RETHINKING SUSTAINABILITY IN URBAN AREAS:

SÃO PAULO, LONDON, BERLIN

Organized by ***Robert Cowley***
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Global Research Academy

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Preface

The five chapters of this volume speak to a series of social and environmental problems faced by many cities around the world: the degradation of green public spaces; homelessness; access to blue-green infrastructure; and food waste. Such problems – like many other challenges to the sustainability of our urbanising world – have global dimensions, but their concrete forms relate to local contexts limiting the applicability of 'best practice' solutions derived from experiences elsewhere. Each of the studies here therefore takes a cross-comparative approach, grounded in the specificities of three cities with very different historical trajectories and expectations for the future: London, Berlin and São Paulo. This approach has allowed the authors not only to diagnose successes and failures in relation to their immediate environments, but also to draw out cross-cutting recommendations for the future.

The work is the result of the 'Global Research Academy' study programme undertaken by doctoral researchers from University of São Paulo, Freie Univerisität Berlin, and King's College London. This programme was initiated in 2021 with joint funding from each of the three universities. Following a competitive application process, the participants attended study visits in London (2022), Berlin (2022), and São Paulo (2023), working in interdisciplinary groups to devise and implement the projects whose findings are presented here. These projects also kindled a series of alternative forms of dissemination, available via the USP repository web pages at: https://interscity.org/gra

The study groups were supervised jointly by Prof Fabio Kon (Computer Science, University of São Paulo), Prof Sérgio Costa (Sociology, Freie Univerisität Berlin), and Dr Robert Cowley (Geography, King's College London).

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Fabio Kon, Sérgio Costa, and Robert Cowley.

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1

GUARANTEEING GREEN: URBAN SUSTAINABILITY, CITIZEN PARTICIPATION AND GREEN SPACES IN CITIES

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ABSTRACT

Green spaces are vital to public health and well-being but are often under pressure for development of both housing and public infrastructure. Over the past five decades, green spaces have been reduced in London, Berlin and São Paulo. In response to this, citizens have joined together to form community action groups to prevent development on their valued green spaces. This project first aims to study whether public green space has been reduced over the past few decades through analysis of city zoning maps. Secondly, we seek to understand the effectiveness of citizen action groups in these three cities in preventing development on green spaces as well as the relationship between the methods taken by citizen action groups and the governmental organisations against which they campaign. The differences and similarities can then be used to provide future insight and aid to those seeking to protect their public green space in the future.

1. INTRODUCTION

Cities throughout the world are expanding at a rapid rate. Because of this expansion, sustainable planning is required to counteract the environmental and societal impacts. Where poor or no planning may lead to increased urban sprawl, slums and traffic, good planning may mitigate these harmful outcomes and result in increased health and well-being for citizens. Cities have long been hubs of learning, community and creativity, and are fast becoming the centres of the modern world. To keep pace with the new demands of cities, commitments to urban sustainability must be made and kept, despite their challenges, in order to improve living conditions for all.

Sustainability requires consideration for, and input from, a number of major sources: the environment, the economy, the community and the state/government. For the past forty years, urban planners have been conscious of balancing development and conservation for both present benefit and future security (IUCN, 1980; Wu, 1998). Increasingly however, the role of community in urban sustainability has moved to the forefront. Problems in planning urban sustainability are, after all, issues of people *and* environment. Therefore, the requirements of residents and community within an environment should play a pivotal role during planning; if they are not, this can lead to disconnect between a governing body and the community, and may favour some stakeholder groups over others (Dempsey et al., 2011). An example of this can be seen in the development of green spaces, where economic requirements of some stakeholders are put above the needs of the community for green space access.

Green spaces are essential within cities for ecological sustainability, but additionally provide immense health and well-being effects to the community near a green area. Access to parks and increased park density (park space in proximity to an area) are both correlated with increased levels of physical activity and mental well-being (Capaldi et al., 2014; Eichinger et al., 2015; Roemmich et al., 2018), an effect observed in all age ranges (Yi et al., 2021). Community cohesion is improved through engagement with local parks or green spaces, improving a sense of belonging and community attachment (Peters et al., 2010; Wood et al., 2017). Parks provide additional health benefits through improvements

to air quality (via increased tree cover and carbon storage) (Heidt & Neef, 2008; Paolettia et al., 2011), directly reducing risks of asthma and heart disease (Ulmer et al., 2016). Increasing tree cover in a local environment also assists in reducing the urban heat island effect and preventing flooding during adverse weather (Akbari et al., 2001). The benefits demonstrated above can also be expressed financially; the Trust for Public Land 2013 report stated that Massachusetts, USA, yielded $4 in natural goods and services (reductions in flood risk, mitigation of climate events, human physical and mental well-being) for every $1 it spent on the conservation of green space (The Trust for Public Land, 2013). Economic benefit is further exemplified through the iTree Landscape platform (i-Tree, 2023). Parks are a vital part of city infrastructure, providing benefits at the macro level through ecological methods, community level and on an individual level through reductions in obesity, heart failure and asthma. If it can be agreed that these benefits are necessary to human health and survival within an urban environment, parks must be considered a central aspect of urban sustainability, as they encapsulate environmental, societal, human and economic good in one clear and discrete package.

The aim of the research presented in the following report was to identify common principles for successful citizen defence of urban green space in Berlin, London and São Paulo. As such, we have developed a 'Decalogue of Good Practices'. These recommendations, based on six semi-structured interviews with members of initiatives to protect green spaces from development, are necessarily high-level. The recommendations concern disparate economic, legal, environmental and socio-political contexts, in which, for example, "development" itself might signify various practices, both formal and informal, although the line between the two is far from clear (Chiodelli & Moroni, 2014). However, the developments we discuss in the following report have been authored by local governments or private investors, usually in cooperation with the former and based on existing regulations.

2. DISAPPEARING GREEN SPACE

Since there have been relatively few studies that demonstrate a significant reduction in the amount of green spaces available in a city (Colding et al., 2020; Finley, 2019), we first wanted to examine whether parks and green spaces have been developed on in the last 50 years. Therefore, we cross-referenced historical maps of Berlin, London and São Paulo with contemporary maps to understand these transformations. For each of the cities, the major parks that existed in the city centre (for example, *Tiergarten* in Berlin, Hyde Park in London, *Parque dom Pedro II* in São Paulo), are in their present form as they were 50 years ago. The same is true for many more, smaller and less famous parks throughout each of the cities. However, it was noted that, within Central London and further into the Greater London suburbs, there were reductions in small green areas. Small gardens in the centre of housing estates, railway sidings and other non-official park spaces have since been developed, usually into housing. A comparison of the central London area from 1990 to 2018 showed a reduction of approximately 90 unnamed green spaces. This effect was even greater in Berlin; there were several parkland areas in 1986 (denoted as "sports ground" (*Sportplatz*) or "allotment garden" (*Kleingarten*) in these maps), which have since been developed on. One of the examples includes the areas south of the Teltow Canal (*Teltowkanal*) and present-day Tempelhof Field (*Tempelhofer Feld*); around half a square kilometre of parkland has now been developed into a suburb (***Figure 1*****Erro! Fonte de referência não e ncontrada.Erro! Fonte de referência não encontrada.**, left).

Additionally, there have been several reductions in green space area; for example, an unnamed area of parkland west of *Volkspark Jungfernheide* has since been made into housing (***Figure 1***, right), and the area surrounding *Kienhorstpark* has also been significantly reduced. This effect is stronger in São Paulo, which has undergone a significant increase in size since 1971, particularly into the suburbs (Nasa Earth Observatory, 2014). In maps obtained from 1971, there are large areas of land which

Figure 1: Extracts from maps of Berlin (Hallwag, 1986/87) demonstrate the reduction of green space in Berlin. (Left) region south of modern-day Tempelhof Feld and (right) Siemensstadt region. Cyan overlay indicates extent of present-day park area, pink overlay indicates extent of contiguous green space in 1986. Maps courtesy of the British Library Maps room.

are denoted *Floresta; Mata rala e macega baixa* ("Forest; thin woods and low scrub") and which have since been heavily developed into suburbs. Two examples of these (though there are many) are: *Jardim Textil* and *Novo Parque Lar Nacional*, both in eastern São Paulo (***Figure 2***).

Figure 2: Parkland size has significantly been reduced in São Paulo, as seen through excerpts of geological survey maps (Instituto Geografico e Geológico, 1971-72). (Left) Jardim Textil development and (right) Novo Parque lar Nacional development from orchard and low forest to suburbs. Cyan overlay indicates area of current park, pink overlay indicates extent of contiguous green space in 1971. Maps courtesy of the British Library Maps room.

While many of the established parks have escaped development, this is not always true; the *Vila Prudente* ecological park is now less than half the size it was in 1971, where a housing estate has been built in central São Paulo, demonstrating that development has not only been taking place in the peripheries of the city.

Figure 3: The size of ecological parks within the city centre have also been reduced (Instituto Geografico e Geológico, 1971-72), cyan overlay indicates area of present-day ecological park, pink overlay indicates area of green space in 1971. Maps courtesy of the British Library Maps room.

The reductions in green spaces available in these cities are an inevitable consequence of continued urban expansion. Modern maps show that many of these unofficial green space areas have now been developed on, which has set an example for other developers to follow in relation to established parks. In each of these three cities, examples of the latter abound: the developments on *Parque dos Búfalos* (Parque Dos Búfalos, n.d.), the referendum that took place in Berlin over the proposed development of the Tempelhof Field (Rutz, 2014), and the CPRE 2022 (CPRE London, 2022) report showing that there are over 50 planning applications for developments on parks and green spaces in London. As development on green spaces threatens urban sustainability from both an ecological and a community perspective, we wanted to understand the

interactions between the community in a city and the governing bodies of cities (and other "stakeholders"). Therefore, we conducted interviews with prominent members from six different grass-roots initiatives, introduced below, to understand the processes by which citizens organise themselves and how they tackle the issue of the loss of urban green spaces as well as to provide insight and possible directions for other such initiatives.

3. METHODOLOGY: COMPARATIVE METHOD OF SOCIAL SCIENCES

In our work, the collection of information and its subsequent analysis seeks to develop adequate methods and explanations for complex social phenomena, such as citizen participation and prevention of green areas in three different cities. The following methodological appreciations are intended to serve to support the diagnosis that we made in the first instance. For the above, we carried out a mixed comparative methodology between large structures and individuals. In this way, we carried out a systematic comparison of structures and processes, which will not only place our own situation in perspective, but also help in the identification of causes and effects (Tilly, 1984). In this way, we carry out a comparative methodology with an interpretive purpose, where the analysis of variations through the study of similarities or differences of the units of analysis allows us to establish correlations. Under this logic, the comparisons track uniformities and variations between units, processes, and combinations of them.

To do this, we define complete analysis units. Units were defined to effectively analyse how the organizations: settled a precedent, built democracy, their relationship with democratic practices, their level of success, what their impact is on the prevention of green area development, the analysis of their legal framework and its relationship with bureaucracy, and their perception of main obstacles. When comparing the analysis units, we searched for uniformities and variations between to better understand the behaviour of these organizations facing the problem of loss of green areas in large cities, but we will not answer the behaviour of world systems (losing of green areas).

Table 1: Introductions to the initiatives interviewed (For more information about each initiative, please see Appendice).

