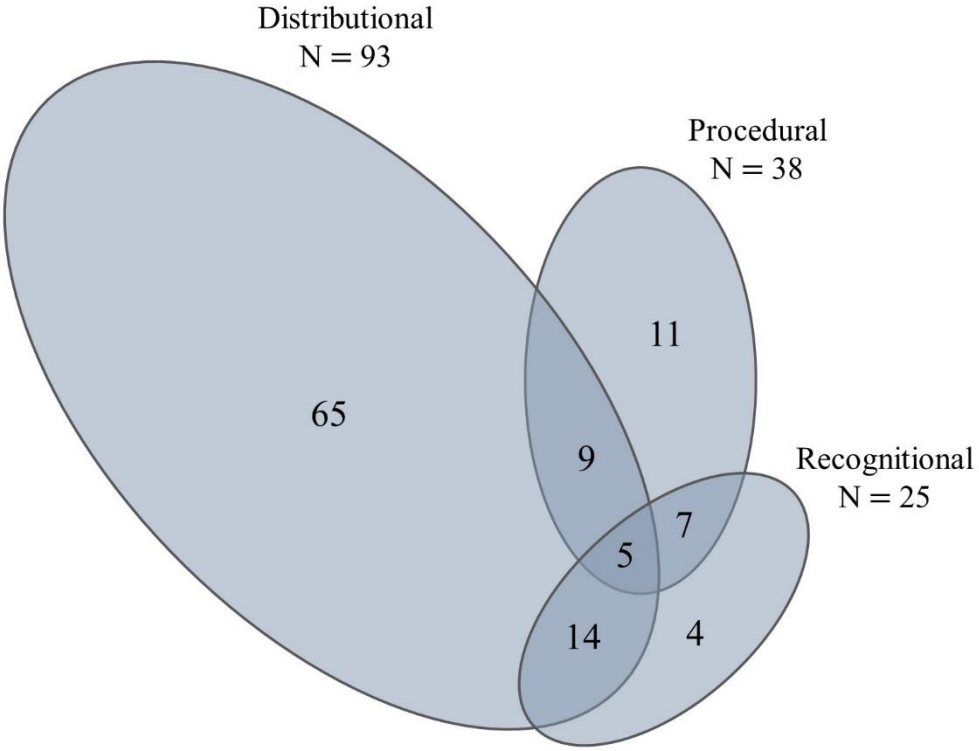

Fig. 7. Venn diagram with overlapping bubbles representing the three dimensions of justice (i.e., Distributional, Procedural and Recognitional justice) considered in the reviewed articles (N = 126). Each number within the figure represents the number of articles that have examined one or more dimension of justice simultaneously. Additionally, 10 articles did not examine any dimension of justice in particular but rather employed a general approach to the concept.

Social stratification mechanisms (Fig. 8) showed that income is the most common variable used when examining differences in ES assessments (43.7%), closely linked to educational attainment (26.2%). Race/ethnicity, including migrants and indigenous groups, was also widely considered (30.2% of the publications). We found that very few studies examined race, age or gender as the only EJ variable of their study and we found a lack of in-depth analysis on the social determinants and mechanisms of exclusion related to those other variables (for exceptions see Byrne and Wolch, 2009, Fortnam et al., 2019, Kabisch and Boschvan, 2017).

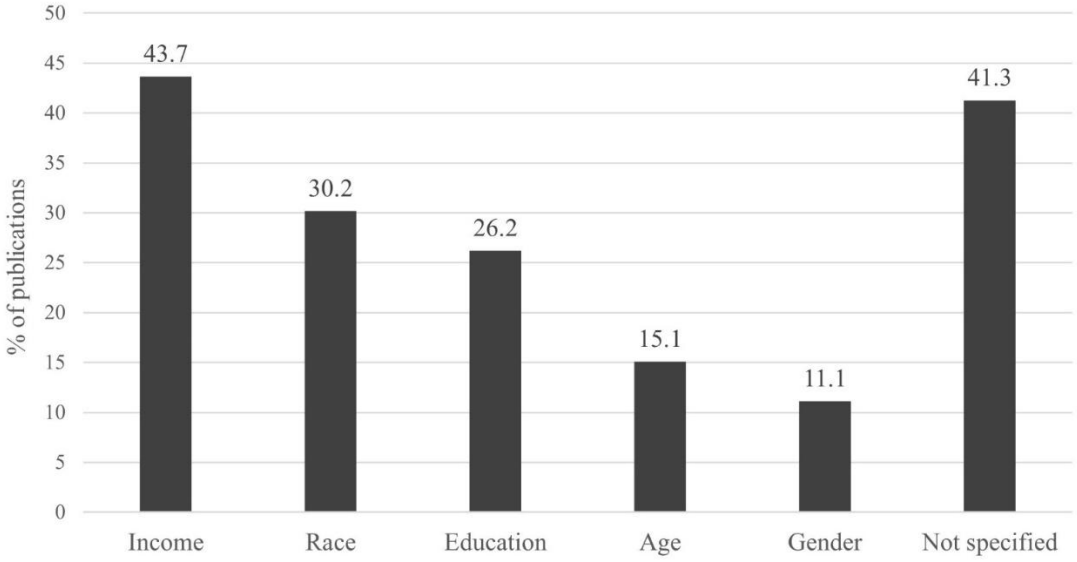

Fig. 8. Social stratification related to the considerations of justice sorted by frequency (% of 126 entries).

A wide majority (74.6%) of the reviewed articles included a stakeholder assessment as part of their study (Fig. 9). Local residents and the general public were frequently involved in ES assessments (38.1%) along with various public local authorities (32.5%). Policy-makers (29.4%) and various public regional authorities (22.2%) were also often considered, either participating in surveys, interviews and workshops or as mediators facilitating maps and other data.

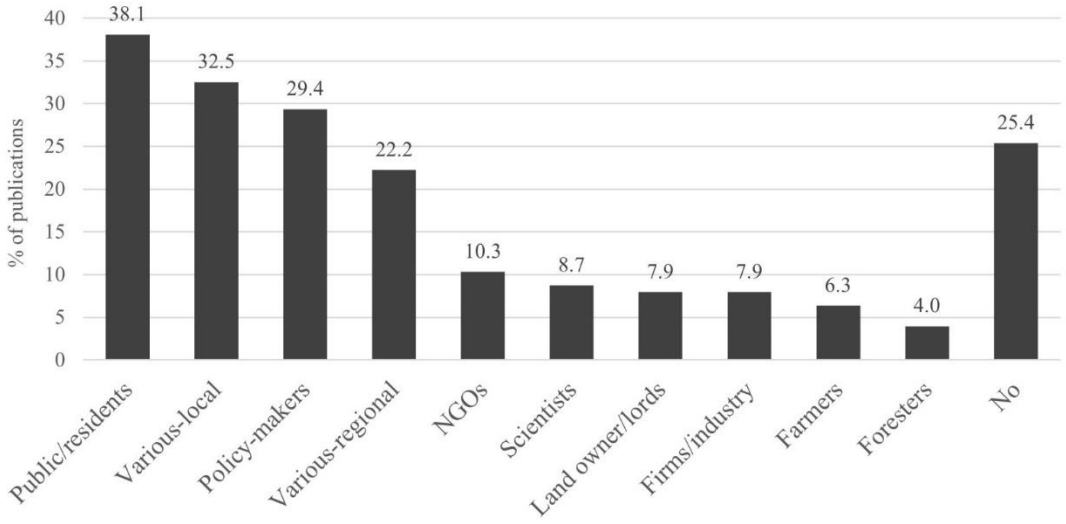

Fig. 9. Stakeholders involved in the ES assessments sorted by frequency (% of 126 entries). The bar labelled "No" means that no stakeholder was assessed in the reviewed article.

Fig. 10 shows a cross-tabulation of ES groups and EJ dimensions. This overview allows us to identify the extent to which distributional justice dominates across ES groups, consistently

followed by procedural and recognitional dimensions. This distributional focus is especially pronounced in regulating ES studies, with 45 articles in total. On the other hand, procedural justice is mostly considered in cultural ES studies (18 articles). Recognitional aspects emerge mainly in cultural ES assessments (10 articles) but also in regulating and general ES assessments. To better illustrate the different intersections among ES groups and EJ dimensions, Table 2 displays some key and illustrative examples of articles included in our review and how they approach EJ in a similar cross-tabulation table.

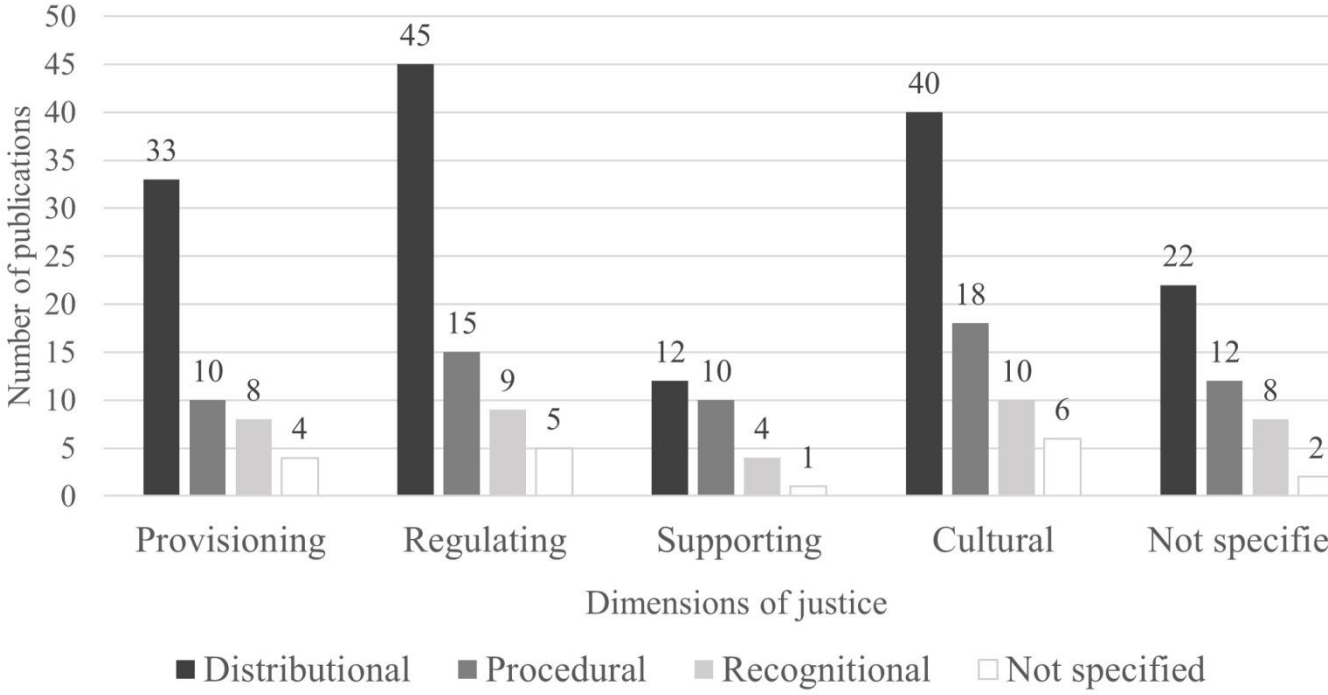

Fig. 10. Cross tabulation of group of ES by dimension of EJ (showing number of publications). Each column represents the number of entries that considered one ES group and EJ dimension at the same time. Note multiple hits per entry were possible.

Table 2. Cross-table of key examples from our sample (N =126) showing how articles have considered EJ dimension for each ES group.

	Distributional	**Procedural**	**Recognitional**
Provisioning	Exploring spatial inequities and vulnerability in access to water (Favaro et al., 2016), food (Bozeman, Ashton, & Theis, 2019), and resources (Balbi et al., 2019).	Examining participatory processes, policies, stakeholder involvement (Dennis, Armitage, & James, 2016) and community organization and mobilization (Porter, 2018) in gardens, and ES values for coastal	Accounting for needs, aspirations (Fortnam et al., 2019) identities, perceptions, social interactions and trust (Bremer et al., 2018; Juntti & Lundy, 2017) in relation to farming, fishing and water resources.

		management (Atkinson et al., 2016).	
Regulating	Socio-spatial analysis of the distribution of ES provided by street trees, green roofs and drainage systems across urban areas (Baró et al., 2019; La Rosa & Pappalardo, 2019; Sanchez & Reames, 2019).	Evaluating urban climate change adaptation planning processes (Hughes, 2015) engagement, governance and political actors of green stormwater infrastructure (Finewood, Matsler, & Zivkovich, 2019) and management policies and decision-making in abandoned areas (Gulachenski et al., 2016).	Considering the influence of historical legacies of private and public green spaces (Anderson et al., 2020) and cultural heritage, local perceptions and awareness of a forestry program by urban-rural communities (Caro-Borrero et al., 2015; Suhren et al., 2014).
Supporting	Distribution and access to habitat and biodiversity provided by green areas across socio-spatial data (Dobbs, Nitschke, & Kendal, 2014; Escobedo et al., 2015) and strategic spatial plans (Wilkinson et al., 2013).	Analyzing participatory processes and programs (Cohen et al., 2019; Pearson et al., 2010) and policies enhancing community participation (Gregory, Leslie, & Drinkwater, 2016) of land use scenarios frameworks providing habitat for biodiversity.	ES perceptions across socioeconomic gradient of street trees (Graça et al., 2018) and cultural rights and preferences of minority groups doing home gardening (Koh, Hahn, & Ituarte-Lima, 2017; Raymond et al., 2019) for biodiversity conservation.
Cultural	Examining uneven access and use of cultural ES such as recreation and place attachment through spatial distribution and availability of residential water and green areas (Fleischer, Felsenstein, & Lichter, 2018; Łaszkiewicz, Kronenberg, & Marcińczak, 2018; Viinikka, Paloniemi, & Assmuth, 2018).	Exploring public participation for urban green infrastructure planning (Rall, Hansen, & Pauleit, 2019), water governance, planning and management (Paloniemi et al., 2018) and institutions, policies and democratic processes in diversified farming systems (Bacon et al., 2012).	Analyzing how experts recognize citizen demands, obstacles and opportunities for recreation in blue spaces (Assmuth et al., 2017) as well as individual needs, expectations and preferences regarding urban green space management and governance (Biernacka & Kronenberg, 2018) and the significance of environmental education (Wolsink, 2016).

4. Discussion

4.1 Prevailing justice dimensions in the urban ecosystem service literature

The trilogy of now-classic categories for understanding the dimensions of social justice including distribution-procedure-recognition has been widely used in EJ research (Bustos et al., 2017, Holifield, 2012, Paloniemi et al., 2015, Whyte, 2011) and is starting to spread throughout ES research. Our analysis reveals that, as might be expected given its predominant role in EJ studies, the distributional dimension of justice is the most covered with regard for EJ approaches taken up by urban ES assessments. Procedural justice and analyses of participatory processes are receiving increasing attention, especially vis-à-vis

decision-making and governance structures for the operationalization of ES in policy or planning, for instance. Nevertheless, the existing scholarship still barely considers recognitional justice: The diversity of needs, values and identities that different social groups hold vis-à-vis urban ES has been generally overlooked, despite the rich literature on plural values in ES research, both from a theoretical (Arias-Arévalo et al., 2018, Dendoncker et al., 2013, Kenter, 2016) and an applied perspective (Langemeyer et al., 2015, Martín-López et al., 2014, Turkelboom et al., 2018).

Given the scope of papers in this review, in order to expand and refine analyses of distributional justice, ES researchers should consider expanding their socio-spatial analysis in terms of methods, temporality and scale (cf. Ernstson, 2013, Langemeyer and Connolly, 2020). For instance, besides comparing urban green infrastructure and the socio-economic profile of nearby residents (which is also necessary), new research should combine quantitative and qualitative methods at different temporal and geographical scales while striving for more ambitious analyses of access, power and institutional structures (Lehmann, Martin, & Fisher, 2018). Studies like Connolly and Anguelovski, 2021, Nardone et al., 2021 are an example of how to examine prior historical processes such as the practice of redlining in the US and how they continue to influence the distribution of green spaces and contribute to racial health inequities. Moving beyond residential metrics of access to green amenities and considering the multiple geographies of where urban residents work, play or study (see for instance Baró, Camacho, Pérez Del Pulgar, Triguero-Mas, & Anguelovski, 2021) can also contribute to a better understanding of ES distributional inequalities.

The common view within ES research that EJ concerns can be reduced to distributional aspects may reflect a biased emphasis on the specific geographic location of ES (e.g. socio-spatial analysis of residential green areas), and sometimes generates a justice-blind, de-politicized analysis of ES provision (Dikeç, 2001, Perreault et al., 2015, Soja, 2015, Swyngedouw and Heynen, 2003). Indeed, the emphasis on the equitable spatial distribution of ES is seen as less relevant for certain aspects of ES that can (or cannot) be enjoyed regardless of the proximity to the place of production (Baró et al., 2019, Fisher et al., 2009). For instance, while street trees regulates temperatures at a local scale by diminishing the urban heat island effect (Mueller et al., 2019), carbon sequestration mitigates climate change at a global scale, and nearby residents have no privilege in perceiving such benefits. Furthermore, exclusively distributional approaches can be rendered incomplete, and even misleading, by the enduring presence of urban dynamics of inequality and exclusion, which

are driven by complex and multi-scalar processes, such as historic segregation, housing discrimination, inter-racial wealth gaps, or the broader political economy of uneven urban development (Pulido, 2000).

In recent research, recognitional justice has begun to be addressed in a broad manner, emphasizing individual needs and perceptions (e.g. Assmuth et al., 2017, Graça et al., 2018, Nesbitt et al., 2019) and pointing out the lack of consideration of specific socially vulnerable groups (e.g. Koh et al., 2017, Suhren et al., 2014). However, we found that urban ES assessments examining recognitional aspects of justice often lack a deeper analysis of how individual perceptions are translated into environmental inequities and related with sociopolitical arrangements and structural exclusion processes. For instance, one overlooked question is whose values are prioritized in greening policies, given the differential access of communities to green space within the mechanisms that create and maintain inequality among them. Another one concerns which specific identities, needs and practices of socially vulnerable groups are being neglected in a way that deprives them of such benefits.

However, we did find that recognitional justice research dealing with historical and racialized legacies of unequal access to urban greening interventions and ES in more context-specific approaches is emerging (e.g. Anderson et al., 2020, Draus et al., 2019). However, the ES scholarship can further refine both conceptualization and operationalization of the recognitional implications of ecological structures. For instance, this research path has been explored by EJ research through the interrogation of legacies of violence, exclusion and trauma experienced in urban green spaces by racialized and gendered minorities (Anguelovski et al., 2020, Brownlow, 2006, Finney, 2014, Rigolon and Németh, 2018).

While we found few cases focused exclusively on recognition (Fortnam et al., 2019, Graça et al., 2018), recognitional and procedural EJ perspectives usually play complementary roles in the way they are addressed in ES research (Assmuth et al., 2017, Nesbitt et al., 2019). This link might be explained by the common use within ES studies of participatory processes as a legitimate tool for effectively recognizing diverse preferences and values within and among social groups. In contrast, distributional assessments seem to have a privileged epistemic position in which there is no need to build legitimacy in alliance with the other dimensions of EJ, implying that the ultimate operationalization of justice of most urban ES researchers is articulated around the fair distribution of and access to ES across different social groups. This epistemological assertion implied by the trends within ES research is one that has been long debated with EJ research and social justice scholarship more widely (Fraser, 2009).

Meanwhile, even while the tridimensional approach to justice used in EJ literature is mobilized in limiting ways within the ES literature, we found that the conceptualization of justice within the reviewed ES studies is deeply anchored into one or into a combination of the distributional, procedural and recognitional dimensions. However, in order to avoid imposing boundaries that close off a broad range of potential urban injustices and how they are experienced by the studied communities (Anguelovski et al. 2020), it is necessary to expand the research on broader and novel analytical approaches of (in)justice within ES literature.

4.2 Environmental justice across ecosystem service types

Our findings show that assessments of regulating and cultural ES are those that address EJ concerns the most. These are the ES groups that are in general more often addressed in urban ES assessments, as seen in previous reviews (Haase et al., 2014, Luederitz et al., 2015). The regulating ES assessments we examined primarily focused on climate change adaptation, resilience, and mitigation of environmental risks (e.g. Baró et al., 2019, Finewood et al., 2019, Jenerette et al., 2011, Kabisch et al., 2017). These assessments discuss, among other topics, the unequal distribution of environmental health threats and propose more participatory governance and the implementation of ES to mitigate the higher exposure of vulnerable populations. Similarly, EJ research has already taken an increasing interest in climate issues, and has pointed out the unequal distribution of climate change risks, which disproportionately affect the urban poor (Anguelovski et al., 2016, Chu et al., 2017, Shi et al., 2016, Thomas and Twyman, 2005).

Regulating ES assessments have the potential to support climate justice claims by identifying which ES can be more climate-responsive so as to build urban adaptive capacity without exacerbating environmental inequities (Byskov et al., 2019). This approach would require accounting for social and structural inequalities vis à vis climate change impacts and their adaptive interventions. It would also call for effectively including the needs of disadvantaged and vulnerable populations in urban green infrastructure programs (Schlosberg, 2013) and ensuring that they are not displaced by them, as the recent EJ scholarship discusses (Anguelovski et al., 2019, Connolly, 2018, Shokry et al., 2020). Yet, it remains to be seen whether ES assessments will fully incorporate climate justice perspectives in urban resilience and climate action programs.

EJ considerations are also frequent in cultural ES assessments, with recreational opportunities (and the related physical and mental health improvements) included in almost half of the reviewed articles. This heterogeneous group of urban ES assessments addresses the different uses of green spaces and related public health outcomes, and the incorporation of perceptions and preferences into decision-making processes (e.g. Chen et al., 2019, Cochran et al., 2019, Jennings et al., 2016, Wolch et al., 2014). Recently, cultural ES assessments have explored new research approaches for the analysis of recreational opportunities in cities, like participatory mapping (Rall, Hansen, & Pauleit, 2019), use of social media data (Amorim Maia et al., 2020, Langemeyer et al., 2018) and structured observations (Winter et al., 2019). We contend that the use of mixed methods combining these novel approaches with social science approaches of qualitative and participatory methods and interviews (e.g. Derkzen et al., 2017), has potential to advance towards a more effective consideration of plural values and experiences of (in)justice departing from cultural ES.

Additionally, novel conceptualizations related to cultural ES are gaining momentum through the relational values approach (e.g. Bremer et al., 2018, Calcagni et al., 2019), which offers new channels of connection with the dimensions of EJ that are currently under-represented in urban ES literature. Cultural ES can contribute to building out a recognitional and procedural justice analysis by incorporating plural cultural identities, knowledge systems and social interactions in policies and decision-making processes (Gómez-Baggethun & Barton, 2013). More specifically, relational values, that is, preferences, principles, and virtues associated with the relationships between people and nature (Chan et al., 2016) can play an important role in extending the ES framework beyond narrow and techno-economic utilitarian framings and towards more inclusive and pluralistic decision-making (Chapman, Satterfield, & Chan, 2019) and consideration of the relations and perceptions of vulnerable communities with respect to urban nature (Himes & Muraca, 2018).

In relation to provisioning ES, our results show that this group has been mainly linked to EJ through food provision from urban gardens and allotments (e.g. Dennis et al., 2016, Egerer et al., 2018, Gregory et al., 2016, Porter, 2018). The minor role of provisioning ES in the literature can be explained by the perception of many urban gardens as sources of cultural ES rather than solely food production, leaving their provisioning role as secondary (Langemeyer, Camps-Calvet, Calvet-Mir, Barthel, & Gómez-Baggethun, 2018). Another area of research addressing provisioning ES found in our review is the analysis of PES programs

(e.g. Abebe et al., 2019, Bremer et al., 2018, Caro-Borrero et al., 2015, Kovacs et al., 2016, Moreno-Sanchez et al., 2012, Van Hecken et al., 2012). These analyses examined perceptions over watershed and forestry PES schemes and their potential conflict for water supply between urban and rural–urban residents. Although it is controversial whether PES schemes can aggravate environmental inequalities in rural areas (Calvet-Mir et al., 2015, Kosoy and Corbera, 2010, McDermott et al., 2013, Pascual et al., 2014), interactions between PES and urban environments and their implications for EJ remain unexplored through cross-scale approaches (Scholes et al., 2013) and may offer important pathways for understand the ES-EJ link of cities and their surroundings.

4.3 Moving the field of urban ecosystem services forward

While this review demonstrates the still narrow and uneven link between urban ES assessment and different aspects of EJ, we argue for the inclusion of an expanded analysis of dimensions of justice within the ES framework, including restorative, reparative and intersectional aspects of justice as it is being explored by EJ researchers (Agyeman et al., 2016, Anguelovski et al., 2020, Aragão et al., 2016, Draus et al., 2019, Draus et al., 2019) and tentatively suggested in some of our reviewed articles (e.g. Anderson et al., 2020, Fortnam et al., 2019). Restorative justice highlights the need to acknowledge past experiences of violence, oppression and exclusion and the extent to which green interventions can address historical trauma and promote the inclusion of specific neighborhoods and communities (Draus, Haase, & et al., 2019). Intersectional justice can help to understand how multiple identities (such as gender, class, race/ethnicity, sexuality or disability, among others) interact and are (un)recognized in the green infrastructure planning processes (Anguelovski et al., 2020, Jerneck, 2018). In short, the new frontier of EJ research offers ES scholarship an opportunity to not just catch up in terms of justice considerations, but also to leap forward and help shape that frontier.

While research on urban ES has been geographically biased towards US, China and Europe (Haase et al., 2014, Luederitz et al., 2015), our review shows a pattern with a predominance of US and European studies and a meager presence of Chinese assessments. The reason behind this pattern is probably related to the historical urban-oriented focus of the EJ scholarship, which developed in the US (Anguelovski, 2013) and to the bias due to the use of English as the language of publication in our inclusion criteria. Additionally, our results show a clear preponderance of household income as the main indicator of social vulnerability. Although income is widely used in the stratification of environmental

inequalities, other forms and drivers of exclusion and alterity coexist in subtler or often fully visible but overlooked ways (Gregory, Johnston, Geraldine, Watts, & Whatmore, 2009). Several EJ studies have pointed out that race is often the primary driver of injustice (Mohai and Saha, 2015, Pulido, 2000). Assessments addressing race/ethnicity are mostly from North American cases (accounting for 22 out of the 36 articles examining race/ethnicity as a social stratification mechanism), which is likely explained by the importance of EJ movements and the relevance of environmental racism both as a field of activism and a field of study in the US (Pulido, 2000). However, they are the not the only places where race-driven environmental inequities or inequities in ES manifest in practice. For example, the exclusion, marginalization, and racism directed at racialized immigrants in Europe is also shaping access to environmental amenities (Antypas et al., 2016, Harper et al., 2009).

Furthermore, we detect that gender-specific barriers have been especially overlooked in the general ES literature (Brown and Fortnam, 2018, Cruz-Garcia et al., 2019, Fortnam et al., 2019, Yang et al., 2018). From the articles covered in this review, only 2 included gender as a central part of the study (Fortnam et al., 2019, Suhren et al., 2014) and 12 other articles treated it as one of many other demographic variables, giving it a relatively limited relevance. Some studies, for instance, accounted for the differences in the way that men and women perceive and value urban ES (e.g. Abebe et al., 2019, Asah and Blahna, 2019, Graça et al., 2018, Keith et al., 2018, Winter et al., 2019), but only gave rather brief explanations concerning the environmental attitudes attributed to women (Zelezny, Chua, & Aldrich, 2000). This trend implies that most articles including gender as a variable did not further explore the justice implications of gendered mechanisms of exclusion in green infrastructure planning processes. We contend from our results that there is lack of analysis focusing into how gender interacts with urban ES and how gendered perceptions of the public space translate into unequal access to green and blue infrastructure, institutions and decision-making power. Environmental and sustainable development urban agendas have already been explored in gender-focused urban planning research (Buckingham, 2020, Hayden, 1980, De Madariaga and Roberts, 2012, Spain, 2014) and gender mainstreaming policies (UN Women, 2020). However, we argue that adding the gender and intersectional justice perspective into the ES framework can offer crucial and novel insights when designing greening and sustainability agendas.

