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Article

Green Gentrification, Social Justice, and Climate Change in the Literature: Conceptual Origins and Future Directions

Roberta Cucca [1,*], Michael Friesenecker [2], and Thomas Thaler [2]

[1] Department of Urban and Regional Planning (BYREG), Norwegian University of Life Sciences, Norway
[2] Institute of Mountain Risk Engineering (IAN), University of Natural Resources and Life Sciences, Austria

* Corresponding author (roberta.cucca@nmbu.no)

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Abstract
While global urban development is increasingly oriented towards strategies to facilitate green urbanism, potential community trade-offs are largely overlooked. This article presents the findings of a quantitative and qualitative meta-analysis of the current literature on green gentrification (the process leading the implementation of an environmental planning agenda displacing or excluding the most economically vulnerable population) in connection with climate change adaptation and mitigation across the globe. Based on specific keywords, we selected the recorded entry of 212 articles from Scopus covering the period 1977–2021. Our review focused on the historical and geographical development of the literature on urban greening and gentrification. The analysis shows that the concept of green gentrification has strong roots within the environmental justice debate in the US. In terms of intervention, most studies focused on urban parks and trees and were primarily oriented towards restoration. However, debates around the role of green facades, green roofs, or blue infrastructure (such as ponds and rivers) and other nature-based solutions as a driver for green gentrification are few and far between. Finally, we also identified a strong gap between the observation of green gentrification and potential countermeasures that respond to it. Most studies suggest that the existence of a stronger collaborative planning process within the affected communities may overcome the challenge of green gentrification. Based on our results, we identify several gaps and new research directions to design a green and just city.

Keywords
climate change adaptation; climate justice; mitigation; social justice; urban design; urban planning

Issue
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1. Introduction

Climate change adaptation and mitigation policies have become more important in urban areas in recent years since these areas are more vulnerable to the negative impacts of climate change in terms of severe flooding or heat-wave events (Intergovernmental Panel on Climate Change [IPCC], 2022). Warmer climates will change the current urban thermal environment, especially as urban areas lack green and blue spaces (Grimm et al., 2008). Consequently, urban areas will face a drastic rise in temperature during the day (average temperature > 30 °C) and at night (tropical nights) in the coming decades (IPCC, 2021). The lack of green and blue spaces is mainly driven by the extensive past, current, and future urbanisation, resulting in an increase in urban impervious surfaces (Tian et al., 2021). Additionally, post-industrial cities underlie a socio-economic transformation process, culminating in large vacant spaces within the city boundaries (Rigolon & Németh, 2020). As a result, the (re-)creation of nature-based solutions (NbS) or ecosystem services, such as parks, lakes, rivers, green lines, and trees, has become highly relevant (Haase et al., 2014; Nesshöver et al., 2017; Pesola et al., 2017;

Raymond et al., 2017). Following Raymond et al. (2017), NbS can be understood as using nature to solve the current and future challenges within our societies, like climate change adaptation and the mitigation of the loss of biodiversity.

Many policymakers and stakeholders encourage the implementation of NbS to improve cities' liveability and resilience towards extreme weather events associated with climate change (Rahman et al., 2022; Shokry et al., 2022). Moreover, NbS are attractive as they can encourage new people and businesses to settle their centre of life and business activities in these new green urban centres. Furthermore, NbS can act as cooling areas to adapt against urban heat waves or store water in the case of flooding (Green et al., 2022; Huang et al., 2020; Pallathadka et al., 2022; Zuvela-Aloise et al., 2016). Accordingly, we observe a shift within most urban strategies from grey (classical focus on technical-engineering solutions) to green programmes. Green programmes include a stronger focus on green infrastructure to implement NbS across the city. The aim is to improve economic resilience and individual well-being, or restore ecosystem services (Rigolon & Németh, 2020; Rigolon et al., 2020). In other words, the goal is to deliver a liveable city. As various trade-offs within "new" green policies also exist, the key challenge is how to provide a resilient city without encouraging the risk of displacement within the cities (Rigolon & Németh, 2020; Rigolon et al., 2020; Xu et al., 2022). One of the potential trade-offs is the risk of displacing vulnerable householders who have usually already been negatively affected by past urban policies. One example is the redlining housing policy in the US back in the 1930s, which created large spatial inequalities in the cities. Today, the consequences of the redlining policy can still be observed in different US cities (Lane et al., 2022; Li & Yuan, 2022; Nowak et al., 2022). So-called green or environmental gentrification is a serious threat in different urban regions across the globe (Anguelovski, 2015; Anguelovski et al., 2018, 2019; Checker, 2011; Meishar, 2018). Within this article, we define green gentrification as the process of the "implementation of an environmental planning agenda related to public green spaces that leads to the displacement or exclusion of the most economically vulnerable human population" (Dooling, 2009, p. 621).

This article presents the findings of a critical review of the literature dealing with the socio-spatial justice implications of NbS implementation across the globe. We focus on how climate change adaptation and mitigation policies can encourage gentrification and how both of these aspects are reflected and linked in the literature. We define climate change adaptation based on the current understanding of the European Commission (2022), i.e., "taking action to prepare for and adjust to both the current effects of climate change [and] the predicted impacts in the future." Moreover, we understand climate change mitigation based on the United Nations Environment Programme (2022) definition, i.e., "efforts to reduce or prevent [the] emission of greenhouse gases." The selected articles were published in international (English-speaking) academic journals over the past 40 years. Firstly, the critical review focused on the historical development of the literature, exploring how it started in the framework of studies and investigations in the environmental justice literature and gradually shifting towards a more defined focus on green gentrification studies. Secondly, it analyses the topics, methodologies, and trends in recent studies. Finally, it discusses the research gaps and future agendas in light of the current climate and social justice crisis.