Interview name for analysis	**Initiative Name**	**Brief**
Berlin 1	100% Tempelhofer Feld	*Tempelhofer Feld* is a popular park in central Berlin, on the repurposed site of the famous Tempelhof airport (closed in 2008). The park opened in 2010 and attracted the attention of many housing developers. To retain park access, 100% Tempelhofer Feld gathered enough signatures for a referendum to oppose proposed developments to the park, which was won with a 64% majority in 2014.
Berlin 2	Aktionsbündnis Teufelsberg	*Teufelsberg* in south-west Berlin is an artificial hill with a very rich history. In the 1990s, the Teufelsberg Plateau (4.6 hectares) was sold to a private investor by the city and made accessible to a limited degree (and for a fee only) in the 2010s. The initiative *Aktionsbündnis Teufelsberg* was formed in 1997 to demand the reappropriation of the land from the city. Since then, the initiative has been successful in blocking many attempted developments but has not yet achieved reappropriation of the land.
London 1	Save Whitewebbs	*Whitewebbs Park*, located in north London, has a long history associated with the city and the English monarchy. In 2019, the local council advertised and, in 2021, elected Tottenham Hotspur Ltd to build a football academy and several pitches in a large portion of the park. In response, Save Whitewebbs Park was created, it has challenged the legality of such a development. Development remains in the planning stage but opposition has support from wider organisations and local politicians..
London 2	Save Wimbledon Park	*Wimbledon Park* in south London is a landscaped park of approximately 270 acres of cultural and environmental significance. A section of the park was sold to the All England Lawn and Tennis Club (AELTC) in 1993 under a covenant of no significant development. In 2021, plans were submitted to construct several buildings, courts and a stadium. Save Wimbledon Park was formed from several local neighbourhood associations and is currently fighting the development with political and legal support, on a legal and ecological basis.
Sao Paulo 1	Jardim Alfomares	*Jardim Alfomares* is a large park with immense ecological value, reminiscent of the native *Mata*

		Atlantica biome. In 2001, the land was sold from private ownership to INPAR, who immediately made plans and bypassed laws to develop the land and begin deforestation. The initiative formed into an official neighbourhood association and successfully resisted development by proving that the deforestation was illegal. In 2020, renewed efforts by INPAR resulted in the official recognition of the value of the area by the City's Council for the Preservation of Historical, Cultural and Environmental Heritage (CONRESP), though the fight continues.
Sao Paulo 2	Parque dos Búfalos	*Parque dos Búfalos* is located near the Billings Reservoir and has societal, social, cultural and ecological value as a huge freshwater reserve for the city. In 2013, the city of São Paulo began construction of a large affordable housing development on the site, spurring the creation of the initiative. It aims to have the remaining half of the land recognised as a park to prevent further development and it has now joined forces with OEKOBR to further assist in legal processes.

4. GATHERING QUALITATIVE INFORMATION: CONDUCTING SEMI-STRUCTURED INTERVIEWS

To collect secondary information and data, we carried out six semi-structured interviews with members of different citizen initiatives that work or have worked in the protection of green areas in Berlin, London and São Paulo. The objectives of conducting these interviews are, firstly, to understand the perception of the actors of these organizations about the effectiveness of citizen participation in preventing the loss of green areas in cities. Secondly, to obtain insights that allow us to develop a decalogue of good practices, with working experience of these organizations and actors.

The selection of the cases sought to produce a representative sample of the different realities faced by citizens in Berlin, London and São Paulo; taking into consideration the different levels of success, the extent of their work overtime, and the socioeconomic context in which the initiative takes place. Based on the above, we chose six organizations in total, two for each city (***Table 1***).

When carrying out the research for the selection of cases based on the evidence in press articles, in popular science magazines and based on our own experience, we realized that there is a tendency for those initiatives with a higher level of success (preventing development of a green space) to be found in high socioeconomic locations in the three cities. This effect was seen clearly in São Paulo, one of the most unequal cities in the world, where the success of the organisations seemed to correlate with socioeconomic level of the park neighbourhood. In London both interviews were conducted with initiatives located in middle-high socioeconomic locations, with one interviewee acknowledging the fact that such initiatives were unlikely to be as successful in lower socioeconomic areas. Contrary to this observation however, the same did not apply in Berlin, as both initiatives concerned higher socioeconomic locations though only one had secured success in their initial goal.

5. STRUCTURE OF THE INTERVIEW

First, we divided the content of the interview to effectively study the fundamental pillars of our research. To do this, we defined different sub-themes for each of the units of analysis, dividing the content of the interviews into 7 different themes. These themes are all related to participation in the prevention of development in green areas that are of interest to us when analysing the responses of our interviewees. The themes are:

6) **Setting a precedent**, which sought to understand the level of success in setting a precedent in the elaboration of public policies and its relationship with citizen participation.
7) **Building community**, to study how the initiative had been able to build a community outside its formal organization.
8) **Democracy**, which aimed to assess how important democratic, grassroots participation is in decision-making concerning the preservation of urban green spaces.
9) **Success of the initiative**, which sought to understand the perception of the initiative actors being successful in achieving its initial goals.
10) **Preservation of green areas**, which sought to understand the perception of the interviewees in how important this initiative had been or will be in the preservation of green areas in the city.
11) **Legal framework**, to understand the formal relationship that exists between the organization and local institutions, as well as the perception of the actors on the relevance of this point to achieve their objectives.
12) **Main obstacles of the initiative**, as perceived by the initiative actors.

6. FINDINGS

The following analysis examines the interviews in a qualitative and quantitative manner, shedding light on recurrent themes and common phrases. However, it is first necessary to take a holistic view of the interviews to understand the sentiments and motivations behind the initiatives. Throughout the interviews, there was an emphasis on the opposition between members of the initiative and other actors (e.g. governmental bodies, stakeholders) that drove the formation and maintained initiative momentum, a feature of many protest movements identified by Snow & Soule (2010). In all cases, the interviewees spoke of an inciting incident that forced a reaction and how they were able (to varying degrees) to influence the political landscape surrounding the initiative. This observation fell alongside a disenchantment with the planning and governmental bodies responsible for development on the greenspace, whereby members of the initiative felt brushed aside and ignored by those making decisions. Taking both expressed sentiments together, the beginnings of these initiatives align with protest cycle frameworks outlined by Tarrow et al (2001), suggesting that momentum behind these initiatives will reach a critical mass and (succeed or fail on their own), will likely lay the groundwork for future protests and successes.

After carrying out the six interviews, the findings obtained on the relationship between citizen participation and the protection of green areas are varied. Initially, we carried out an evaluation of the objectives and the success of the initiatives. In general, organizations tended to have two objectives: i) inform people of what is happening; ii) prevent the loss of green areas. Although the level of success varies in each of the initiatives, the general rule is that they have at least met their minimum objectives, which is to raise awareness in the communities surrounding the projects that there is a development risk on their green space. This can be seen from ***Figure 4***, which represents the intersections of the themes of the six interviews. To build this graph, we studied the number of intersections between themes at the time of conducting the interview. For example, if within the same answer, the interviewee talked both about their perceptions of "Success of the Initiative" and "Building Community", then it is considered an intersection between the two

themes. In addition, we imposed a threshold on the graph based on themes that had intersections at least five times during all the interviews.

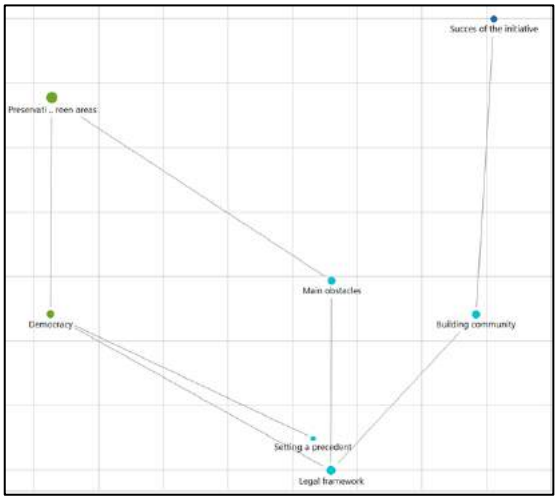

Figure 4: Graph demonstrating the interconnectedness and relationships of the units of analysis from the interviews. Relationships were thresholded on at least 5 intersections per theme.

Analysing ***Figure 4***, if we examine how the different themes are connected in the interviews, we can see that the 'Legal Framework' theme is the one that has the most intersections with other themes, becoming a central node of the interviews. This is mainly linked to the 'Main Obstacles', with 'Building Community' and with 'Democracy'. In relation to the interviews, this allows us to draw two conclusions: Firstly, the formation of a formal organic structure (such as a neighbourhood council, an NGO, etc.) to formally link the communities that these organizations seek to represent was beneficial to the initiative. However, because of the inherent difficulties that creating a legal entity entails, (especially because of the problems of self-financing and facing a bureaucratic apparatus), did not expedite the constitution of these entities. Secondly, 'Setting a Precedent' is directly linked to 'Democracy', which can be interpreted as the importance given by those interviewed to the fact that the most important milestones in their actions have been the promotion of citizen participation.

Another discovery based on the interviews was the emphasis that the interviewees give to the different topics covered (***Table 2***). In this table, the proportionality that each interviewee gave to each of the themes described is shown. This does not mean how much time was given to each answer, but how many times they mentioned the units of analysis that were defined. For example, in the São Paulo 1 interview, the interviewee referred to the theme "Democracy" in 24% of the entire interview. The aforementioned does not seek to demonstrate statistically verifiable correlations, but rather helps us to better understand how the interviewees relate to the defined units of analysis.

In the table, the themes that were given the most emphasis in most of the interviews were the 'Preservation of Green Areas' in first place, 'Legal Framework' in second place and 'Building Community' and 'Democracy' jointly in third place. Please refer to Appendices: supplementary figures for word clouds of interviews.

Table 2: Proportionality of theme per interview. Proportionality is calculated as percentage of total interviewees response spent on the theme.

Theme	Sao Paulo 1	Sao Paulo 2	Berlin 1	Berlin 2	London 1	London 2
Democracy	24%	7%	23%	12%	5%	16%
Preservation of green areas	10%	35%	35%	36%	18%	24%
Building community	19%	19%	3%	12%	20%	16%
Setting a precedent	5%	2%	3%	4%	3%	4%
Main obstacles	14%	21%	5%	4%	20%	8%
Success of the initiative	5%	7%	18%	12%	10%	8%
Legal framework	24%	9%	15%	20%	25%	24%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Source: elaboration based on interviews carried out						

When analysing in depth what was said by the interviewees on the 'Preservation of Green Areas' theme, there was generally great homogeneity in the analysis of the interviews. From the analysis, it is evident that there is a large difference in the type of green areas that are sought to be protected in São Paulo than with other cities. Since in Brazil the green areas are spaces of biodiversity and jungle, where indigenous communities or people from the periphery reside. However, all the interviews agree that the main objective of the initiatives is to protect green areas; and the genesis of these initiatives is given as a response to the non-existent state intention to protect green areas. In other words, they are usually organizations that arise from the reaction to a problem; they arise to stop something, and then transmute into meeting spaces that tend to exceed their initial objectives of stopping a project. The initiatives also arise as a reaction to a project of an unfair nature which ignored many legalities. In this sense, all the interviews have a feeling that they have managed to prevent the loss of green areas, although with different degrees of success. For example, the Berlin 2 interview makes a differentiation in the success of their own initiative with that of Tempelhofer Feld, where the interviewee feels that his level of success in the protection of green areas is lower than that of Tempelhofer Feld due to the greater social connotation of the latter.

On the other hand, by analysing the quantitative results of the survey, we can see that the most frequent word combinations in the interviews are always linked with the concept of "people". The interviewees have the perception that the protection of green areas is not only given by a need to protect the native flora and fauna, but that it is related to the well-being of the communities and with citizen participation. For example, in the Berlin 2 interview, the interviewee gives special emphasis to the sense of belonging: they do not identify themselves as a legal organization, not only because of the problems that this brings, but also because they are a meeting and organisation space of humans, friends, colleagues:

> *"This is no cooperation, no organization, we are members."*
> (Berlin 2 Interview, 2023:, Pos. 104).