Our review confirms that examining the participation of different stakeholders in decision-making effectively enhances the identification, valuation, and management of context-

specific urban ES (Luederitz et al., 2015) and is therefore a useful tool when considering the EJ implications of accessibility to urban green infrastructure and its benefits. The high degree of stakeholder involvement within the reviewed articles explains their emphasis on policy-making and participatory processes in the design, allocation and management of green and blue infrastructure. Actually, green infrastructure, green spaces or canopy cover in general is the main focus in almost half of the empirical studies of the reviewed literature. Nevertheless, our results point to the particular importance of blue infrastructure in building the climate adaptation capacity of cities (BenDor and Stewart, 2011, Favarodo et al., 2016, Garcia-Cuerva et al., 2018) as well as its recreational opportunities (Assmuth et al., 2017, Derkzen et al., 2015, Suhren et al., 2014, Unnikrishnan et al., 2016). A more nuanced classification of ecological structures, as already extensively used in ES literature (i.e. green, blue and grey infrastructure such as street trees, green roofs, coastal areas, lakes, rivers, wetlands) would greatly benefit EJ literature in pushing its scope beyond parks and urban forests, which have received most of its attention so far (Heynen et al., 2006, Nesbitt, Meitner, Sheppard, & Girling, 2018, Walker, 2011). Thus, ES research can develop a more complete analysis of the connections between environmental injustices and different ecological structures while acknowledging the current uncertainties and knowledge limitations regarding issues of ecosystem interactions, climate-change effects, decision making and management (Solé & Ariza, 2019).

4.4 Implications for policy and practice

An EJ perspective has the potential to make ES assessments more effective at contributing to the good quality of life for all in urban areas. Policy-makers cannot assume that ES-based greening strategies in cities will always reach historically disenfranchised neighborhoods or include the needs and values of their unprivileged residents (Anguelovski, Argüelles, & et al., 2018). Urban planning agendas need to acknowledge the interconnections between different needs, in order to achieve greener, healthier, more climate-responsive, and inclusive cities. For this reason, we propose three guidelines for urban policy and practice towards an effective inclusion of social equity and justice considerations in urban ES-based assessments and interventions.

1) Provide explicit considerations of EJ with clear operational definitions.

Urban ES assessments should not only mention but rather fully integrate a clear operational definition of how justice is being conceptualized and examined. This would also help to

reveal biases, implicit assumptions and instrumental motivations (Friedman et al., 2018). Thus, it is necessary to provide clear indicators of environmental inequities in ways that allow for standardization and comparison, and to further discuss the links between ecological structures, social stratification processes and their political and economic context. Urban greening strategies should clarify the indicators that will measure not only the preexisting forms of environmental inequity and social exclusion in the context of their interventions, but also those that may arise from the intervention itself. Further, social inequities should be examined in both the process and the outcome of planning, implementation and management of greening strategies and projects. ES scholarship should also scrutinize the different priorities behind ES-based plans and strategies, the negotiation of their benefits and trade-offs, and the general political agendas that they serve (Kotsila et al., 2020). This involves answering questions like in which proportion men and women access a given urban green space, how its design and implementation takes into account people with disabilities or how representative the participatory process was in regard to migrant communities, among other examples.

2) Incorporate new methodologies and cross-sectoral collaboration

The ES scholarship should engage and co-evolve with the EJ research agenda in a mutual dynamic of developing interdisciplinary methods, theoretical framings and practices vis-à-vis urban environmental inequities (Berbés-Blázquez et al., 2016, Langemeyer and Connolly, 2020). ES assessments now have the opportunity to fully develop their own analyses of procedural and recognitional justice and assimilate the perspectives of stakeholders from different backgrounds (Charoenkit and Piyathamrongchai, 2019, Fortnam et al., 2019). Embracing contrasting views and perspectives of different stakeholders is a necessary step in achieving a more representative and legitimate decision-making process for green interventions and governance model of cities. Multiple methods have been developed within EJ and other social disciplines, which may broaden our understanding of ES by capturing different dimensions of value (i.e. relational, intrinsic, non-monetary, etc.) and valuation methods (Langemeyer & Connolly, 2020). For instance, feminist urban researchers have explored qualitative methods such as photovoice, participatory research and further mixed praxis as effective strategies to increase women's participation in urban planning (Hesse-Biber, 2012, Kindon, 2003, McIntyre, 2003, Ortiz Escalante and Gutiérrez Valdivia, 2015). The incorporation of such qualitative methods in ES assessments opens a promising path of

novel research practices, especially those that can uncover recognitional dimensions of injustice.

As stated in target 11.7 of the SDG, cities are places of encounter and must "provide universal access to safe, inclusive and accessible, green and public spaces, particularly for women and children, older persons and persons with disabilities". However, lack of access to environmental benefits is only one of the several drivers of injustice that surround cities. Urban green infrastructure will follow global trends of gendered and ethnically exclusionary urban planning unless policies and governance institutions explicitly coordinate against this. To achieve this end, local and regional level governments need to include civil society organizations in a multi-actor model of governance and take a cross sectoral approach to coordinate the work of departments like urban green planning, public health, social affairs, housing, gender equality and others.

3) Consider trade-offs, conflicts, and deep inequalities across different dimensions of justice and ES

It is indispensable that environmental and planning policies incorporate trade-offs and complexity into their analyses, so as to reflect potential disservices related to urban green infrastructures (Anguelovski, 2016, Berbés-Blázquez et al., 2016, Wolch et al., 2014). Urban planning interventions that promote green branding discourses involve trade-offs between ecological and social processes that can ultimately exacerbate unaffordability and social inequalities, and constitute a form of green gentrification (Garcia-Lamarca et al., 2021, Wolch et al., 2014). For instance, green intervention that might seem inclusive and/or equity-driven might in fact involve the short- or mid-term displacement or exclusion of the most socially vulnerable groups (Anguelovski et al., 2018, Cole et al., 2017, Curran and Hamilton, 2012, Wolch et al., 2014).

Further, there is a need to better understand the consequences of privileging one dimension of justice above others in urban green planning (Friedman et al., 2018). Focusing exclusively on the distributional aspects of ES can mask injustices in green planning procedures and historical privileges imposed by past planning decisions and policies such as racial residential segregation (Nardone et al., 2021, Yi et al., 2019). Still, procedural and recognitional approaches have not yet been widely incorporated in ES-based urban green interventions. In fact, inadequate institutional structures, exclusionary participatory processes and limited citizen participation hinder distributional just outcomes (McDermott et al., 2013). Likewise, acknowledging recognitional concerns can help to expand our knowledge of the needs and

values of urban communities, thereby encouraging their participation and stewardship. Finally, restorative concerns in green interventions need to be addressed as well (Draus, Haase, & et al., 2019) by acknowledging the exclusionary effects of previous land use policies in disinvested spaces, to then effectively promote corrective and restorative, emancipatory measures for marginalized groups (Anguelovski et al., 2020).

5. Conclusion

The urban ES literature has generally taken a normative and prescriptive approach to green and blue spaces by assuming that everyone will benefit equally from their services, but without properly problematizing and contesting the urban greening agenda that is being implemented in many cities worldwide (Anguelovski et al., 2018, Haase et al., 2017). However, current research on urban ES is increasingly taking into account the EJ implications that arise from the planning, implementation and management of urban green and blue infrastructure. In this paper, we have systematically reviewed how urban ES assessments have incorporated EJ perspectives, accounting for the operationalization of different justice dimensions, social groups and stakeholders. We found that the literature on urban ES explicitly addressing EJ issues is still nascent, raising many possibilities for further research in new theoretical, empirical, and geographical directions. Distributional analyses of regulating and cultural ES are the most frequent studies within the literature so far, especially focusing on recreational opportunities and climate change adaptation benefits.

We contend that the urban ES literature has followed a similar pattern to that of EJ in its progressive incorporation of justice dimensions and social groups into its analysis. The prevailing focus on distributional justice might be hindering the conceptualization of other drivers of environmental inequalities, such as historical legacies and power imbalances across socio-spatial scales. The next step in this development of synergies between EJ and ES assessments will require a broader incorporation of procedural and recognitional dimensions of justice. This can be achieved by expanding current methodological approaches with more qualitative methods, and by involving stakeholders with contrasting needs and perspectives. It is crucial to take an intersectional approach in analyzing the perceptions, preferences, and identities of historically unprivileged social groups, in order to understand and ultimately overcome their specific social-ecological vulnerabilities. Likewise, ES-based urban green interventions have yet to tackle broader conceptions of justice, such as restorative justice related the historical trauma faced by social groups that may have suffered oppression under past policies and land uses.

Finally, the ES framework can enrich the assessment of urban environmental inequalities, in providing both conceptual and practical tools to better understand the benefits, disservices and trade-offs that are at stake within urban green and blue infrastructure interventions. Conversely, EJ can support the empowerment of local communities in the co-production of urban ES and ensure the creation of greener and more just cities.

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CHAPTER III. GREENING PLANS AS (RE)PRESENTATION OF THE CITY: TOWARD AN INCLUSIVE AND GENDER-SENSITIVE APPROACH TO URBAN GREENSPACES

Abstract

Cities around the world are increasingly expanding their sustainability agendas and adopting urban green and blue infrastructure planning as a strategy to become more resilient, healthy and sustainable. However, the development of urban greening governance often lacks a holistic vision that considers social inequities within the planning, implementation and management of green and blue spaces. Further, gender inequities have been a specific dimension particularly overlooked in urban greening planning, despite gender concerns gaining increasing political relevance in recent years. In this research, we assessed the extent to which social and gender equity are being considered in urban greening plans and projects at the local level. We chose Barcelona (Spain) as main case study due to its pioneering role in implementing crosscutting equity and gender policies at the municipal level. Building on document analysis and semi-structured interviews with key stakeholders, we examined how social justice and gender are understood and operationalized in practice, from the design phase to implementation and maintenance of greening projects. Our findings suggest a shift in the role of urban greening which evolved from an ornamental role to a multifunctional vision of greening and is recently incorporating equity and inclusivity concerns. We identified three action areas of inclusive, gender-sensitive urban green planning practices: first, the incorporation of inclusivity and care as guiding visible values to recognize multiple needs of city residents; second, urban design for different uses and perceptions of greenspaces, particularly in relation to accessibility and autonomy; and third, the awareness and expertise from municipal staff vis-à-vis the consideration of social and gender equity in green planning and participatory approaches. Finally, we provide practical examples of the strategies that the City of Barcelona is implementing in each area and discuss some challenges and limitations, including what we identify as ad hoc intersectional greening.

Graphical abstract:

Keywords: Ecosystem services; Feminist urbanism; Environmental justice; Governance; Planning; Policy; Gender equity.

This chapter corresponds to the following published article:

Calderón-Argelich, A., Anguelovski, I., Connolly, J. J. T., & Baró, F. (2023). Greening plans as (re)presentation of the city: Toward an inclusive and gender-sensitive approach to urban greenspaces. Urban Forestry & Urban Greening, 86, 127984. https://doi.org/10.1016/j.ufug.2023.127984

1. Introduction

Urban greening is gaining more and more prominence in municipal policies. Cities worldwide are expanding their sustainability agendas through the planning and implementation of urban green and blue spaces to address different environmental and social challenges like adapting to climate change, protecting biodiversity, improving citizens' health and well-being, and creating spaces for social interaction and recreation opportunities, among others. As part of this trend, concepts such as Urban Green Infrastructure (UGI), Ecosystem Services (ES), and Nature-based Solutions (NbS) have been incorporated into many official city plans. Such frameworks have been especially integrated by Global North local governments, often in response to international directives, strategies, and awards (Grădinaru and Hersperger, 2019, Lindley et al., 2018, Matsler et al., 2021, Neidig et al., 2022, Pauleit et al., 2018). As part of this trend, for instance, the EU's biodiversity strategy for 2030 has recently called for European cities of more than 20,000 inhabitants to "develop ambitious urban greening plans by the end of 2021" (European Commission, 2021).

Urban plans of all types often have significant implications in terms of social and EJ (Cortinovis and Geneletti, 2018, Grabowski et al., 2023) and yet, green planning has often lacked an equity perspective (Gradinaru et al., 2023, Hansen et al., 2022, Pearsall and Pierce, 2010). In recent years, there has been an increasing interest in how urban greening is not neutral in front of pre-existing social inequities (e.g., Schell et al., 2020) and how (green) planning practices can trigger or exacerbate such inequities among marginalized and socially vulnerable groups (Anguelovski et al., 2020, Wolch et al., 2014). Environmental justice scholarship has produced increasing evidence that some vulnerable social groups face injustices in cities' green transformation: they are more exposed to environmental hazards, experience more disadvantages in the benefits from UGI and lack agency to participate in city making processes (Agyeman, 2013, Haase et al., 2017, Wachsmuth and Angelo, 2018). The assumption that greenspaces in cities are always win-win interventions has been thoroughly questioned, problematizing so-called "sustainability fixes" and calling for a re-politization of urban greening (Diep et al., 2022, Diep et al., 2022, Kotsila et al., 2020a, Neidig et al., 2022, Rutt and Gulsrud, 2016).

However, far too little attention has been paid to how gender inequities in particular are reproduced in the use and planning of UGI and to how such inequities should be considered through a feminist lens in the design of (green) cities (Bella, 2023). Indeed, research shows that women and girls tend to use and perceive greenspaces differently, for instance by being

discouraged from developing certain activities or spending time in parks (Fernández Núñez et al., 2022). We draw here on EJ (Buckingham, 2016, MacGregor, 2020) and feminist geography (Curran, 2017, Hayden, 1980, Miralles-Guasch et al., 2016, Sánchez de Madariaga and Neuman, 2020) delving into how gender inequities permeate people's experience of the urban environment. A key insight yielded by this literature is that cities have been historically designed to meet the needs of the male-dominated productive sphere of work, relegating women to (unpaid) care work in the private sphere (Kern, 2021, Spain, 2014, Wiesel et al., 2020). This hierarchization of urban activities reproduces gender inequities in the way women and girls interact with public space and meet their daily needs (Sánchez de Madariaga and Roberts, 2016).

Efforts towards achieving gender equity in cities have recently become more prominent in policy frameworks at different levels. For instance, Sustainable Development Goal 11's Target 11.7 calls for "providing universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities". International organizations have launched frameworks and tools to guide the incorporation of a gender perspective in the practices of policymakers and planners (The World Bank, 2020, UN-Habitat, 2021). Cities like Vienna or Paris have launched guides to raise awareness on the subject (Ville de Paris, 2021, Wien Stadt, 2014). Furthermore, "gender mainstreaming" has emerged as a key concern in the European Commission's policies, through "the integration of a gender perspective into the preparation, design, implementation, monitoring and evaluation of policies, regulatory measures and spending programmes" (European Institute for Gender Equality, 2022). Other national governments have followed suit, such as Canada's federal endorsement of the Gender Based Analysis Plus tool (Women and Gender Equality Canada, 2021).

Consequently, there is a need to further understand to what extent planning processes have in practice and on the ground integrated a gender perspective in the design, implementation, and management of greenspaces. Here, we refer to greenspaces as a range of publicly accessible small or large-scale green infrastructures such as parks, gardens, street trees, green corridors and squares, roofs, and walls (Taylor and Hochuli, 2017). To date, research on greenspaces considering gender has mostly focused on users' perceptions (e.g., Braçe et al., 2021; Colley et al., 2022; Ode Sang et al., 2016) and health benefits (e.g., Fernández Núñez et al., 2022; Sillman et al., 2022). What is not yet clear is whether and how urban greening strategies and governance processes attempt to address social justice goals including gender inequities. Gender and greening policy agendas have largely evolved in parallel and are only

now converging within current plans for "inclusive, safe resilient, and sustainable cities" (SDG 11). As a consequence, urban policymakers, planners and other practitioners often continue to lack practical guidance and tools to guarantee that urban greening involves just processes and outcomes (Diep et al., 2022, Ugolini et al., 2022). Thus, the assumption that greenspaces benefit everybody equally is not only inaccurate but also problematic from an EJ perspective (Berbés-Blázquez et al., 2016, Felipe-Lucia et al., 2015, Leach et al., 2018).

In response to these knowledge gaps, this research aims at determining how social justice and gender equity considerations are being incorporated into urban greening policies, and how stakeholders operationalize these perspectives when designing and implementing urban greenspace interventions. These aims are addressed through the following research questions: 1) To what extent do leading examples of green urban planning incorporate social justice in general, and gender equity in particular? 2) How can cities incorporate justice and inclusivity as guiding goals for their greening strategies and practices? Following a non-exhaustive exploratory analysis of urban greening plans recently implemented in Global North cities, we focus on the case of Barcelona (Spain) due to its pioneering role in the implementation of both ambitious greening strategies and cross-cutting equity and gender policies at the municipal level.

2. Material and methods

2.1 Document analysis of justice trends in green city planning

Our analysis first consisted of examining broader international urban trends regarding the role of gender within efforts to link social justice and urban greening practice. Then, we delve in greater detail into our target case of Barcelona's approach. We thus first developed a comparison of the greening plans of cities considered international references according to the strategic greening plan of Barcelona "Pla Natura 2021-2030" (see Table 1). We analyzed each greening plan's main objectives and rationales, how plans framed the role of green spaces in the city, and whether these frames included any social justice and gender considerations. For gauging the degree of social justice considerations, we looked for references to distributional, procedural, and recognitional justice, which comprise the three-dimensional framework of EJ (Schlosberg, 2013), a well-established analytical framework in the context of urban greening research (e.g., Campbell et al., 2022; Fitzgerald, 2022; Mullenbach et al., 2022). For gender considerations, we assessed whether there was any mention of feminism, gender, or any concerns related to women and/or girls in green planning.

Table 1. Key international urban greening plans analyzed through a social justice and gender equity lens.

City	Document	Scope of the document
Barcelona	Pla Natura 2021-2030	Urban greening strategy
Paris	Plan Biodiversité de Paris 2018-2024	Urban greening strategy
Berlin	Strategie Stadtlandschaft Berlin 2012-2050	Urban greening strategy
London	The London Plan 2021	Urban sustainability strategy with greening integrated
Montréal	Montréal durable 2016-2020	Urban sustainability strategy with greening integrated
New York City	PlaNYC 2011-2030	Urban sustainability strategy with greening integrated

2.2 Barcelona as an emblematic case of inclusive green planning

2.2.1 A brief context of urban greening practice

Barcelona is the second largest city in Spain with 1.7 million inhabitants and one of the densest urban areas in Europe with an average of 16,325 inhabitants per km2 (Ajuntament de Barcelona, 2021a). As a Mediterranean city, it is characterized by its compact form and a low ratio of urban greenspaces, that is, a surface of 17.1% publicly accessible greenspaces compared with the European average of 41.2% (Barboza et al., 2021). Indeed, following the World Health Organization's recommendation of having accessible greenspaces within a 300 m distance of residence, Barboza et al. (2021) found that 86.2% of the population of Barcelona does not meet this requirement.

Barcelona's current greenspace deficit originates from a historical legacy of high-density and compact urbanization. Following Honey-Rosés (2022), most of the city greenspaces come from either non-urbanized residual space and squares and gardens that became accessible after urban transformations and claims and petitions from residents. Additionally, the internationalization and touristification of Barcelona since the mid-1990 s due to the organization of the Olympic Games (1992) led to a development-focused strategy. This urban planning strategy shaped the location and size of new parks and public greenspaces, which became notoriously oriented toward international visitors and tourists (Anguelovski et al., 2017). Since 2015, when the progressive Barcelona en Comú party won the municipal elections, Barcelona has held a leading role in the implementation of local sustainability policies aiming to make a more livable and inclusive city. The City Council has led multiple initiatives around the development of citizen participation, feminism, urban ecology, and social economy. Some of these initiatives are standing out as international references for progressive municipal governance including mainstreaming gender policies (C40

Women4Climate, 2019), the Climate Emergency Plan (Satorras et al., 2020), and the Decidim digital participatory platform (Borge et al., 2022). It is in this broader context that, in 2021, the City launched the "Pla Natura 2021–2030" as the key strategic plan for the city's green planning and management.

2.2.2 Content analysis of strategic urban greening policy instruments

To specifically analyze the practice of urban greening in the City of Barcelona, we developed a content analysis of strategic policies, plans and documents. In order to identify how the municipality is framing its strategic urban planning, we conducted an in-depth review of municipal plans, strategic documents and local policies related to urban greening and gender equity in Barcelona from the last 10 years (see Table 2). All documents were identified through the document repository of the City Council BCNROC, other policy documents, and through interviews. Data was analyzed using thematic analysis identifying the main objectives, motivations, and actions of strategic plans and projects. This approach allowed us to identify how official planning documents operationalize social justice and gender concerns surrounding urban greening in the context of Barcelona.

Table 2. Key planning documents analyzed from Barcelona City Council (available in BCNROC).

Year	Document type	Policy document (original title)	Policy document (translated)	Acronym
2022	Guide	Carta del Verd i de la Biodiversitat	Charter of the green and biodiversity	CVB-2022
2021	Strategic plan	Pla Natura 2030	Nature Plan 2030	PN-2021
2021	Strategic plan	II Pla per la justícia de gènere 2021-2025	II Plan for gender justice 2021-2025	PJG-2021
2021	Strategic plan	Pla d'Acció per l'Emergència Climàtica 2030	Action Plan for Climate Emergency 2030	PAEC-2021
2020	Guide	Guia pràctica per a la integració de la perspectiva de gènere als plans i projectes de la ciutat de Barcelona	Practical guide for the integration of the gender perspective in the plans and projects of the city of Barcelona	GPG-2020
2019	Manual	Manual d'urbanisme de la vida quotidiana. Urbanisme amb perspectiva de gènere	Manual of the daily life urbanism. Urbanism with gender perspective.	MUVQ-2019
2019	Strategic plan	Pla del joc a l'espai públic de Barcelona amb horitzó 2030	Plan for Play in public spaces, 2030 horizon in Barcelona	PJEP-2019
2018	Report	Serveis socioambientals dels espais verds de Barcelona	Socioenvironmental services from the Barcelona greenspaces	SSA-2018

2017	Strategic plan	Arbres per viure: Pla director de l'arbrat de Barcelona 2017-2037	Trees for life. Director plan for Barcelona tres 2017-2037	PDA-2017
2017	Government measure	Mesura de govern. Urbanisme amb perspectiva de gènere. L'urbanisme de la vida quotidiana	Government measure. Urbanism with a gender perspective. Daily life urbanism	UPG-2017
2016	Government bill	La implantació de les Superilles a Barcelona	Implementation of Barcelona Superblock Plan	ISB-2016
2015	Government measure	Mesura de govern. La transversalitat de gènere a l'Ajuntament de Barcelona	Government measure. Gender mainstreaming at the City Council of Barcelona	TG-2015
2013	Strategic plan	Pla del verd i de la biodiversitat de Barcelona 2020	Green and Biodiversity Plan 2020	PVB-2013

2.2.3 Semi-structured interviews with key stakeholders

Along with the previous stage, we conducted 15 in-depth semi-structured interviews with key stakeholders including municipal officers, city planners, technicians, and practitioners from environmental, planning or social disciplines that have been involved in the design and implementation of the public greenspace of Barcelona (see Table 3). Interviews were used to further understand how different involved actors understand and translate into practice the relationship between urban greening, social justice, and gender equity in their day-to-day work. We identified interviewees through snowball sampling, building from previous research experience, policy documents and municipal websites review until reaching saturation point. All interviews were conducted via video call in Spanish or Catalan with a 45–60 min length following a semi-structured interview guide (available in Appendix A) and an informed consent form previously signed. Interviews were transcribed and analyzed in their original language using Nvivo software and translated by the authors. Interview data was iteratively coded combining broad categories pre-defined theoretically (e.g., dimension of justice, gender equity strategy, alliances between sectors, limitations) and emerging themes and categories from a grounded theory approach.

Table 3. Interviewee characteristics.

Interview number	**Profile**	**Motivation for inclusion**
I01	Member of the Gender Mainstreaming Department. Barcelona City Council	Involved in the gender mainstreaming strategy of the city and gender equity policies

I02	Members (2) of the biodiversity section in Urban Ecology (original name: Ecologia Urbana). Barcelona City Council	Involved in the Pla Natura 2030
I03	Member of feminist urban planning group	Has experience in working on feminist urbanism projects and activism in Barcelona
I04	Member of Urban Ecology and Parks and Gardens (original name: Parcs i Jardins). Barcelona City Council	Involved in public urban greening projects
I05	Members (2) feminist urban planning group	Have experience in working on urban planning projects in Barcelona, including BCN Superblock (original name: BCN Superilla)
I06	Architect from the Strategy department on Urban Model. Barcelona City Council	Involved in BCN Superblock program
I07	Member of Parks and Gardens (original name: Parcs i Jardins). Barcelona City Council	Has experience as technician managing and designing greenspaces in Barcelona
I08	Member of feminist urban planning group	Has experience in working on feminist urbanism projects and activism in Barcelona
I09	Researcher and expert in urban ecology	Member of the scientific advisory board of BCN Superblock plan
I10	Member of the Participation Department at Urban Ecology Barcelona City Council.	Involved in Pla Natura 2030 and participatory processes related with greenspaces
I11	Member of the Strategic Department and urban model. Barcelona City Council	Involved in the design and implementation of the gender strategy in the public space
I12	Members (2) of the Municipal Institute of Persons with Disabilities (original name: Institut Municipal de Persones amb Discapacitat). Barcelona City Council	Involved in the design and implementation of greenspaces
I13	Member of Climate Change and Sustainability office. Barcelona City Council.	Involved in the Climate Plan Barcelona
I14	Member of Institute for Childhood and Adolescence (original name: Institut Infància i Adolescència). Barcelona City Council	Involved in the strategic plan BCN Playable City (original name: BCN Ciutat Jugable)
I15	Member of the Urban Ecology Department (Barcelona City Council)	Involved in the design and implementation of greenspaces

3. Results

We present our analysis of social justice and gender considerations in local greening strategies. We start by summarizing the greening plans of Barcelona's international reference cities. We then delve into the case of Barcelona to disentangle how social justice and gender equity-oriented strategies are being transversally incorporated into local urban greening

processes. We describe how the City is deploying different strategies in response to social and gender inequity problems, in which we identify three spheres of action: 1) inclusivity and care as strategic guiding values 2) accessibility and autonomy in the use and perception of greenspaces, and 3) awareness and representation in decision-making and participatory processes (see Fig. 1). We analyze the role of these three action points in relation to specific greening interventions to illustrate how justice and inclusivity can be translated into practice. Finally, we provide a summarized compilation of our results in terms of barriers, strategies and limitations as identified in our case study (Table 4).

Our results are presented with the following caveats, building from previous environmental literature on closely related topics like gender and care (Macgregor et al., 2022). First, we treat gender as a category that helps to analyze how power relations interact within green planning processes. We advocate for women as a non-homogenous category and contend that gender intersects with different axes of inequality (including class, race, age, sexual orientation, gender identity, and disability). Further, recognizing non-binary gender and non-heteronormativity should not be overlooked. Finally, we reject any assumption essentializing women as intrinsically more vulnerable and caring and use instead a systemic understanding of gender inequities comprising complex and dynamic relationships, norms, and processes (Lau et al., 2021).