The article is structured as follows: Section 2 shows the methodology used based on the PRISMA format within the article. In Section 3, we analyse the conceptual origins of gentrification studies, including the type of climate change adaptation and mitigation measures, specifically focusing on NbS. First, we will describe the historic and geographic evolution of all the articles in our database (N = 212), especially taking into consideration the motivations and types of NbS-interventions (Section 4), as well as the applied dimensions of socio-spatial justice (Section 5). Section 6 focuses on articles that explicitly deal with "greening" as the causal triggers and their differing impacts in terms of green gentrification (n = 112). We identified these limited sets of studies when coding the articles in more detail and will present them by describing the literature, delineating trends and addressing research gaps. Finally, Section 7 includes the conclusive remarks, including new research directions.

2. Methodology

The results of the article are based on the review of 212 peer-reviewed research articles. All the articles were published on the topic of gentrification in relation to the creation of green and blue spaces in urban regions. The selection was restricted to (a) articles published in the English language, (b) peer-reviewed academic articles, and (c) selected search strings in the titles, abstracts, and keywords. The sampling size was selected from the Web of Science and Scopus databases and included articles from 1977 until April 2021. Our aim is to see how the terms evolved over time. Therefore, we followed an open-date approach, during which we discovered that the first article was published back in 1977. The search started in July 2021 and lasted until August 2021. The review was conducted from October 2021 to February 2022. The process as a whole was based on the PRISMA format (Moher et al., 2009; see Figure 1).

The search query included two main aspects: (a) gentrification and (b) the synonyms for NbS used in the literature. For our general Boolean search query, we selected the following strings: TITLE, ABSTRACT (climate AND gentrification OR eco AND gentrification OR ecological AND gentrification OR environmental AND gentrification OR green AND gentrification OR resilience AND gentrification). Overall, we found 677 articles. The total

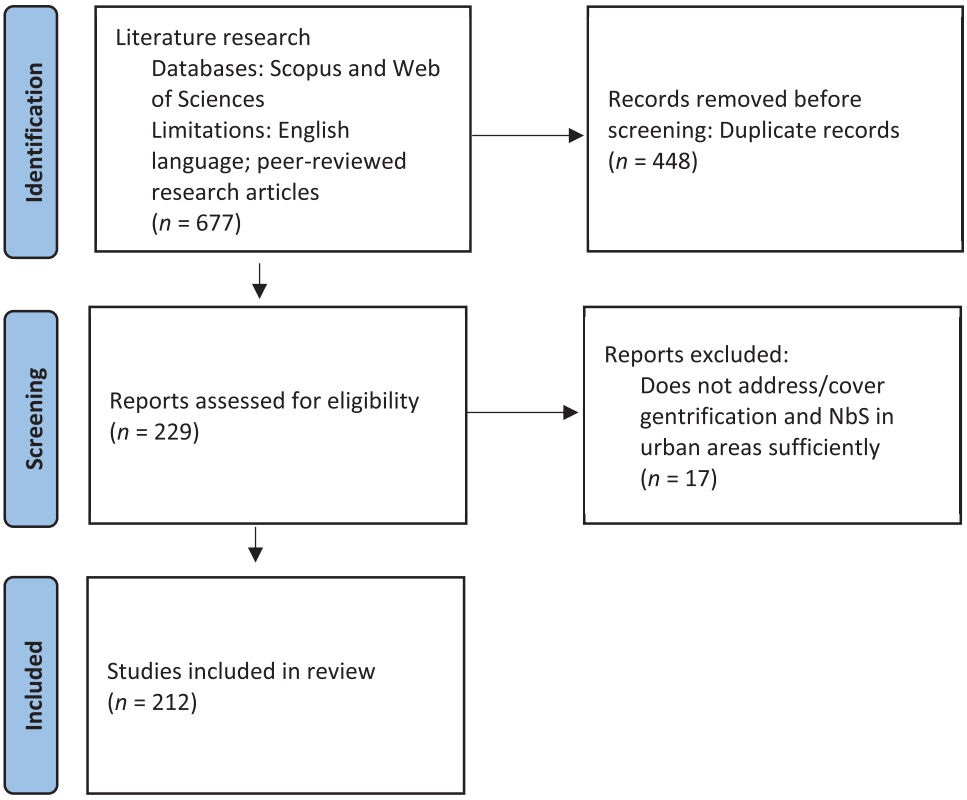

Figure 1. Flow chart of review process based on the PRISMA format.

number of articles for each search string can be found in Table 1.

After excluding duplicates, our database contained 229 articles for review. A first screening of the titles, abstracts, and keywords narrowed the database to 212 articles for our full-text review. The inclusion of the articles had to follow three main characteristics: (a) urban, (b) NbS and its synonyms, and (c) gentrification.

The assessment was based on a structured exploratory research analysis. The exploratory assessment was organised quantitatively based on the assessment of the full text. First, we used Microsoft Excel to classify and quantify our results based on several key themes: (a) year; (b) geography/location of the study sites (three variables: name of the city, country, and continent); (c) methodology; (d) typology of interventions (five variables: parks/urban green, trees, lakes/rivers, green facade/green terrace, and other types of interventions); (e) motivation for using NbS (five variables: climate mitigation, climate adaptation, degraded ecosystem, risk management, resilience, and other motivations for implementing interventions); (f) general dimension of justice reflected in the article (three variables: distributional, representation, and recognition); (g) assessment of impacts (four variables: change of home sale values/rents/housing prize, change of social housing/affordability housing, change of population in terms of income, age, immigration, education, and displacement), and (h) policies and tools to avoid green gentrification (three variables: planning tools to avoid green gentrification, housing policies, and community groups against green gentrification).