The previous quotation meaning can also be shown through ***Figure 5***, where we see that the five most frequent word combinations in all the interviews are related to the concept of "people".

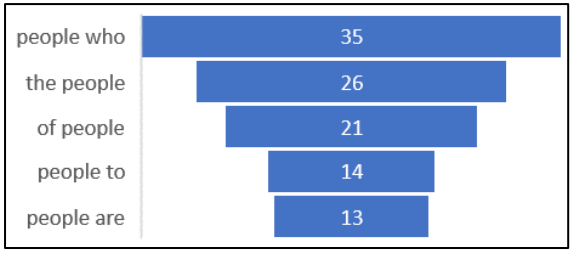

Figure 5: Graph showing the five most frequent word combinations between all interviews.

Following the same line, both London interviews also place special emphasis on the democratic participation of communities when drawing up public policies and influencing institutional decisions. For example, in London Interview 1 the interviewee comments that there are problems when spaces are opened for the community to intervene and say what they think, but there is no continuous association between the two, emphasizing the lack of accountability of the City Council where the initiative is located:

"(...) the Council has taken every measure it can to stifle proper consultation on this."
(London 2 Interview, 2023: Pos. 36)

The interviewee criticizes that there are no formal meeting spaces, but rather "intentions" to work together. Another interesting aspect in the construction of community by initiatives is the emphasis on activism. For example, in the São Paulo 2 interview the interviewee states that thanks to the initiative different generations have managed to meet. Along these lines, one of the strategies was to link the green area project with other projects, such as security:

"For example, today we have several action fronts in our organization. There is an area linked to security in the neighbourhood. [A younger member] has devised an advanced security plan; we hired a private security company to do patrols here in the neighbourhood. A lot of younger people were involved in this (...) So, these

things attract other young people. It demands a lot of time from [them], energy, but you see a lot more people becoming interested."
(São Paulo 2 Interview, 2023: Pos. 66-7)

Finally, in general, in the interviews there was a strong connection between the Legal Framework and Main Obstacles, as shown in ***Figure 4***. This is evidenced by the negative comments that the interviewees gave when answering the questions on this topic. The foregoing can be interpreted by the feeling of fatigue in those interviewed to fight legal battles and confront local bureaucracies. An example of this is reflected in the London 1 interview, when they comment on the feeling of disinterest on the part of local governments by putting in a lot of bureaucratic stages in environmental protection:

"If we're serious about it [green space protection], if the government is serious about protecting the environment, it has got to be made a much simpler process. Because to do anything one has to get involved in all sorts of things for protection of the environment and a lot of that goes through the local council."
(London 1 Interview, 2023: Pos. 125)

This is an example of the common feeling that it is necessary to reduce legal barriers so that citizen action can be a valid and efficient actor when it comes to defending green areas in cities. In addition, this phenomenon increases in the interviewees from Brazil, since, unlike Germany and the United Kingdom, the country has a significant amount of privatized land, which makes it more difficult and sometimes ineffective to deal with public institutions, because they do not have any power over development. For this reason, they give importance to the legal status of the spaces that they want to protect, before initiating certain legal battles:

"It was like that: we won in all instances [courts], recognizing that the land was public. But the city didn't hunt down the false land registrations."
(São Paulo 1 Interview, 2023: Pos. 48)

From here comes the perception that the success of the initiatives is closely linked to overcoming bureaucratic and legal barriers to obtain victories. However, the interviewees also share the view that it is complex to maintain successes in a sustained manner over time:

"*We failed in not securing the success in the sense that it's always in danger (...) we haven't secured our success. It is a success, but it's always on sandy ground. I don't know how to say, but not in safe ground*."
(Berlin 1 Interview, 2023: Pos. 90)

Hence the perception of those interviewed is that they cannot guarantee in the long term that their victories will be maintained. Dealing with public institutions is sometimes not enough because they keep changing political coalitions. The importance of acquiring legal representation is that it stops depending on the good will of the people who are in elected representation positions.

7. PROPOSED SOLUTIONS: CITIZEN ACTION ADVICE, CITY CONVIVIALITY AND ASSOCIATED RISKS

Using information from the interviews with members of the initiatives and an analysis of the literature surrounding this topic, we propose ten courses of action for any citizen (or citizen group) looking to defend their park area. We have not numbered them, because we do not want to suggest any hierarchy or the order in which they must occur. These suggestions are intended to help citizens participate and challenge their governing bodies to defend their rights to green spaces.

Early Intervention

Starting early with intervention was highly recommended by London 1 interviewee, who suggested that the planning stages of a development constituted the best time to stop it from happening. While direct action can certainly prevent development (for example, in the case of *Jardim Alfomares*), attempting to do so from the earliest instance can minimise any permanent damage to the land. Development of Tooting Common was prevented through such a strategy; by challenging the planning permission granted, the community was able to prevent the project swiftly and effectively at the earliest stages (CPRE, 2022).

Mapping the Stakeholders

Mapping the actors involved in the struggle is essential for getting the community to understand whom they are fighting against or alongside. Having a clear understanding of who to contact in city governments, who is leading development and why will help bring a community together in common cause rather than create further confusion.

Resource Management

Having determination and persistence is paramount. Defending or reclaiming an area of land over a long time – for example, the initiative *Aktionsbündnis Teufelsberg* has been active for 26 years – is immensely time- and resource-consuming. Both London 1 and London 2 interviewees suggested that a nucleus of a few people to constantly monitor the situation and be ready to galvanise other members into action can be sufficient to maintain momentum in defending a park.

Challenging developers through legal means and discussing issues with city governments is granular work and requires incredible persistence. Additionally, different tasks should be delegated to different people, depending on their skills and specialisation.

Garnering Community Support

Community support is vital to generate any changes. Berlin 1 interviewee suggested that the importance of social media is overrated as the level of participation required is very low. Instead, it is far more advisable to speak face-to-face with those that use the green space or benefit from it directly or indirectly. This connects to the previous point of *Mapping the Stakeholders*; it does not only apply to those the initiative is opposing, but also to those whom it is led by, allowing community members to easily identify and support those who lead the fight. London 1 interviewee commented on this, stating that they are often asked for updates while visiting the park. Having the support of a large number of community members is also extremely important, as demonstrated by the *100% Tempelhofer Feld* initiative. Without the wide-reaching support of the local community (and those further afield), the referendum would not have been able to take place nor, , succeed. Therefore, obtaining community support through direct interaction will likely propel an initiative to success.

Creating a *fait accompli*

Making use of the green space to demonstrate its value, both to the community and city government, can be highly beneficial. Taking advantage of the space for sports groups, lectures, talks, family group and child-friendly activities gives it a constant sense of 'use'. This will encourage others to enjoy the space and garner support for the continued existence of the park, should development ever be proposed. São Paulo 2 interviewee suggested that child-friendly activities were very important for generating interest in ecological and environmental issues in younger age groups.

Fight for the Obvious

Knowing the legal status of the land you are trying to protect, who owns it and why can be very helpful in fighting development through legal

routes. As demonstrated by both London and both São Paulo initiatives, laws, covenants and deeds may all be bypassed by city governments or stakeholders looking to develop land. These actions, however, can be readily contested in legal proceedings.

Connecting the Community

Reaching out to similar initiatives or organisations can be very useful in seeking local or national advice, as well as experiences or tips from others that have fought through the same situation. London 1 and 2 interviewees expressed their gratitude to CPRE (London), who have assisted both initiatives with legal and strategic help as well as in publicising their fight beyond the local park area. Similarly, the São Paulo neighbourhood alliances have been helpful in advising and connecting organisers and activists.

Favouring Proactivity

Resistance is crucial, but taking a more proactive stance is at least as important. While having legal protection for an area of land in São Paulo did not successfully halt development in any of the discussed cases, ensuring that demands for greater protections for green areas are present on political manifestos for local or national politicians might help defend other green spaces in the future. Joining groups that lobby for these changes and ensuring that any laws are clear, with minimal room for 'interpretation' (as described by London 2 interviewee) and can be implemented consistently throughout a city will help guard green spaces in the future.

Engaging Local Politicians

Contacting and building a relationship with a local politician to use their influence with the local or national government may be helpful in ensuring your goals are met. Berlin 1 as well as London 1 and 2 interviewees all stated that the influence of local politicians had been generally beneficial to their cause. Berlin 1 interviewee also emphasised the importance of accordingly leveraging the help of politicians and allowing them to use the initiative in their campaigns. However, this is a balancing act, and the relationship should not define the initiative nor alter its own goals.

Staying Alert

Awareness of any development proposals is of vital importance in maintaining access to green spaces as any victory you might achieve is not conclusive. As an example, despite the legally binding referendum on the Tempelhof Feld in Berlin, there continues to be interest from successive governments for development on the site. To combat this, constant vigilance is required to make other members alert to new threats to the area, which may arrive with new or renewed tactics, as was the case at *Jardim Alfomares*.

These ten suggestions garnered from the six interviews paint a picture of constant struggle, continual effort to maintain public access to green spaces and an enduring battle against the city government. This takes immense amounts of time and effort. In light of this, we further suggest the following courses of action for the city, to ensure that they work towards greater convivial sustainability.

Creating a True Culture of Dialogue

Firstly, many interviewees commented on the fruitlessness of interacting with the city during planning phases. In these early stages, cities claim to be listening and interacting with citizens, though the outcome often aligns with what the city had already planned to do. This creates a repetitive discussion space, where the same interaction happens continually with no indication of progress. Cities should commit to listening to the needs of communities and acting on their suggestions rather than treating consultation as a box-ticking exercise. This would benefit the city, as they could then cater to the needs of those living in the area, and also the citizens, who would feel a greater sense of agency in their local environment and government.

Consistency and Social Justice

Secondly, legal protections for green spaces should be made clear and be implemented consistently throughout a city, without favouring higher-income areas over lower-income areas. This would ensure that green spaces are defended from development (as they are required for good physical, mental and environmental health), but this would be true for *all* members of a community. Noted in our analysis was the fact that the

most successful campaigns tended to appear in middle- or high-income areas. Guaranteeing that all green space could be equally protected by law would create a more equal urban society and contribute to convivial urban sustainability.

Redressing Power Imbalances

Finally, the present legal system treats all actors as equally resourceful, whereas this is not the case. For instance, Berlin 1, London 1, London 2 and São Paulo 1 initiatives were all opposed to development by private companies, which have huge revenue streams and a strong financial backing for legal representation. In comparison, the initiatives are run by people using their spare time and limited expertise. Treating these two opposing parties as entirely equal is unfair; therefore, an intermediary or third party should be present to treat all actors on an equitable playing field and make an effort that both parties are treated conscientiously. We term this the democratisation between parties and suggest that practising this would result in a fairer assessment of the benefits and risks that development of green spaces brings.