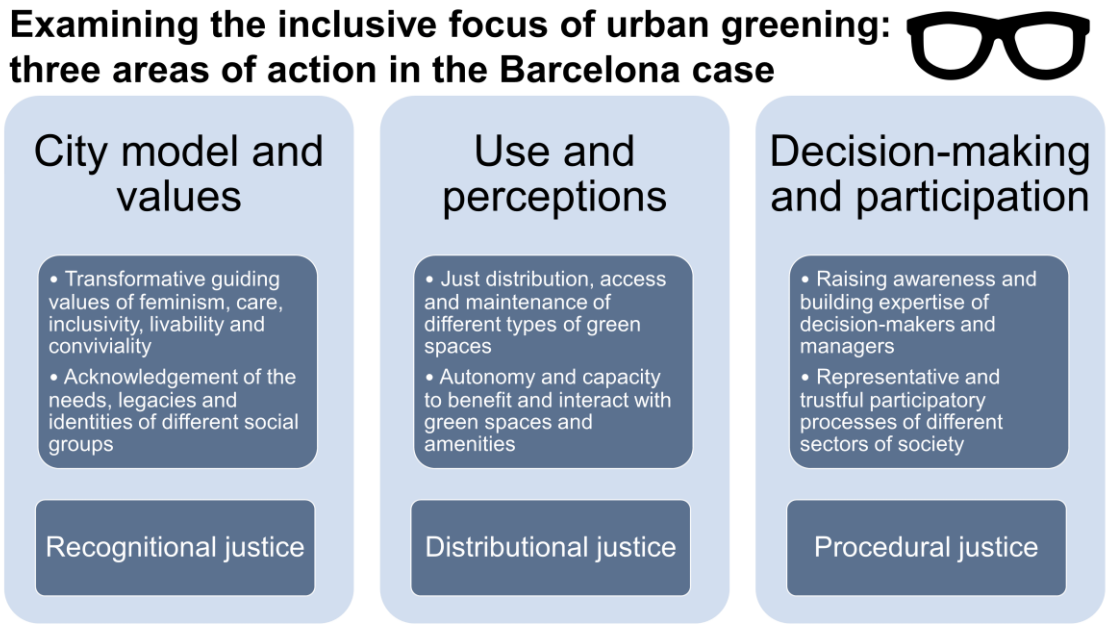

Figure 1. Conceptual framework structuring our results. Three areas of action were identified in the practices and strategies of the City of Barcelona for ensuring an inclusive green planning approach. We propose them as closely related with the three dimensions of EJ.

Table 4. Compilation of barriers, strategies and limitations identified/suggested by our interviews and policy document analysis in the prevention of social and gender inequities in the urban green infrastructure of the Barcelona case.

Barriers in ensuring social and gender equity within urban greenspaces	**Strategies and measures envisioned or already in practice to address inequities**	**(Potential) limitations and risks**
City model and values		
Strategic greening plans do not incorporate a social and gender equity in their diagnosis and objectives. Strategic documents acknowledging environmental, social and gender inequities do not include a specific action plan and mandatory norms. Lack of acknowledgement of historically marginalized communities and activist movements within feminism and LGTBIQ+ movements.	Applying transversally those perspectives in all policies and plans and produce action plans, guidelines, methodological toolkits and indicators. Acknowledging feminist and justice symbolic values in the planning of the city such as inclusivity, care, feminism, daily life, reproductive work and conviviality. Translation of gender-related criteria into clear and replicable technical standards.	Mainstreaming social and gender perspective can banalize its concepts if carried out superficially. Differences in the understanding of concepts and methodologies of gender-related concepts (perceived as subjective). Ideological dissensus or politization of gender-related concepts which hinders consensus (e.g. feminist vs gender perspective) and projects' continuity.
Use and perceptions		
Unequal and patchy distribution of the UGI in the neighborhoods across the city. Unequal maintenance of the UGI and unequal provision of ES across the city. Differences in the use, frequency and perception of city residents, particularly affecting women, migrants, children and elderly feeling unsafe or unwelcome. Inclusivity criteria tends to focus mainly on physical access and overlook cognitive access.	Including socioeconomic variables in the criteria for the implementation, renewal, and maintenance of UGI. Improving inclusivity and accessibility of greenspaces following design guidelines: improve lighting, pruning vegetation to avoid high and dense trees and bushes, prioritize perennial over evergreen vegetation, avoid cul-de-sacs and corners, facilitate permeability and visibility of the park from outside, avoid walls and separations, prioritize polycentric design, and facilitate the orientation and itinerary inside the greenspace. Identifying demands and potential uses for a greenspace within the specific context of the neighborhood. Allowing different activities and uses within greenspaces and avoid mono-functional areas. Promote flexibility, mixed uses and use of naturalization (e.g. use of natural elements as element for playing is suggested as a more gender-neutral space for children).	Ecological and biodiversity criteria of greenspaces do not always coincide with accessibility criteria. Limited capacity to increase the surface of green due to compact form of the city and lack of available land. Design guidelines are easier to apply in new green interventions but are difficult to transfer to the already existing spaces. The design and use of greenspaces may reproduce gender roles (e.g. essentializing women as the caregiver). Limited potential from policies in changing sexist behaviors.

	Focusing on a smaller scale and develop pocket parks used by people of the immediate surroundings responding to their local and context-specific needs. Implementing different types of UGI according to the space availability (e.g., vertical surfaces, terraces, roofs, tree pits, pots and other small structures).	Lack of resources for managing and maintaining the UGI (financial support, staff, etc.).
Decision-making and participation		
Lack of awareness and expertise in EJ and gender topics. In particular, environmental departments focus on ecological and biodiversity criteria but not on the social and justice implications. Reluctancy and contestation towards the use of gender perspective in urban (green) planning. Unequal representation in participatory processes. Some social groups (e.g., single women, children and teenagers, low income, and immigrant residents) tend to be underrepresented. Internal gender inequities among municipal workers, including unequal representation, particularly among gardeners as a traditionally male sector.	Establishing specific teams in charge of applying gender and social equity (e.g., gender mainstreaming department). Increase collaboration among different departments and interdisciplinary work incorporating social equity and intersectionality as complementary goals in urban greening and avoid silos. Establishing training programs to raise awareness to the people working on the public administration and work in close collaboration with professional experts on those topics (e.g., feminist urban planners). Incorporating gender-sensitive methodologies in participatory sessions such as small workshops and focus groups, exploratory walks, online participation, time flexibility in participatory sessions, economic compensation, contacting entities and associations (e.g., associations of people with disabilities, feminist assemblies) and approaching them in the public space instead of making them to come to the institutions. Carrying out participatory processes at different institutional scales like city, district, and neighborhood governments to identify the different needs of citizens and leverage from different governance structures. Targeting specific social groups to ensure representativity with an intersectional focus (not only women, but women with a disability, migrant women, girls, older women, etc.). Developing internal policies and protocols for gender equity, representativity, sexual harassment and gender discrimination.	Lack of transparency and accessibility in participatory processes may impede city residents to participate (e.g., formal language, legal procedures, unclear impact, lack of trust and time poverty). The digital sphere for online participation is a barrier particularly present among women with other intersecting identities (e.g., women with disabilities, migrant women). The politization of gender and feminism can delay changes and compromise its institutional stability. Participatory programs tend to have a limited potential, reduced to compilation of opinions rather than real co-creation processes. Tokenistic approaches to participation.

3.1 Comparative analysis of urban greening plans

Comparing the six cities (Appendix A displays full analysis), we see that all greening plans highlight the contribution of greenspaces to human well-being and to the livability of cities. The Montréal and London plans are framed around a broader urban sustainability strategy and portray greenspaces as a strategic element for addressing climate change challenges, among others. The Berlin and New York plans have a stronger focus on public space, emphasizing the function of greenspaces as places of encounter and as a key infrastructure of the urban landscape with an important economic role (e.g., flagship parks). London's plan includes a chapter explicitly pointing at green and blue infrastructure conceived as a network to be designed and managed in an integrated way within the city's built infrastructure. In contrast, Montréal's plan does not include a green infrastructure approach but frames its objectives in terms of increasing tree canopy cover and protecting natural areas. The Paris plan highlights the importance of conserving urban biodiversity. In short, urban greening plans acknowledge the multifunctional role of greenspaces through the provision of ES but differ in the conception of their relationship with the built environment of the city.

Distributional justice is a central concern of all the analyzed plans. Equity is mentioned as ensuring the availability and accessibility of greenspaces for all city residents. For instance, the Paris plan highlights social justice as a key objective due to the "increased dependency of low-income residents on their immediate greenspaces". Similarly, the NYC plan states greenspaces as a public infrastructure that must be guaranteed "to all New Yorkers". The Berlin plan starts with a universal access goal by stating that all residents should have access to a greenspace within a distance of less than 500 m from their home and, similarly, the NYC and Paris plans aim to ensure accessibility to a greenspace within a 10- and 7-minute walk, respectively. Furthermore, the Barcelona and Berlin plans include a diagnosis of the distribution of their green infrastructure and London's suggests creating accessible open space in "areas of deficiency".

Procedural justice is present in most of the plans through the implementation of participation programs. Paris and Barcelona have ambitious aims for participatory processes, framed in terms of participatory democracy, empowerment, support for citizens' bottom-up initiatives, and their right to participate. Berlin's plan calls for the cooperation of citizens in increasing the sense of belonging and cohesion. However, Montréal's plan does not explicitly mention any participatory approaches in relation to greening and London's plan only cites participation in the case of community gardens. Finally, NYC's plan justifies participatory

processes as a way to maximize impact and promote civic engagement in the co-design and management of greenspaces. Most participatory programs do not specify the mechanisms by means of which to achieve a fair representation of participants, although some are broadly targeted towards children and families, actors from public and private sectors, and non-profit organizations.

Finally, recognitional justice (i.e., the acknowledgment of the different values, needs, and identities of historically marginalized communities) is rarely explicitly considered within the urban greening plans. NYC and Berlin recognize the importance of considering the needs, uses, and preferences of different social and cultural groups in the design of greenspaces. Berlin's Plan also frames greenspaces as spaces of representation where historical legacies have an important role referring to the former Wall separation.

Gender equity is not explicitly mentioned as a goal in any of the plans except for the Barcelona case, which aims to "address to the new needs of parks (...) in [supporting] gender perspective and social justice" (PN-2021, p.98). However, the document does not specify how to apply such perspectives and how it is expected to be implemented in practice. Instead, it leaves it as an action point to be developed in the future. Nevertheless, in this context, Barcelona stands out as a unique example of a city aiming to employ the gender perspective as a cross-cutting lens in bringing together social justice concerns with greening strategies. Thus, unlike the other analyzed cities, Barcelona can provide novel perspectives into how cities integrate social and gender equity into green planning practices. To trace how such goals are being understood and operationalized, we present in the next subsections an analysis of the processes behind the production of Barcelona's strategic greening plan.

3.2 Strategic guiding values: inclusivity and care

The first strategic green guiding plan of Barcelona was the PVB-2013 (see Table 1). The PVB-2013 established a strategic vision for urban greening and framed green and blue spaces as an interconnected, multifunctional infrastructure, while emphasizing biodiversity goals and management criteria. However, that first policy document lacked any consideration on equity or distribution. This strategic vision was consolidated with the PN-2021, which fully deploys a multifunctional role of green infrastructure; and complemented with the CVB-2022, a reference guide for implementation and management needs within biodiversity and sustainability criteria. The PN-2021 presents a green infrastructure aimed at making the city more livable, sustainable, and healthy, in addition to its aesthetic and heritage role. And, as mentioned in previous international comparison, the PN-2021 starts making explicit

reference to the (un)equal distribution and accessibility of greenspaces throughout the city. Thus, we identify a shift in the role assigned to greening, which goes essentially from an ornamental to a multifunctional focus. This shift was experienced by municipal technicians: "*In the last 15 years, it's been like a professional and personal transition (...) from a city that didn't consider greenspace as something strategic (...) we talked about it only as something aesthetic or horticultural (...) to a city that starts to consider it as an infrastructure*" (I7).

In parallel, the city implemented the UPG-2017, a set of measures for the incorporation of gender equity, inclusivity, social cohesion, and care at the forefront of urban planning processes to "situate the sustainability of daily life at the center of policies" and, in sum, for creating an "inclusive public space from a gender perspective". These policies contribute to a broader trend of gender mainstreaming, developed in the TG-2015, designed to incorporate the gender perspective in all local government policies and measures. Consolidated later with the PJG-2021, these documents point out the importance of caring activities in the public space, the feminization and invisibilization of care work, and how such aspects have historically influenced the design of cities.

The explicit link between gender equity and urban greening in practice is crystallized when the City Council launched the MUVQ-2019 and the GPG-2020 as a set of guidelines for the integration of the gender perspective in urban plans and projects. Their purpose is to design and manage public spaces –such as squares and parks– so they can contribute to the creation of spaces of comfort, safety, and autonomy where people can develop their daily tasks, socialize and take care of themselves and others. Building from the understanding of urban space as a mechanism for the reproduction or transformation of gender inequalities, the aim of such documents is to facilitate everyday life activities, also through greenspaces. And, therefore, greenspaces are displayed as a physical infrastructure that can be designed for the diverse needs of city residents in everyday life, that is, also taking into account care work and self-care needs. However, there is no questioning or elaboration of the care work within broader social and gender dynamics of who undertake that work and at what cost.

Such recognitions of inclusivity and care configure a particular model of greening that we see evolving in Barcelona. In this context, the Superblock (originally Superilla in Catalan) program emerges as the ultimate green intervention following proximity, inclusion, and care values (ISB-2016). The Superblocks program is a flagship urban planning initiative aiming to transform public space mostly dedicated to traffic/car parking into new pedestrian areas with more greening and to create accessible and secure public areas for diverse groups with

particular care needs like children, families, and older residents. This project gained international attention as an ambitious city-wide planning model bringing together environmental (i.e., climate change, ES) and social (i.e., human health, inclusivity, conviviality) concerns (Ajuntament de Barcelona, 2022a, Mueller et al., 2020, Torrens et al., 2022). Thus, the Superblocks materialize a reformulation of the public space proposed with special attention to the tasks of everyday life and care, and aiming for "greener, healthier spaces to be, walk, sit, play, and socialize, and with the ability to strengthen the social network of everyday life (…) and make the neighborhood spaces more comfortable for all people and jobs" (p. 98, PJG-2021). Similarly, the 2020 program Protegim les escoles ("Protecting schools" translated), also aims to implement small greenspaces for pedestrians around schools in order to protect children from traffic and provide a more comfortable space to socialize and take care of children (PJEP-2019). Additionally, another policy strategy that explicitly considers gender equity and sustainability is the Climate Plan PAEC-2021, where gender is included within an intersectional perspective of climate change vulnerability (e.g., p. 25 and 29 and first 3 action lines).

While we see an emerging trend of including the gender perspective as a pathway for ensuring social justice within Barcelona's greening plans, some challenges remain in their actual implementation. We found that the increasing prominence of greening in the political agenda of the city has created a political instrumentalization of greening policies: "*A lot of people are like 'all for the green!' (...) [and this] is rhetorical, branding*" (I7) or "*These topics are used as political weapons*" (I6). Another recurrent theme emerging from the interviews was a sense that, even if greenspaces are now considered a key urban infrastructure, the resources allocated have not increased proportionally enough. Besides, although the Superblock program is presented as a long-term green and inclusive transformation of the public space, its implementation may fall short as a city-level transformation: "*I miss a city model (…) that goes beyond specific interventions*" (I9) or lose continuity in time: "*[In] long-term issues with big investments... the administration often gives up. (...) The main risk is that nothing gets consolidated, that [the Superblock program] remains anecdotical*" (I6).

Finally, interviewed feminist architects argued that the current institutionalization of the gender perspective can undermine its transformative potential: "*[Feminist urbanism] is in all agendas, it is a requirement. We could be now in the opposite situation, banalizing the concept*" (I3). Besides, the incorporation of the gender perspective into official documents creates tensions with feminist activists, who consider that their historical influence and societal contributions are not being fully recognized: "*There is a very powerful feminist movement in Barcelona from many*

decades ago. And the City Council builds on that, no doubt. A lot of times without visibility or recognition. (...) [The City Council] appropriates feminist claims and knowledge" (I8).

3.3 Use and perceptions: accessibility and autonomy

Secondly, moving towards operationalization and implementation, a recurring topic during the interviews was the distribution of greenspaces across the city. The average ratio of greenspace per inhabitant in Barcelona is relatively low and unevenly distributed. For instance, the Eixample district has the lowest ratio with 2.01 m2 of urban green per inhabitant, while Sants-Montjuïc has the highest with 17.48 m2 per inhabitant, mostly due to the proximity of the Montjuïc mountain park (Ajuntament de Barcelona, 2021b). However, because of the compact and consolidated urban morphology of the city, the creation of new large greenspaces is often driven by major renewal or development projects rather than a real green equity agenda. This phenomenon relates to an "opportunistic" approach to greening: "*Urbanistically, Barcelona is an almost finished city. There is no space to add greenery, and greenery is placed where there is an opportunity (...) [which] of course, it does not always coincide with the map of deficits*" (I2). In this context, the City Council tries to compensate green deficit areas with the implementation of smaller green interventions such as pocket parks, green walls, façades and community gardens. This approach is best embodied in the Superblock and the Green Axis and Squares (Eixos Verds i Places a l'Eixample) programs, which creates new pedestrianized squares in former traffic intersections with greenery and urban furniture (Ajuntament de Barcelona, 2022a). Still, it is important to consider that green (re)development areas can contribute to green gentrification and tourism, potentially leading to the exclusion and displacement of local residents. To address these concerns, the City Council proposes the implementation of usage plans (Pla d'usos) as a proactive policy approach to regulating specific commercial activities and housing prices.

However, having physical access to greenspaces does not guarantee an equal use and benefit, since differences in citizens' perceptions and preferences –constraint by social roles and dynamics– affect the practices and activities carried out there. This aspect was very present when asking about gender equity in greenspaces, since interviewees very often expressed their concerns about how men and women use such spaces in different ways. Municipal managers (I04, I07, I15) acknowledged how men tend to use these spaces mostly for leisure time and sport, while women tend to use them less intensively, including more passive recreation and care tasks. Besides, women often perceive parks and other greenspaces as unsafe, particularly at night hours, thus preventing them from accessing and using those

spaces autonomously to the same extent as men: "*A greenspace does not mean to be a safe space, or a space for women (...) a lot of times it is the opposite*" (I9). To address this problem, the City Council is applying a set of design and management guidelines (compiled in GPG-2020, p.31–34) on green infrastructure quality and accessibility (further detailed in Table 4). Such guidelines tended to go hand in hand with considerations of further axes of vulnerability and inequalities, making reference not only to gender but also (dis)ability, age and migration background. Several common points around accessibility and autonomy in the public space were suggested when asked about specifically gender equity (I12, I14, I10), forming spontaneous interdepartmental alliances in their needs and diagnosis: "*It's interesting because, coming from different discourses, like gender or disabilities, at the end we reach the same conclusion. (…) Accessibility is linked with disabilities (...) [but] safety, community, comfortability, autonomy are features that benefit everybody*" (I12). Besides, the operationalization of the gender perspective in urban greening is not applied as a one-size-fits-all solution: "*The reality is not standard*" (I12) but as an inclusive framework for the improvement of public space design: "*Safety is not only good for women, it is good for everybody. (...) Gender criteria brings quality*" (I10).

Such principles for accessibility and autonomy, when brought to greenspaces, may entail some tradeoffs vis-à-vis ecology and biodiversity needs. Environmental professionals expressed certain incompatibilities with what is recommended for fauna in terms of habitat conditions: "*For fauna preservation, during the night there should be no lighting. [Parks] should be dark spaces (...) and [they] should be closed so people don't enter*" (I4). This tradeoff also limits the potential of some ES like temperature regulation: *"[When creating open and visible greenspaces] you lose the buffer effect that greenspaces can have, even on noise or heat reduction*" (I4). Additionally, green interventions more embedded in the urban fabric present a reduced potential transformation from the environmental and biodiversity point of view. Although small-scale greening may increase the canopy cover within the compact form of the city, the extent and quality of such greenspaces is rather limited. For instance, Superblocks are often built with tactical temporary elements such as flowerpots that limit plants growth and are costly to maintain, according to municipal managers: "*Those are spaces which are complex to manage because having trees in large pots is not viable (...) neither for the trees nor for the gardeners*" (I7).

Last, another gender-sensitive aspect relevant in greenspace design is the facilitation of care tasks (e.g., taking care of children and older adults) through the installation of benches, tables, playgrounds and other street furniture. This approach is embedded in a broader city model emphasizing the value of care work, as reflected in the "Caring city Plan" (original name Ciutat Cuidadora), the PJG-2021 and the Government Measure for Democratizing Care

Work (2017–2020) (original name, Democratització de les cures a la ciutat de Barcelona, Ajuntament de Barcelona, 2022b). However, presenting the care-oriented design for greenspaces as an isolated measure for the benefit of women poses the risk of creating an image that essentializes women as mothers and caregivers: "*I am a mother and I am happy to bring my children to the park, but my partner can also bring them. (...) Not as an axioma that says that our greenspaces use must be this [taking care of children]*" (I09). Heeding this concern reflects a delicate balance between use, demand and gender roles: "*One thing is the reinforcement of gender roles, and another is not to take into account the differential day-to-day reality of women and men*" (I8). These measures, according to the above-mentioned policies promoted by the City Council, meet two equally important objectives: to acknowledge and dignify care tasks developed in the public space, and to redistribute the responsibility toward care (Ajuntament de Barcelona, 2022c).

3.4 Decision-making and participation: awareness and representation

The third relevant aspect emerging from our results is related to procedural justice within Barcelona's greening strategies. With the aim of attending the different needs and values of society, the City Council has established participatory programs as a priority within their urban planning policies. Participatory processes related to urban greening unfold in two aspects: one, for the inclusion of citizens' opinions and needs in the diagnosis, design, and evaluation of plans, programs, and interventions; and two, for the stewardship of greenspaces with programs like volunteering and co-management of parks and gardens.

The former includes, for instance, the formulation of the Superblock program, the "Barcelona Green Axes" project (Eixos Verds i Places de l'Eixample), and strategic plans like PN-2021, PAEC-2021 and PGJ-2021. These programs have often been accompanied with feminist methodologies like exploratory walks, that is, urban routes led by women neighbors that allow for in situ public space assessments (Departament de Transversalitat de Gènere, 2019). However, when we asked interviewees from environmental departments, who work addressing citizen petitions and complaints, they expressed fewer requests centered on girls' and women's needs comparing with other users of greenspaces such as dog-owners or people doing sport (I04). These comments suggest somehow a gender imbalance in the articulation of demands related to greenspace use: "*We have few petitions in this sense [gender-related needs or demands]*" and "*Barcelona's planning process takes different neighborhood needs into account [but those] are frequently dominated by men*" (I7). Besides, while participatory processes and methods entail an important step toward bringing gender issues to bear on

urban greening interventions, participatory schemes have tended to be limited to a compilation of opinions rather than a real co-creation process, and often based in an incomplete and biased representation of the population.

Regarding the latter aspect, participatory mechanisms for public greenspaces stewardship seem to face a high demand: "*There is a high demand in collaborating, in being able to participate (...) The City Council is always behind the demand*" (I10). With such demands coming particularly from women, according to municipal workers involved in participatory programs: "*The majority of proposals come from women who want to plant and take care of spaces and who have this awareness. (...) The leadership comes from women*" (I10). This observation follows other research findings on Barcelona's informal green spaces, including community gardens, in which women have been shown to take a particularly important role throughout (Kotsila et al., 2020b) – a role that is being compromised by the overburdening of women and by administrative procedures and timelines that can undermine the sustainability of the civic green projects.

On the other hand, the operationalization of a social and gender equity perspective in green public spaces is an intrinsically interdisciplinary task which requires close –yet challenging– collaboration between different municipal departments and institutions. Municipal staff from greening areas recognize difficulties in breaking silos and working across disciplines and in collaboration with different departments: "*It's difficult to work with everybody coordinated*" (I2) and "*In the end, we end up doing participation for the administration. Departments are very fragmented, they don't have this internal communication*" (I5). In this sense, the Gender Mainstreaming department works with the objective of applying a cross-cutting approach: "*What we do is to assess, collaborate and assist all City Council [areas] to integrate the gender perspective*" (I01). However, we find that the institutionalization and mainstreaming of the gender perspective is still a relatively new and challenging task for the City Council. First, some respondents expressed a lack of awareness and knowledge in gender-sensitive planning, particularly among departments related to environmental issues: "*It's a new world to us*" (I2). This is also noted by experts on gender issues who work in the implementation of public space projects: "*Is it guaranteed that there are expert persons carrying out the projects? What does it mean to apply a gender perspective? To put more public lighting and that's it? What is the level of depth being applied?*" (I3). Second, some interviewees expressed that it is frequent to find reluctant attitudes towards gender equity in the administration: "*We find a lot of resistance*" (I1) and "*When the word 'gender' appears you have to justify yourself, and whatever you present cannot have any mistake*" (I5). However, this situation has apparently evolved over the last years: "I remember doing [participatory] gender walks, and the urban planner was laughing. Younger generations of

architects/planners have it [the gender perspective] more incorporated" (I10). Third, the rise of a gender perspective in the political agenda is a conspicuously contested topic and gender policies might get compromised by political turnovers and changes in the municipal government. Public officers working on gender mainstreaming expressed their fears about the fragile institutionalization of gender equity criteria and the risk of projects losing continuity: "*We are interested in institutionalizing these [gender equity-driven] processes (…) so it can be maintained [across time and institutional changes] and some elements remain and impregnate the organization*" (I1). The challenge here is that gender equity goals in the public space often do not benefit from legally binding rules. Municipal staff with experience working with people with disabilities and public space expressed similar obstacles and experiences that were eventually overcome through mandatory guidelines and policies: "*What is going on with gender is like what happened with accessibility for people with disabilities. (…) When norms get approved, planners and architects have to adapt*" (I10).

Finally, another aspect that emerged from our analysis is the potential reproduction of gender inequities within staff positions in the City Council, including discrimination, harassment and (under)representation of women in different units and agencies. For instance, the management and maintenance of greenspaces is a highly masculinized sector which has faced sexual harassment complaints by its workers in the last 20 years (El Crític, 2021). In response, the City launched an internal equity plan with a protocol for the "prevention, detection and action" of sexual harassment (PN-2021) and a campaign to encourage the incorporation of female gardeners called "I am a woman, I am a gardener" (Soc dona, soc jardinera) (Ajuntament de Barcelona, 2021c).

4. Discussion

The goal of this article was to determine whether and how urban green planning addresses social justice with a focus on gender equity, using the pioneering agenda of the city of Barcelona as a particularly exemplary case study. First, our initial international review revealed that social justice is often addressed in a superficial and unstructured manner within strategic greening plans. Second, our case study stands out in the realm of green infrastructure planning by effectively incorporating multiple objectives related to social and gender equity. We identified three key spheres of action where these objectives are prioritized and implemented.

4.1 Adding the lenses of social justice to urban greening: a shifting focus

Our comparative analysis indicates consistent patterns in how urban greening is being addressed within strategic policies across various cities. In all policy documents, greenspace is portrayed as a multifunctional infrastructure that brings social, economic, and environmental benefits to city residents. However, this multifunctional approach does not necessarily align with ambitious goals for social justice to ensure that benefits are equally shared. Similar to previous research conducted in different geographic contexts (Grabowski et al., 2023, Gradinaru et al., 2023, Hoover et al., 2021), the policy documents we examined demonstrated a superficial engagement with justice, focusing primarily on distributive aspects and participatory processes. Additionally, we observed minimal direct connections with recognitional justice and gender equity.

Drawing on the literature problematizing "technocratic approaches" to greenspaces (Diep et al., 2022) our findings question the potential of urban greening as a transformative amenity that can automatically contribute to inclusivity in a trickle-down manner. For instance, if girls and women perceive parks as unsafe and consequently utilize them less frequently, as reported by our interviewees and supported by research (Derose et al., 2018, Fernández Núñez et al., 2022, Fontán-Vela et al., 2021, Marquet et al., 2019), we cannot assume that the benefits of greenspaces will be equally received unless additional gender equity-driven policies are implemented. The issue of care and gender follows a similar line of reasoning: merely providing high-quality greenspaces to support and acknowledge care work will not bring about transformative change unless accompanied by comprehensive policies and structural adjustments aimed at redistributing care tasks. This shift is necessary to ensure that care work is not solely perceived as a women's burden but rather shared equitably both within households and public space (Macgregor et al., 2022). According to Buckingham (2016), there is a risk that city planners may overlook gender relations and inequalities, mistakenly assuming that these issues are adequately addressed within the broader sustainability urban agenda This is why it is necessary to problematize and account for different social groups that may be more or less advantaged by greening and sustainable-driven activities, even when these activities and plans are framed as broadly inclusive and beneficial.