3. Article Characteristics

In recent decades, geographers, planners, and sociologists with an interest in environmental justice and privilege have shown that green interventions can create enclaves for privileged social groups, while low-income and minority residents are often excluded from the

Table 1. Number of articles per search string.

Search dimension	Total number of articles
Climate gentrification	60
Eco gentrification	19
Ecological gentrification	83
Environmental gentrification	289
Green gentrification	161
Resilience gentrification	56

neighbourhoods in which new environmental goods are created. However, more recently they have started to show how green interventions can serve as the primary drivers of new socio-spatial inequalities by moving from an interest in the unequal distribution of environmental advantages and disadvantages (historically associated with the environmental justice scholarship) to an assessment of gentrification-related mechanisms such as displacement and rising housing costs following NbS interventions. Before moving to the justice-related and gentrification-related characteristics, in this section, we describe the evolution of such literature by presenting an overview of the main characteristics of the articles collected. First, we describe the geographical and methodological trends of our dataset; secondly, we focus on the interrelation of types of interventions and motivations related to climate change.

3.1. Historical and Geographical Trends

The overall literature analysed in our review is marked by a clear trend concerning the popularity of issues related to the implementation of NbS and their (un-)intended consequences in urban contexts. Whilst before 2010 the subject was mostly unexplored, in 2020 more than 50 publications on the potential effects of green gentrification, socio-spatial justice, and housing market dynamics were published. Until 2010, almost all studies focused on the UK, the US, and Canada (Bunce, 2009; Dooling, 2009; Phillips et al., 2008). The literature's focus on the US became even stronger after 2010, while a limited number of studies were conducted in Asia (Chen et al., 2020; Kwon et al., 2017) and Europe (Anguelovski, 2015; Anguelovski et al., 2018). Figure 1 suggests that in 2015 the concept gained further popularity as approximately two-thirds (n = 167 of N = 212) of all studies were published in the last five years (2016–2021). While North American and British studies continued to dominate the field, an increasing number of articles based in South America, Europe, Asia, and Oceania were published.

In terms of location, the case studies broadly focus on the central areas of cities, while the attention towards suburban or peripheral areas is less developed (Figure 1). In sum, it is no surprise that the majority of current case studies focus solely or in part on cities in North America (n = 112), mainly in the US (n = 94), with a high concentration investigating New York City (e.g., Black & Richards, 2020; Gould & Lewis, 2018; Pearsall, 2010). This is quite easy to justify due to the long history and tradition of environmental justice research in this context. However, we also noticed an increasing number of studies focusing on European cities (n = 40), especially in the UK and Spain, where active research groups on urban green justice research have recently been established, including a focus on Barcelona and the implementation of green measures originating from the 1992 Olympics (Anguelovski, 2015; Anguelovski et al., 2018). In the rest of the world, instead, gentrification processes connected with the implementation of NbS are still an underinvestigated topic, with 24 articles published in Asia, four in Oceania, and zero in Africa (as seen in Figure 2).

3.2. Methodological Trends

From a methodological perspective, most of the articles focus on case studies (n = 177), while only n = 35 are theoretical/conceptual/opinion articles. Early articles in the latter category focus on how gentrification research conceptionally underestimated the impact of nature (e.g., Bryson, 2013), whereas recently more conceptual work of a wide range has been published. These accounts discuss the connections between green gentrification and environmental justice perspectives, how environmental activists, planners, and other actors might resist green gentrification and the relationship between greening and health effects (Cole et al., 2017; Pearsall & Anguelovski, 2016).

The methodologies used by case study settings mostly rely on qualitative (n = 90) designs, followed by quantitative designs (n = 63). Mixed method approaches (n = 24) are less frequently applied (see also Table 2). Qualitative studies focus to a large degree on the role of social movements and environmental activism, rooted in the environmental justice movement in the US (see Checker, 2011; Curran & Hamilton, 2012). Another strand deals with the impacts and outcomes of policy-making, planning processes, and implementation associated with green interventions, while a third strand focuses on the experiences and practices of residents (Kern, 2015; Pearsall, 2012; Rosol, 2015).

Quantitative studies stem mostly from North America as a result of the good availability of census data and the growing popularity of environmental justice issues in human geography studies, followed by Europe and Asia (Anguelovski et al., 2018; Rigolon & Németh, 2020; Rigolon et al., 2020). Broadly speaking, these studies either focus on assessing the distribution or access to green infrastructure or on the implications of greening measures on the socio-demographic makeup, housing affordability, or particular groups. Historically, these studies focus on how the renovation of urban green or the design of new parks affected the socio-demographic landscape of the cities or neighbourhoods, specifically examining the housing and population trends (education, age, migration background, income levels) of the surrounding districts in relation to park creation. Mixed-method approaches are more marginal and usually combine a socio-spatial analysis with interviews, observations, and/or (planning) document analysis (Shokry et al., 2022).