8. CONCLUSIONS

With the effects of the climate crisis becoming increasingly detrimental and urbanisation reaching record levels around the globe, preservation of publicly available urban green spaces will become a matter of critical importance. Both environmentally, in terms of climate change mitigation or ecosystem and species protection measures as well as socially, as a way of enhancing the mental and physical well-being of urban populations and strengthening social cohesion. However, in the three cities we have studied, we have observed a reverse phenomenon: the loss of a substantial amount of green spaces to development in the past few decades. Starting from the premise that the three cities are not acting to protect precious green spaces, we decided to look at local citizen participation in preserving some of these areas. We then conducted a total of six semi-structured interviews with prominent members of grass-roots initiatives fighting to defend or reclaim a specific park or green area; primarily to analyse their different struggles and strategies by taking a comparative perspective. Each of these initiatives being unique and distinct in multiple ways, we nevertheless succeeded in identifying seven recurrent themes – the most prominent being 'Preservation of Green Areas', 'Legal Framework' and 'Building Community & Democracy' – and how they interrelated with one another in all of the interviews. Although the degree of emphasis placed on particular themes varied depending on the interviewee, it is remarkable that the most recurrent line of argument did not concern environmental or public health, but citizens' right to specific green spaces. In other words, , these initiatives have been conceptualised, first and foremost, as *social, communitarian* projects more than any other factor (ecological, prioritising human well-being, etc.). An interesting variation concerns the socioeconomic status of the areas in which each of the parks analysed here is located, which has led us to the conclusion that lower-income neighbourhoods and urban districts are less likely to succeed in protecting their green spaces, possibly due to being regarded as areas that can be discarded more easily and their residents having less power when confronted with private investors and local governments.

Equipped with the knowledge we gained from the six interviews, we were then able to propose a list of recommendations both for citizens considering taking action to protect their green spaces as well as

governing bodies intending to make the decision-making process fairer, more transparent and truly equal. They are necessarily high level, since successful action is always context-dependent, and the three contexts studied here are varied. We advise that measures be taken as early as possible, before a given decision or course of action becomes a *fait accompli*. For the same reason, it is crucial that developments are not only resisted, but also prevented in advance: for example, by lobbying local governments for binding legal protections for green spaces. Clearly marking the presence of local communities in specific parks and making use of them for community activities is another such preventive measure, one that makes it more difficult for potential investors or decision-makers to carry out their development projects and effectively alter the local social 'landscape'. When setting up an initiative, it is useful to list all of the stakeholders and interest groups for clarity and better planning. It is also essential to know the legal status of the land that is to be protected and of the actions taken by investors and city governments, so that they can be contested in court; as the former are likely to take advantage of every loophole or even bypass the law. Securing support for the initiative is of critical importance to gain momentum: not only in the local community, but possibly beyond it. Reaching out to other groups who have faced similar struggles and then integrating these different communities and allies can help further the cause. So does engaging like-minded politicians, who can lend the initiative much-needed publicity and support, in which case it is important that they are credited for that appropriately, so as to encourage future cooperation. Political struggles can be extremely burdensome and may last for a long time, which is why not only perseverance, but strategic planning, including fair and tactical division of labour or self-care and care for others in a group, are fundamental. Finally, constant alertness is necessary, since no victory or status quo is conclusive, and there will always be attempts to subvert it from the same parties or ever new ones.

Concerning local councils and municipal governments, we recognise that they may not be necessarily looking for recommendations to improve the decision-making process around the use of green spaces, since many of these initiatives are directed against those in power and their vision of how to use a given area. Nevertheless, if a governing body seeks to make that experience more inclusive and democratic, we recommend that they treat public consultations seriously and all involved participants with

respect. For example, it is best to survey local communities before any development plans are publicly announced; otherwise, this creates a climate of distrust, and citizens feel that they lack agency, while the sense of democratic participation proves illusory. Next, it is vital that nature protection and environmental policies are applied consistently throughout a city. This is crucial not only from the point of view of effective nature maintenance, but also public trust and social justice. For this reason, it is mandatory that the same regulations are universally applied, regardless of whether the area in question is located in a low-, middle- or high-income neighbourhood or how much power the respective stakeholders have and what interests they represent. Furthermore, we advise that the decision-making process is further democratised by taking into consideration systemic inequities and the discrepancies in power between the involved parties and interest groups. This can be done, for example, by engaging an intermediary or an independent third party in the negotiations, who could then balance out any advantage that the more powerful actor might have, or by introducing greater legal restrictions on development projects on green spaces.

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REFERENCES

Akbari, H., Pomerantz, M., & Taha, H. (2001). Cool surfaces and shade trees to reduce energy use and improve air quality in urban areas. Solar Energy, 70(3), 295–310.

Aktionsbündnis Teufelsberg (n.d.). Für öffentliche Zugänglichkeit und landschaftliche Gestaltung!

Allin, S. (2021). Community "ignored" as Tottenham Hotspur win bid to take over Whitewebbs Golf Course. Enfield Independent.

Amt für Statistik Berlin-Brandenburg (2014). Volksbegehren und Volksentscheid über den Erhalt des Tempelhofer Feldes. Online: https://www.berlin.de/wahlen/historie/volksbegehren-und-volksentscheide/tempelhofer-feld-2014/artikel.770335.php (accessed 20 April 2023).

Bradbury, M. (2021). Portfolio Report. (Key Decision: KD5177). London Borough of Enfield.

Capaldi, C. A, Dopko L., R. L., & Zelenski, J. M. (2014). The relationship between nature connectedness and happiness: A meta-analysis. Frontiers in Psychology, 5(AUG).

CDU-Spitzenkandidat (n.d.). Wegner will Volksbefragungen zu Tempelhofer Feld und A100-Verlängerung | rbb24.

Change.org (n.d.). Petition · Stop Enfield Council leasing out Whitewebbs Park to Tottenham Hotspurs Football Club. Online: https://www.change.org/p/stop-enfield-council-leasing-out-whitewebbs-park-to-tottenham-hotspurs-football-club?source_location=search&utm_source=Web&utm_medium=SocialMedia&utm_campaign=SaveWhitewebbs (accessed 28 April, 2023).

Chiodelli, F. & Moroni, S. (2014). The complex nexus between informality and the law: Reconsidering unauthorised settlements in light of the concept of nomotropism. Geoforum, 51: 161–168.

Colding, J., Gren, Å., & Barthel, S. (2020). The Incremental Demise of Urban Green Spaces. Land 2020, Vol. 9 (5), p. 162.

CPRE (2022). Tooting Common campaign victory - CPRE London. Online: https://www.cprelondon.org.uk/news/tooting-common/ (accessed 22 April 2023).

CPRE London (2022). Forever Green? Privatisation, neglect and financial gain: why 50 London parks and green spaces are under threat and how we can save them. Online: https://www.cprelondon.org.uk/wp-content/uploads/sites/10/2022/03/Forever-Green-March-2022.pdf (accessed 20 April 2023).

Cracknell, J. (2022). Anger as council publicises lease of Whitewebbs Park to Tottenham Hotspur - Enfield Dispatch. Online: https://enfielddispatch.co.uk/anger-as-council-publicises-lease-of-whitewebbs-park-to-tottenham-hotspur/ (accessed 17 April 2023).

Dasgupta, S., Lall, S., & Wheeler, D. (2022). Cutting global carbon emissions: where do cities stand? Sustainable Cities. Online: https://blogs.worldbank.org/sustainablecities/cutting-global-carbon-emissions-where-do-cities-stand (accessed 08 April 2023).

Dawson, D. G. (2021). Submission on Wimbledon Park in the consultation on the LB Merton draft Local Plan. Wimbledon Park Resident's Association, London.

de Oliveira, R. (2023). Criação de parque dos Búfalos envolve até ameaça de morte na periferia de SP. Folha de São Paulo. Online: www1.folha.uol.com.br/cotidiano/2023/02/criacao-de-parque-dos-bufalos-envolve-ate-ameaca-de-morte-na-periferia-de-sp.shtml (accessed 17 April 2023).

Dempsey, N., Bramley, G., Power, S., & Brown, C. (2011). The social dimension of sustainable development: Defining urban social sustainability. Sustainable Development, 19(5), 289–300.

Eichinger, M., Titze, S., Haditsch, B., Dorner, T. E., & Stronegger, W. J. (2015). How are physical activity behaviors and cardiovascular risk factors associated with characteristics of the built and social residential environment? PloS One, 10(6).

Enfield Council (n.d.-a). Green space and other parks. Online: https://www.enfield.gov.uk/services/leisure-and-culture/green-enfield (accessed 28 April 2023).

Enfield Council (n.d.-b). Marketing of Whitewebbs Park Golf Course. Online: https://www.enfield.gov.uk/services/property-and-economy/marketing-of-whitewebbs-park-golf-course (accessed 28 April 2023).

Enfield Council. (1932). Lease. Online: https://www.cprelondon.org.uk/wp-content/uploads/sites/10/2022/11/1-Draft-of-1932-lease.pdf (accessed 19 April 2023).

Enfield Council. (2022). Public notices. Online: https://www.enfield.gov.uk/services/your-council/public-notices (accessed 19 April 2023).

Fatorelli, C. (2021). Carlos Fatorelli: Alfonso Martín Escudero e a Chácara Alfomares em Santo Amaro, São Paulo. Online: https://carlosfatorelli27013.blogspot.com/2021/02/alfonso-martin-escudero-e-chacara.html (accessed: 17 April 2023).

Finley, B. (2019). Green space disappearing from the "city within a park". AP News. Online: https://apnews.com/article/d3aaaf8239924adea58230d4e9d44dbd (accessed 16 April 2023).

Folha (2020). Oásis na metrópole. Online: https://www1.folha.uol.com.br/opiniao/2020/12/oasis-na-metropole.shtml (accessed 19 April 2023).

FOWP (2022). Submission on Planning Applications Merton 21/P2900. Online: https://www.friendsofwimbledonpark.org/wp-content/uploads/FOWP-AELTC-planning-application-fifth-submission-01.pdf (accessed 17 April 2023).

Friends of Whitewebbs (n.d.-a). History of Whitewebbs Park. Online: https://www.friendsofwhitewebbs.org.uk/past (accessed 28 April 2023).

Friends of Whitewebbs (n.d.-b). Today at Whitewebbs Park. Online: https://www.friendsofwhitewebbs.org.uk/present (accessed 28 April 2023).

Gesetz zum Erhalt des Tempelhofer Feldes (ThF-Gesetz) (2014). Testimony of Berliner Vorschriften- und Rechtsprechungsdatenbank. Online: https://gesetze.berlin.de/bsbe/document/jlr-ThFGBErahmen (accessed 20 April 2023).

Heidt, V., & Neef, M. (2008). Benefits of Urban Green Space for Improving Urban Climate. In Ecology, Planning, and Management of Urban Forests. Springer, New York, NY.

Heisig, M. (2014). Der Kampf um das Feld, Die Entstehung von Flughafen Tempelhof, Volkspark Tempelhof und Sportpark Neukölln. In: Werner Breunig, Uwe Schaper (Hrsg.): Berlin in Geschichte und Gegenwart, Jahrbuch des Landesarchivs. Berlin, pp.75-108.

IBB Wohnungsmarktbericht (2021). Senatsverwaltung für Stadtentwicklung, Bauen und Wohnen. Online: www.ibb.de (accessed 20 April 2023).

i-Tree (2023). Tree Benefits! Online: https://www.itreetools.org/ (accessed 28 April 2023).

IUCN (1980). Living Resource Conservation for Sustainable Development. (Vol. 1). Gland, Switzerland: IUCN.

Mengue, P. (2022). Novo Parque Alto da Boa Vista ganhará mirante, trilha sensorial e "cachorródromo"; entenda. Estadão, 08 August, 2022. Online: https://www.estadao.com.br/sao-paulo/sao-paulo-novo-parque-alto-da-boa-vista-ganhara-mirante-trilha-sensorial-e-cachorrodromo-entenda/ (accessed (17 April 2023).

London Borough of Merton. (1993). 1993 Covenant. Title number TGL94008. Online: https://www.friendsofwimbledonpark.org/wp-content/uploads/1993-Covenant.pdf (Accessed 15 December 2023)

Merton Council (n.d.). Wimbledon Park | Merton Council. Online: https://www.merton.gov.uk/leisure-recreation-and-culture/parks-and-open-spaces/parks-and-recreation-grounds/wimbledon/wimbledon-park (accessed 28 April 2023).