Our findings also indicate that urban greening plans and gender equity policies remain relatively separate in urban governance. We acknowledge that although justice-oriented goals were scarcely mentioned in urban greening plans, this does not imply that cities steer away from social and gender equity discussions in their agendas. However, we found that this

discussion has not transversally permeated across greening and other environmental policies. And therefore, even if European institutions push for gender mainstreaming recommendations, the incorporation of the gender perspective in greening plans and policies is still scarce and inconsistent. On this particular topic, the City of Vienna stands out as a historically pioneering case introducing gender-sensitive parks and officially accounting for women and girls' needs in public space design (Irschik and Kail, 2016, Stadt Wien, 1999).

Despite considerable disparities in terms of implementation, awareness of social justice issues in urban greening is gaining increasing attention (Gradinaru et al., 2023; Hansen et al., 2022). As depicted in Fig. 2, we contextualize this trend in relation to a previous approach of valuing greening for its ornamental, patrimonial value, materialized in more estheticized and manicured gardens and large parks. As we have seen in the case of Barcelona, this focus has shifted toward a model valuing ecological functions and social benefits, materialized in smaller pocket parks and squares integrated within the compact urban fabric. While the ornamental focus builds on a vision of nature as an urban asset for the beautification of the city (Angelo, 2020), the multifunctional focus articulates greening as an integrated, connected infrastructure addressing daily life needs of city residents. Such vision of the green infrastructure is aimed at making cities sustainable and resilient (Connolly, 2019) and considers greenspaces essentially as "infrastructural fixes" (Diep et al., 2022). Although an in-depth historical analysis of urban greening models is out of the scope of this article, we suggest that our case study exemplifies a shift in urban greening approaches, introducing the lenses of social justice, inclusivity and care to the multifunctional model. In the context of Barcelona's green planning model, these lenses gradually and unevenly shape an urban greening approach that addresses inequities and incorporates socially inclusive governance processes.

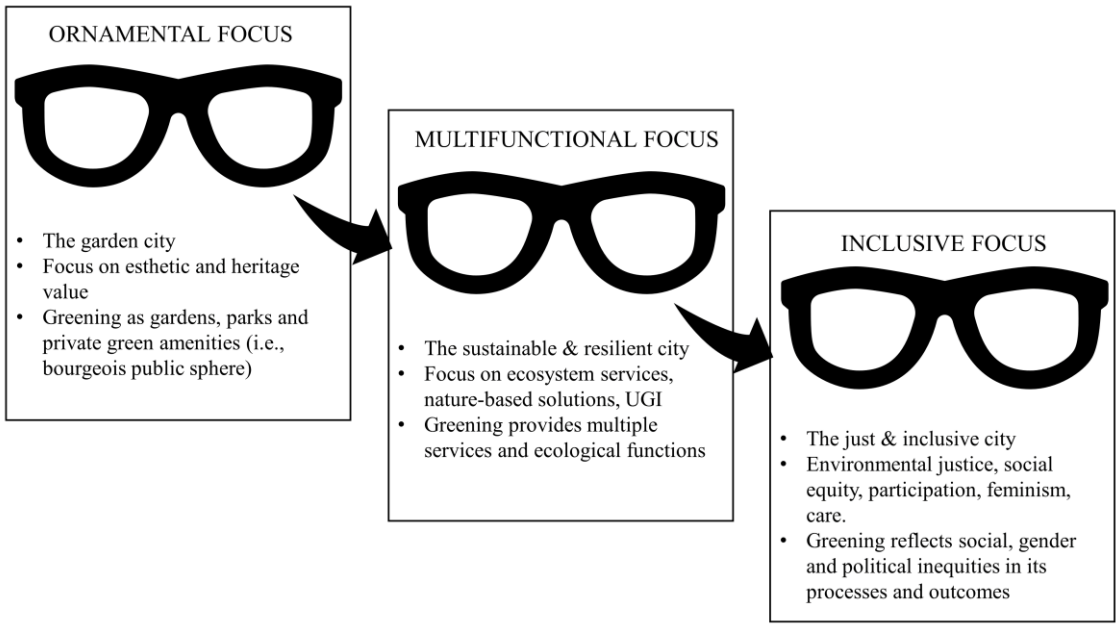

Figure 2. Conceptual framework for the three urban greening models proposed in our analysis. The ornamental focus, the multifunctional focus and the inclusive focus act as lenses that can be added to the operationalization of green planning in cities.

4.2 Consensus-based and ad hoc intersectional planning in urban greening practice

Our analysis shows how in Barcelona similar criteria for the different spheres of action stemmed from greening policies and gender-sensitive planning guidelines and plans. The strategic role assigned to public space in policy documents–even if coming from different departments and disciplines– is increasingly linked with delivering equitable, inclusive, and accessible public spaces and ensuring "livable, proximate and green" neighborhoods. This finding suggests a strong resemblance between explicitly gendered approaches and implicitly-gender sensitive approaches emphasizing quality of living, a matter already described in the literature (Sturm et al., 2019). However, we have identified two elements to consider for the unique pathway created by bringing the gender lens on to socially just greening.

First, although we often see "green" or "sustainable" at the forefront of urban policies (Andersson, 2016, Garcia-Lamarca et al., 2021) while "feminism" and gender-related concepts tend to be disguised and more implicitly addressed in urban planning. At the discursive level, greening can contribute to processes of "consensus-making" (Angelo, 2020, Neidig et al., 2022) under a broader current of de-politization of urban environmental planning (Rosol et al., 2017). In contrast, the contested and politicized disposition toward feminist cross-sectional policies may hinder the explicit incorporation of such terms. In

consequence, inclusivity and equity terms are employed instead, encompassed within broader objectives of promoting well-being and fostering social cohesion.

Second, our Barcelona analysis reveals that similar recommendations for greenspaces quality and design converged even if planned for different social groups separately. We call this apparently spontaneous confluence ad hoc intersectional planning. Our interviewees –when asked for justice-driven actions in greening– expressed their concerns for girls, women with disabilities, single mothers and migrant families, among others. Therefore, the intersection of different axes of inequalities was present when applying inclusivity and accessibility guidelines in greenspace practice. Although these strategies may not have been explicitly integrated in advance, they were reflected through the day-to-day implementation of greenspaces by the City. We argue that, under the terms "inclusivity" and "accessibility", we found an ad hoc intersectional planning approach responding to different combinations of residents' needs, even if not being strategically anticipated as such.

However, we contend that adopting an inherently intersectional approach, building from previous scholarship on intersectionality and greenspaces (Anguelovski et al., 2020, Colley et al., 2022, Henderson and Gibson, 2013, Powers et al., 2020) would enable a more accountable and responsive focus on the specific needs of marginalized communities. In the case of Barcelona, this approach is particularly absent in relation to racialized minorities (Amorim-Maia et al., 2022). Similarly, participatory programs tend to build on top-down approaches aimed at "collecting opinions" and failing in the fair representation of underprivileged population and their perspectives. Such tokenistic approaches, rather than a real co-design process, have shown a limited empowerment potential (Kotsila et al., 2023).

4.3 Recommendations for inclusive urban greening policy and practice

In this article, we aimed to assess the relevance of social and gender equity within urban greenspaces to eventually identify best practices and examples from our case study. In the following subsections, we provide recommendations for policy-makers and practitioners in urban greening to move beyond consensus-based and ad hoc intersectional planning. Nevertheless, it is important to acknowledge that the implementation of some of our recommendations may be limited and contingent upon specific contexts.

1) Define green infrastructure goals aligned with equity goals

First, urban greening policies need to explicitly incorporate the social and equity links with their environmental goals and actions. To achieve this, it is necessary to provide clear

definitions and goals of justice and equity in the outcome and processes of (greening) policies. Second, guiding strategies, action plans and indicators ought to be provided to ensure the execution, continuity and evaluability of the policy. City planners working on green interventions often lack the tools and guidelines for ensuring equity, particularly regarding procedural and recognitional justice aspects. This can take form as toolkits with indicators previously identified by the literature (see, for instance, Kato-Huerta and Geneletti, 2022) and by gathering sex-disaggregated data for understanding gender inequities in urban issues. Third, green infrastructure interventions are not necessarily win-win solutions. It is important to openly address and discuss conflicting interests and trade-offs that can arise during such interventions. By doing so, we can proactively prevent and manage potential urban processes that may hinder accessibility and inclusivity. For instance, Oscilowicz et al. (2022) reviews anti-gentrification, displacement and equitable greening policies. Finally, gender inequities have shown to been particularly overlooked within green planning, and therefore we consider that environmental and city planners would greatly benefit from other framing lenses, such as feminist urbanism. Greening planners and decision-makers could seriously incorporate guidelines, toolkits and manuals from research and international organisms working on the topic (e.g., UN-Habitat, 2021).

2) Provide adequate training and work in an interdisciplinary manner

Breaking silos and interdisciplinary work constitute an essential step in ensuring a real integration of the urban green infrastructure into strategic urban planning. Facilitating collaborations with different infrastructure types, policy domains and stakeholders is crucial. Transversal departments such as those dedicated to participation and gender mainstreaming have shown to be useful in ensuring the inclusion of certain criteria throughout different policies and avoiding duplication of efforts. Additionally, cities can benefit from building alliances with other cities and regions with similar greening strategies and demands (e.g., the "Green City Accord" by the EU, or the Covenant for Mayors for Climate & Energy at the global level). For instance, a common repository of greening plans could facilitate the consultation of strategic policies and serve as example to other cities.

Furthermore, changes in the decision-making processes and new planning concepts have continued to develop and, hence, there is a need to provide continuous training to municipal officers (e.g., training on gender perspective, LGTBIQ+, and social justice aspects to environmental departments). Likewise, it is very necessary to provide training and resources

about sexual and gender harassment and to develop protocols on action and prevention of abuse and discrimination, which is an indispensable condition for gender equity among staff.

3) Avoid standardization and assess needs intersectionally

There is no standard solutions or one-size-fits-all approach for an inclusive green infrastructure. Put differently, the prioritization of increasing m2 of greenspace per inhabitant (as often conveyed) does not necessarily address conjunctural unjust aspects of everyday access to and use of greenspaces. Applying a social and gender equity perspective requires engaging with the diversity of needs, preferences and values of all users, which can evolve or enter in conflict. This involves attending different communities, listening to civil society organizations and activists, and acknowledging historical injustices and legacies. Therefore, it is important to take into account local needs at different scales (i.e., neighborhood, district, municipality, metropolitan area, etc.) and to ensure meaningful participatory processes and co-production of strategies. An intersectional approach can serve to acquire a deeper and more precise understanding and a justice-led action towards the inequalities that are reproduced within public space.

4) Engage with the specific characteristics of green infrastructure

We have seen how cities are increasingly planning greenspaces as a strategic, multifunctional, multi-scalar and networked infrastructure. However, the multi-functional and multi-scalar characteristics of the urban green infrastructure add a layer of complexity in ensuring an environmentally just governance. A key policy priority should therefore be to plan for the long-term care of the greenspaces considering the specific demands that differentiate such infrastructure from others. As stated by Rivera and Hendricks (2022), the planning and management of green infrastructure requires not only its initial design and implementation, but also a frequent maintenance over a lifecycle. For instance, newly implemented green interventions require time to grow and provide their full potential of benefits (e.g., shade, fruits…), polluted ecosystems might need to be restored, and some species may not adapt to the new conditions and structures of climate change and urbanization processes.

Besides, unlike other infrastructures, greenspaces may take form in different degrees of formality, and the responsibility for its maintenance is sometimes shared between municipalities and volunteer work by city residents. For instance, Barcelona developed the program "Hands on Green" (Mans al Verd) for the collaborative management of greenspaces to involve citizens, organizations and businesses from the city. A reasonable

approach in ensuring an equitable maintenance of greening could be to involve different actors while attending to the local dynamics of environmental stewardship and the capabilities of each neighborhood (Campbell et al., 2022) and then provide adequate resources.

5. Conclusion

This study is, to the best of our knowledge, one of the first attempts to evaluate the incorporation of social justice and gender equity within urban greening plans and strategies. Consequently, it sheds light on the unique trajectory formed by applying a gender lens to the pursuit of socially just greening. Despite the growing adoption of ambitious greening plans by cities to address urgent environmental and social issues, our analysis reveals that these plans often inadequately address justice considerations in a superficial and unstructured manner. As a result, there is a risk of perpetuating existing social and gender inequities within greenspaces.

We contextualize our findings as part of a shifting trend in the strategic role of urban greening. Global North cities are currently building and promoting its green infrastructure under a multifunctional urban greening model in mind, which builds from an "infrastructural fix" understanding of greening. This multifunctional focus has evolved from a former and more traditional role of greening seen as an ornamental asset. However, the increasing considerations of social and justice aspects within green planning processes have recently shaped a new justice- and inclusivity-focused lenses for urban greening. We situate our case study, Barcelona, as a city gradually pushing for this model.

We identified the key characteristics of three spheres of social and gender equity action that Barcelona is currently implementing within its green planning. First, greening is assigned a social and functional role centered on values of inclusivity and care with a transformative potential on the public space. Yet, we saw that those values have not fully permeated greening guidelines and there is room to improve synergies and coordination between greening, urban and feminist/gender policies. Second, regarding the implementation of green interventions, the City launched some design guidelines for the accessibility and autonomy in the use and perceptions of greenspaces. These included, more notably, measures to increase comfort, safety, and visibility in parks for different socially vulnerable groups. However, such guiding principles can enter in conflict with recommendations for the fauna and habitat conservation. Third, decision-making and governance processes are increasingly incorporating justice and gender concerns and establishing participatory approaches. Yet, greater progress in this area

will likely be achieved through clear guidelines and definitions able to transcend both professional traditions and gender-adverse practices by municipal staff and through the implementation of participatory processes that move beyond top-down tokenistic approaches. Finally, the combination of the above-mentioned strategies on the day-to-day practices of the City Council produces particular solutions for intersectional inequalities, in what we call an ad hoc intersectional planning approach.

We acknowledge the limited scope of this research, focusing on having an overview of social justice with a particular emphasis on gender issues. Future research directions could explore how different axes of inequality (like gender and sexual identities, dis/ability, socioeconomic status, race, age, religious beliefs, among others) shape use and perception of greenspaces (differentiated from other public spaces) and how results can be incorporated into urban policies and governance processes. Besides, while our analysis was limited to official planning documents and practices, there is much space and need for research exploring community and grassroot led efforts, particularly outside Global North contexts. Future studies are needed to develop interdisciplinar contextual research of the potential pathways wherein green interventions can simultaneously contribute to social and gender-transformative change.

Lastly, we would like to include a final note in the light of the municipal elections of May 2023, which took place during the final stages of this article's review. The election results revealed that most votes were obtained by a moderate conservative party campaigning against to Mayor Colau. We are yet to witness the implications of a likely post-Colau leadership in Barcelona, and whether the transformation towards a just and inclusive model of public space, including greenspaces, will be successfully consolidated.

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CHAPTER IV. GENDERED USE AND PERCEPTIONS OF PUBLIC GREEN AND BLUE SPACES IN GENTRIFYING NEIGHBORHOODS DURING THE COVID-19 PANDEMIC

Abstract

The COVID-19 outbreak triggered a combined health, social, and economic crisis, imposing multiple restrictions that altered how people use and perceived public green and blue spaces. In this article, we explored the extent to which the COVID-19 pandemic and its restrictions affected the use and perceptions of women and non-binary residents regarding the public green and blue spaces at the neighborhood scale. Simultaneously, we examined how COVID-19 restrictions shaped residents' perceptions of gentrification and touristification, and how those perceptions in turn affected their use and perception of public green and blue spaces. To this end, we conducted an analysis of two case study neighborhoods in Barcelona, Spain, employing a feminist, intersectional, and participatory mixed-methods approach. Results show that the pandemic crisis highlighted an already existing deficit of public green and blue spaces with quality and accessible public amenities and furniture. During the lockdown, strict restrictions and a drastic reduction of gentrification and tourism pressure led women and non-binary residents to intensify their use of local green and blue spaces. However, as restrictions eased, visitors and tourists re-appeared and contributed to the crowding of public spaces, particularly in the beach, making long-term residents feel unsafe and displaced. These perceptions were exacerbated with the reopening of bars and restaurants, which introduced more private terraces mainly oriented for visitors. We discuss how the use and perception of public green and blue spaces depend on multiple factors, including neighborhood density and housing conditions, public demand for green and blue infrastructure, as well as the intersectional social dynamics behind gentrification and touristification. We underscore the relationship between gentrification and touristification in green and blue spaces and the role of community sense and informal networks of care. Finally, we emphasized the importance of inclusive planning and access for the well-being of women and gender minorities.

Keywords: ecosystem services, environmental justice, feminist research, urban green infrastructure, mixed-methods, participation, urban planning.

This chapter corresponds to the following submitted article:

Calderón-Argelich, A., Anguelovski, I., Valeria-Carolin Cuenca, Helen V.S.Cole, Margarita Triguero-Mas, Blanca Valdivia, & Baró, F. (2023). Gendered use and perceptions of public green and blue spaces in gentrifying neighborhoods during the COVID-19 pandemic. Submitted to: People and Nature. Under review.

1. Introduction

Urban greening is increasingly recognized as a key strategy for addressing the urgent challenges posed by climate change and urban densification. Over the past decade, many municipal governments have developed ambitious greening plans aimed at establishing extensive and multifunctional urban green infrastructure, with the goal of enhancing the sustainability, biodiversity, resilience, and overall livability of cities (Angelidou et al., 2022; Hoover et al., 2023a). These plans arise from a growing recognition of the multiple environmental and social benefits, known as ecosystem services (ES), that urban green infrastructure can offer to city residents. Such urban ES include the mitigation of climate change impacts, such as the intensification of the urban heat island effect and flooding events (Hoover et al., 2023b; Lobo et al., 2023), providing habitat for biodiversity, improving the physical and mental health of residents, offering recreational opportunities, and facilitating social interaction and community cohesion (Jennings & Bamkole, 2019), among others.

1.1 The importance of public green and blue spaces in a (post) pandemic world

In this article, we refer to public green and blue spaces (PGBS) as those components of the Urban Green Infrastructure that are publicly accessible and primarily managed by municipal authorities, such as parks, gardens, green corridors, community allotments, and waterfronts. PGBS play an essential role for urban residents, particularly those lacking access to private green areas, living in densely populated and compact cities and/or in areas with uneven PGBS distribution.

In the last decade, there has been an increasing body of research advocating for incorporating justice and inclusivity within urban green planning to guarantee high quality, accessible and proximate PGBS to all residents (Apostolopoulou, 2023; Di Marino et al., 2023; Meerow, 2020; Zuniga-Teran et al., 2021). Urban greening policies indeed have important social and Environmental Justice implications, ranging from: 1) availability and geographical distribution (Boulton et al., 2018; Nesbitt et al., 2019); 2) representativeness, legitimacy, and transparency in decision-making and governance processes (Kiss et al., 2022); and 3) recognition of different needs, preferences, and capacities of diverse communities (Zuniga-Teran et al., 2021). Green planning frequently lacks a justice-oriented perspective that incorporates specific measures to guarantee universal benefit from ES for historically marginalized communities. This might be caused by an implicit assumption of a trickle-down effect from green interventions, which expects an automatic equal social and environmental

benefit for everyone (Anguelovski et al., 2020; Jung, 2023). However, evidence suggests that historically marginalized groups, including women and gender minorities, racialized individuals, lower-income workers, and migrants, still have less access to quality green and blue spaces than more well-off residents (Cucca & Thaler, 2023; Langhans et al., 2023; Silva et al., 2018; Sykes, 2022).

In this context, the outbreak of the COVID-19 pandemic sparked a significant health, social and economic crisis, with various mobility restrictions and social distancing measures affecting how people interacted and used public space (Honey-Roses et al., 2020). A growing number of studies have recognized the vital role that the PGBS played during the pandemic in preserving the mental health and well-being of urban residents (Labib et al., 2022; Soga et al., 2021). Additionally, the pandemic changed some of the activities, perceptions, and motivations towards PGBS, promoting a more intensive use and generalized appreciation of these spaces (da Schio et al., 2021; Litleskare & Calogiuri, 2023; Nay et al., 2022; Tansil et al., 2022; van Eeden et al., 2023).

Far from acting as a social equalizer, the COVID-19 pandemic introduced a new layer of complexity in the urban realm, exacerbating pre-existing social, economic, racial and health inequities. These patterns have highlighted the need and urgency for public policies and planning measures to improve access and quality of urban PGBS with a justice perspective (Bayulken et al., 2021; Bikomeye et al., 2021; Samuelsson et al., 2020). For instance, several studies have already explored the (lack of) availability of proximate PGBS during the pandemic, bringing evidence into its unequal distribution across social strata and urban areas (Pallathadka et al., 2021; Reinwald et al., 2021). However, to date, few studies have assessed how gender aspects shape the use and perceptions towards PGBS in the context of the COVID-19 pandemic (Mayen Huerta & Utomo, 2022).

1.2 The gender gap in use and perceptions of public green and blue spaces during the pandemic

Recent research indicates that women and gender minorities have distinct needs, barriers, and perceptions vis-à-vis PGBS (Braçe et al., 2021; Colley et al., 2022; Terraza et al., 2020) but they are frequently underrepresented in urban greening planning and decision-making processes (Boulton et al., 2021). Gendered barriers and perceptions determining the use of PGBS include the lack of proximate spaces, concerns about personal safety, sexual harassment, and violence, as well as poor quality or inadequate facilities (Derose et al., 2019; Stessens et al., 2020). Consequently, these barriers can hinder the ability of women and

gender minorities to engage in specific activities and fully reap the benefits of PGBS (Fernández Núñez et al., 2022; Sillman et al., 2022). Moreover, women have historically borne a disproportionate burden of care responsibilities, including domestic and reproductive tasks (De Madariaga, 2016). In this context, PGBS form an important part of the public space where daily care tasks are carried out (Calderón-Argelich et al., 2023; The Care Collective, 2020; Wiesel et al., 2020). Furthermore, research on use and needs of PGBS by gender minorities –including transgender, genderqueer, non-binary, or gender non-conforming individuals – is still scarce, resulting in a knowledge gap regarding how gender inequities extend beyond heteronormative assumptions and the binary framework of men and women (Bain & Podmore, 2023; Goldsmith & Bell, 2022).

Understanding how women and non-binary people have differentially used and perceived PGBS during the pandemic can help identify new types of gender and environmental inequalities. It can also shed new light on potential inclusive and gender-sensitive approaches to urban greening.

1.3 Gentrification and touristification at the neighborhood scale

The full potential and equitable distribution of benefits from PGBS toward historically marginalized groups can be compromised by other urban processes, such as gentrification and touristification (Triguero-Mas et al., 2021). Gentrification is a complex and multifaceted process of social and demographic change that contributes to the transformation of neighborhoods through new capital directed at previously under-invested areas (Anguelovski et al., 2021; Cocola-Gant & Lopez-Gay, 2020; Lees & Phillips, 2018). This process can lead to the displacement of long-term underprivileged residents and the influx of newcomers with a higher socio-economic status. Different factors can contribute to gentrification, including real estate investments, tourism, changes in commercial offering, and new environmental and green amenities (Oscilowicz et al., 2020). Tourism gentrification, also known as touristification, can raise the value of commercial and residential properties and eventually reshape entire neighborhoods into tourist destinations (Cocola-Gant, 2019). Consequently, gentrification and touristification processes can negatively impact the quality of life of long term residents and historically marginalized groups and limit their ability to use and benefit from urban public spaces (Cocola-Gant, 2023).

In Global North cities, mobility restrictions during lockdown raised awareness of residents' housing and neighborhood characteristics, especially in relation to green amenities (Cole et al., 2021a; López-Gay, Spijker, et al., 2022). Nevertheless, the precise impact of the COVID-

19 outbreak on gentrification trends remains inconclusive. Scholars have argued that while certain impacts of gentrification might have temporarily diminished in intensity and scale during the pandemic (Cole et al., 2021b) others might have intensified, such as an increased interest in residing near green and open areas (Broitman, 2023).

1.4 Gender, gentrification, and COVID-19 impacts

Finally, gentrification, as a key driver of neighborhood transformation, can serve as a clear barrier for women and non-binary individuals in accessing and benefiting from public spaces, including PGBS. Therefore, it is important to understand not only the impact of the COVID-19 pandemic on the use and perception of PGBS, but also how this phenomenon interacted with ongoing gentrification trends in certain neighborhoods. In this context, the inclusion of a gender perspective on the use and perception of public space in gentrifying neighborhoods remains limited (Sakızlıoğlu, 2018).

In the gender literature, two roles have predominated the discussion on women within gentrification processes, particularly in the Global North context. First, as in the last decades women have consolidated their position in the labor market, gained economic independence, and accessed family planning resources (Curran, 2017), these factors have contributed to the identification of affluent women as gentrifiers in certain neighborhoods. Second, women experiencing gentrification and displacement are affected by gendered dynamics that make them particularly vulnerable to its impacts, especially those who are underprivileged and come from historically marginalized communities. In this context, many women tend to occupy low-earning jobs, bear higher labor precarity, deal with economic and housing instability, and face the added burden of sexual harassment and domestic violence (Kern, 2022; Parker, 2011). On top of this, women, as main caregivers, often rely on informal care networks to collaborate within their communities to support various caregiving responsibilities, like taking care of children and older people. This reliance makes them more vulnerable to the gentrification impacts on fragmentation and loss of community networks. (Kern, 2022). Likewise, within the LGTBIQ+ community and gender minorities, they have experienced gentrification differently. While some in the community have benefited, particularly in so-called "gay neighborhoods", others who do not share privileged socioeconomic and racial characteristics have consistently confronted displacement and exclusion. (Curran, 2017).

Finally, during the pandemic, a substantial portion of women either faced unemployment or worked in precarious essential positions, placing them in a vulnerable situation regarding

both economic instability and the risk of contagion (Máiz-Mazuela et al., 2023). Evidence indicates that women experienced an increase in their caregiving responsibilities, difficulties in maintaining a work-family balance, higher risk of sexual harassment and violence, as well as a general deterioration in their mental health (Carreras et al., 2022; Mayen Huerta & Utomo, 2022). Furthermore, a study in Spain found that women reported deeper concerns regarding their personal finances and fear of infection during the COVID-19 pandemic (Jacques-Aviñó et al., 2020). Jacques-Aviñó et al. (2021) also demonstrated that women and non-binary individuals experienced higher levels of anxiety and depression during the lockdown period compared to men.

1.5 Research question and contribution

As depicted in **Fig.1,** we aim to consider the intricate impacts of the COVID-19 pandemic on the use and perceptions of PGBS while taking into consideration the broader context of ongoing gentrification and touristification processes that were already occurring in the neighborhood and that, in turn, were also affected by COVID-19 effects and restrictions. Therefore, we frame our twofold research question as: What changes have women and non-binary people experienced in the use and perception of PGBS during the COVID-19 pandemic? How have those uses and perceptions been shaped by concurrent perceptions of gentrification and touristification? We are thus interested in understanding how the simultaneity of these processes impacted the daily lives of women and non-binary residents, particularly in their use and perception of PGBS. Additionally, we want to explore the role of PGBS as spaces of social encounter where sense of community and care can be developed through the intersectional experiences of women and non-binary residents. By intersectionality, we refer to the recognition that individuals possess multiple social identities added to gender, such as class, age, health, race, etc., which intersect and interact to shape their experiences and perspectives. In our research, we aim to account for these intersecting experiences to comprehensively report our findings.