4. Climate Policy Measures and Green Gentrification: NbS-Types and Motivations

Before having a closer look at the relationship between types of NbS and motivations to cope with climate

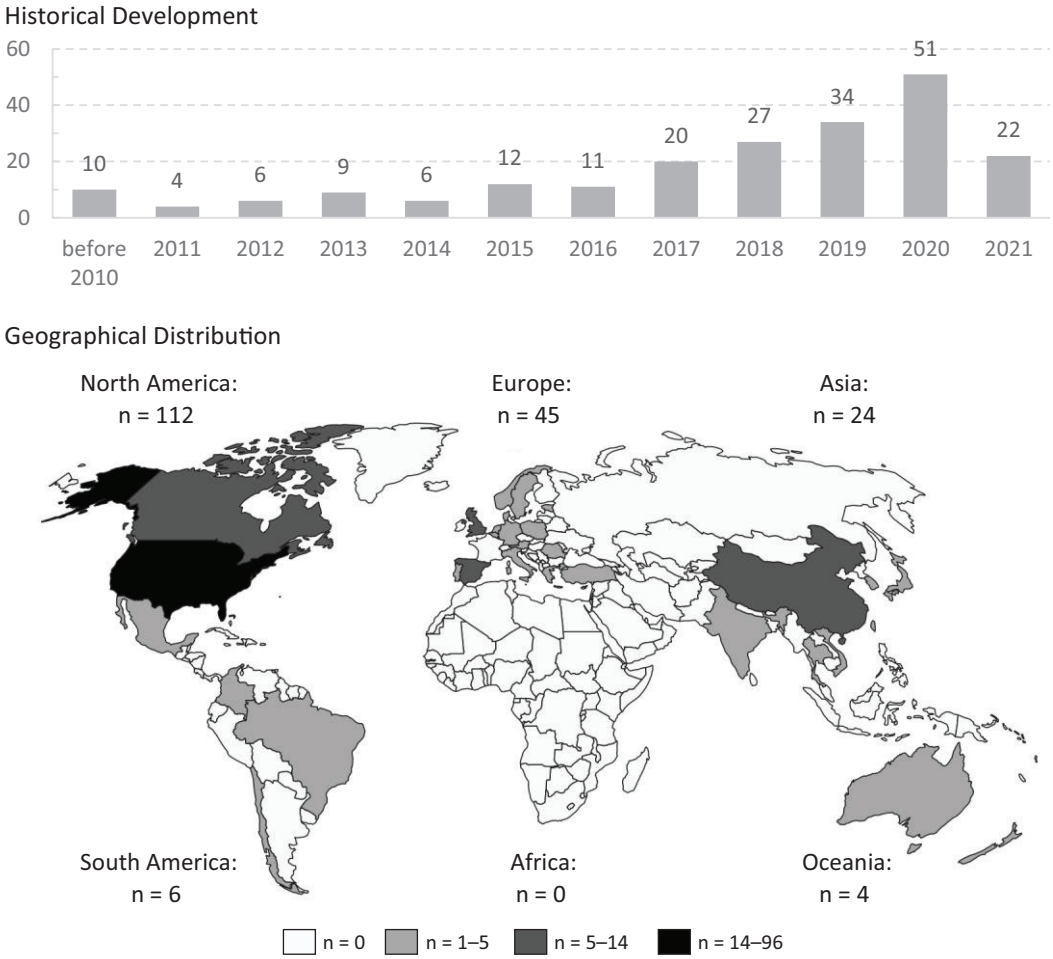

Figure 2. Article characteristics from the selected articles.

change, it should be noted that the implementation of different types of interventions and motivations overlap in many cases. Figure 3 indicates that 42 studies investigate the implementation of more than one type of intervention, while parks and urban gardens are the most significant of the interventions that have been investigated. The second most significant group of interventions comprises a diverse set of "other" interventions that, strictly speaking, are not NbS (*n* = 36). This includes the energetic retrofitting of buildings, eco-food provision, clean-up of toxic sites or brownfields, and interventions promoting environmentally friendly modes of transport (walking, cycling and railways, often along greenbelts). We have also grouped green corridors into this category because they have often been presented as distinct from parks as they include bike lanes or other transport infrastructure. Waterfront developments (*n* = 12), trees (*n* = 4), and green facades or roofs (*n* = 2) have

Table 2. Methodology of articles by geographical focus.

	Conceptual/review/opinion	Mixed	Qualitative	Quantitative
Total	35	24	90	63
America	11	14	52	37
Asia	1	1	11	9
Europe	7	3	21	14
Oceania	1	0	1	2
Comparative			3	1
Not specified	22		3	3