Mielke, H.-J. (2016). Die unendliche Geschichte des Berliner Teufelsberges Wald und Politik. (1). Berlin, Pro BUSINESS.

Nasa Earth Observatory (2014). Growth of São Paulo, Brazil. Online: https://earthobservatory.nasa.gov/images/83987/growth-of-sao-paulo-brazil (accessed 20 April 2023).

Paolettia, E., Bardelli, T., Giovannini, G., & Pecchioli, L. (2011). Air quality impact of an urban park over time. Procedia Environmental Sciences, 4, 10–16.

Parque dos Búfalos (n.d.). Movimento pela Defesa do Parque dos Búfalos. Online: www.parquedosbufalos.com/sobre-2/ (accessed 18 April 2023).

Peters, K., Elands, B., & Buijs, A. (2010). Social interactions in urban parks: Stimulating social cohesion? Urban Forestry & Urban Greening, 9(2), 93–100.

Przewieslik, W. (2011). Der (Fall) von Tempelhof - Wie Klaus Wowereit den Flughafen Tempelhof schloss und ihn zu einer Stadtbrache machte. Berlin, Shaker Media; 1., edition.

Ramalhoso, W. (2019). Sonho Frustrado. Notícias Uol,18 August, 2019. Online: noticias.uol.com.br/reportagens-especiais/a-falta-de-estrutura-no-maior-minha-casa-minha-vida-de-sao-paulo/ (accessed 27 April, 2023).

Roberts, A. (2022). Enfield's plans for Whitewebbs Park unlawful, we say. CPRE London. Online: https://www.cprelondon.org.uk/news/enfields-plans-for-whitewebbs-park-unlawful-we-say/ (accessed 28 April 2023).

Roemmich, J. N., Johnson, L. A., Oberg, G., Beeler, J. E., & Ufholz, K. E. (2018). Youth and Adult Visitation and Physical Activity Intensity at Rural and Urban Parks. International Journal of Environmental Research and Public Health, 15(8).

Rondeau, B. (1995). Wimbledon Park: from private park to residential suburb. 1. London. Bernard Rondeau Editorial.

Rutz, C. (2014). Berliner Volksbegehren „100 Prozent Tempelhofer Feld" auf Erfolgskurs. Mehr Demokratie e.V. Online: https://www.mehr-demokratie.de/news/2014/berliner-volksbegehren-100-prozent-tempelhofer-feld-auf-erfolgskurs/ (accessed 20 April 2023).

Save Wimbledon Park (n.d.). Home | Save Wimbledon Park. Online: https://www.savewimbledonpark.org/ (accessed 28 April 2023).

Snow, D. & Soule, S. (2010). A primer on social movements. New York: W. W. Norton & Company.

Tarrow, S., McAdam, D, & Tilly, C (2001). Dynamics of Contention. Cambridge: Cambridge University Press.

Tottenham Hotspur (2023). Tottenham Hotspur Proposals. Online: https://www.tottenhamhotspur.com/media/39082/whitewebbs.pdf (accessed 28 April 2023).

Teufelsberg - Berlin.de (n.d.). Online: https://www.berlin.de/ba-charlottenburg-wilmersdorf/ueber-den-bezirk/freiflaechen/berge/artikel.177406.php (accessed 23 April 2023).

The AELTC (n.d.). Wimbledon Park Project - The Championships, Wimbledon - Official Site by IBM. Online:

https://www.wimbledon.com/en_GB/about_wimbledon/the_wimbledon_park_project.html (accessed 28 April 2023).

The Trust for Public Land. (2013). Revitalizing communities and creating jobs. Online: http://www.census.gov/econ/ (accessed 28 April 2023).

Tilly, C. (1984). Big Structures, Large Processes, Huge Comparisons. 1. New York: Russell Sage Foundation.

Ulmer, J. M., Wolf, K. L., Backman, D. R., Tretheway, R. L., Blain, C. J., O'Neil-Dunne, J. P., & Frank, L. D. (2016). Multiple health benefits of urban tree canopy: The mounting evidence for a green prescription. Health & Place, 42, 54–62.

United Nations (2015). Cities - United Nations Sustainable Development Action. Online: https://www.un.org/sustainabledevelopment/cities/ (accessed 22 April 2023).

United Nations (2020). Sustainable Cities: Why They Matter. Online: https://www.un.org/sustainabledevelopment/wp-content/uploads/2019/07/11_Why-It-Matters-2020.pdf (accessed 28 April 2023).

VisitBerlind.de (n.d.) Tempelhofer Feld Berlin: Eingänge & Öffnungszeiten. Online: https://www.visitberlin.de/de/tempelhofer-feld-berlin (accessed 28 April 2023).

Wood, L., Hooper, P., Foster, S., & Bull, F. (2017). Public green spaces and positive mental health - investigating the relationship between access, quantity and types of parks and mental wellbeing. Health & Place, 48, 63–71.

Wu, C. (1998) The concept of urban social sustainability: Co-ordinating everyday life and institutional structures in London. PhD thesis, London School of Economics and Political Science.

Yi, L., Mason, T. B., Yang, C. H., Chu, D., & Dunton, G. F. (2021). Longitudinal Associations Between Neighborhood Park and Open Space Access and Children's Accelerometer-Assessed Measured Physical Activity: The Evidence from the MATCH Study. Journal of Physical Activity & Health, 18(9), 1058–1066.

APPENDICES

Supplementary information on the history of the initiatives, compiled from publicly available information and the interviews conducted:

Demokratische Initiative 100% Tempelhofer Feld

The impulse behind the initiative was the aftermath of the decision on the part of the administration of the city of Berlin to shut down one of the then three passenger airports in the Berlin/Brandenburg metropolitan area: the Berlin-Tempelhof Airport (*Flughafen Berlin-Tempelhof*) (Heisig, 2014; Przewieslik, 2011). The site, henceforth referred to as *Tempelhofer Feld* ("Tempelhof Field"), is 386 hectares (3.86 km^2) in area and located in the middle of Berlin, approximately four kilometres south of the city centre (VisitBerlin.de, n.d.). After the airport closed in 2008 (it later opened as a public park in 2010), it understandably became a highly attractive piece of land, and the local government made plans to use it for development. Initially, it was only a small group of local residents who opposed the idea, but it grew with time, becoming more heterogenous and representative not only of the surrounding neighbourhoods, but of visitors to the park from all around the city, which, since its opening in 2010, has become one of the most beloved recreational areas in, and a true symbol of, Berlin (CDU-Spitzenkandidat, n.d.). In the process, some individuals from the original action group left due to conflicting visions of how to further run the initiative. It received the name *Demokratische Initiative 100% Tempelhofer Feld* ("Democratic Initiative 100% Tempelhof Field") to account for the fact that the group objected to any construction plans on the site whatsoever—hence the hundred per cent. Moreover, the decision was made to formalise the initiative into a *Verein* (e.V.), or an "association" – a non-commercial legal entity in German law – which allows it to receive donations, among others (Berlin, Interview 1, 2023). By the end of 2012, the group started collecting signatures for a referendum, which eventually took place on May 25, 2014, on the day of the election to the European Parliament, and which was intended to settle the issue conclusively. The voters could vote on two draft bills concerning the Tempelhof Field, one from the initiative and one from the city administration, with the latter including developmental projects to be carried out on some parts of the area. The result was 64.3% to 40.7%, which was a clear victory for the initiative, and the respective bill became

law a month after the referendum (Amt für Statistik Berlin-Brandenburg, 2014; *Gesetz Zum Erhalt Des Tempelhofer Feldes (ThF-Gesetz) Vom 14. Juni 2014.*, 2014). However, it is not conclusive; various politicians have since tried to animate new discussions about using this piece of land for development, especially in the wake of the city's growing housing crisis (IBB Wohnungsmarktbericht 2021, 2021). After the conservative, Christian-Democratic CDU party won the recent Berlin repeat state election of 2023, the prospective mayor of Berlin, Kai Wegner, has announced plans to reconsider the issue and challenge the status quo (Hermel, 2023; 100% Tempelhofer Feld, 2023).

Aktionsbündnis Teufelsberg

Located in the district of Grunewald in the surrounding forest of the same name in south-western Berlin, Teufelsberg in an artificial hill made of debris and rubble rising 394 feet (120.1 metres) above the sea level of historical and cultural importance. Among other things, it is the site of an unfinished Nazi military technical college and a U.S. radio listening station during the Cold War, whose walls have been covered with graffiti, making it one of the most famous street art galleries in Berlin (*Teufelsberg - Berlin.De*, n.d.). The initiative was founded in 1997 after the Teufelsberg Plateau (4.6 ha) had been sold by the city of Berlin to a private investor and fenced off, and it has demanded that the city reappropriate this piece of land and make it publicly available (access is limited and not free of charge) ever since – albeit unsuccessfully (Mielke, 2016). While most of its constituent members are formalised in one way or another, being a loose association of a number of non-governmental environmental and nature protection organisations as well as residents' and religious groups – hence the name "action *alliance*" *(Aktionsbündnis Teufelsberg*) – it does not have a particular legal form itself, which, according to our interviewee, is deliberate (Berlin Interview 2, 2023). Other demands made by the initiative include the elimination of parts of the complex in danger of collapsing; the preservation of the distinctive reinforced concrete tower of the former listening station and its transformation into an observation point and a museum of the history of the site; the reintroduction of official nature protection to the entire area; and the cancellation of any construction projects to be carried out there (Aktionsbündnis Teufelsberg, n.d.). Although the alliance has not achieved its main goal – the reacquisition of Teufelsberg on the part of

the city of Berlin – it has contributed, in cooperation with numerous other actors, to thwarting a number of contentious investments on the hill, as related by our interviewee. While it has not abandoned its primary objective, its strategy has been mostly reactive, consisting in mitigating potential further damage to the site and its nature (Berlin Interview 2, 2023).

Whitewebbs Park

Whitewebbs Park is located in North London in the borough of Enfield and consists of approximately 196 acres, including an area of ancient woodland and a golf course. The presence of the Park, previously the Royal hunting grounds of Enfield Chase, can be traced back to the Doomsday book (Enfield Council, n.d.-a), with a rich history including involvement in the Gunpowder Plot and Tudor family (Friends of Whitewebbs, n.d.-a). The land was sold to Enfield Council in 1931, with the golf course constructed by Messrs Hawtree and JH Taylor Ltd in 1932 to provide income for the upkeep of the land (Enfield Council, 1932). In 2019, Enfield Council advertised and received expressions of interest from bidders for the development of Whitewebbs Park, aiming for "*the park to be rejuvenated and to be used in a way that benefits the wider local community*" (Enfield Council, n.d.-b). In 2021, Tottenham Hotspur Ltd (THL) were evaluated to be the strongest of the bidders, and proposed to enter into an Agreement to Lease for 25 years (Bradbury, 2021), based on planning permission for their development proposal (Tottenham Hotspur, 2023). During the necessary, though poorly implemented, public notice period the group "Save Whitewebbs Park" was formed from concerned members of the local community who object to the development on environmental, legal and ethical grounds (Allin, 2021; Cracknell, 2022; Enfield Council, 2022; Froends of Whitewebbs, n.d.-b). Save Whitewebbs Park are backed by CPRE and Enfield RoadWatch and are actively campaigning against Enfield Council and the Agreement to Lease (Change.org, n.d.; Roberts, 2022).