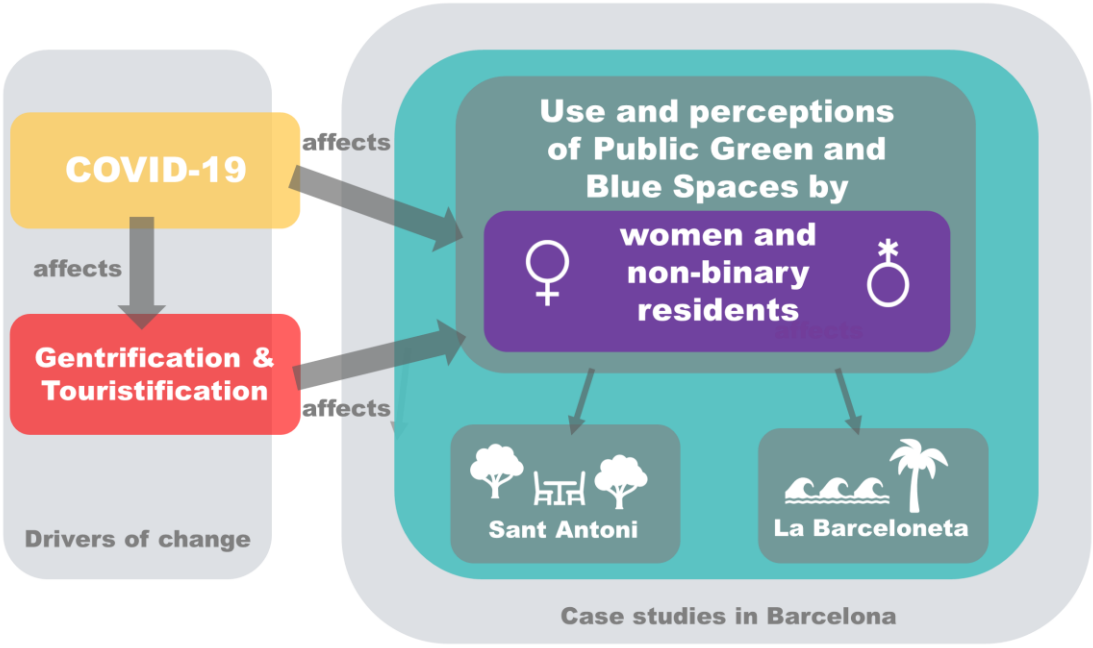

Figure 1. Conceptual framework on the research question of the study.

2. Methods

2.1 Project setting and COVID-19 periods

This research was part of a larger research project called FEMPUBLICBCN which adopted a community-engaged approach. This involves a participatory research project conducted in collaboration with a community advisory board, which provided input throughout the research process (Davis & Ramírez-Andreotta, 2021). For specific details on the project setting, refer to Appendix A.1. We employed a concurrent mixed-methods approach (Schoonenboom & Johnson, 2017) to offer a comprehensive contextualization of the intricate urban dynamics and motivations occurring in each case study neighborhood.

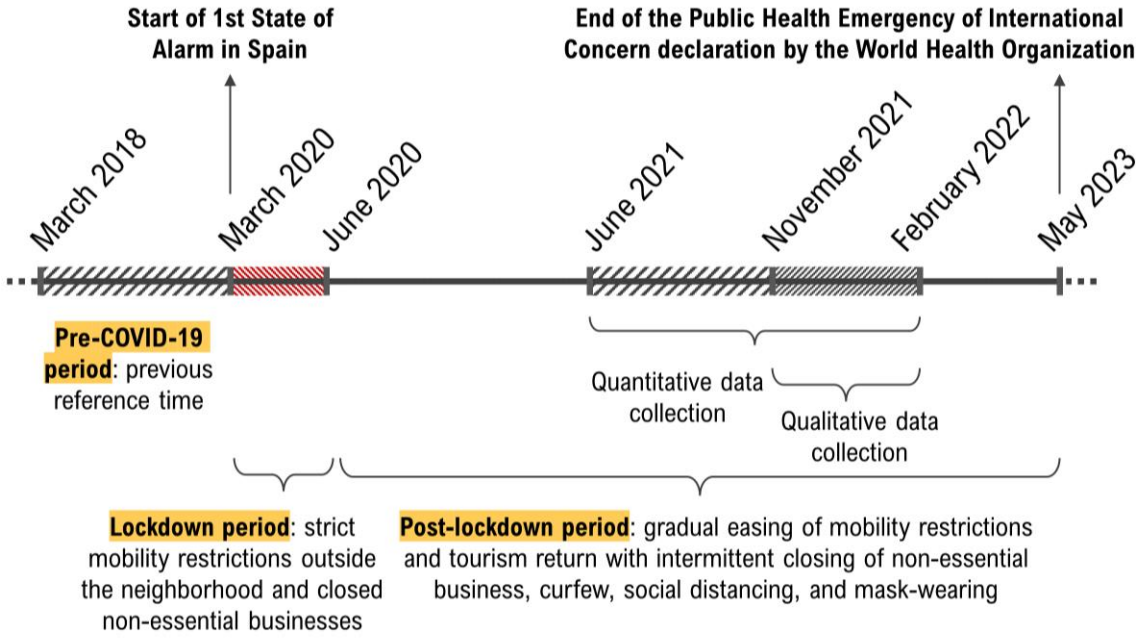

Figure 2. Chronological timeline (not drawn to scale) of the data collection process in reference to the COVID-19 restrictions in Spain.

To facilitate the contextualization of our research findings across the different COVID-19 restriction phases, we adopted a simplified approach with three times periods, as highlighted in **Fig. 2**: 1) Pre-COVID-19 period, encompassing the two years before the COVID-19 outbreak; 2) Lockdown period, which commenced on March 15, 2020, with the announcement of the state of alarm in Spain and the implementation of national-level coordinated restrictions. Although specific regulations evolved weekly, restrictions included severe mobility limitations, urging non-essential workers to stay at home. Going out was reserved for essential activities, and access to public spaces was limited to local residents. This period lasted until June 21, 2020, with the end of the state of alarm and the delegation of de-escalation measures to regional governments; 3) Post-lockdown period, characterized by a gradual easing of lockdown measures (i.e., de-escalation) in response to the health situation in each region (CatSalut. Servei Català de Salut, 2021). This so-called "new normal" period included intermittent restrictions and an overall gradual relaxation of mobility limitations and business openings. During this period, city residents could move freely among neighborhoods, and the presence of tourists gradually recovered. After the post-lockdown period, almost all restrictions were lifted, and by May 5, 2023, all of them were completely removed with the end of the public health declaration by the World Health Organization.

2.2 Case study description

We adopted a case study approach, focusing our analysis in two historical neighborhoods (see **Fig. 3**) in the city of Barcelona, the second largest city in Spain with 1,66 million inhabitants. (Ajuntament de Barcelona, 2021). The selection of these two neighborhoods (Sant Antoni and La Barceloneta) as case studies responded to certain similarities which makes them comparable: 1) both have emblematic PGBS that confer a central character to the neighborhood and attract visitors; 2) both experienced distinct processes of gentrification and touristification in pre-COVID-19 times, closely related to the central role of their PGBS.; 3) both are compact neighborhoods with a diverse population in terms of socio-demographic characteristics, with gradual transformation in levels of income, education and country of birth due to gentrification processes (López-Gay et al., 2019).

Figure 3. Aerial orthophoto map of Barcelona with zooms to the two case study neighborhoods (in red). Important meeting points and reference urban parks are pointed out on the map. Source: CartoBCN. Photos from the authors.

The dense grid-like neighborhood of Sant Antoni has historically lacked large PGBS. However, public squares and traffic-free green streets in Sant Antoni have significantly increased and improved since the implementation of the Barcelona Superblock program in 2019. The Sant Antoni Superblock consists of two new neighborhood plazas together with traffic calming measures throughout the neighborhood streets and the installation of new tactical elements like tables, benches, playgrounds, and greenery (Ajuntament de Barcelona, 2022). Relatively recent gentrification trends seem to be salient in Sant Antoni, with increasing housing prices and rents, the opening of new hotels and touristic apartments, and

a renovated commercial activity including organic food shops, high-end restaurants, and boutique stores catering to wealthier residents and tourists (Cocola-Gant & Lopez-Gay, 2020; López-Gay, Ortiz-Guitart, et al., 2022).

In contrast, La Barceloneta is a neighborhood with small parks, playgrounds, and most notably, the coastline with the seafront and the beach. La Barceloneta's beaches, squares, pedestrianized streets, and parks were linked to the major city-level renewal for the celebration of the Olympic Games in 1992 in Barcelona (Crespi-Vallbona & Mascarilla-Miró, 2018). Since then, mass tourism, speculative real estate market, and privatization policies in the port and coastline have caused tensions and congestion in the use of certain public spaces (Juventeny Berdún, 2016). While tourism has grown in both neighborhoods, La Barceloneta is primarily experiencing touristification due to its appealing amenities for visitors near the beaches, including restaurants, nightclubs, and bars (Nofre et al., 2018). This has led to a rise in the percentage of vacation rentals along with illegal tourist apartments, as denounced by activist local movements (Crespi-Vallbona & Mascarilla-Miró, 2018), and conforming a longer gentrification and touristification trend.

2.3 Quantitative data collection and analysis

Quantitative data were collected through face-to-face street intercept surveys. The survey collected information from 907 participants (see **Table 1)** on changes in the use of PGBS between the pre-COVID-19 and post-lockdown period; as well as on gentrification and touristification perception in both periods. The complete survey questionnaire is available in Appendix A.2.

Questions regarding changes in frequency and duration of visits to PGBS were adapted from questions previously used in other studies (Van den Berg et al., 2016) and distinguishing between: 1) the beach for La Barceloneta, and the Superblock for Sant Antoni as emblematic local PGBS; 2) proximate PGBS accessible within 15 minutes by bike or on foot; 3) PGBS in the city accessible in more than 15 minutes by bike or on foot; and 4) PGBS outside the city. Perceived gentrification was assessed using the Neighborhood Change and Gentrification Scale as described in (DeVylder et al., 2019), and perceived touristification was measured using two questions about the presence of tourists and tourist accommodation. All questions assessing perceptions were framed using a Likert scale and developed in collaboration with the community advisory board to adapt it to the local context.

Only available data were used to calculate results, excluding NA responses which ranged from 6 (1.2%) to 52 (5.8%) on PGBS visit questions; from 17 (2.3%) to 299 (67.8%) on PGBS activities questions; and from 0 to 46 (9.48%) on gentrification and touristification questions. Descriptive statistical analyses on complete responses were performed using Chi-squared and T-student tests (significance level set at p value <0.05) to assess differences in the sociodemographic characteristics, neighborhoods, or COVID-19 time periods.

*Table 1. Sociodemographic characteristics of the two neighborhoods of study (N=907) for the post-lockdown period. *P-value of <0.05 denotes significant differences among sociodemographic variables according to Chi-squared for categorical variables and T-test for age.*

	Sant Antoni	**La Barceloneta**	**Test**
Participants [n(%)]	485 (53.47)	422 (46.53)	
Gender [n(%)]			
Women	478 (98.56)	417 (98.82)	
Non-binary/other/NA	7 (1.44)	5 (1.18)	
Age [years: average (sd)]	46.15 (16.55)	46.52 (16.55)	t = 0.33
Education [n(%)]			Chi^2 = 37.01*
University studies	251 (51.75)	134 (31.75)	
No university studies	233 (48.04)	286 (67.77)	
NA	1 (0.21)	2 (0.47)	
Country of birth [n(%)]			Chi^2 = 1.91
Global North	399 (82.27)	332 (78.67)	
Global South	84 (17.32)	90 (21.33)	
NA	2 (0.41)	0 (0)	
Employment status [n(%)]			Chi^2 = 3.90
Full or part-time employment	270 (55.67)	207 (49.05)	
No stable employment	212 (43.71)	210 (49.76)	
NA	3 (0.62)	5 (1.18)	
Perceived economic situation [n(%)]			Chi^2 = 6.81*
Comfortable	235 (48.45)	168 (39.81)	
Precarious	247 (50.93)	250 (59.24)	
NA	3 (0.62)	4 (0.95)	
Care responsibilities (personal/healthcare/financial/homemaking) [n(%)]			Chi^2 = 1.73
Care responsibilities	159 (32.78)	156 (36.97)	
No care responsibilities	321 (66.19)	262 (62.09)	
NA	5 (1.03)	4 (0.94)	

2.4 Qualitative data collection and analysis

Thirty-two participants formed the qualitative segment of this study, ranging in age from 19 to 90 years old. Qualitative methods were conducted using feminist research methodologies,

building on previous research experience (Col·lectiu Punt 6, 2014; Ortiz Escalante & Gutiérrez Valdivia, 2015), and with the support of the community advisory board. We developed, separately in each neighborhood, a focus group with a participatory mapping exercise, and an exploratory walk session (with 5 participants per neighborhood). Then, semi-structured interviews were conducted in parallel (12 for La Barcelona and 10 for Sant Antoni).

The focus group session included a participatory mapping exercise to analyze how the COVID-19 pandemic had affected the daily life of the residents in relation to the PGBS and the overall neighborhood. Participants were then asked to reflect on the use of these spaces in their daily life and share their positive and negative perceptions across COVID-19 time periods. The different PGBS and amenities were noted on a printed A1 map of the neighborhood (**Fig. 4**), obtaining a representative network of the most important spaces and activities for the daily life of the participants. Finally, the exploratory walk itinerary was collectively defined based on the spaces they considered most used and representative of the neighborhood.

Figure 4 Focus group maps from participatory mapping exercises. Sant Antoni (left) and La Barceloneta (right).

Exploratory walks are a method that allows participants to speak in the first person and create a collective reflection, pointing out elements found at the street and neighborhood scale and combining personal and collective experiences (Col·lectiu Punt 6, 2014; Ortiz Escalante & Gutiérrez Valdivia, 2015). During each walk, different urban elements were examined within PGBS (see **Fig. 5**), such as public facilities and services, perception of safety, mobility, housing conditions, as well as community participation in the neighborhood during the three COVID-19 periods.

Figure 5. Photos taken during the exploratory walks. Sant Antoni walk in Superblock area (left) and La Barceloneta walk at La Repla square (right).

Finally, semi-structured interviews were conducted until a saturation point of the overall qualitative information was reached. Interviewees were asked about their daily use of the neighborhood and its PGBS, their positive and negative perceptions, the changes they had perceived in the neighborhood with gentrification and touristification, and the impact of COVID-19 on such spaces (Appendix A.3 displays interview guidelines).

Interviews were transcribed and coded line-by-line using Atlas.ti software, following both a deductive thematic and grounded theory coding approach. The deductive thematic approach was based on predefined categories to address the core topics of our research question: changes in PGBS use and perception, changes in gentrification and touristification, COVID-19 time periods, neighborhood and community life, and intersectional experiences. From there, categories were iteratively compared and refined to identify and address emerging themes and patterns (see coding guide in Appendix A.4).

3. Results

We structure our results of this research by following the three COVID-19 time periods chronologically. We do this to demonstrate how the different restrictions and conditions characterizing each period of the pandemic altered the use and perceptions of PGBS, as well as gentrification and touristification perceptions, which in turn impacted the use of PGBS.

3.1 Pre-COVID-19 pandemic period (March 2018 – 2020)

Our analysis reveals that Sant Antoni was highly valued as a livable neighborhood for its renovated PGBS around the Superblock area, its shops, public services, and its proximity to the city center. The Superblock was widely used and positively perceived by the residents in their daily lives, particularly those with childcare responsibilities. As explained by a resident when asked about it since its inauguration in 2018: "*I value them [Superblocks] really positively.*

These are spaces where [...] my daughters can be with other people their age, but also for us, families. They provide that space where we can take care of them" (Non-binary person, more than 40 years old, care responsibilities, migrated from Global South country, chronic illness, interview).

However, some residents reported missing the presence of more vegetated and permeable areas and feeling uncomfortable with the amount of car traffic surrounding the street-calmed Superblock. Residents also expressed safety concerns due to the allowed traffic in the Superblock area, which is not always separated from play/leisure areas by a physical barrier. This fact created difficulties in their care activities: "*These spaces [the Superblock] could still be improved. Children are playing and suddenly there are four cars passing by in a second. It is not completely safe*" (Cis woman, less than 40 years old, care responsibilities, born in Sant Antoni, exploratory walk). Despite the Superblock area, the persistent noise and air pollution remained a source of stress and discomfort: "*It's a bit difficult for me to find a place to disconnect in the neighborhood. I believe there should be some open space without traffic and, if possible, with a bit of [more] greening… something other than asphalt. What overwhelms me the most in Sant Antoni is indeed the traffic*" (Cis woman, less than 25 years old, no care responsibilities, born in Spain, interview).

Residents also complained about the presence of external visitors (tourists and residents from other neighborhoods) who were attracted by the commercial services of the area, particularly bars and cafeterias surrounding the Superblock and historical market. The central location of Sant Antoni also facilitated a high tourist accommodation offer, as manifested by the presence of short- and mid-term rentals and hotels. As shown in **Fig. 6**, more than half of surveyed Sant Antoni residents agreed or strongly agreed that, during the pre-COVID-19 period, they had witnessed a lot of renovation activity (74%) and affluent residents moving in (62%), and that they had experienced or heard about landlord harassment (65%). Additionally, 88-89% of surveyed people had observed a (drastic) increase in tourists, tourist apartments, and hotels during the two years prior to the COVID-19 outbreak.

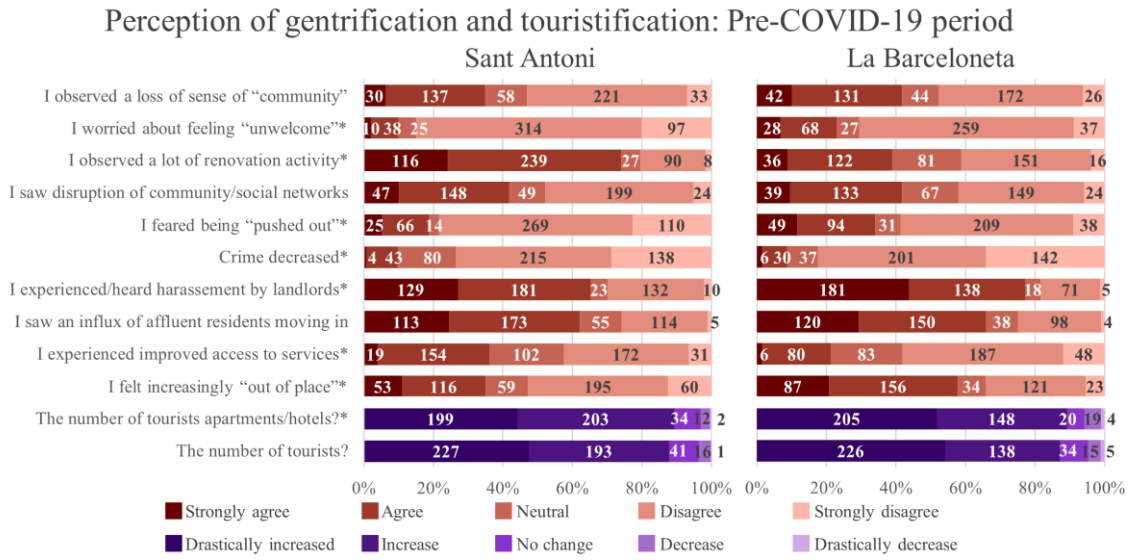

*Figure 6. Perception of gentrification and touristification by each neighborhood during pre-COVID-19 period. *Denotes significant differences (p-value<0.05) according to Chi-squared between neighborhoods.*

Results also show that in La Barceloneta, the beach and seafront areas were highly valued and frequently used by the residents during the pre-COVID period. As some expressed on several occasions, the sea was one of the main incentives for living there: "*The sea is my well-being. I need the contact with the sea, and since I discovered it, it changed my life completely"* (Woman, more than 40 years old, no care responsibilities, migrated from Global South country, interview). In contrast, green spaces in La Barceloneta were perceived as scarce and poorly maintained. For instance, residents complained about the lack of green elements in La Repla, a central square that serves as a meeting point in the neighborhood: "*The Repla is actually a massive cement block. In the Summer, it gets very hot, and in the Winter, it's cold. There aren't enough trees"* (Cis woman, more than 40 years old, care responsibilities, born in La Barceloneta, interview). And: "*[Square La Repla] It is an extensive space, with terraces where at least you can go with older people. [But] There is a lack of trees, benches...*" (Cis women conversation, more than 40 years old, care responsibilities, born in Spain, focus group).

Over the last three decades, La Barceloneta neighborhood has faced significant gentrification pressures, primarily from tourists and gentrifiers attracted to the beach areas and the nightlife of the nearby marina. During the pre-COVID-19 period, more than half of the surveyed residents agreed or strongly agreed with witnessing landlord harassment (77%), an influx of affluent residents moving in (66%), and between 89-87% indicated an increase or a drastic increase in the number of hotels and tourists in their area. As stated by one resident: "*When I was 18 years old, it was even embarrassing to say that you lived in La Barceloneta. Because we were considered like 'gypsies'. However, now, you see, they go crazy for the apartments*" (Cis woman, more

than 90 years old, no care responsibilities, born in La Barceloneta, interview). In comparison to Sant Antoni, a higher proportion of La Barceloneta respondents seemed to perceive strong gentrification and touristification pressures, showing statistically significant higher percentages of agreeing or strongly agreeing with perceptions of feeling unwelcome (23% vs. 10%), feeling "pushed out" (34% vs. 19%) and feeling "out of place" (58% vs. 35%).

Nevertheless, in both neighborhoods, perceptions varied substantially depending on the intersectional background of respondents. For instance, younger female interviewees expressed greater concerns about sexual harassment and gender-based violence in parks specially at night, while a middle-age non-binary participant disclosed not having experienced harassment. Furthermore, women who migrated from the Global South expressed feeling safer in the neighborhood in comparison with their country of origin. Other participants with migrant backgrounds also expressed more tolerance with the presence of tourists.

3.2 Lockdown period (March – June 2020)

In Sant Antoni, the Superblock area became a highly used and appreciated public green space by residents once the strict lockdown restrictions were eased. Additionally, due to the closure of bars and restaurants, residents reported that the Superblock area was solely used as a place for gatherings, without the usual commercial activities of the pre-COVID period: "*During the confinement, (...) there were a lot of people having a drink [in the Superblock]. It was a change. Bars were closed but people kept meeting and looking for this public space.*" (Cis woman, less than 35 years old, no care responsibilities, born in Spain, interview).

However, the absence of larger PGBS in the neighborhood led residents to seek out parks in nearby neighborhoods (once restrictions permitted), offering a more naturalized environment than the Superblock. Consequently, they began visiting larger parks located beyond their neighborhood, such as Montjuïc Park (one of the city's largest parks, featuring a diversity of gardens and forested areas, within a 15-20-minute walk from the neighborhood): "*Montjuïc [Park], after all, is very close to my home. I thought it was very far away. I go more than before for sure. I am from Barcelona, and I had gone to Montjuïc very few times [before the COVID-19 outbreak]"* (Cis woman, less than 35 years old, no care responsibilities, born in Spain, interview). To a lesser extent, La Barceloneta residents expressed a similar motivation to visit larger PGBS. In their case, they often mentioned La Ciutadella Park, a historic urban park located within a 15-20-minute walk from the neighborhood.

During the lockdown period, the absence of external visitors (from other neighborhoods or cities) resulted in a substantial reduction in gentrification and touristification perception. In

Sant Antoni, tourist accommodations such as hotels and apartments suddenly became vacant, fostering new and different interactions among residents:
"I know that there are many tourist apartments in the neighborhood and since they remained empty for many months, we noticed that the ones [of us] who were in the neighborhood were the ones living in the neighborhood permanently. (...) The gatherings that occurred were among known people" (Cis woman, more than 40 years old, care responsibilities, born in Sant Antoni, interview).

La Barceloneta also experienced a sudden and significant decrease in tourist presence and related noise, allowing PGBS to be reclaimed and enjoyed by local residents. As a result, residents frequently visited the beach and relished the silence, calmness, and the reduction in air pollution and dirt. Although this trend was perceived as highly positive for their well-being, the social and economic crisis severely impacted La Barceloneta residents due to their strong economic dependence on tourism activities. Some interviewed women expressed how they observed an increased social vulnerability among certain residents:
"*The positive aspect was reclaiming the neighborhood. It was a neighborhood dominated by tourism.* (…) *We all say it was the best Summer of our lives. I mean, beach empty, clean, without noises... (...) It was a sad feeling, because you knew that a lot of people were suffering. But as residents, the ones who didn't have anything to lose because we don't depend on tourism, we were enjoying it so much!*" (Cis woman, more than 40 years old, care responsibilities, born in La Barceloneta, interview). Other residents reported experiencing a sudden sense of cleanliness and tranquility that they greatly appreciated:
—*"[We were] confined, confined.*
—*A delight.*
—*We slept with open windows (...).*
—*The neighborhood smelled like coffee, as I say… not like piss.*
—*The colors of the sea and the birds... (...).*
—*It was amazing, the neighborhood was clean... well, the reason was sad, but...*" (Cis women conversation, more than 40 years old, care responsibilities, born in Spain, focus group).

As a response to the COVID-19 crisis, residents self-organized to provide help and support to those in greater need, which included assisting with shopping tasks, supporting local businesses, and donating food and other essential goods and caregiving responsibilities. Although this solidarity process occurred in many neighborhoods of Barcelona, la Barceloneta network stood out, nurtured by the social capital of residents, the diversity of existing local organizations and activist movements, the small and compact nature of the neighborhood, the strong sense of belonging among long-term residents: *"I think it's one of the few neighborhoods that still preserves this"* (Cis women conversation, more than 40 years old,

care responsibilities, born in Spain, focus group). The maintenance of the network was facilitated with the intensive use of PGBS like La Repla for meetings, socializing, and mutual support: "*The network, we were a reference to other sites... (...). We were all integrated in the same space, simply to help"* (Cis woman, more than 60 years old, no care responsibilities, born in Spain, with disabilities, interview).

However, in both neighborhoods, respondents also reported that the economic impacts caused by the pandemic, including the subsequent increase in unemployment and job precarity, were noticeably felt in public spaces, resulting in a higher number of unhoused residents. These challenges were compounded by the reduced presence of people in PGBS due to lockdown restrictions (i.e., social distancing, curfews, policing). The combination of these factors heightened perceptions of unsafety among women and non-binary residents, particularly concerning crime, violence, and sexual harassment. Residents also expressed a fear of being fined by police if they violated any lockdown rules.

3.3 Post-lockdown period (June 2020 – May 2023)

Fig. 7 and **8** display the changes in visits and activities carried out in PGBS when residents were asked about the post-lockdown period compared to the pre-COVID-19 period. Nearly all PGBS-related questions received approximately 40% of responses indicating no changes from the pre-COVID-19 period. These results indicate that, while the pandemic altered some patterns of PGBS use during the lockdown, a considerable share of residents did not maintain these altered patterns in the longer term, or did not change from before at all.

However, when comparing the two neighborhoods, two different trends emerge. On the one hand, after the lockdown, and compared to the pre-COVID 19 period, 44% of survey responses in Sant Antoni show that residents increased or drastically increased their frequency and duration of visits to the Superblock space, 39% increased frequency of visits to proximate PGBS, and 31-30% to more distant PGBS (**Fig. 7**). Conversely, in La Barceloneta, the increase in the frequency and duration of PGBS visits is lower, less than 20% reporting an increase. Instead, 35-36% of respondents indicated a decrease in the frequency and duration of visits to the beach (and to a slightly lesser extent, the rest of the neighborhood PGBS). These trends are also reflected in the activities carried out in the PGBS, with statistically significant differences between neighborhood in activities such as doing a picnic or having a drink; walking, cycling, and doing sports; relaxing, and meeting with family and friends (**Fig. 8**). Most notably, in comparison with the pre-COVID-19 period, 51% of responses from Sant Antoni indicated an increase or a drastic increase in

activities like walking, cycling, and doing sports during the post-lockdown period (compared to 37% in La Barceloneta). Furthermore, in La Barceloneta, 33% of respondents reported a significant decrease in relaxing on their own, and 37% reported a decrease in socializing with family and friends in PGBS (in contrast to 14% and 30% in Sant Antoni, respectively).