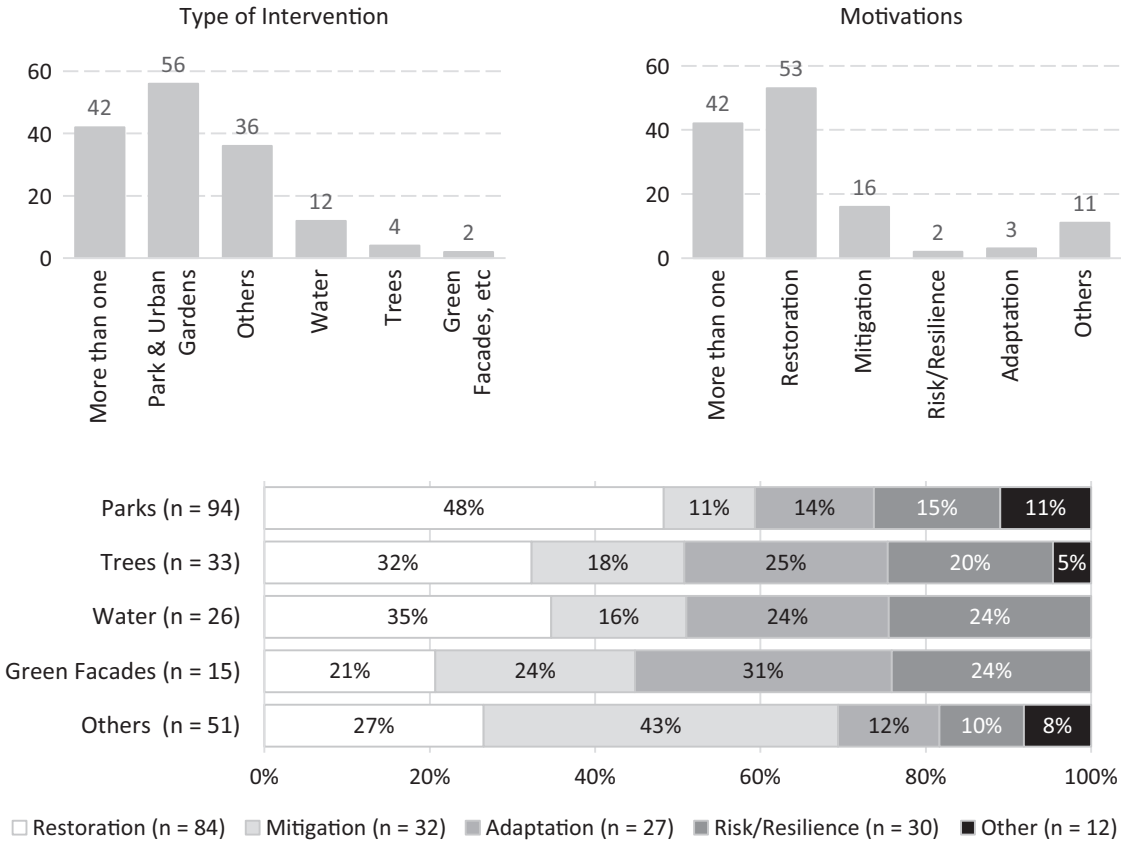

Figure 3. Typology and motivation of interventions.

been the focus of few studies as single interventions. With regard to motivations, 42 studies in our database report multiple motivations for the implementation of NbS. Despite this, the restoration of degraded ecosystems is by far the most important single motivation. Climate change mitigation (*n* = 16) and other motivation types (*n* = 11) are more frequently mentioned, while motivations for climate change adaptation (*n* = 3) and risk management and improving resiliency (*n* = 2) are clearly underrepresented.

Focusing on the interrelations between types and motivations, we begin with interventions regarding urban parks and/or gardens, which have been the prime focus of the case studies (*n* = 94). When it comes to the motivations behind this type of intervention, the restoration of degraded ecosystems is the most critical. In practice, the cleaning up of former industrial sites through the creation of urban parks and gardens, for instance, is often undermined by the fact that projects are oriented towards the interests of private developers rather than focusing on the needs of local residents or ecosystems (Anguelovski et al., 2018; Checker, 2011). This broadly resonates with our finding that urban parks and gardens are more often motivated by rationales not directly related to climate change, such as urban revitalisation for example (11% other motivations in Figure 2). As Figure 3 also demonstrates, climate change mitigation, adaptation, or risk management via enhancing the resiliency of urban infrastructure are less important motivations, especially when compared to other types of interventions, such as green buildings or water-related interventions. Nevertheless, these responses to climate change face similar challenges. Risk management and the establishment of resilient infrastructures to climate change impacts, for instance, without a social justice lens seems to heighten social risks for already vulnerable residents (Shokry et al., 2022; Tubridy, 2021). It should be once more noted, however, that the motivations and different types of interventions are in many cases overlapping.

In the second most important group of (quantitative) interventions, we have grouped a high number of articles that focus on other kinds of interventions—that are not strictly NbS (*n* = 51). This category is diverse, including the energetic retrofitting of buildings, interventions promoting environmentally friendly modes of transport (walking, cycling, railways), eco-food provision, and the clean-up of toxic sites or brownfields. Accordingly, green corridors, which are often presented as being distinct from parks as they include bike lanes or other transport infrastructure, are categorised under this label. It is, therefore, not surprising that underlying motivations are either the restoration of degraded ecosystems or to a large extent climate mitigation aiming at reducing emissions in transport and housing.

Concerning NbS, the second most important type of intervention is planting new trees (*n* = 33). Compared

to urban parks, studies on trees are still rather marginal. But, as Figure 3 shows, tree planting is much more commonly associated with climate adaptation, mitigation, and risk management. With regard to these motivations, studies in our database rarely focus explicitly on tree planting policies, but rather highlight its important functions, such as the general benefits of better air quality and temperature regulating functions as responses to heat waves or intense pollution (Donovan et al., 2021; Saverino et al., 2021). Still, the restoration of degraded ecosystems is the most vital motivation and tree planting usually accompanies park creation.

More recently, another key focus in the literature has been given to new urban developments along the waterfront (lakes, rivers, and seasides). Mainly motivated by the restoration of degraded ecosystems, cities have been redefining their relationship with water infrastructure, such as the renewal of obsolete urban industrial harbour locations (Avni & Teschner, 2019). Nevertheless, redevelopments are to a large extent also motivated by rationales associated with climate change adaptation and risk management through improved resiliency to the rise in flood events (Shokry et al., 2020; Taguchi et al., 2020). Given the increasing number of studies, well-intended protection measures may tend to indicate unintended negative socio-spatial consequences.

Another outcome of recent developments is a range of new approaches to implementing NbS into residential buildings, such as using green facades and green roofs. Indeed, a small number of articles in our database deal with the possible trade-offs and negative outcomes of greening buildings, such as increasing housing attractivity and associated rising housing costs (n = 15). Unsurprisingly, these measures are dominated by an adaptation rationale and signal an increased response to reduce the effects of urban heat and to improve the quality of life in residential buildings. Rationales and interventions presented in our literature analysis often overlap with others, and green facades and green roofs, among others, are usually not the core focus of analysis but rather appear as supportive measures in greening strategies.