Wimbledon Park

Wimbledon Park is located in South West London and comprises approximately 270 acres of parkland (Merton Council, n.d.). The park was originally part of Wimbledon Manor and landscaped by Lancelot

'Capability' Brown in the 19th Century, work that included the introduction of the lake and several tree avenues (Rondeau, 1995). This area was bought by Wimbledon Borough Council in 1914 and used as a public park; containing the lake, woodlands, a golf course and later a children's water play area. In 1993 the area including the golf course in Wimbledon Park was sold to the All England Lawn Tennis Club (AELTC) by Merton Borough Council (Merton Borough Council Minutes, 1993). The park is widely used, accessible through multiple public transport routes and hosts community events, such as fireworks night celebrations. The park is of ecological significance, as the lake contains several important species of newts and birds (Dawson, 2021).

In 2021, AELTC submitted plans to develop new tennis courts, a stadium, supporting buildings and new pathways on the golf course site (The AELTC, n.d.). The plans were opposed by many local residents' associations and local interest groups, with this common interest the group 'Save Wimbledon Park' was formed (Save Wimbledon Park, n.d.). Save Wimbledon Park opposes the development on several grounds: legally, the land was sold to AELTC in 1993 under the covenant that there would not be significant development. Additionally, the area falls under Open Metropolitan and Green Belt land, providing significant legal protection from development. Secondarily, the land is of significant ecological importance within London and provides much needed public green space (FOWP, 2022). Thus far, the group has received a good response from local residents and politicians, bringing together a wide group of people who oppose the development proposal. Other related organisations, such as CPRE and Friends of Wimbledon Park have submitted formal complaints regarding the development.

Jardim Alfomares

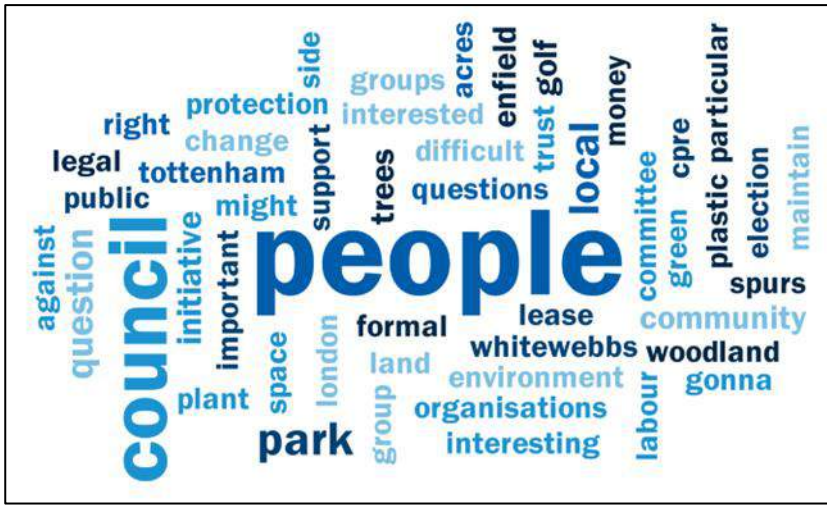
Located in the wealthy neighbourhood of Alto da Boa Vista, Jardim Alfomares comprises an area of 60 thousand square meters. It is home to water springs and a rich variety of animals and plants. Reminiscent of the native Mata Atlantica biome, the area is considered a natural "oasis" in the middle of a concrete jungle (Folha, 2020). Formerly, the land was owned by a rich Spanish entrepreneur. In the 1980s, he intended to sell the land to the Orthodox Church to build a cemetery in the area. The local community organised themselves to fight the sale and propose the

creation of a public park instead. They were successful in preventing this project from being brought forward. A few years later, the owner was mysteriously murdered in his office, a crime that shocked the city (Fatorelli, 2021). A claimant to be his heiress, successfully secured ownership of the area. The land was sold in 2001 to INPAR, a big local developer. They planned to build an enormous condominium, and, without following the right environmental procedures and regulations, started deforesting the area. The members of the initiative, who at that time had already consolidated themselves into a registered neighbourhood association, were able to stop the construction through legal procedures, by proving that the deforestation was illegal. Then, for almost two decades this matter went back and forth through the judicial system without a final outcome. The members spent lots of time and financial resources in this fight. On the 16th of November 2020, the developer decided to resume the project and once again started deforesting the area. The neighbourhood quickly mobilized in a matter of hours, albeit being under the restrictions of the Covid pandemic. The protest caught the attention of the media, and the developers halted all works. In less than a month, the CONRESP (the City's Council for the Preservation of Historical, Cultural, and Environmental Heritage) recognized the local as a preservation area. Although the Supreme Court's ruling is still awaited, the developer has agreed with the city to exchange the land for what is called a "transfer of constructive potential" (a mechanism that allows them to bypass zoning regulations in other areas, e.g., for building more floors where limits are in place). Despite some advances, the struggle continues, the initiative recently has put a lot of effort into guaranteeing that the creation of a nature reserve park appeared in the city's strategic plan (Mengue, 2022).

Parque dos Búfalos

The Parque dos Búfalos is an area located on the margins of the Billings Reservoir, one of the largest sources of drinkable water in Sao Paulo. Lying on the outskirts of the city, its surroundings are occupied by poor neighbourhoods and favelas, that began settling in the region in the 1960s. The location is close to the so-called "Great ABC", a group of cities that became a powerful industrial pole at the time. From the beginning, the inhabitants that lived near the area had an intimate relationship with it, using the space for recreational purposes, as a source of drinkable

water, as a place of worship for diverse religions and as a spot for closer contact with the nature (Parque dos Búfalos, n.d.). The area is home to as many as 20 water springs and a variety of fauna and flora. Initially, the area comprised almost 1,000,000 square meters and remained largely unoccupied, despite attempts from land grabbers to invade the place. However, in 2013, the city administration decided to use the area for building a huge affordable housing development that would bring an extra 20 thousand residents to the area, which already suffered from poverty and a lack of public services (Ramalhoso, 2019). That is when the fight to protect Parque dos Búfalos intensified. The city government was able to bypass a series of public laws and environmental regulations to quickly get the construction approved and start building. Despite that, the initiative to protect Parque dos Búfalos was still able to make the city agree on the installation of a public park comprising half of the initial area (around 500 thousand square meters). Since that time, they have worked restlessly to relocate many of the dwellers of the nearby favelas to the new buildings, while providing access to welfare to the locals, who continued largely lacking access to public facilities. In 2019, the initiative has merged with an environmental NGO called OEKOBR, which gave it full legal powers and helped in the implementation of educational environmental projects, as they were now eligible to apply for public funding. The organisation continues its fight. So far, the park has not been implemented and there is a constant struggle to avoid land grabbers from occupying the area (de Oliveira, 2023). Nonetheless, they were able to make themselves an important focal point to the local community, engaged in different kinds of activities.

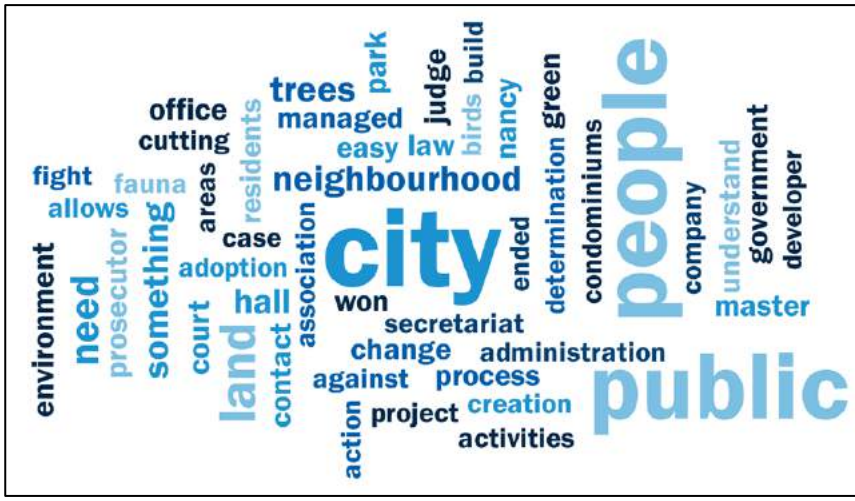


Supplementary Figure 1: word cloud of London Interview 1.

Supplementary Figure 2: word cloud of London Interview 2.

Supplementary Figure 3: word cloud of Berlin Interview 1.

Supplementary Figure 4: word cloud of São Paulo interview 1.



Supplementary Figure 5: word cloud of São Paulo interview 2.

2

INCREASING HOMELESS RESILIENCE IN EXTREME TEMPERATURES: LESSONS FROM BERLIN, SÃO PAULO, AND LONDON

P. KATTI, T. KELLY, A. MARTINS, L. S. MUÑOZ, X. ZHAI

ABSTRACT

The world faces an unprecedented environmental emergency due to climate change. Extreme weather events, such as heat and cold waves, are becoming commonplace, with vulnerable portions of society, particularly the homeless, being severely impacted. This project diagnoses the current issues of extreme temperature and homelessness in Berlin, London, and São Paulo and analyses proposals for providing short-term relief to the homeless under extreme temperatures. Methodologically, it draws upon census and meteorological data, newspaper articles, government publications, and secondary literature, and performs both qualitative and quantitative analysis. The article points to temporal and spatial mismatch between the solutions already in operation and the reality, as well as problems of scale and planification of the policies, especially regarding the increasing heat waves caused by climate change. Overall, this project points to a global concern and positions itself in the larger framework of political ecology.

1. INTRODUCTION

In a global landscape marked by a continuous rise in urban populations and the development of increasingly arid and impermeable cities, climate change will get worse if the greenhouse gases (GHG) emissions remain uncontrolled. Cities are home to 55% of the total world population and are responsible for 70% of the total GHG emissions (UCCRN, 2022). The year 2021 was considered the sixth hottest in history, and saw a number of extreme weather events, such as heat waves,[1] which have broken meteorological records in many areas across the planet (WMO, 2022). This dramatic change in climate was largely due to the increase in average global temperature recorded that was approximately 1.1 °C warmer than during the pre-industrial years (1850 - 1900).

If, on the global scale, the GHG emissions are the main driver of climate change, on the local scale, anthropogenic actions play this role (Masson-Delmotte et al., 2018). These actions are especially related to the suppression of vegetation and ground properties changing, which was done in favour of impervious surfaces. All these processes lead to an increase in the emission of longwave radiation (Stone, Jr, 2012), a decrease of latent heat available (Erell, 2017) and, consequently, to the urban energy imbalance (Oke et al., 2017) and urban heating.

While extreme weather threatens the well-being of people from all walks of life, disadvantaged communities are usually hit the hardest. The homeless, here defined as people without physical shelters, face a more severe challenge under extreme temperatures than the securely-accommodated population. The issue is a global concern and is visible in developing and developed economies alike (The Associated Press, 2022). The issue also appears increasingly pressing in recent decades, because climate change exacerbates the intensity, severity, and frequency of extreme weather events which expose the homeless to more acute and less predictable risks.

In this context, this paper aims to diagnose the current issues of extreme temperature and homelessness in Berlin, London, and São Paulo and

[1] Natural phenomena when temperatures are higher than what is usual for a place during a period of consequent days (Stone, Jr., 2012).

analyses proposals for providing short-term relief to the homeless under extreme temperatures in Berlin, London, and São Paulo. While in all three cities, especially in Berlin and London, initiatives have been proposed to protect the homeless from cold spells, limited attention has been given to the growing problem of heat.

The focus on homeless people was due to their high level of vulnerability, since they are exposed to extreme temperatures and all sorts of climatic events. Putting this aside, this population is also totally dependent on social care and public policies, which will require additional funding and expanded programmes as climate change progresses.

Comparing São Paulo, one of the largest and most important cities of the Global South, to European cities like London and Berlin highlights different aspects in terms of policy-making and social initiatives aimed at improving the lives of this almost "invisible" population: the homeless. To do so, the literature related to climate change and the effect of extreme temperatures on cities and the homeless was reviewed. The existing publicly-funded programmes and social initiatives aimed towards the homeless populations of these three cities was analysed. Lastly, we proposed our own solutions based on their features and contexts and included a risk assessment of their viability. These proposals are mainly related to urban greening, the availability of freshwater, the accessibility of information, and the development of public spaces that could shelter this vulnerable population.