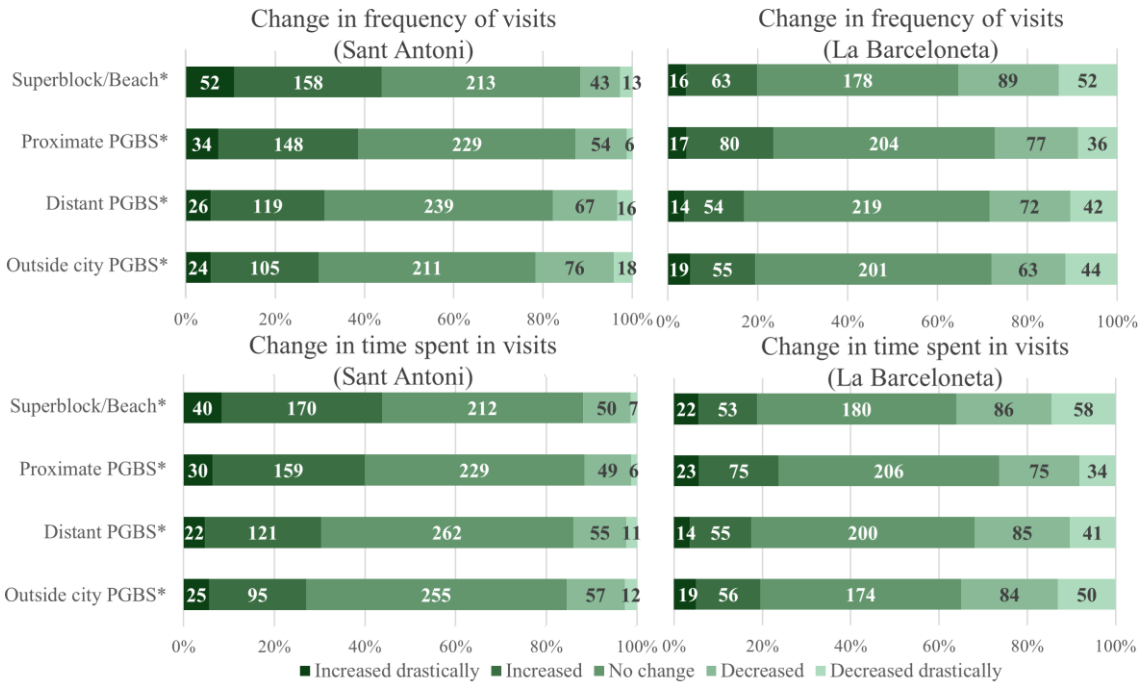

*Figure 7 Change between pre-COVID-19 and post-lockdown periods in the use of PGBS by frequency of visits and time spent during visits. *Denotes statistically significant differences (p-value<0.05) between neighborhoods according to Chi-squared test.*

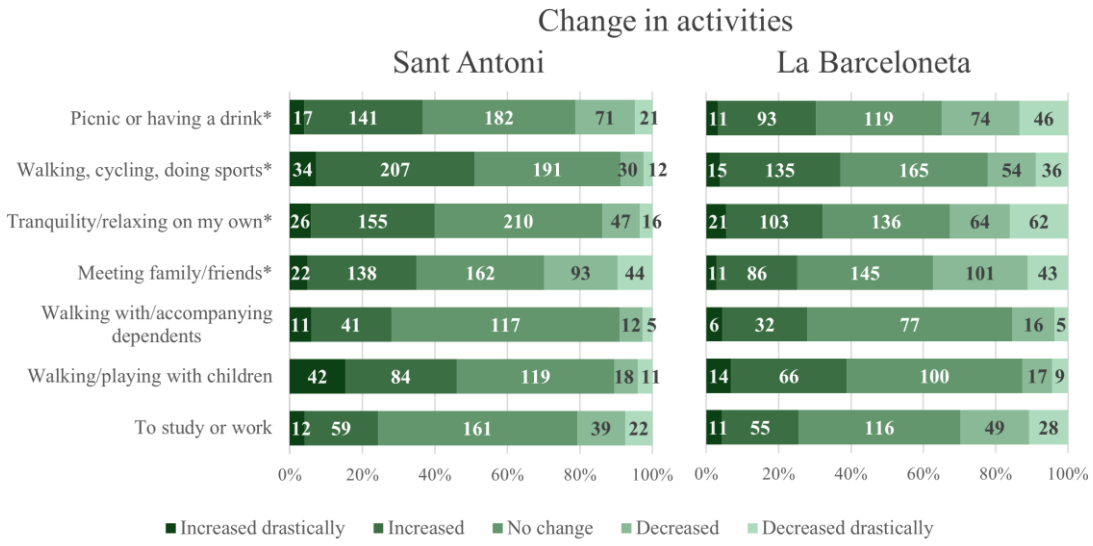

*Figure 8 Change between pre-COVID-19 and post-lockdown periods in the activities carried out at PGBS. *Denotes statistically significant differences (p-value<0.05) between neighborhoods according to Chi-squared test.*

Comparing **Fig. 6** and **9**, the perceptions of gentrification and touristification in each neighborhood revealed that 6 out of 12 indicators significantly changed after the lockdown

period. In the post-lockdown period, a smaller share of responses indicated high gentrification and touristification pressures (i.e., residents who agreed or saw an increase in gentrification and touristification indicators). Of these 6, two touristification indicators notably changed in Sant Antoni and La Barceloneta in comparison with the pre-COVID-19 period: the decrease or drastic decrease in the presence of tourists (76-60% of responses); and the decrease or drastic decrease in tourist accommodations after the lockdown (59-56% of responses). The other four gentrification indicators with significant changes included perceived renovation activity, landlord harassment, influx of affluent residents, and a sense of feeling "out of place". However, the remaining 6 indicators did not exhibit significant changes after the lockdown period, suggesting persistent gentrification pressures. For instance, between 37-40% of surveyed residents in Sant Antoni and La Barceloneta still agreed or strongly agreed with experiencing an increased loss in their sense of community, and 46-43% reported disruption in their social networks. Besides, 75-85% of respondents disagree or strongly disagree with perceiving a decrease in crime.

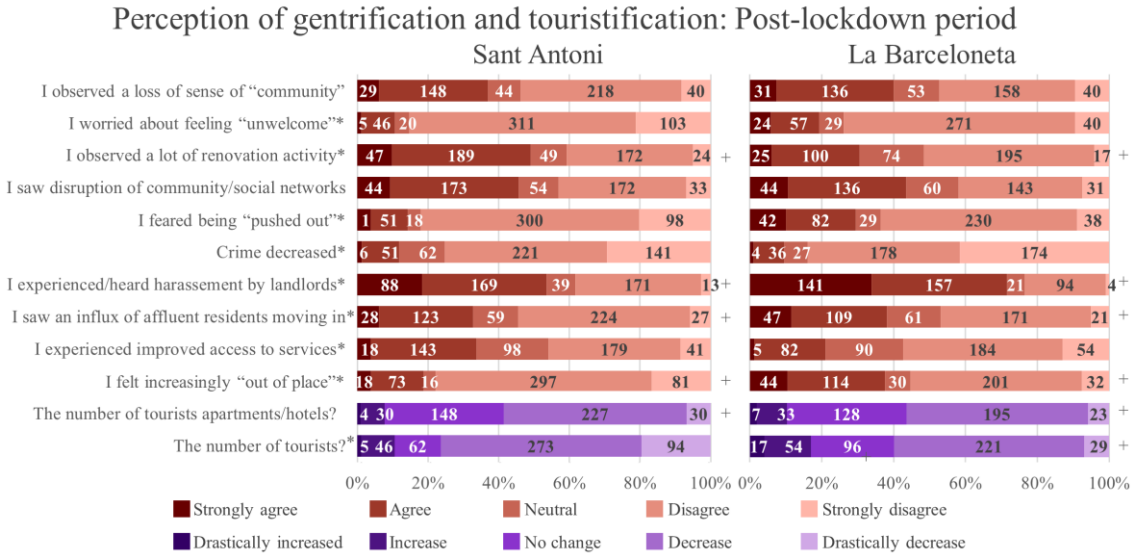

*Figure 9. Perception of gentrification and touristification by each neighborhood during post-lockdown period. According to Chi-squared (p-value<0.05) * denotes significant differences between neighborhoods and + denotes significant differences between pre-COVID-19 and post-lockdown periods for the same neighborhood.*

In relation to the use of PGBS, in Sant Antoni, as during the lockdown, the Superblock area remained popular among residents and visitors from other neighborhoods: "*With the lockdown, it seems like we learned to appreciate the [public green] space we have (...). Sometimes, now, what I do is grab a coffee and hang out with my friends just down in the street. Enjoying the space, which is actually ours, but it wasn't before.*" (Cis woman, less than 40 years old, no care responsibilities, born in Spain, interview). Despite ongoing perceived gentrification pressures, Sant Antoni residents emphasized the value of PGBS in preserving a sense of community and social cohesion,

facilitating interactions and socialization: "*If you are less familiar with your neighbors, you have fewer sources of support and a smaller care network. (...) When the use of public space is encouraged, it promotes getting to know your neighbors*" (Non-binary person, more than 40 years old, care responsibilities, migrated from a Global South country, chronic illness, interview). Interviewees also expressed positive views on the social cohesion that the Superblock could provide: "*In the superblock area, you see local shops and so... It makes you feel like you belong a little, like it's a neighborhood [barrio], and that there's a [community] network there*" (Cis woman, less than 40 years old, no care responsibilities, born in Spain, interview).

However, Sant Antoni residents also expressed concerns about the enduring gentrification in the neighborhood. They expressed their fear of displacement due to the commercial renovation and the gradual return of visitors and newcomers around the Superblock after the end of lockdown: *"The Superblock area, while in certain aspects has provided me with more social fabric and made me closer to the residents... but the fact that the bars, restaurants have changed, and the old ones have been lost... (...) [It] makes me feel anonymous"* (Cis woman, more than 40 years old, care responsibilities, born in Sant Antoni, interview). Similarly: "*[Talking about increasing prices of rent and essential goods linked to the COVID-19 crisis] I like seeing that the neighborhood is so lively and that so many people like it (...). But at the same time, it's like... I won't last here"* (Cis woman, less than 20 years old, no care responsibilities, born in Sant Antoni, racialized, interview).

In the case of La Barceloneta, after the easing of restrictions, visitors from other neighborhoods and tourists reappeared along the seafront, using the beach intensively during day and night. This surge in visitors pushed the local residents out of their preferred PGBS: "*And then the beach got overcrowded with people (...). I had to go very carefully. And I lost the beach, because it was so full of people that I didn't dare to go"* (Cis woman, more than 40 years old, care responsibilities, born in Spain, chronic illness, interview). Residents from both neighborhoods agreed that the widespread use of public space and disruptive behavior were primarily attributed to the return of both visitors from other Barcelona neighborhoods and tourists. This return to "business as usual" worsened residents' sense of well-being and spurred anger, frustration, and mental distress: "*After the lockdown, [we were] with FFP2 mask, limited social groups... (...) and you had to live together with [tourists doing] night parties, people drinking in the street..."* (Cis women conversation, more than 40 years old, care responsibilities, born in Spain, focus group).

Furthermore, residents of La Barceloneta historically relied on public spaces for many of their daily activities, partly due to their housing conditions, which typically consist of small

apartments, around 30 m^2 in size. Consequently, the extensive use of public spaces in La Barceloneta severely disturbed the quieter daily life that residents had enjoyed during lockdown: *"[After the restrictions were lifted] A lot of people remained confined, mainly elderly. They looked out [the window] and said 'Wow, what is this?' (...). A total invasion. (...) All the people who came here didn't think we had the need to get out of the house, [despite] we are in 30m²"* (Cis women conversation, more than 40 years old, care responsibilities, born in Spain, focus group).

Additionally, the presence of visitors exacerbated the perception of fear of crime and sexual harassment in PGBS: "*As a woman, I'm telling you... I used to go to the beach at eight in the morning, I've gone twice this week, here, and once I turned back (...) Three or four English guys were telling me things, I felt cornered*" (Cis women conversation, more than 40 years old, care responsibilities, born in Spain, focus group). Young women and women with care responsibilities were particularly concerned about safety issues and displacement. However, there was not an unanimous opinion regarding touristification, as certain participants, particularly those born outside Spain, did not express similar levels of unease: "*I was also a tourist, at some point (...) This is not a fishermen neighborhood anymore. It is a neighborhood for tourism*" (Cis woman, more than 40 years old, care responsibilities, migrant background, interview).

Finally, the post-lockdown period saw bars and restaurants expand their outdoor terrace spaces (i.e., adding more tables and chairs outdoors). This was particularly pronounced in La Barceloneta, further exacerbating the commodification of public space oriented toward tourist activities. Besides, the presence of new terraces hindered free use and mobility within public spaces and posed challenges for caregiving tasks:

"*My mother uses a wheelchair, and we have noticed this post-pandemic. The public space has been limited because of the table invasion. (...) There was no space to cross (...) [More] Terraces were allowed due to the prohibition to stay inside. The problem is that this will remain.* (...) *The terraces are not for the people from the neighborhood*" (Cis women conversation, more than 25 years old, majority of them with care responsibilities, born in Spain, exploratory walk).

This privatization of public space for commercial purposes was also perceived and lamented in Sant Antoni: *"I also get angry that it [Superblock area] took out the cars to give it to us [pedestrians], but in the end, nearly 80% of it is occupied by bar terraces. (...) I think those spaces worked better when the bars were closed [during lockdown]"* (Cis woman, less than 40 years old, no care responsibilities, born in Spain, interview). However, since the Superblock area is equipped with benches and tables for common use provided by the municipality, people could choose whether they

wanted to stay in a cafeteria surrounding the area or in the middle of the square engaging in other activities.

4. Discussion

In this research, we employed a participatory mixed methods approach to identify the various impacts associated with different periods of the COVID-19 pandemic on the perception and daily use of PGBS by women and non-binary residents. We also examined how these impacts have been shaped by concurrent changes in exclusionary urban development processes, namely gentrification and touristification. In other words, we leveraged the COVID-19 pandemic as a "natural experiment" to observe changes in the use and perceptions of PGBS in neighborhoods affected by gentrification and touristification pressures.

Using a feminist intersectional perspective, we analyzed a diverse range of qualitative and quantitative data sources, including surveys, focus groups, exploratory walks, and interviews. Additionally, we explored how the use and perceptions of PGBS vary according to different intersecting socio-demographic variables, including gender, age, health conditions, care responsibilities, and migrant background. Our findings contribute to recent debates on PGBS equity and accessibility, providing a more nuanced understanding of how residents are impacted by the gendered effects of the COVID-19 pandemic and gentrification and touristification processes.

4.1 Use and perception of PGBS as altered by COVID-19 restrictions

First, our findings reflect how the effects of COVID-19 mobility restrictions changed the use and perceptions of PGBS during the varying stages of the pandemic and under varying degrees of gentrification and touristification pressures. During the lockdown, residents relied on their neighborhood's spaces for socializing and daily activities, resulting in an intense use of PGBS primarily by its proximate residents. Our results align with previous studies, showing that urban green and blue spaces closer to people's homes tended to encourage people to spend time there, making them the most visited during the early stages of the COVID-19 pandemic (Mayen Huerta & Utomo, 2022; van Eeden et al., 2023).

Results have shown how the pandemic crisis highlighted the existing deficit of PGBS in both compact neighborhoods, with two different trends in the changes of PGBS visits for each neighborhood. The Sant Antoni Superblock had a substantial percentage of women and non-binary residents who increased its use since the lockdown. However, even though it was promoted and marketed as a greenspace by the City, it was often perceived as small, grey,

and trafficked. On the other hand, in La Barceloneta beach area, after the unprecedented use of PGBS exclusively by its residents, a substantial percentage of women and non-binary people decreased its use after the lockdown. The beach and seafront area was perceived as a very crowded space with too many tourism-oriented activities and businesses. Previous research found that women were more likely to report decreased time spent in PGBS due to their higher perception of risk in public spaces than men (Burnett et al., 2021). Similarly is suggested with older people, due to their high fear and risk of infection (van Eeden et al., 2023). Our research corroborates previous studies on PGBS perception by women, showing the importance of aspects like safety, comfort, and maintenance (Safer Parks Consortium, 2023).

The share of women and non-binary people with no changes in the frequency and duration of PGBS visits can be partly explained because, unlike previous studies on COVID-19 and greenspaces focusing on the initial period of the lockdown (Collins et al., 2022; Ribeiro et al., 2021), our results took into consideration the post-lockdown period, when most social and mobility restrictions were already eased. This may indicate that, even though the COVID-19 may have impacted the way people use PGBS, either such changes were rapidly reversed once mobility restrictions were lifted, or their use was already high (da Schio et al., 2021).

4.2 Gentrification and touristification effects on PGBS use and perceptions

Our findings show how the infrastructure characteristics of each neighborhood alters the use and perception of PGBS in close relation with gentrification and touristification pressures. The Superblock area was positively valued and increasingly used due to its public amenities and furniture, facilitating everyday life, care activities, socializing, and community sense. However, the Superblock configuration, even though it prevented, to some extent, the space from undergoing major privatization (as happened in the seafront area), is associated with the green and commercial gentrification in Sant Antoni (López-Gay, Ortiz-Guitart, et al., 2022) which can compromise the neighborhood's affordability for long-term residents.

Despite the "positive hiccup" in local PGBS use during the lockdown, the post-lockdown period reverted to previous perceptions of gentrification, such as feeling out of place, pushed out, unwelcome, and anonymous. Our findings demonstrate how the massification and commodification discouraged the use of PGBS by women and non-binary residents during post-lockdown, a trend seen in other neighborhoods in Barcelona (Cocola-Gant, 2023).

4.3 The role of PGBS for community sense and informal networks of care

After a brief respite from tourism and visitors during the lockdown, the persistent pressures of gentrification and touristification in the post-lockdown period led to displacement processes that disrupted care networks, and heightening feelings of anonymity and unwelcomeness in both neighborhoods. These findings align with broader research on gentrification and gender, highlighting how women actively engage with informal care networks, rendering them particularly sensitive to gentrification pressures (Curran, 2017; Kern, 2022).

Previous research in Barcelona has shown how public spaces, including PGBS, can serve as meeting points for long-term residents that contribute to their sense of belonging and social cohesion (Cocola-Gant, 2023). For instance, despite the intense touristification pressures, La Barceloneta residents demonstrated their persistent sense of local identity (Juventeny Berdún, 2016). The daily use of PGBS like central squares to meet and socialize, facilitated coordination for collective action and solidarity support during the COVID-19 pandemic.

In our study, women and non-binary residents expressed their need for PGBS as a daily space to develop their care activities with children, older relatives, and neighbors. The development of such activities within PGBS contributed to the (resisting) creation of an informal network of care, which encompassed social relations contributing to the well-being of individuals (Kotsila et al., 2020). However, physical and social displacement due to gentrification pressures can result in the exclusion of long-term residents from such meeting places, significantly impacting community life and diminishing their well-being (Cocola-Gant, 2019). This, added to the impacts of the COVID-19 crisis, can negatively contribute to social vulnerability, economic and health precarity. Evidence suggests that these processes can particularly affect women and non-binary residents, increasing their social, economic and health inequities (Curran, 2017; Jacques-Aviñó et al., 2021). Yet, our research shows how enduring networks of care, fomented and articulated through PGBS, can further strengthen a sense of community, well-being, and in return fight gentrification.

4.4 Study strengths and limitations and future research

Our findings are derived from participants' perceptions and usage of PGBS with the aim to assess the complexity and simultaneity of urban change processes, and how these changes affected the utilization of PGBS. We placed emphasis on the use and perceptions of historically marginalized communities, and tried to contextualize them within the broader conditions of the neighborhood. It is beyond the scope of this article to delve deeply into

the full range of gendered effects of the COVID-19 crisis or to establish an exhaustive description of the gentrification and touristification impacts at the neighborhood and the city scale.

Secondly, qualitative interviewees were recruited from survey participants, social media dissemination, and suggestions from the community advisory board, potentially excluding opposing views and experiences. As a project centered on addressing gender inequities, we encountered challenges in data collection due to caregiving responsibilities, limited availability of time, and lower presence of women and non-binary individuals in public spaces. Unfortunately, the available resources and time constraints of the research project limited our capacity for reaching a larger sample, which somewhat limits the generalizability of the findings.

Finally, throughout this process, we adopted a gender-inclusive approach, inviting all participants and survey respondents to state their gender identity in their own terms. However, the number of people who identified as a gender minority represents a very low percentage of our respondents (only 1%). Therefore, we consider that our sample does not fully represent the particular needs of transgender, non-binary people, and those who do not identify within the man/woman binary. However, our goal was to acknowledge the importance of recognizing non-binarism and non-heteronormativity in research and supporting inclusivity in our studies while creating a space for reflection about research assumptions and gender inequities.

Future research could assess the long-term effects of COVID-19 on the use and perception of different types of PGBS, particularly those differing from the classical model of a large green urban park. Additional research is needed to better understand the use and perceptions of blue spaces (Wilczyńska et al., 2023), particularly beyond the North European geographical context (Assmuth et al., 2017; Korpilo et al., 2022; Palliwoda et al., 2022; Raymond et al., 2016) and in relation to the (re)development of coastal areas and the tensions of gentrification and touristification, a matter of increasing relevance for Southern European cities (Novy & Colomb, 2019; Sequera & Nofre, 2018).

5. Conclusion

This study examined how the use and perception of PGBS by women and non-binary residents interacted with gentrification and touristification processes across different periods before and after the COVID-19 pandemic. Our findings revealed that PGBS has an essential role in the quality of life and well-being of residents, while also enhancing a sense of

community, social cohesion, and informal networks of care, which were crucial in the face of gentrification and touristification challenges. The use and perception of PGBS were, in turn, influenced by factors such as gender, care responsibilities, migrant background, age, and health status, among others. Our findings contribute to the existing literature on gender, gentrification, and public urban space, offering a more nuanced understanding of the gendered dynamics within neighborhood infrastructures, particularly regarding PGBS. We also provide new insights into the effects of COVID-19 on women and non-binary individuals in their daily lives and in proximity to PGBS.

Finally, this research holds important implications for urban policy and planning, as urban dynamics and needs pertaining to PGBS elements can influence their capacity to deliver ES and other benefits to diverse populations. Our findings underscore the significance of specific characteristics of PGBS, such as proximity, safety, accessibility, and design, in facilitating the utilization of these spaces by women, non-binary residents, and external visitors. Consequently, we urge city planners and decision-makers to take into account the simultaneous urban processes and social dynamics occurring within PGBS, and to prioritize their quality and accessibility with a gender-sensitive approach. Furthermore, the development of inclusive PGBS cannot be considered in isolation from other critical measures in addressing gentrification and touristification, such as housing policies that promote affordability or stringent regulations that limit mass tourism.

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CHAPTER V. GENERAL DISCUSSION AND CONCLUSIONS

1. Synthesis and key findings

This thesis contributes to a critical understanding of the implications of urban greening planning and practice for environmental, social, and gender inequities. Throughout my dissertation, I considered a series of Environmental Justice (EJ) dimensions related to urban greening in the context of research assessments, planning instruments, and the lived experiences of city residents. To do so, I first built on the Ecosystem Services (ES) concept, which currently serves as the main theoretical framework guiding urban greening research and policy in many cities worldwide. Additionally, I examined Urban Green Infrastructure (UGI) as a key ES-based planning term used in recent greening strategies at the local level. Finally, I focused on PGBS, which constitute a vital component of the UGI within the urban public space. The main novel contribution of this thesis lies in the explicit incorporation of a gender and intersectional lens in understanding the EJ ramifications and dimensions of urban greening.

As described in the introductory chapter, this thesis encompassed several transversal objectives: advancing the conceptual understanding of ES-based greening approaches in relation to justice; applying concepts from EJ and feminist urbanism into urban greening; synthesizing international research, policy documents, and empirical data to offer critical insights into the strengths and weaknesses of the current practice of urban green planning; applying innovative research methodologies to the study of urban green planning and associated uses and perceptions of residents; and providing practical recommendations for policy and practice.

To achieve these objectives, I conducted three studies presented in Chapters II-IV, where I explored: 1) the ways in which urban ES assessments use and apply various EJ concepts and dimensions, including those related to gender; 2) the strategies and actions employed by local urban governments to design and implement socially just and gender-inclusive greening plans and interventions; and 3) the use and perceptions of PGBS by women and non-binary residents in a context of interacting social and ecological urban processes, such as those shaping COVID-19 impacts, and gentrification and touristification outcomes.

Chapter I provided a brief overview of urban greening-related concepts (i.e., ES, UGI, and NbS) in research and policy contexts and justified the importance of adopting a justice and

inclusive approach to address environmental, social, and gender inequities. Building upon previous conceptual models, particularly the ES Cascade model (Potschin-Young et al., 2018), this chapter also outlined the mechanisms through which urban ecosystems ultimately provide benefits and contribute to human well-being. Additionally, I integrated elements of the ES and Well-being chain Daw et al. (2016) to illustrate how well-being is unevenly distributed across social groups due to EJ questions. Last, I outlined my dissertation research questions and objectives before presenting the methodological framework and case study approach I followed.

Chapter II presented a global systematic literature review examining how urban ES assessments have incorporated EJ perspectives. This study quantitatively examined 126 research articles and reviews to explore which ES, UGI elements, dimensions of justice, social axes of inequity, and stakeholders were taken into account in recent academic literature. This analysis revealed that recent studies primarily focused on the unequal geographical distribution of ES and its biophysical structure. Income and race/ethnicity were the two key mechanisms of social stratification more greatly considered within ES assessments. Furthermore, I found that almost half of the reviewed articles chose to delve into regulating and/or cultural ES, examining their roles in enhancing resilience and adaptive capacity, and/or in fostering recreational values, social cohesion, and place-making.

In this chapter, I discussed how the predominant focus on distributional justice may limit the exploration of other factors contributing to environmental inequalities, such as historical legacies and power imbalances across socio-spatial scales. Finally, I argued that the ES framework can enrich the assessment of urban environmental inequalities, providing both conceptual and practical tools to better identify and quantify the benefits, disservices, and trade-offs present in urban green planning. Conversely, I indicated that EJ can support a better diagnosis of ES assessments in regard to social inequities in both urban greening research and practice, as well as contributing to the empowerment of local communities for the production of greener and more just cities.

Findings underscore gender as a critical factor that has been overlooked in the assessments of ES. This oversight has significant implications for understanding the diverse ways in which women, girls and gender minorities interact with and benefit from ecosystems. It highlights the need for a more comprehensive and inclusive approach to ES assessments that takes gender-related dynamics and perspectives into account.

In **Chapter III**, I explored the integration of social and gender equity factors in local urban greening plans and projects. Despite the increasing adoption of ambitious greening plans by cities worldwide to address urgent environmental and social challenges, a comparison with five other international cities in Europe and North America revealed that many of these international plans often lacked thorough and concrete justice considerations, with a noticeable gap in addressing gender inequities. For this chapter, I selected the case study of Barcelona due to its nascent but innovative incorporation of social and gender equity approaches into urban greening.