5. Climate Policy Measures and Dimensions of Justice: A Prelude to Green Gentrification?

An interesting aspect to evaluate is the specific dimension of justice considered in relation to the types and motivations of climate change-related interventions. Fraser (1995, 2008) argues that groups in society may suffer three distinct types of injustices: cultural/symbolic, socioeconomic, and political injustices. Cultural-symbolic injustices, which Fraser calls "recognition," are associated with "interpretation, communication, [and manifest in] cultural domination, nonrecognition, and disrespect" (Fraser, 1995, p. 71). Socioeconomic injustices, on the other hand, are associated with the unequal distribution of material resources between groups in society, which Fraser (2008) often refers to as unequal "redistribution." Some of the examples include income inequality, capitalist exploitation (displacement and housing speculation), and substandard living conditions arising from inadequate material resources. The third pillar, which she calls "representation," is related to "political voicelessness." This is becoming increasingly important to consider in struggles for justice and democracy in a globalising world.

A majority of the articles frame their analysis specifically within environmental justice dynamics (n = 114). Over the years, numerous studies have used this lens to report that minorities or socio-economically disadvantaged people are exposed to greater environmental harm, being concentrated in areas affected by high levels of pollution (poor air quality, unavailability of green areas, high levels of noise, etc.). More comprehensively, about two-thirds of the articles in our database use one of the three aforementioned justice dimensions, while the rest fail to explicitly specify the dimensions of environmental justice. Half of the studies focus solely on the spatial distribution of environmental risks and amenities and the resulting disparities among socio-economic (different income, gender, educational level) and minority groups (n = 35). About one-quarter of our studies integrate all the justice dimensions (n = 19), while another quarter considers at least two justice dimensions (n = 18). These results show that procedural mechanisms and justice implications in terms of recognition, such as a decreased sense of belonging to the local contexts and new green amenities created in the process, are studied mostly in relation to the distributional question of justice. Only two studies focused solely on procedural mechanisms related to access and participation in decision-making processes and procedures (López et al., 2020; Rigolon & Németh, 2018).

Most of the articles in our database analysed social justice issues related to the implementation of NbS with a specific focus on redistributive aspects (n = 87). These studies often investigate forms of socio-spatial injustice, such as the unequal distribution of green amenities and environmental threats among the population and the effect of proximity to green(ed) or brownfield sites and which sites are greened first (Ali et al., 2020; Maantay & Maroko, 2019). Another strand focuses on analysing the spatial associations of demographic changes, rising housing costs, and (forced) greening (Anguelovski et al., 2018; Schinasi et al., 2021). This general focus is not surprising since redistributive aspects are a fundamental topic both in the environmental justice literature and in gentrification studies. With about half of all studies (see Figure 4), distributional justice is by far the main focus among all types and motivations that have been investigated in the studies included in our database.

The weak representation of vulnerable groups in the decision-making process is also the focus of attention in several articles (n = 38). Indeed, Figure 4 illustrates that there is also no substantial variation between types and

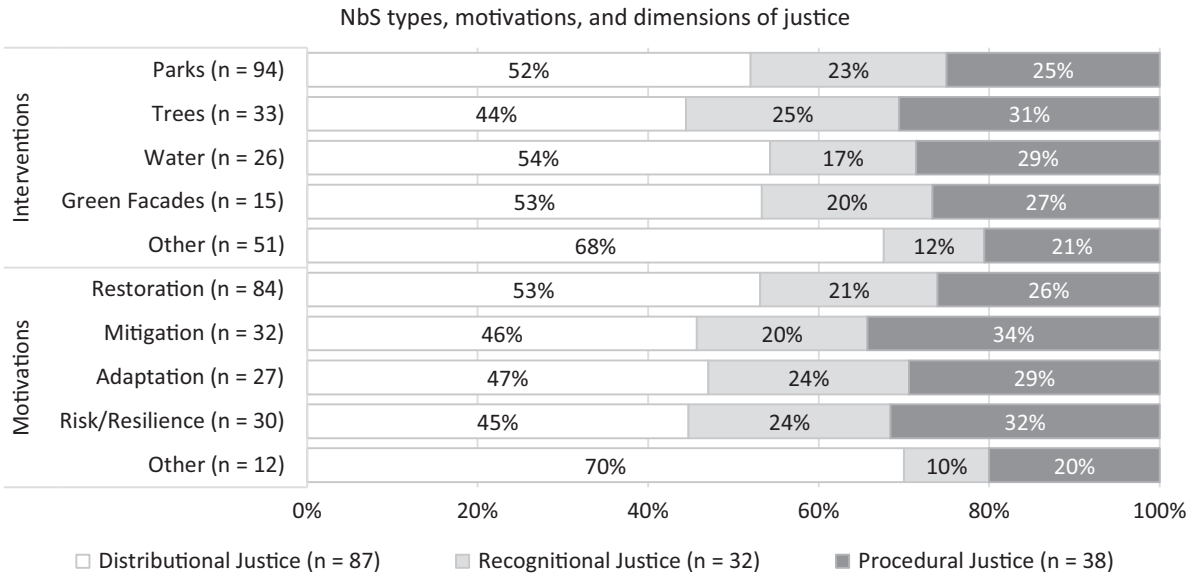

Figure 4. Types, motivations, and dimensions of justice.

motivations with about 30% of all studies considering procedural justice issues. One literature strand is much more rooted in the North-American context and its environmental justice activism. Studies show, for instance, how consensual-oriented planning processes neglect activists' "alternative" ideas about how to develop green spaces, including the needs of (poor) residents and homeless people for green spaces (Checker, 2011). Other literature focusing on procedural justice identifies exclusionary tendencies caused by practical problems in planning processes, e.g., language barriers or inconvenient scheduling of public meetings, as potential drivers for green gentrification (Miller, 2016).