2. LITERATURE REVIEW

2.1. Extreme temperatures and their effects on cities

Cities are the main areas affected by the extreme events, such as cold waves, urban heat islands,[2] landslides, flooding, and droughts (the latter two being directly related to changes in precipitation patterns) (UNEP, 2020). As direct consequences of climate change, these events are becoming more frequent and severe and sometimes occur at the same time (Stone, Jr, 2012; WMO; UNEP, 2020). Among all of them, urban heating is the most common. Its causes can be explained by four main features of the city: a lack of evaporative cooling, the reabsorption of reflected radiation, low surface reflectivity capacity, and generated heat (Duarte, 2016).

Heat and cold waves have been forcing people to face and deal with extreme temperatures very often throughout the year. Living under heat and cold stress have become as frequent as have diseases and deaths related to this phenomena. Considering the advance of urbanisation processes, in which good practices like preserving and expanding the existing vegetation have not been taken into account, promoting climate adaptation is a great challenge.

In 2020, the summer season was severe for both hemispheres, but especially for the Northern one, which registered its second hottest summer in history (Di Liberto, 2020). The same tendency was observed in other areas of the globe, which reached temperatures up to 0.94 °C higher than the average for land and ocean surfaces, the second highest value ever recorded in history (NOAA, 2020). In the same year, in Brazil, an intense heat wave took place in October, when the city of São Paulo registered 37.4 °C, the highest temperature in 2020 and the second highest of the historical average.

[2] Climatic phenomena resulting from urbanization processes in which urban areas present higher temperatures and lower humidity when compared to non-urbanised areas, with maximum difference at night, under clear sky and calm wind conditions (OKE *et al.,* 2017).

In 2022, Europe had its hottest summer in history and faced a severe heat wave in Northern and Western areas, hitting countries like Spain, Portugal, France, Italy, and the United Kingdom the hardest (Copernicus, 2022). On July 18th, London registered air temperatures of over 40 °C and very hot nights, in which people faced physical difficulties (Lydall et al., 2022). During periods like this, people become desperate to feel comfortable and seek cooling centres, outdoor spaces, such as water bodies and shaded spaces, shelters, and insulated spaces (***Figure 6***). It is important to highlight that although cold and heat waves are equally dangerous, cultural and weather aspects must be considered. In cities like London and Berlin, buildings are less prepared to face heat waves, while in cities like São Paulo, the opposite occurs.

On July 20th, 2021, the city of São Paulo registered -2.3°C in a South end neighbourhood, the lowest temperature recorded since 2004 (G1 SP, 2021). On the same day, the mean temperature registered for the entire city was 5.4°C for air temperature. In 2022, the mean temperature registered for the city was not as low as in the previous year, but even so was around 6.7 °C (G1 SP, 2022). While in Brazil, the population is not naturally adapted to this pattern of low temperature, in Europe, in cities like Berlin and London, common challenges related to the low temperatures during the winter have overlapped with the gas crisis since 2022.

Figure 6: Notices warning of extreme heat and kids playing in public water fountains in London in July, 2022. [Source: Evening Standard (2022)]

The consequences of climate change not only affect the environmental aspects, but also the economic and social ones. Another important point to be discussed is that the effects of climate change have a more severe

impact on most vulnerable people (Pörtner et al., 2022). In general, vulnerable people present more difficulties to adapt due to a lack of financial resources and low housing quality (Nobre et al., 2011). In the case of homeless people, this impact is even harder. Given that they live on the streets and are in extreme poverty, most of the homeless are heterogenous in terms of culture, have nutritional and health fragilities, and therefore face a greater challenge of surviving cold and heat waves.

2.2. The Homeless under Extreme Temperatures

While the impact of extreme temperatures on the homeless populations of cities has only captured scholarly attention recently, a number of studies have offered invaluable insights into why and in what aspects the group is particularly vulnerable. To start, the majority of the homeless come from less advantaged socio-economic backgrounds and are more likely to have experienced displacement during childhood, failed in accessing and proceeding with education, training, or employment, and developed substance abuse and mental illness during adolescence (Benjaminsen, 2015). These disadvantages trap them in poverty and homelessness, both of which further trigger physical and mental diseases, a lack of stable social networks and support, and social exclusion and discrimination (Every et al., 2019; Richardson, 2014; Sanders and Brown, 2015). Taken as a whole, the group possesses insufficient economic, social, and cultural capitals and is less resilient and adaptable to crises.

Additionally, the access and mobility of homeless populations in public spaces has been under threat in recent years due to the prevalence of anti-homeless design features. Often called 'defensive', 'disciplinary', or 'hostile' architecture, this includes benches that are unable to be used for sleeping (metal dividers, uncomfortable materials etc), use of high-frequency noise and bright lights to dissuade loiterers, and, what has attracted the most controversy, the use of spikes and fences around buildings, train stations, overpasses etc. to keep out unwanted and undesirable groups, see ***Figure 7*** for examples. These are often employed by local governments and private real estate holders, who according to J. Petty, 'make use of a range of regulatory and coercive tactics and mechanisms' to exercise their control over the type of users that occupy

public spaces and environments (Petty, 2016, 69). The homeless and specifically rough sleepers, by existing outside and being disruptive to the aestheticised image of urban capital, are the targets of such disciplinary interventions. One additional effect of these urban design barriers is they prevent the homeless from accessing the shaded areas of buildings leaving them open to the harmful effects of sun damage. It also sends a dangerous message that victims of systemic inequality have no place in cities and must be excluded rather than looked after by the authorities.

The livelihoods of the homeless are profoundly endangered under extreme temperatures. First, excess heat and cold directly threaten their physical health. For example, chronic diseases, which are prevalent among the homeless, can trigger and develop into heatstroke, dehydration, and cardiovascular, renal, or respiratory issues during heatwaves, causing slight discomfort at best and risking lives at worst (McMichael et al., 2009, Health Canada, 2011, cited in Cusack et al., 2013). While water fountains and aiding centres with cooling facilities, drinking water, and baths can help relieve the situation, the infrastructures are often undersupplied in cities (especially in downtowns, where the homeless concentrate), and many homeless lack the information as to their locations (Cusack et al., 2013). Extreme temperatures also affect mental health, with one study showing that those on medications such as psychotropic drugs might have an increased sensitivity to heat (Westaway et al., 2015). The homeless report that they are more likely to be involved in, or fall victim to, physical and verbal violence when extreme weather strikes (Every et al., 2019). It is also suggested that depression, psychosis, and drug and alcohol intake tend to surge during and after extreme weather events, especially when combined with the loss of temporary shelter and forced relocation (Every et al., 2019). Last, while some homeless earn a modest income by begging and scavenging, the income is often significantly reduced and disrupted under cold and heat waves (Every et al., 2019). In all, extreme temperatures aggravate the suffering of an impoverished, physically- and mentally-troubled, and socially marginalised community and force it deeper into poverty and homelessness.

Figure 7: Use of spikes under an overpass and a shop to stop rough sleepers. [Source: Imaginechina/REX]

3. DIAGNOSIS OF THE THREE CITIES

3.1. São Paulo

The city of São Paulo has the largest population of homeless people in Brazil; around 41% of the homeless in Brazil live here (Dias, 2021). According to the same author, from the total number of homeless people registered in São Paulo, approximately 90% of them are living in extreme poverty and 28% have been living on the streets for up to 12 months. Based on ***Chart 1***, which shows the evolution of the homeless people population in this city from 2012 to 2021, it is possible to observe that this population is currently almost ten times larger.

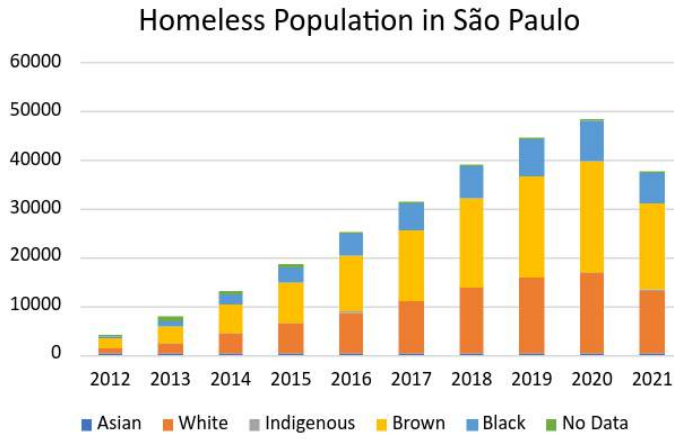


Chart 1: São Paulo Homelessness trend over the years, and its racial composition. [Source: Adapted from Observatório Brasileiro de Políticas Públicas com a População em Situação de Rua (2022) and organised by the authors.]

Another interesting statistic is related to gender predominance and age group. The proportion of men living on the streets was higher than that of women, corresponding to approximately 87%, during the entire period analysed. Regarding age group patterns, people from 30 to 59 years were predominant, which corresponded to around 70% during the whole time range analysed (Observatório Brasileiro de Políticas Públicas com a População em Situação de Rua, 2022). Overall, approximately 90% of homeless people living in the city of São Paulo can read and write, and

the majority is encompassed by black population[3] that represents more than 70% of the total. These numbers are shown in ***Chart 1***.

Homeless people are predominantly concentrated in the city centre, especially in the region of Subprefeitura da Sé and in its expanded area. However, this pattern is changing, since their presence in regions like the South and North Zones increased sharply between 2019 and 2021, by approximately 78% and 74%, respectively (Bernardo et al, 2022). The main point of this discussion is that, the further away from the central region, the less shelters and social initiatives are available (Bernardo et al, 2022). Thus, the peripheral or suburban homeless are receiving much less assistance than the central homeless, who benefit from the majority of social policies and charitable works.

A megacity with an estimated population of over 12 million people in 2021, São Paulo is classified as a subtropical metropolis (Cfa, according to Koppen classification), which presents mild temperatures and high levels of precipitation in summer (IBGE, 2023; Duarte, 2015). São Paulo has wet and hot summers, cold and dry winters and the average temperatures for both seasons are 22 °C and 17 °C, respectively (Diniz, 2022). The highest maximum temperature is expected to be registered in February, which the average is approximately 29 °C, and the lowest minimum one is expected to occur in July, when the average temperature is around 12.8 °C (INMET, 2023). Regarding precipitation patterns, the average of 1400 mm is unequally distributed throughout the year, with December, January, February, and March being the rainiest months (Duarte, 2015).

According to CGE (2021),[4] the highest absolute temperature ever recorded since 2004 was equal to 40.4 °C, which was registered on September 27, 2004 in the North Zone. On October 10, 2020 37.3 °C was the highest maximum average temperature ever recorded since 2004 for

[3] It is important to clarify that black population means the sum of black and brown people (Observatório Brasileiro de Políticas Públicas com a População em Situação de Rua, 2022).

[4] The Emergency Management Centre is the body of the city of São Paulo responsible for monitoring its weather conditions (CGE, n.d.).

São Paulo (CGE, n.d.). The lowest absolute temperature recorded by CGE since 2004 was -0.6 °C, that was registered on June 13, 2016 in the South Zone. On the same day, the lowest minimum average for the city was recorded: 3.5 °C (CGE, 2021; INMET, 2021).

Putting air temperature data aside, land surface temperature (LST) is also important to understand the extreme temperature profile in São Paulo. Beyond this, crossing the profile data of homeless people living in São Paulo with the extreme temperature patterns in the city is important to understand their vulnerability.