First, after an international contextualization of Barcelona's greening plan, I identified how the planning of UGI in Barcelona illustrates a shift from a primarily ornamental function attributed to greening towards a multifunctional ES-based approach. This multifunctional approach is increasingly incorporating social benefits, equity, inclusivity, and gender-sensitive concerns. Since the mid-2010s, Barcelona has indeed integrated inclusivity and care as prominent guiding values and applied gender-sensitive approaches to the management of public space. However, these values have not yet fully permeated specific greening guidelines, leaving room for the improvement of formal decisions, documents, and projects to align with broader urban and feminist/gender visions and agendas. Second, Barcelona illustrates an urban design practice that adapts to accommodate diverse green space uses with a focus on accessibility and individual autonomy. Nevertheless, certain design guidelines, such as those related to comfort, safety, and visibility, occasionally conflict with fauna and habitat conservation recommendations, and such guidelines also risk essentializing women as caregivers. Third, Barcelona showcases high awareness and increasing expertise among municipal staff regarding the integration of social and gender equity into green planning and participatory processes, but results show that concrete progress in integration on the ground will depend on building expertise and collaboration across departments, and on the adoption of empowering participatory approaches instead of top-down consults.

Ultimately, this chapter discusses how the combination of these strategies, as put into practice within the City Council's daily operations and projects, results in specific solutions aimed at addressing intersectional inequalities for women from different backgrounds and needs. This approach can be described as an ad hoc intersectional planning approach.

Lastly, in **Chapter IV**, I explored the extent to which the COVID-19 pandemic and its restrictions affected the use and perceptions of women and non-binary residents regarding the PGBS of two Barcelona gentrifying neighborhoods (Sant Antoni and La Barceloneta).

Simultaneously, I examined how COVID-19 restrictions shaped residents' perceptions of gentrification and touristification, and how those perceptions, linked to urban development dynamics, in turn affected their use and perception of public green and blue spaces.

Results show that the pandemic crisis highlighted an already existing deficit of PGBS with quality and accessible public amenities and furniture within these two dense neighborhoods close to the city center. During the lockdown, which started in March 2020, restrictions and a drastic reduction of gentrification and touristification pressures led residents to rely on neighborhood networks of public areas, intensifying their sense of community through the use of local green and blue spaces. However, as restrictions eased in June 2020, visitors and tourists were able to move more freely, which contributed to the crowding of seafront areas in La Barceloneta and made women and non-binary residents feel unsafe and displaced. These perceptions were exacerbated in both neighborhoods with the reopening of bars and restaurants, which introduced more private terraces in the surroundings of PGBS, mainly oriented for visitors. In short, I argue that although women and non-binary residents experienced improved access to PGBS during the lockdown, post-lockdown perceptions of gentrification pressures did not notably diminish. Residents continued to feel out of place and unwelcomed, hindering their use of PGBS and displacing them from the neighborhood.

In summary, Chapter IV demonstrated how the use and perception of PGBS depend on multiple factors, including neighborhood density and housing conditions, neighborhood typology, public demand for UGI, and the social dynamics behind gentrification and touristification. Such factors were in turn mediated by aspects such as gender, care responsibilities, migrant background, age, and health status, among others. Finally, the results highlighted the relationship between gentrification and touristification in green and blue spaces and emphasized the importance of inclusive planning and access for the well-being of women and gender minorities.

2. Research contributions

2.1 Theoretical contributions

This research makes relevant contributions to three main fields of study: 1) *urban ecology* and *urban greening planning* with a focus on ES and UGI research, 2) *Environmental Justice* with a focus on green justice, and 3) *gender and feminist (urban) studies*. A conceptual framework displaying all transversal concepts that were mobilized and informed throughout the thesis is shown in **Fig. 1**.

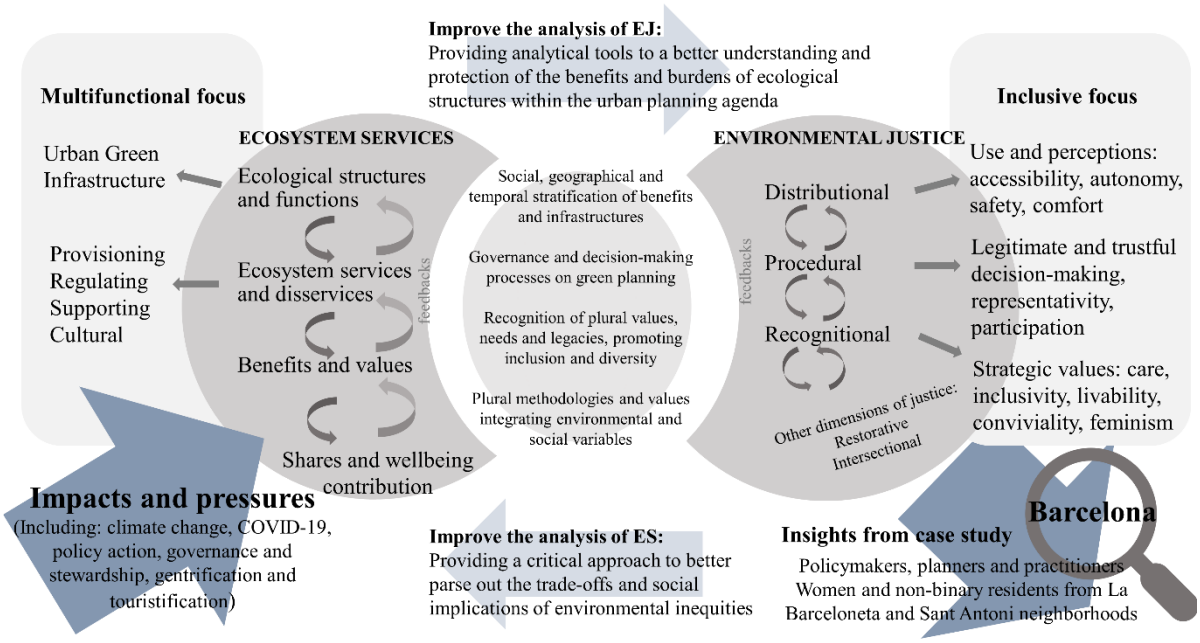

Figure 1. Conceptual framework of the contributions and feedbacks between the Ecosystem Services and Environmental Justice frameworks. Author's adaptation from (Rincón-Ruiz et al., 2019).

Expanding dimensions of Environmental Justice

Building on research calls advocating for the inclusion of an EJ perspective in ES-based assessments and planning (Enssle & Kabisch, 2020; Ernstson, 2013; Langemeyer & Connolly, 2020; Loos et al., 2023), I provided a comprehensive overview of the current state of EJ considerations in urban ES-based research and practice, including a review of the debate on urban greening, dimensions of justice, and gender. In light of this thesis' findings, I demonstrate that EJ has been examined in limited ways, focusing mostly on the (spatial) distribution of environmental "goods and bads" while tending to leave questions of recognition and participation behind. However, the geographical distribution of greenspaces represents just the tip of the iceberg (Zuniga-Teran, 2021) concerning urban green (in)justices in relationship to ES provision. Findings reveal that the predominance of the distributional EJ dimension in ES assessments can lead to a narrow and de-politicized analysis of urban greening initiatives, potentially perpetuating forms of exclusion (Diep et al., 2022).

Furthermore, I question the extent to which green interventions benefit all residents equally in a trickle-down effect, especially if urban greening is solely approached from a distributional standpoint, isolated from other urban processes of exclusion. While this observation is not

novel in the (urban) EJ literature (Agyeman et al., 2016; Anguelovski et al., 2020; Schlosberg, 2013), I noted limited progress in how cities are incorporating the operationalization of justice within ES-based approaches for a diversity of urban residents in green strategies and plans. Thus, I emphasized the need for a wider incorporation of procedural and recognitional dimensions in urban greening assessments and planning strategies.

Furthermore, I also suggested the inclusion of intersectional justice and restorative justice dimensions within the urban ES framework. This inclusion underscores their potential to offer a more comprehensive understanding of urban environmental inequities. Intersectional justice considers how multiple identities interact and are recognized across different axes of (under)privilege, and is a perspective still scarce in the urban ES literature (Mikulewicz et al., 2023). This perspective applies to urban greening by acknowledging that various communities may experience urban green and blue spaces differently based on their unique combinations of race, class, gender, and other intersecting factors. Thus, an intersectional approach in urban greening can help ensure that green interventions consider and address the different needs and experiences of diverse populations (Colley et al., 2022). Restorative justice focuses on acknowledging past experiences of violence, oppression, and exclusion, which can be applied to urban greening by emphasizing the need to address historical injustices in urban planning and development, and by actively involving affected communities in decision-making processes to ensure that greening efforts not only enhance their urban environment but also acknowledge their historical traumas and promote processes of healing and empowerment (Draus et al., 2019).

Situating inclusivity, gender, and care concepts in urban greening

This thesis builds upon existing knowledge regarding challenges to the incorporation of a gender perspective in urban planning (Sánchez de Madariaga & Roberts, 2016) by examining the context and attributes of urban greening as a field of practice. By recognizing gender as a cross-cutting factor in the integration of an EJ perspective into urban greening, we can better identify and analyze the nuanced ways in which the urban environment –and improvements to that environment through greening– impacts women and gender minorities.

While justice and equity in the ES literature tend to be used in the context of the distribution of environmental benefits and burdens from ecosystems (Nesbitt et al., 2018), the use of *inclusivity* usually serves to emphasize the recognitional and procedural aspects of urban greening. In other words, it underscores the need for social recognition to ensure that all

individuals, regardless of their background, have fair and meaningful access to decision-making processes, resources, and benefits related to urban greening (De Haas et al., 2021; Fors et al., 2021; Oscilowicz et al., 2022). Inclusivity also carries a gender equity connotation, as it is a term commonly used in gender-sensitive approaches and policy guidelines (Øian et al., 2021; The World Bank, 2020). For instance, this is reflected in Sustainable Development Goal 11's Target 11.7, which calls for "providing universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities".

Furthermore, building on the gender literature on urban planning (Chinchilla, 2020; Kern, 2021; The Care Collective, 2020), I introduced the concept of *care* as a pivotal aspect of urban greening and its role in relation to well-being and livability in daily life. Care acts as a guiding element for the participation and recognition of plural needs in diverse communities, acknowledging both productive and reproductive work. Care thus also highlight how PGBS form part of the infrastructure necessary to develop care tasks while reinforcing a sense of community and belonging (Raymond et al., 2023).

Shifting focus in urban ecology and urban green planning

I explored the discrepancy between the theoretical underpinnings and the practical implementation of EJ-oriented urban greening strategies (Boulton et al., 2021; Rivera & Hendricks, 2022; Wijsman & Berbés-Blázquez, 2022). My findings provide new evidence for the current approach of cities adopting a multifunctional model for their greening agendas, which emphasizes multiple ecological functions deriving into social benefits. This contributes to a larger paradigm shift in global urban policy and discourse, wherein cities are not merely viewed as sources of unsustainable practices, but as fundamental components of the sustainability solution (Angelo & Wachsmuth, 2020).

However, multifunctional ES-based assessments, both in research and practice, often focus primarily on ecological functions, and depict greening initiatives as win-win solutions (Hoover et al., 2023). Drawing on literature that problematizes "technocratic approaches" to urban greening (Diep et al., 2022; Kotsila et al., 2020; Neidig et al., 2022), I argue that this approach can lead to top-down decisions and exclusionary practices, which in turn result in unjust access and planning of ES.

Nevertheless, the increasing pressure to address social and environmental inequities through urban greening (Hansen et al., 2022) promotes the incorporation of EJ approaches into the

multifunctional approach mentioned above. I describe this incorporation as a shift in the role that cities attribute to greening, moving toward a more inclusive focus that gradually incorporates the social and justice dimensions of urban greening. However, such considerations are still in their early stages in the policy agenda and tend to be treated superficially, without clear action plans for operationalization.

Additionally, I explored the use and perceptions of PGBS by women and non-binary residents in the context of other exclusionary dynamics, which are also gendered, such as gentrification and touristification (Curran, 2017; Sakızlıoğlu, 2018), and the impact of the COVID-19 pandemic (Carreras et al., 2022; Jacques-Aviñó et al., 2020; Mayen Huerta & Utomo, 2022; Ryan & El Ayadi, 2020). Building on the literature on green gentrification (Anguelovski et al., 2021), my findings reveal how gentrification and touristification pressures affect access to and benefits derived from PGBS during the COVID-19 pandemic.

2.2 Empirical contributions

In the framework of this thesis, I have explored various scales and stages of urban greening, endeavoring to bridge gaps between research, policy, planning, and practice. I began by examining the theoretical connections between the ES framework and EJ terminology. From there, I delved into the planning and implementation of UGI. Finally, I shifted focus towards questions of use and perception by women and non-binary residents in public green and blue spaces.

This analysis encompassed a wide array of aspects within urban greening processes, spanning different scales, planning stages, and involving various key stakeholders. I undertook a comprehensive review of global academic discourse, examined local greening strategies in diverse international cities, and conducted a comparative case study of residents' perspectives at the neighborhood scale. Additionally, I traced the evolutionary trajectory of urban greening, from its conceptualization and theoretical underpinnings to the stages of planning, design, implementation, management, and use. This scrutiny included an investigation into the roles played by diverse actors such as policy-makers, designers, planners, and other urban planning professionals, as well as the perspectives of long-term residents and local activists.

Throughout my case study findings, I explored how municipal greening plans fall short in providing a comprehensive assessment framework and an actionable plan for ensuring a meaningful reaping of benefits across the entire population, particularly those groups that are historically disadvantaged. Results indicate that the predominant emphasis in municipal practice lies in adopting a (spatial) distributional perspective when considering matters of EJ.

This approach, however, leaves a significant gap in the understanding of how to effectively appraise the diverse needs, values, and use patterns of distinct urban communities. Additionally, the urban greening processes involving public participation and decision-making are frequently characterized by a lack of inclusivity and representativeness, often exhibiting a hierarchical, top-down structure led by planners and technicians, which ultimately undermines community trust.

Furthermore, I identified how gender inequities manifest in different stages of urban greening: from its design and planning to its use and perceptions. In my case study of Barcelona, I discerned a range of barriers impeding the achievement of gender equity within urban greenspaces. Such barriers included, for instance, perceptions of unsafety by women and girls in green and blue spaces due to poor maintenance or design, a lack of adequate facilities for reconciling the use of such spaces with caregiving tasks, and a lack of awareness regarding gender inequities within environmental departments. Additionally, I examined the strategies and measures envisioned or already implemented by the City Council to mitigate these disparities, while also considering their potential limitations and associated risks.

These findings also indicate that specific aspects of the UGI can help address such inequities. These include increasing the maintenance of vegetation through pruning and providing adequate lighting, clearly indicating the routes and exits of green spaces to facilitate orientation, promoting the connection of greenspaces with other infrastructures in the area, and encouraging diverse uses and activities in such spaces. These findings align with and expand upon the five urban qualities considered necessary to account for the experience of everyday life from a gender equity perspective (Col·lectiu Punt 6, 2014). Furthermore, I found that gender-sensitive design guidelines in practice contributed towards creating more inclusive and accessible spaces for different intersectional vulnerabilities.

Furthermore, the diversity of UGI components, including street trees, beaches, green squares, and pocket parks, can provide various benefits and functions to address different daily needs. For instance, in Barcelona, the limited availability of new large parks has been partially compensated by the implementation of Superblock areas and pocket parks. Barcelona thus serves as a relevant case study of innovative approaches for integrating social and gender considerations into greening policies, setting a precedent for other cities to operationalize EJ in urban greening. This includes providing PGBS that can serve as meeting points for socialization and the creation of informal care networks for residents, as well as

developing and implementing design guidelines that ensure women's comfort, safety, and visibility.

Barcelona's pioneering position in green policies can be attributed to strong political support and widespread public awareness of their benefits, coupled with collaborative governance initiatives. However, gender remains an overlooked aspect in implementing EJ in urban greening practices. City planners face distinct challenges when it comes to incorporating a gender perspective into urban greening efforts. These challenges include factors such as the lack of gender-disaggregated data, unfamiliarity or resistance from some stakeholders towards feminist concepts and methodologies, and a superficial implementation of feminist urbanism principles. This implies a risk, particularly relevant when consensus-building between different sectors may inadvertently deviate from the original goals outlined in feminist urbanism guidelines. Additionally, conflicting priorities between ecological criteria and inclusive design for green spaces may pose a significant challenge in their design and management. Finally, there is concern about reinforcing stereotypes by overemphasizing women's roles as caregivers in PGBS.

2.3 Methodological contributions

Finally, this thesis explored and built on different methodological approaches, encompassing quantitative, qualitative, and mixed-method analysis. This approach contributes to the advancement of social science research methods in the fields of urban ecology and ES (which are still mostly dominated by quantitative approaches), providing a more diverse methodological framework for understanding social and gender inequities within these contexts. This multifaceted approach not only broadens the methodological resources accessible to researchers and practitioners but also emphasizes the critical role of incorporating varied perspectives and experiences in the creation of more inclusive and sustainable urban environments.

On the one hand, the inputs from interviews with urban planners, municipal officers, and practitioners involved in urban greening processes (particularly reflected in Chapter III) facilitated a deeper understanding of the practical challenges and opportunities inherent in implementing green strategies with an inclusive approach. Since a more inclusive approach to urban green planning is still emerging and unevenly implemented, a qualitative in-depth analysis was necessary to obtain an overview of how the concepts of EJ and gender equity were understood and operationalized in practice, as well as the different strategies and barriers that the City Council was facing. These exchanges enriched the thesis with real-world

insights and actionable recommendations for urban planning and development. This contribution bridges the theoretical framework of the thesis with practical, on-the-ground perspectives and provides a deeper understanding of the challenges and opportunities faced by city planners and technicians in the actual implementation of inclusive green strategies in the Global North.

On the other hand, the participatory process undertaken as part of Chapter IV, involving women and non-binary residents and the community advisory board, resulted in a nuanced exploration of their experiences and needs in relation to PGBS as well as their interactions with other crucial aspects of public space. Besides, the application of a feminist participatory methodology in urban greening research is still in its early stages and is not widely used (Hesse-Biber, 2011). Therefore, with this thesis, I contributed to bringing a feminist and community-centered perspective to urban greening research, while prioritizing the voices and experiences of historically marginalized communities through a context-specific approach and through exchange and collaboration with residents.

3. Limitations and caveats

This thesis has several limitations. First, the consulted bibliography and literature reviews throughout the thesis may have overlooked relevant studies due to the reliance on English-language, peer-reviewed articles available in the chosen databases, as well as limited previous research knowledge and experience. Moreover, especially in Chapter II, the use of specific search terms may have shaped or restricted the scope of the studies examined in the systematic review.

Second, this thesis primarily focuses on Barcelona as the main case study, leaving ample room and a need for further research exploring urban greening outside of Global North contexts. Similarly, I acknowledge a potential bias in the selection of municipal planning documents, stakeholders, and resident participants, influenced by practical considerations such as availability or their willingness to engage in the research process. Self-selection bias may play a role in voluntary participation, as those with a particular interest or experience in urban greening may be more inclined to participate in the study. While great care was taken to incorporate a wide array of sources and perspectives, and with a conscientious effort to recognize and address any inherent biases during the data collection and analysis process–especially with participatory research approaches–it is important to acknowledge that certain perspectives or voices may not have been fully captured.

Lastly, it is crucial to acknowledge that the extrapolation and applicability of the findings and recommendations in this thesis are constrained by its focus on one main case study. While diverse methods and sources were employed to extract principles, tactics, and lessons with the potential to benefit other local practices and contribute to scholarly discussions on urban greening and EJ, the universal applicability of these lessons may be limited.

4. Future research

There are numerous potential avenues for further investigation and expansion of the topics addressed in this thesis. In this subsection, I outline promising directions for future research, providing a roadmap to deepen our understanding of urban greening practices and their intersection with broader societal dynamics.

First, future research could delve more profoundly into understudied dimensions of EJ in the context of urban greening. This includes exploring aspects of restorative justice and intersectional justice. This direction also involves examining in further depth the intricate interplay of various axes of inequality, such as gender, sexual identities, disability, socioeconomic status, race, age, and religious beliefs, among others. Understanding how these factors may influence the design and use of greenspaces can be instrumental in shaping inclusive urban policies and governance practices.

Furthermore, there is a critical need for interdisciplinary empirical research in this field. This entails conducting analyses of diverse urban processes and aspects related to urban greening, including the sectors of energy, mobility, housing, and health, among others, and their intersection with gender and other intersecting backgrounds. Additionally, future research could explore the inclusion of diverse stakeholders and policy spheres, including elected officials and policy-makers at regional and national levels.

Moreover, future research should aim to balance the US- and Euro-centric bias prevalent in urban greening scholarship with studies in other regions. Expanding research to understudied regions can reveal unique challenges and opportunities in implementing green strategies, especially those under different climate stressors, urban forms, and sociopolitical differences. This will ultimately contribute to a more inclusive and globally applicable understanding of urban greening and EJ dynamics. For instance, compact cities like Barcelona can provide insights into how to better integrate UGI within grey infrastructure, as vacant space for large urban parks is very limited.

Finally, future research endeavors could further explore the use of mixed and qualitative methodologies aimed at amplifying the perspectives and voices of historically marginalized communities. This might involve an expansion of participatory approaches, such as participatory-action research (Davis & Ramírez-Andreotta, 2021), which remains relatively unexplored within ES-based urban greening research. These approaches could provide a robust framework for understanding the nuanced experiences and challenges faced by diverse communities and for enhancing inclusive urban greening initiatives.

5. Recommendations for policy and practice

The following set of recommendations, based on the findings of this thesis, aims to delineate key steps to enhance a holistic integration of EJ and a gender perspective in urban greening policies and practices.

Implement environmental justice and gender equity as a goal and a praxis in urban greening

Current urban greening planning practices frequently prioritize concrete and quantifiable ecological and environmental outcomes over embracing a holistic vision of EJ. However, the clear definition and establishment of justice goals within urban ES-based assessments and urban greening plans are essential steps to track and prevent exclusionary practices and outcomes. This involves identifying indicators and developing clear action plans to achieve these goals. Indicators should encompass not only environmental and ecological variables, but also those related to the socioeconomic characteristics of the population. In this context, it is crucial to gather data that is disaggregated by gender and other socioeconomic variables to quantify and design strategies to address inequities.

For example, collecting information about the composition of participants in various programs, data on the uses of PGBS, and the specific environmental amenities required by different needs can uncover hidden social and gender inequities that may have gone unnoticed. Rather than, for instance, setting an overarching goal of increasing the total share of tree canopy cover, municipal governments should establish specific quality and maintenance goals with concrete elements of the UGI while addressing intersectional needs and uses at the neighborhood level.

Promote interdisciplinary collaboration

Current urban greening practices tend to be fragmented and often lack a comprehensive perspective on the interconnectedness of ecological and socioeconomic factors within urban environments. This can result in missed opportunities for maximizing the benefits of urban

green and blue spaces and may inadvertently perpetuate environmental and social inequalities. To effectively integrate EJ considerations into urban greening strategies, it is imperative to adopt a multifaceted approach that steers clear of one-dimensional approaches to urban greening. This involves integrating the planning of UGI with other key urban infrastructures such as mobility or housing infrastructure, as well as maintaining fluent communication and collaboration with other municipal departments. Breaking down professional silos and fostering interdisciplinary collaboration is central to promoting just and effective green planning.

This can also include creating alliances with other cities and regions that share similar greening strategies or being part of international networks such as C40 or the International Covenant of Mayors where more progressive agendas and practices can be shared, diffused, and amplified. Gender mainstreaming offices or gender-equity task forces within city administrations can play a pivotal role in ensuring that greening strategies are inclusive and considerate of diverse intersectional perspectives and needs. By actively involving all stakeholders and drawing on a range of "knowledges" and a plurality of values, urban areas can cultivate more comprehensive and impactful approaches to green planning, ultimately leading to more sustainable and equitable cities.

Finding a straightforward solution for planners to enhance urban sustainability while simultaneously meeting community needs is not an easy task. Proactive and transparent management of conflicting interests and trade-offs is paramount in achieving equitable outcomes. Equally important is developing transparent, participatory deliberative processes that embrace the diversity of urban communities and promote civic stewardship in urban greening initiatives.

Provide training and embrace novel methodologies

Incorporating a gender perspective into urban greening practices poses a challenge due to a prevailing lack of expertise in gender-inclusive approaches and methodologies among urban planners and stakeholders. To address this, it is imperative to offer comprehensive training on gender-sensitive planning approaches. Moreover, implementing gender equity protocols is crucial to guaranteeing equal representation and working conditions for professionals involved in urban greening, including municipal gardeners, planners, designers, and facilitators of participatory programs, among others.

Furthermore, embracing a diverse range of feminist participatory methodologies in urban diagnosis, such as exploratory walks focus group, and photovoice elicitation, can empower marginalized social groups and provide valuable insights into the unique experiences and needs. These methodologies offer a more nuanced understanding of how urban spaces are navigated and experienced, allowing for more inclusive urban greening participatory approaches. These measures collectively serve to bridge the knowledge gap and facilitate the seamless integration of gender considerations into greening strategies.

6. Concluding remarks and final thoughts

This research work began from my interest in urban ecosystems, which are primarily embedded in the daily landscape of the majority of the world's population. Green and blue spaces –including parks, gardens, street trees, green axes, public allotments, rivers, and coastlines, among others– serve numerous concurrent people's needs. Their ES range from mitigating and adapting to climate change, to improving the physical and mental health of individuals and communities, providing local food, enhancing social cohesion and community spirit, and facilitating everyday life care work, to name a few.

Throughout my PhD journey, I have observed how urban greening just reflects the social, gender and environmental (in)equities that occur in urban societies. As Jane Jacobs exposed in her book *Death and Life of Great American Cities*: "Too much is expected of city parks. Far from transforming any essential quality in their surroundings, far from automatically uplifting their neighborhoods, neighborhood parks themselves are directly and drastically affected by the way the neighborhood acts upon them" (Jacobs, 1993, p.95). Thus, urban greening initiatives are woven into the fabric of urban life, influencing and being influenced by a myriad of social, economic, racial, gender, and cultural dynamics. This thesis has sought to shed light on the relationship between urban greening and environmental, social, and gender inequities.

There are promising avenues for further research and action. Delving deeper into the gender dimension on urban (green) planning, or into the understudied dimensions of justice within urban greening research and practice, and understanding the interplay of various axes of intersectional inequality are critical steps.

In conclusion, this thesis calls for a more holistic and nuanced approach to urban greening—one that recognizes its intricate interplay with broader societal and gender dynamics. By heeding these recommendations and embracing a multifaceted understanding of EJ, cities can forge a path toward greener, more inclusive, and ultimately, more just urban

environments. Only through such comprehensive efforts will municipalities be able to unlock the full potential of urban greenspaces for the benefit of all residents.

As a final note, during the last weeks leading up to the submission of this thesis, a strong backlash to greening policies has emerged in Barcelona due to political changes and court decisions. While controversy and debates in the media had surrounded the Superblocks Plan and the new Green Axes projects from its conception, recent changes in Barcelona's political landscape, coupled with the influence of commercial and touristic lobbies, are now driving efforts to halt or even reverse green interventions such as the recent (and longest) green corridor of the city in Consell de Cent Street (Betevé, 2023). This backlash is happening despite prior agreements and community involvement, support for, and use of these interventions by local residents and visitors.

These recent facts remind us that advancements in equitable, accessible, and inclusive urban greening in public spaces cannot be taken for granted. There is a genuine threat that these initiatives aimed at creating a more livable city and promoting policies centered around care become eroded or even eradicated. The evolving narratives around greening policies in Barcelona stands as a poignant reminder of the complexities and fragilities that surround the existence of nature in cities. May this serve as an inspiration and constant motivation for all of us who believe in a greener, more inclusive future for cities.

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APPENDICES

Appendix A. Supplementary data for Chapter II

A.1 Search strings

Search terms for the analysis in **Table S1**. Concepts in the same columns were alternatively included using the OR Boolean operator. The asterisks are used as an operator that can find variants of the same root word (e.g. *urban* can retrieve results such as "periurban" or "urbanized"). The search included all articles and reviews where respective search term occurs in title, abstract or keywords.

Table S1. Search strings.

ecosystem servic*	AND	*urban* city cities town	AND	*equit* *justice* *fairness

A.2 Reviewed publications

List of the 126 publications included in the review.