Finally, recognitional issues related to social diversity are also a fundamental topic of interest, comprising 20% (*n* = 32) of the articles in our database. Again, our analysis shows no substantial differences based on motivations and interventions (Figure 4). However, related to the representational aspects presented previously, for example, few articles focus on how changes in the functions of green spaces may advantage a specific social group and disadvantage another, subsequently decreasing the sense of belonging of the local community to the green areas after their renovation (Miller, 2016). Other studies, mostly situated within the North-American context, emphasise the role of racialised histories and geographies as formative elements for green gentrification (Abel et al., 2015; Williams, 2021).

6. Interrelations Between Climate Policy Measures and Effects

Similar to the literature on greening and (in)justice, the number of articles that identified a (causal) relationship between greening and gentrification (112 out of 212 studies) increased. While in 2008 only one article reported the impact of greening as green gentrification (Phillips et al., 2008), 27 articles stated this relationship in 2020. Following the general literature, we have classified the unintended (or in some cases intended) effects of implementing different NbS or climate change adaptation and mitigation measures into four interrelated categories: displacement, social impacts such as changing socio-demographic compositions, rising housing or rental prizes, and the qualitative upgrading of the housing stock.

About one-third of studies (*n* = 41) reported more than one impact associated with green gentrification. Within this category, a vast majority of those studies tied displacement to effects on the housing market and socio-demographic impacts. Most of the studies related displacement to changes in housing, specifically to the upgrading of the housing stock (*n* = 19), while an integrated perspective of rising housing prices, changes in the stock and socio-demographic upgrading were reported by 14 studies. The empirical study from Anguelovski et al. (2018) exploring how newly established parks in underprivileged neighbourhoods in Barcelona affected the socio-demographic landscape of the city, for instance, largely examined housing trends and population changes (education, age, migration background, and income levels) of the surroundings in relation to park creation. Another empirical study considering housing changes and socio-demographic changes emphasised the risk of "exclusionary displacement pressures" for vulnerable groups in accessing homeownership in urban areas with a marginal rental market (Cavicchia, 2022).

Our analysis shows that 24 studies focus only on displacement or displacement pressures, without going into too much detail about socio-demographic changes or changes in housing prices. This strand of literature connects displacement trends to various other factors such as social, political, and cultural changes. Goossens

et al. (2020), for instance, argue that displacement pressures—a loss of sense of place—for long-term residents stem from socio-political hierarchies and place identities. The last strand of literature focuses on greening initiatives and their effects on housing prices without embedding them in a displacement framework (*n* = 14). Black and Richards (2020), for instance, investigated the influence of New York City's High Line on the housing market in terms of who benefits from increasing rents and house prices.

Turning to the interrelations of the types and motivations of NbS interventions and effects, our analysis shows no substantial differences (see Figure 5). Between 40%–44% of the studies that investigated the impacts of parks, trees, water, and green facades reported issues of displacement and another 22%–30% reported housing price increases as the core drivers of green gentrification. However, the planting of trees (*n* = 26) and waterfront developments (*n* = 23) seem to be slightly more strongly associated with changes in the housing stock. This resonates with the fact that many cities develop defunct harbour sites into new, high-quality urban districts that are affected by the processes of self-segregation of affluent groups into brand-new neighbourhoods to gain direct access to the water and creative, cultural, and entertainment spaces (Bunce, 2009). In contrast, studies that focus on other types of interventions, such as green corridors, transportation, and eco-retrofitting are increasing (*n* = 29), appearing to have a stronger focus on the effects of housing prices, with about 38% of the studies focusing on this type of effect.

The interrelations between motivations and effects in terms of green gentrification also present no substantial differences. Displacement remains the key effect of green gentrification along all motivations, ranging from 39%–45%. However, the restoration of the deprived natural environment, as the main reported motivation (*n* = 68), seems to be slightly more strongly associated with rising housing costs (32% vs. 21%/24% for the other motivations). This is unsurprising as restoring ecosystems has been portrayed as the main motivation behind the creation or renovation of new parks and waterfront developments. Adaptation, on the contrary, seems to be more strongly associated with reported impacts on housing costs and changes in the housing stock. This is probably related to green facades and waterfront developments that are more often motivated by an adaptation rationale (Shokry et al., 2020; Tubridy, 2021).

Finally, very few articles focus on tools and policies dealing with green gentrification. Most of them analyse case studies of community engagement against increasing housing costs or displacement following green renewal (*n* = 21) and only a very limited number analyse or at least discuss planning tools (*n* = 13) such as the "just green enough" approach or housing policy (*n* = 4) interventions (rent control or social housing implementation in greening strategies).

7. Concluding Remarks

The analysis of the database has revealed urban scholars' increasing interest in social justice issues associated with NbS interventions. In particular, over the last couple of years, we have observed an increasing interest in discussing the potential trade-offs of green interventions. The literature review highlights interesting differences and current trends developed surrounding the process. The first is related to the main differentiation in the analytical framework adopted in the investigations and analysis. We are able to distinguish two main specific approaches connected with different research traditions: In the North American milieu, social scientists and