Abebe, S. T., Dagnew, A. B., Zeleke, V. G., Eshetu, G. Z., & Cirella, G. T. (2019). Willingness to pay for watershed management. Resources, 8(2), 1–18. https://doi.org/10.3390/resources8020077

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Appendix B. Supplementary data for Chapter III

A.1 International analysis

Barcelona: Pla Natura 2021-2030

General focus and greening conceptualization

Greening strategic document on the planning and management of the city greenspaces and its biodiversity. It includes an extensive compilation of action lines to be developed and materialized. The plan emphasizes the functional role of greening, the protection of urban habitats and biodiversity, and the promotion of participation and stewardship from different sectors of society. The greenspaces of the city are framed as a functional urban green infrastructure that provides "socialenvironmental or ecosystem services" and contributes to human well-being. The document highlights benefits related with health and climate change adaptation.

Environmental justice and gender approach

The plan incorporates an EJ approach in its objective, which aims to achieve "an equitable, accessible green" with "near, accessible and quality green spaces for all citizens" (page 38). Terms of justice are displayed as a challenge: "to attend to the new needs of parks such as (...) gender perspective and social justice." (p. 110) and are framed within a distributional and procedural focus. The plan aims to increase greenspaces to "guarantee a distributionally equitable of the services and benefits from green and biodiversity" (p. 97) by prioritizing those districts with lower ratio of green canopy per capita (p. 18). However, this prioritization does not consider any socioeconomic variable by neighborhood. Besides, an action of the plan proposes "to plan the city's green infrastructure (...) prioritizing fairness, the gender perspective, accessibility, size and quantity as well as city and metropolitan connections" (p. 98) but it does not specify how this can be identified, measured or evaluated. Further, the plan has a strong focus on participation, citizen initiatives and empowerment (p. 45) through participatory processes of joint diagnosis, citizen initiatives and collaborative management of greening (p. 109). However, there is no recognition of different social groups with historic and ongoing inequalities, except for gender. Gender is mentioned in two different contexts: as a perspective to be prioritized in the planning of the green infrastructure of the city (in actions 1, 9 and axis 1 at p. 123) and as part of the internal protocol for avoiding sexual

harassment and guaranteeing gender equity in the internal selection and communication of gardeners and technicians (p. 78). However, on the first point, there are no further specifications about how the gender perspective is envisioned in the planning and management of greenspaces.

Paris: Plan Biodiversité de Paris 2018-2024

General focus and greening conceptualization

Extensive greening strategic document on the city biodiversity and greenspaces with a first strategic part and a second part with specific action lines and objectives. It is framed within two main criteria: ecological and biodiversity. Urban biodiversity is presented as a provider of services to citizens, framed as ecosystem or ecological services. They highlight health improvement, climate change adaptation and city attractiveness.

Environmental justice and gender approach

Social justice is mentioned as an objective due to the increased dependency of low-income residents to their immediate greenspaces (p. 11). However, justice does not form part of any of the actions and there are no indications into how to address potential inequities. Actions proposed to increase the urban green infrastructure in certain areas do not respond to distributional justice criteria but to land availability, ecological connectivity and biodiversity. However, distribution of greenspaces is addressed under the umbrella policy of the 15-min city, with the objective of guaranteeing access to open spaces in a maximum of 7 minutes walking (p. 108). Procedural justice is framed as participatory democracy, emphasizing access to information, open data and participatory processes involving different actors of the public and private sectors and civil society (p. 46) and different governance bodies to engage and manage participation (p. 18). Gender is not mentioned in the document.

Berlin: Strategie Stadtlandschaft Berlin 2012-2050

General focus and greening conceptualization

Greening strategic document on the urban landscape with an interdepartmental and transdisciplinary approach. It recognizes the ES and ecological value provided by the green infrastructure, conceptualized in 3 themes: beautiful city, productive landscape and urban nature. Green and open spaces are not considered in isolation, but in relation to the social, economic and cultural demands and within the historic evolution of the city. Greenspaces are valued for their regulating services and habitat provision, and a lot of emphasis is put in

cultural services like recreation opportunities and social interaction. Ecosystem services are explicitly mentioned and addressed as part of their strategy on biodiversity (p. 38). Green infrastructure is understood as a crucial part of the public space of the city with a vital role "for an increasingly heterogeneous urban society" (p. 10).

Environmental justice and gender approach

The plan acknowledges the role of greenspaces in future social challenges (i.e., demographic change, climate change, economic inequities, conflicts of interests) and as a matter of justice: "A socially just green space design must therefore allow and encourage new forms of appropriation and use" (p. 29). Criteria for EJ is framed in terms of availability and accessibility for diverse residents and city visitors (p. 38). The plan aims to distribute greenspace prioritizing areas with particular social needs that also have deficit of green spaces (p. 46). Green spaces are also framed as spaces of representation, and the historical legacy of the city is acknowledged when aiming "to reconnect the long-separated halves of the city" after the fall of the Berlin Wall. Calls for citizen cooperation and participation of the citizens in taking responsibility and maintenance are found in the document. It also encourages participation to "identify more strongly with the city's greenery" (p. 53) while recognizing the needs, uses and preferences of different social and cultural groups (e.g., older population in the city, people living alone and young families). The plan acknowledges the consequent need to address such topics through a greenspace "design for all". Gender is not mentioned in the document.

London: The London Plan 2021

General focus and greening conceptualization

Urban strategic document with a chapter on "Green Infrastructure and Natural Environment". The chapter adopts a strategic approach to the urban green infrastructure as an integral infrastructural element of the city, highlighting its social and economic value. It displays the London Green Belt as a flagship and ambitious city-scale project. The plan emphasizes the ecological and biodiversity function of greenspaces and its contribution to the Londoner's quality of life, with a detailed classification of open space typologies. The plan explicitly adopts a green infrastructure approach, recognizing the network of green and blue spaces as elements that provide benefits and which must be therefore planned, designed and managed in an integrated way (page 313).

Environmental justice and gender approach

The plan aims to address both environmental and social challenges with strategic green infrastructure interventions (p. 313) promoting mental and physical health and well-being, providing recreation opportunities and adapting to climate change. Environmental justice objectives are framed in distributional terms, improving public access and quality of greenspaces "for all" and promoting an inclusive design. However, there are no further specifications for the criteria and operationalization of these objectives. Besides, they aim to "create areas of publicly accessible open space, particularly in areas of deficiency" (p. 319) but it is not clear how do they understand or measure deficiency. Gender is not mentioned in the "Green Infrastructure and Natural Environment" chapter of the document. However, gender and women are mentioned in other sections (Economy and Social infrastructure) related to gender-based violence, discrimination, access to infrastructure and economic opportunities.

Montréal: Montréal durable 2016-2020

General focus and greening conceptualization

Broad urban strategic plan on city sustainability including objectives for reduction of greenhouse gases and fossil energy, greenspaces and biodiversity, sustainable neighborhoods and green economy. The objectives related to greenspaces consist in increasing the canopy cover and the surface of protected areas, and the improvement of the water and waste management. The document acknowledges once the "services provided by nature" (p. 26). However, it does not focus on the green infrastructure and the functional role of greenspaces.

Environmental justice and gender approach

The plan aims to address the "notions of environmental, social, economic and cultural justice" (p. 26) as part of a broader objective of offering a healthy, safe and inclusive city to their residents. However, there is no further specification on how they understand EJ. Distributional justice is addressed within the objective of ensuring the access to infrastructures and services to their citizens, and participation is valued as a democratic process for citizens. However, these processes are not framed in relation with greenspaces but with access to infrastructure and buildings by "vulnerable people" (p. 22). Besides, participation is only mentioned as part of the planning and management of urban greening for community gardens. No mention of gender as a justice aspect. However, the plan mentions some cultural and sports programs that state to be focused on young people,

families, women, people with disabilities, migration issues and persons with other social vulnerabilities.

New York City: PlaNYC 2011-2030

General focus and greening conceptualization

Urban strategic extensive plan. We focus on the second section: Parks and Public Space, where greenspaces are considered a new fundamental aspect to ensure the quality of life of residents (p. 9). Parks are considered a highly demanded part of the public space that also act as flagship infrastructure. The plan identifies a growing demand of parks and public space and presents projects to build and increase access to them. Ecological and biodiversity protection is present but playing a secondary role. The plan envisions parks, parkways, green streets, and plazas together with public space and streetscape as a way to extend the public realm and meet the outdoor needs of citizens in a "variety of modes, and as ecological assets". Green spaces are displayed as part of the identity of the city. Ecological functions are acknowledged referring to all services except the cultural ones. Recreational opportunities are emphasized separately. The term urban green infrastructure is employed but only in a climate change adaptation context, particularly with stormwater management.

Environmental justice and gender approach

Environmental justice is acknowledged in the document since it recognizes that access to green spaces is not enough and that the needs for open space are diverse (p. 34) and must be ensured to "all New Yorkers" and future generations. The majority of actions and priorities are framed distributionally, focusing on improving accessibility to parks and public spaces through high-impact projects. The plan emphasizes the creation of spaces for recreation and the incorporation of underutilized spaces as part-time public spaces, and restoration and remediation projects. Besides, the plan proposes the creation of tools to identify parks and public space priority areas. Such tools would use demographic and environmental criteria but no further specifications are displayed in the document (p. 35). Participatory processes are mentioned as part of the of community's success and engagement in greenspaces design (p. 34). Besides, the plan aims to promote and encourage stewardship with non-profit, volunteer organizations engaging communities and volunteers. However, the justification is more centered in maximizing impact and bringing together efforts rather than democracy or legitimacy values. Gender is not mentioned in the document.

A.2 Interview questions – municipal/public sector representatives (stakeholders from greening department)

Semi-structured interviews of aprox. 45-60 minutes for planners, designers, departmental/sectoral managers including greenspace/environmental department. Interview guidelines based and modified from Garcia-Lamarca, M. et al. (2021).

Background

The goal of the background portion of the interview is to develop a 15 minute conversation about the general priorities of the department with regard to greening; the motivations for those priorities; and the general extent to which social inclusivity and gender issues are integrated in their work related to urban greening policy and planning. These questions should serve as a detailed guide to help accomplish this goal, but only focus on those questions where the respondent is particularly knowledgeable. Start with a presentation of yourself, your research and its main goal. Ask about recording the session and the signed consent form.

- To begin with a bit of an overview…thinking about the period of the last five years or so, what have been your main vision and objectives for improving or developing public space and greening? What are the most important benefits and values that you see in creating a greener city?

[Mention a few of the key projects you have read about and that have caught your attention for being innovative or ambitious. Show you know the city!]

- What have been the main focal points and approaches for creating a greener Barcelona? [consider mention Pla Natura 2030]
- To what extent have social issues been integrated into the urban greening agenda and strategic planning? We refer here to issues related to equity, inclusion, access to the different people that live in the city (including children, elderly, women, LGTBI communities, people with disabilities, different nationalities, racial minorities). For instance, SDG 11 and specifically *Target 11.7: 11.7 by 2030, provide universal access to safe, inclusive and accessible, green and public spaces, particularly for women and children, older persons and persons with disabilities.*
- What kinds of neighborhood, community, or other social issues have come up around greening?

- What do you think about the greening from tactical interventions such as the model Superilla o the Eixos Verds?

Gender and intersectionality

The goal of this section is to use the specific examples and general context established earlier on as a basis for a 20-minute (roughly) conversation about issues of gender and intersectionality. For respondents that are particularly knowledgeable, it is likely that an extended or follow-up interview will be required.

- How do you understand the relationship between urban greening and addressing issues of gender inequities? For instance, do you think women use and access in the same way green spaces? What do you think are their main needs, values, problems?

[Mention strategic plans from the city and how these can be related to social inclusivity and gender. If necessary, suggest different aspects to consider following the five urban qualities for everyday life and gender perspective: proximity, diversity, autonomy, vitality, representativeness]

- To what extent have you been able to integrate gender when designing and implementing novel green interventions (from a more strategic/overall point of view)? How has it evolved over time? What were the main trigger points or incentives when deciding to approach urban greening, and its relationship to gender issues in those ways? What were the greatest obstacles and constraints?

- How are the different needs of residents integrated in the last main greening interventions in Barcelona [Parc de les Glòries, Superilles, Eixos Verds]? What was your role/responsibility in those projects? Can you give specific examples in which gender came as an important aspect in your projects?

- If any, what were the greatest challenges the City/you encountered/encounter (or exist in general) in planning for more inclusive green spaces? To what extent is the municipality able to overcome them? How? What can be improved?

Closing

The goal of this section is to bring the interview to a logical stopping place. This section should include a 5-10 minutes conversation about suggestions of model projects and other people to talk to.

- Have you encountered specific cases in [Europe] where a municipality has done interesting work to ensure that urban greening (or public space planning) is equitable, inclusive, and gender-sensitive? If yes, what have they done?
- What have you learnt from the COVID-19 experience? Have you been able to incorporate it in your work?
- Is there anyone else you suggest I talk with about issues related to urban greening (or public space), social equity and gender in Barcelona?

A.3 Interview questions – municipal/public sector representatives (stakeholders from social and gender departments)

Semi-structured interviews of aprox. 45-60 minutes for planners, designers, departmental/sectoral managers including gender equity department and private organizations. Interview guidelines based and modified from Garcia-Lamarca, M. et al. (2021).

Background

The goal of the background portion of the interview is to develop a 15 minute conversation about the general priorities of the department with regard to gender and public space; the motivations for those priorities; and the general extent to which urban greening policy and planning are integrated in their work related to social inclusivity and gender issues. These questions should serve as a detailed guide to help accomplish this goal, but only focus on those questions where the respondent is particularly knowledgeable. Start with a presentation of yourself, your research and its main goal. Ask about recording the session and the signed consent form.

- To begin with a bit of an overview…thinking about the period of the last five years or so, what have been your main vision and objectives for improving or developing public space with a gender perspective?

[Mention a few of the key projects you have read about and that have caught your attention for being innovative or ambitious. Show you know the city!]

- What have been your main vision and objectives for developing and integrating a gender-based approach in policy making and planning in the city? To what extent do you think social issues been integrated into the use and access of the public space? We refer here to issues related to equity, inclusion, access to the different people that live in the city (including children, elderly, women, LGTBI communities, people with disabilities, different nationalities, racial minorities). For instance, SDG 11 and specifically *Target 11.7: 11.7 by 2030, provide universal access to safe, inclusive and accessible, green and public spaces, particularly for women and children, older persons and persons with disabilities.*

Green and intersectionality

The goal of this section is to use the specific examples and general context established earlier on as a basis for a 20-minute (roughly) conversation about issues of gender and green spaces. For respondents that are particularly knowledgeable, it is likely that an extended or follow-up interview will be required.

- What have been your main vision and objectives for developing and integrating a gender-based approach in relationship to public green space planning in particular? (here we refer to parks, green corridors, squares, gardens…) To what extent and how you see a relationship between your work gender and issues of social inclusivity in green spaces? Examples, do you think women use and access in the same way the green spaces? What do you think are their main needs, values, problems?

[Mention strategic plans from the city and how these can be related to social inclusivity and gender. If necessary, suggest different aspects to consider following the five urban qualities for everyday life and gender perspective: proximity, diversity, autonomy, vitality, representativeness]

- To what extent have you been able to integrate the gender perspective in (green) urban planning interventions [Parc de les Glòries, Superilles, Eixos Verds]? Has this situation evolved over time? What were the main trigger points or incentives when deciding to approach it in those ways? What were the greatest obstacles and constraints? Can you give specific examples in which green/public spaces came as an important aspect in your projects? What was your role/responsibility in those projects?

- If any, what were the greatest challenges the City/you encountered/encounter (or exist in general) in planning for more inclusive green spaces? To what extent is the municipality able to overcome them? How? What can be improved?

Closing

The goal of this section is to bring the interview to a logical stopping place. This section should include a 5-10 minute conversation about suggestions of model projects and other people to talk to.

- Have you encountered specific cases in [Europe] where a municipality has done interesting work to ensure that urban greening (or public space planning) is equitable, inclusive, and gender-sensitive? If yes, what have they done?

- What have you learnt from the COVID-19 experience? Have you been able to incorporate it in your work?
- Is there anyone else you suggest I talk with about issues related to urban greening (or public space), social equity and gender in Barcelona?

Appendix C. Supplementary data for Chapter IV

A.1 Project setting

The FEMPUBLICBCN project focused on how the COVID-19 pandemic changed the use and perception of public space and perceived gentrification and touristification, as well as changes in the health and well-being of women, trans and non-binary people. Prior to their participation, all participants were provided with information about the study and subsequently signed a consent form. All the data collection, analyses and interpretation of results were done in accordance with Declaration of Helsinki principles and with the ethics approval from the Universitat Autònoma de Barcelona (CEEAH 5465).

To ensure that the FEMPUBLICBCN research project responded adequately to the needs and concerns of community members, 3 women from each neighborhood were recruited to serve on a community advisory board. The community advisory board members are either individual neighborhood residents or representatives of community organizations who are also neighborhood residents and were recruited via neighborhood community organization contacts. The objective of the community advisory board was to provide essential feedback to the study team on the coherence and adequacy of the study objectives and to co-create the data collection instruments. They were also asked to advise researchers on whether important concerns of challenges faced by women in the neighborhood had been overlooked by the research strategy. The participation of the advisory board and of the study participants was economically compensated through direct payment to the board members.

Throughout the project, three meetings for each neighborhood in separate were hold with its community advisory board. In the first meeting (May-June 2021) we explained the project aims and scope and presented the survey questions for the quantitative part. We collected their doubts, comments and suggestions and adapted the questions accordingly. The second meeting (September-October 2021) consisted of an update on the progress of the quantitative part and a presentation of the design qualitative part. Similarly, we collected their comments and suggestions including how to improve survey participation, where to hold the qualitative focus groups and potential local stores to get the compensation vouchers. In the third meeting (June 2022) we presented the preliminary results of the project and gathered their feedback and suggestions for dissemination strategies. Finally, an open public event was held in June 2022 to share the final results and dissemination materials with the broader community of both neighborhoods and to reflect on our findings collectively.

Quantitative data were collected with either a tablet or a mobile phone during weekdays and weekends between 9h-20h during the time period from June 2021 to February 2022. All participants were over 18 years old, had lived in the neighborhood for at least 2 years, spoke Spanish, Catalan, or English and provided a written consent prior to answer the survey. We used anchoring places in each neighborhood to recruit our participants (i.e., a variety of public places pre-identified in different parts of the neighborhood such as the library, different points within the public space, outside of the neighborhood health clinic, etc.) with the intent of reaching a diverse sample representative of the neighborhood. Participants who completed the survey received a voucher to spend on a local shop as compensation for their time and contribution. Vouchers of 10€ were assigned randomly every 20 participants in the form of a lottery.

The recruitment process and data gathering of the qualitative part was conducted between October 2021 and February 2022. The participants of this part of the study were recruited from the survey respondents who volunteered to participate in the qualitative analysis, social media dissemination, suggestions from the community advisory board and contacts from neighborhood associations. Focus groups were held in a public facility from each neighborhood, and all started with a presentation of the project, consent form explanation and an acknowledgement of the knowledge contribution and time availability of participants. At the end of the session, all participants received a 20€ voucher to spend on a local shop as compensation. Exploratory walks were conducted following an itinerary previously decided during the focus group.

Interviews were conducted either in person in a public or semi-public space of the case study neighborhoods, or via videoconference. Total duration of interviews ranged from 20 to 60 minutes and were conducted in Spanish or Catalan. All qualitative sessions were audio recorded and photographs were taken of all output materials for posterior transcription and analysis.

A.2 Survey questionnaire

Questionnaire used for quantitative survey. These questions form part of a larger subset of questions from the FEMPUBLIC project. Surveys were undertaken in either Catalan, Spanish or English, according to the preference of respondents.

Table S1. Questions from the survey for the quantitative data collection and analysis.

SECTION A. USE OF PUBLIC SPACE		
Comparing the last 4 weeks with the 4 weeks before the state of alarm started in March 2020, how has the frequency with which you visit or go to the following green spaces changed?	1. Sant Antoni superblock or Barceloneta Beach? 2. Green/blue environment close to your home (less than 15 min by foot/bike)? 3. Green/blue environment in your city/town (more than 15 min by foot/bike)? 4. Green/blue environment close to your city/town?	It has decreased drastically It has decreased It has not changed It has increased It has increased drastically No answer
How much has the time spent in each of the following green spaces changed in the last four weeks compared to before the pandemic? (per visit)	5. Sant Antoni superblock or Barceloneta Beach? 6. Green/blue environment close to your home (less than 15 min by foot/bike)? 7. Green/blue environment in your city/town (more than 15 min by foot/bike)? 8. Green/blue environment close to your city/town?	It has decreased drastically It has decreased It has not changed It has increased It has increased drastically No answer
Comparing today with before the pandemic, how much has the frequency with which you use these green spaces changed for the following activities?	9. Picnic or having a drink 10. Walking, cycling, doing sports 11. Experiencing tranquility and nature or for relaxing on my own (reading, chilling, watching people, sunbathing, etc) 12. Meeting family/friends 13. Walk with or accompany dependents 14. Walk or play with children 15. To study or work	It has decreased drastically It has decreased It has not changed It has increased It has increased drastically No answer/Does not apply
SECTION B: GENTRIFICATION AND TOURISTIFICATION		
Thinking about the two years before the state of alarm that began in March 2020…	1. I felt increasingly "out of place" in my neighborhood 2. I experienced improved access to neighborhood amenities and city services 3. I saw an influx of affluent or nonminority residents moving into the neighborhood 4. I experienced or heard of others being harassed by their landlords to vacate an apartment 5. Crime decreased in my neighborhood 6. I feared being "pushed out" of my neighborhood 7. I saw disruption of local community ties and social networks 8. I observed a lot of renovation activity in the neighborhood 9. I worried about feeling "unwelcome" in my neighborhood. 10. I observed a loss of sense of "community" in the neighborhood	Strongly disagree Disagree Neutral Agree Strongly agree No answer

Thinking about the two years before the state of alarm that started in March 2020, do you consider that there were changes related to tourism in that period? For each possible change, would you say that…	11. The number of tourists in your neighborhood…? 12. The number of tourists apartments/hostels/hotels/aparthotels in your neighborhood…?	It had decreased drastically It had decreased It had remained the same It has increased It had increased drastically No answer
Thinking about the Summer of 2021 comparing it to the Summer of 2019 before the pandemic…	13. I felt increasingly "out of place" in my neighborhood 14. I experienced improved access to neighborhood amenities and city services 15. I saw an influx of affluent or nonminority residents moving into the neighborhood 16. I experienced or heard of others being harassed by their landlords to vacate an apartment 17. Crime decreased in my neighborhood 18. I feared being "pushed out" of my neighborhood 19. I saw disruption of local community ties and social networks 20. I observed a lot of renovation activity in the neighborhood 21. I worried about feeling "unwelcome" in my neighborhood. 22. I observed a loss of sense of "community" in the neighborhood	Strongly disagree Disagree Neutral Agree Strongly agree No answer
Thinking about the Summer of 2021 comparing it to the Summer of 2019 before the pandemic, do you consider that there were changes related to tourism in that period? For each possible change, would you say that…	23. The number of tourists in your neighborhood…? 24. The number of tourists apartments/hostels/hotels/aparthotels in your neighborhood…?	It had decreased drastically It had decreased It had remained the same It has increased It had increased drastically No answer

SECTION C: SOCIODEMOGRAPHIC & CARE		
	1. What gender do you identify with?	Female Non-binary/other: (specify) No answer/Does not apply
	2. What country were you born in?	Country list (to choose) Other: (specify)
	3. What is your highest level of education completed?	Studies completed at the time of the survey. To choose: no studies at all, incomplete primary studies, complete elementary school, secondary education, high school diploma, intermediate or advanced professional studies, university undergraduate, graduate or postgraduate studies, other (specify).
	4. Before the pandemic, thinking about your total available financial situation, would you say…?	You cannot make ends meet You have just enough to get along You are comfortable No information/Do not know

5.	Currently, thinking about your total available financial situation, would you say…?	You cannot make ends meet You have just enough to get along You are comfortable No information/Do not know
6.	What was your employment situation before the pandemic?	Working full time Working part time Casual jobs In school/A student Caring for the home/family Unemployed Retired Incapable of working due to health reasons No answer/Does not know
7.	What is your employment situation currently?	Working full time Working part time Casual jobs In school/A student Caring for the home/family Unemployed Retired Incapable of working due to health reasons No answer/Does not know
8.	Prior to the pandemic, did you provide this type of unpaid or assistance to a family member or friend?	Yes No No answer/Does not apply
9.	Prior to the pandemic, if applicable, what type of care did you provide to your family member or friend?	Companionship (talking, reading, keeping company) or supervision Transportation (driving to doctor's appointments, driving for errands) Homemaking (shopping, cleaning, preparing meals) Personal care assistance (feeding, bathing, toileting, dressing, grooming) Healthcare assistance (help with medications, wound care) Financial assistance (paying bills, managing budget) None of these activities - please specify other activity: _____ Does not apply
10.	Currently, do you provide this type of unpaid or assistance to a family member or friend?	Yes No No answer/Does not apply
11.	Currently, what type of care did you provide to your family member or friend?	Companionship (talking, reading, keeping company) or supervision Transportation (driving to doctor's appointments, driving for errands) Homemaking (shopping, cleaning, preparing meals) Personal care assistance (feeding, bathing, toileting, dressing, grooming) Healthcare assistance (help with medications, wound care) Financial assistance (paying bills, managing budget) None of these activities - please specify other activity: _____ Does not apply

A.3 Interview guidelines

Question guidelines developed for the semi-structure interviews.

1. For how long have you been living in the neighborhood?
2. What public and community spaces do you use in your daily life? How do you rate these spaces? Favorable and unfavorable elements
3. Are there any public and community spaces in the neighborhood that you avoid or do not use because of the impact on your health? (What impact does tourism and gentrification have?)
4. What impact do you think living in the neighborhood and using the public and community spaces in the neighborhood have on your health? (Understanding health, not as the absence of disease, but from a holistic perspective, biopsychosocial health). That is, what link do you think exists between your health and the public spaces in the neighborhood?
5. Do you think that your use of public space is different because you are a woman or a person with a non-binary identity?
6. How do you think the pandemic has affected in your use and enjoyment of public spaces in the neighborhood and therefore in your health? Have you intensified your use of some space? Or have you diminished it?
7. How was your experience of using public spaces, in the first moment of confinement and restricted mobility? And when the measures were more relaxed, but we were still in a state of alarm? After the state of alarm?
8. How has the return of tourism to the neighborhood after the pandemic affected you? How has this affected your health?
9. What qualities do you think the public and community spaces of your neighborhood should have?
10. Is there anything else you would like to add that we have not talked about?

A.4 Coding guide for qualitative analysis

Code categories and number of quotations from all qualitative data transcripts.

I. COVID-19
    1. Pre-COVID-19 period (11)
    2. Lockdown period (54)
    3. Post COVID-19 lockdown period (86)

II. PUBLIC SPACE
    1. Green spaces (91)
    2. Safety perception (68)
    3. Beach (47)
    4. Superblock (52)
    5. Mobility (29)
    6. Activities: consume (30)
    7. Activities: meet family/friends (27)
    8. Activities: relax/sport (34)
    9. Activities: work/study (1)

III. GENTRIFICATION-TOURISTIFICATION
    1. Rent increase/end (40)
    2. Displacement/unwelcome (43)
    3. Access (lack of) to services (30)
    4. International tourists (54)
    5. Visitors from Barcelona but not the neighborhood (23)
    6. Privatization of public space (24)

IV. INTERSECTIONALITY
    1. Gender (25)
    2. Migrant background/race (22)
    3. Age (46)
    4. Health (26)
    5. Economic status (19)
    6. Care responsibilities (44)
    7. LGTBIQA+ (4)

V. NEIGHBORHOOD
    1. Barceloneta characteristic (49)
    2. Sant Antoni characteristic (31)

3. Solidarity networks (47)
4. Participation in governance (10)