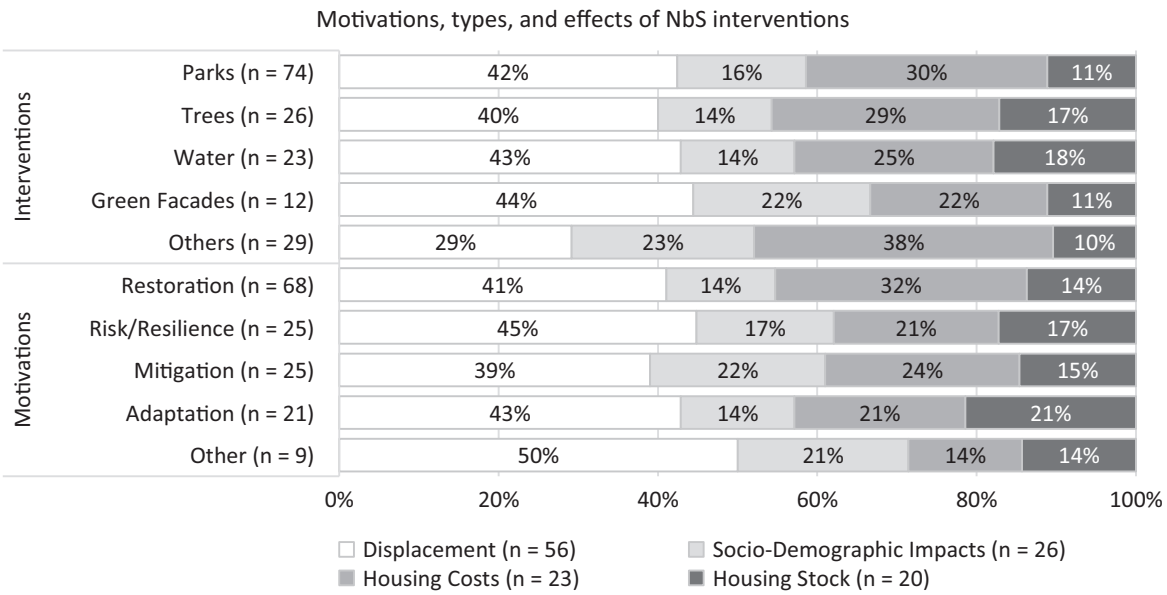

Figure 5. Motivations, types, and effects of NbS interventions.

environmental justice scholars have used classifications based on income and race, while the European context has preferred to use the relational concept of social class. Although distributional and procedural aspects are distinguished in both cases, Europeans highlight the social conditions producing injustices, whereas Americans insist on the racial dimension of discrimination and exclusion from decision-making processes that are detrimental to minority groups. This likely relates to the first studies investigating environmental injustices being carried out in ethnic minority communities, which are strongly characterised by pollution. It is noteworthy that green gentrification has now overturned the perspective and is instead exploring whether discrimination processes have occurred in "standard" communities resulting from green measures. Starting from an interest in urban farming, transportation, and the renewal and design of urban parks, today the debate surrounding green gentrification has evolved, discussing the implications of climate change adaptation and mitigation in cities.

Within this framework, the literature review has highlighted some research gaps. The first concerns the geographical representation of the case studies, with an over-representation of case studies in the Global North, especially due to the legacy of the EJ movement and scholarship in the US. Additionally, comparative research designs taking into consideration different context variables (residential patterns, housing regimes, and greening strategies) are quite uncommon.

The second research gap is related to the over-representation of case studies located in large urban areas, mostly investigating dynamics at the neighbourhood scale. By comparison, investigations covering medium-sized cities, suburban, and rural areas are quite rare, although the implications of greening could be different according to diverse settings.

The third is related to the methodology implemented in the case studies, with a prevalence of qualitative analysis over quantitative, and a lower number of cases of mixed method analysis, which may be helpful to define trends and unpack the mechanisms underlying these processes.

The fourth research gap is associated with the fact that most of the case studies still focus on the restoration of deprived green areas, while the attention towards interventions targeting the adaptation of mitigation is still limited. In the coming years, instead, the latter could start to play a huge role in planning and urban design practices, especially related to flooding risk and heatwave adaptation, with huge implications as far as housing prices and displacement dynamics are concerned.

A fifth aspect reflects the impact of climate change adaptation and mitigation policies. So far, most studies have focused on the impact of vegetative greening and the potential negative consequences in the communities. There is little information about how we can implement the needed actions against climate change and how to avoid the risk of displacement for vulnerable householders. This is especially vital as these vulnerable groups are highly prone to the negative consequences of a warmer climate. In particular, studies investigating the implication of selective incentives (e.g., aid to low-income families for the insulation of the building) are still very rare, although they represent a potentially crucial mechanism.

A sixth research gap is related to the mechanism behind green gentrification and displacement. The open question reflects the aspect of what triggers the initial displacement process: (a) gentrification or (b) the realisation of green spaces. Most of the selected research studies focus on green spaces triggering the displacement of vulnerable groups. However, the literature needs to assess if the gentrification process started before the greening of the city. The research needs to understand if the early "gentrifying" encouraged a greener surrounding, which could have triggered further gentrification processes.

Finally, there is an urgent need for investigations taking into consideration the multidimensional aspects of justice related to climate change (redistribution, recognition, and representation), especially with the aim of designing policies and strategies able to combine environmental justice with climate change adaptation and mitigation, as well as a general "right to the city" for the most vulnerable groups.

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Conflict of Interests

The authors declare no conflict of interests.

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About the Authors

Roberta Cucca is an associate professor at the Norwegian University of Life Sciences, in the Department of Urban and Regional Planning, where she teaches urban sociology. Her main research interests focus on social inequalities in contemporary cities, participation in local policy decision-making, and the social dimension of sustainability. She serves as a member of the Board of the RC21 (Urban and Regional Development) in the International Sociological Association.

Michael Friesenecker is a project staff member at the Institute of Mountain Risk Engineering, University of Natural Resources and Life Sciences. Previously, he worked as a research assistant at the Department of Geography and the Department of Sociology of the University of Vienna. Broadly, his work focuses on multi-scalar and comparative perspectives on urban transformations. His recent research has covered urban (development) policies, neighbourhood revitalization, gentrification, and the social and spatial implications of housing and environmental policies.

Thomas Thaler holds a PhD in environmental science and is currently working as a post-doc researcher at the Institute of Mountain Risk Engineering at the University of Natural Resources and Life Sciences. His research and teaching activities focus on social justice, risk governance, and flood risk management.