Parts of the city centre, South and North regions - where this population is most concentrated - are also scenarios of critical land surface temperatures (LST) during both summer and winter seasons (***Figure 8***). Most of the South and extreme North regions also presented the lowest LST during the winter, which is mainly due to its proximity to some parks and green preserved areas.

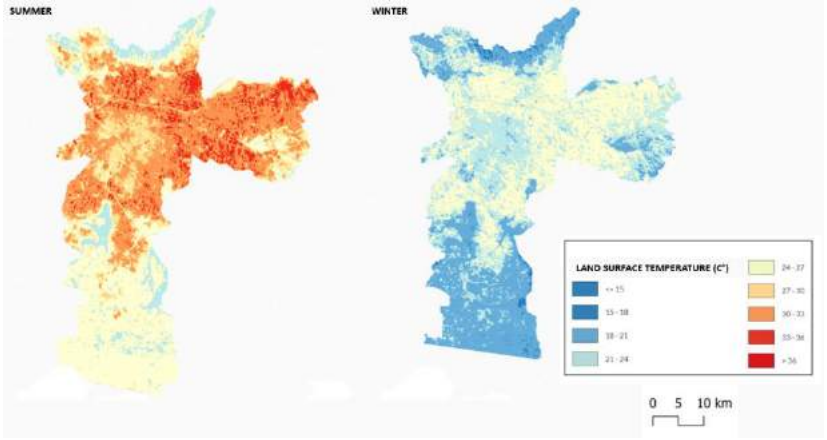


Figure 8: Land surface temperature spatial distribution across the city for summer and winter between 2013 and 2022. [Source: Map from Castro (2022) edited and modified by the authors (2023)]

During the summer (***Figure 9***), it is possible to observe that the highest values of average LST between 2013 and 2022 were registered in districts located in the expanded centre or next to it, in the North and East

areas (Castro, 2022). In most of these areas, LST values were also the 6% highest in the city during the same analysed period (Castro, 2022).

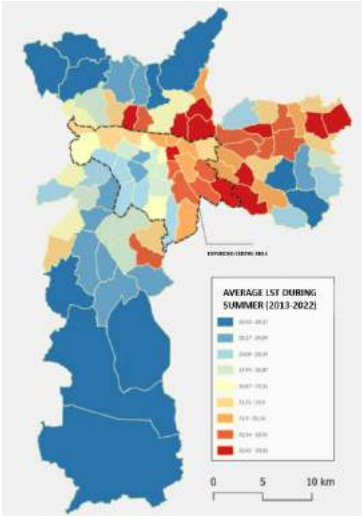


Figure 9: The land surface temperature spatial distribution across the city for summer and winter between 2013 and 2022. [Source: Map from Castro (2022) edited and modified by the authors]

From what has been discussed, it is very clear that extreme temperatures and homeless people's spatial distributions overlap in São Paulo, which increases their vulnerability. Therefore, public policies, organisations, and initiatives aimed at this situation are essential to help this population survive extreme temperature conditions.

All the initiatives presented in this topic are focused on low temperature measures. Policies and programs focused on heat and high temperatures were not only not found, but some important strategies for the homeless to get cool, such as public water fountains and faucets, were interrupted by the city hall. Having access to water is as important a measure for these people to survive extreme heat as shelters and blankets are for surviving the winter.

The lowest temperatures are expected to be recorded between the months of May and September in São Paulo, a period in which autumn

and winter take place (Secretaria Municipal de Direitos Humanos e Cidadania, 2021). During this, the temperature can be extremely low and completely different from the local patterns, which creates a critical scenario. In these kinds of situations, the homeless are the main group impacted among the vulnerable people (Secretaria Municipal de Direitos Humanos e Cidadania, 2021). It is important to highlight that CGE considers a criticality scale for air temperature and thermal sensation and emits alerts when values under 10 °C are registered (GCE, n.d.).

Thus, it is up to the government to create strategies and public policies to solve and to mitigate extreme temperatures situations. However, due to a range of reasons, the government's initiatives and programs are not always capable of tackling these problems, which makes nonprofits and NGOs' actions essential. In this context, this topic will present a public policy and two nonprofits initiatives focused on extreme cold periods in São Paulo. The former is the municipal government program 'Low Temperature Operation', and the latter ones are the initiatives developed by the NGO 'SP Invisível' (Invisible SP) and by Father Júlio Renato Lancellotti.

3.1.1. Low Temperature Operation

The Low Temperature Operation occurs throughout the city and exists from the necessity of elaborating, implementing, and monitoring the application of the 'Low Temperature Situations Contingency Plan' by the 'Low Temperature Situations Management Permanent Committee'. This plan was launched by Ordinance 513 on May 5, 2020, which resulted in the creation of the named committee,[5] and the integration of a range of annually reviewed measures to be applied when the temperatures or thermal sensation reach critical levels (Secretaria Municipal de Direitos Humanos e Cidadania, 2021). The plan relies on services already offered by the government, such as the Federal Health System (SUS), social assistance network, mobile emergency care (SAMU), and health teams

[5] Launched by decree 56.102, of May 8th of 2015.

working on the streets (Consultório na Rua)[6] (Secretaria Municipal de Direitos Humanos e Cidadania, 2021).

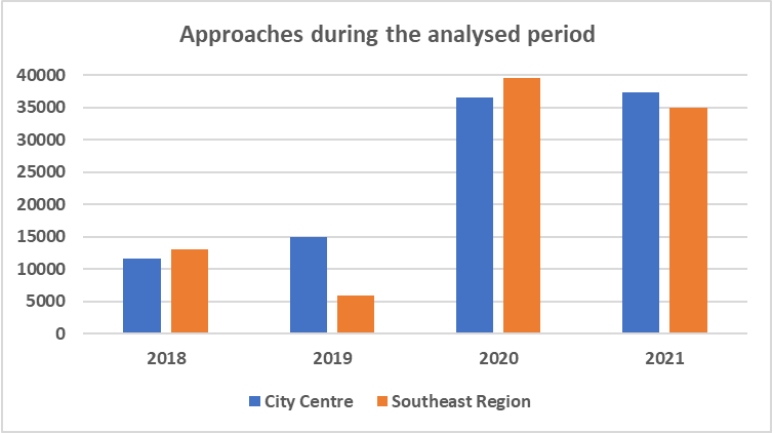


Chart 2: Total amount of approaches carried out during the operation in the city Centre and Southeast Region. [Source: Data from São Paulo (2018, 2019, 2020, 2021) and organised by the author (2023)]

According to the data available on the operation between the years 2018 and 2021, among all homeless people approached by the health care teams, most of them are men who live on the streets of the city centre and Southeast region (Secretaria Municipal de Direitos Humanos e Cidadania, 2018-2021). Numbers related to the approaches carried out during the analysed period are available on ***Chart 2***.

Another important data is related to the delivery of blankets, which the total amount in each year is plotted in ***Chart 3***. It is important to highlight that the reports about the operation in 2019 and 2021 showed conflicted data about delivering blankets. In the Official Report of 2019, it was declared that 12,150 units were delivered while, in 2021 in a comparison

[6] Formed by multidisciplinary teams acting in the city centre, the initiative is focused on on-site care for homeless people and has two main goals: (i) to insert them on the Federal Health System offering health maintenance and prevention, care and treatment for their diseases; (ii) to handle with their different health problems, including drug and alcohol addiction (São Paulo, 2014).

table, the numbers shown are equivalent to 11,771 (Secretaria Municipal de Direitos Humanos e Cidadania, 2019; Secretaria Municipal de Direitos Humanos e Cidadania, 2021). In this work, the authors considered the numbers available on the official report from 2019 (Secretaria Municipal de Direitos Humanos e Cidadania, 2019). In 2021, some additional actions were carried out to deliver water, hot food and beverages, and warm clothes (Secretaria Municipal de Direitos Humanos e Cidadania, 2021).

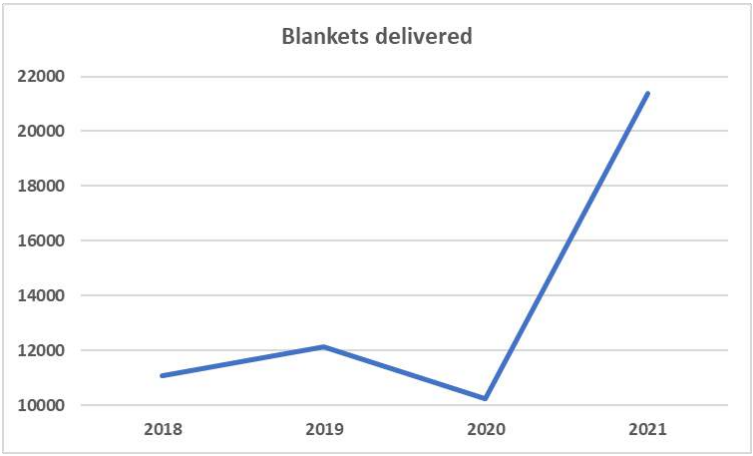


Chart 3: Total amount of blankets delivered during the operation in the period analysed. [Source: Data from São Paulo (2018, 2019, 2020, 2021) and organised by the author (2023)]

3.1.2. Invisible SP and Father Júlio Renato Lancellotti

The NGO Invisible SP was created in 2014 by André Soler and Vinícius Lima and, since then, it has helped 30,350 homeless people to survive low temperatures in the city ('INVERNO INVISÍVEL', n.d.). Nowadays, this NGO also has campaigns focused on different themes, such as Christmas and Easter holidays, Invisible Talents, and others.

Since 2016, volunteers from this NGO have been delivering a kit on the coldest nights in the city of São Paulo. This kit is composed of dental hygiene items, one glove, one pair of socks, and one sweatshirt (SP

Invisível, n.d.). It is important to highlight that all items are new. During winter campaigns, they also provide other items, such as blankets, milk, bottles of water, protein bars, cookies, condoms, soaps, and hygiene kits. Almost 30000 kits were delivered by Invisible SP between 2016 and 2022.

Father Júlio Lancellotti is a Vicar of São Miguel Arcanjo Congregation and an Epischopal Vicar for the people of the streets[7] since the 1990s where, together with his collaborators and other volunteers, have been developing important actions aimed at homeless people, especially those from the city centre (Altemeyer Junior, 2006). These actions are not only aimed at providing food, clothes, and water regularly to this population, but also providing shelter, hot beverages, and soup during the coldest days and social assistance. It is also important to say that Father Júlio Lancellotti is a public figure and, due to this, has played an important role in claiming homeless people's needs and in highlighting injustices suffered by them.

3.2. Berlin

As the biggest city in Germany, Berlin had in January 2022 3,677,472 inhabitants, from which 25,975 (0.71%) were homeless people that were registered as living in a shelter (14.6% of the total in Germany) (Hundenborn and Hees, 2023). The amount of homeless people living not in shelters, but on the streets, in parks, or train stations has been harder to measure. The first official homeless census in Berlin was organised by the Senate of Berlin in January 2020 with the participation of almost 3,000 volunteers. In the night from 29th to 30th January 2020, 1,976 people were counted as homeless on the realisation of the "Night of Solidarity" (***Figure 10***), modelled on the basis of a street census that has been conducted in Paris for the last few years ('La Nuit de la Solidarité') (Senate Department for Integration, Labour and Social Affairs, 2020). Nonetheless, the planned homeless census in the following years were

[7] Free translation of "Vigário da Paróquia de São Miguel Arcanjo" and "Vigário Episcopal para o Povo da Rua".

cancelled due to a lack of volunteers, so that a diachronic comparison would still not be possible.

From these 2,000 and more people counted on the streets of Berlin in January 2020, 14% were female, 84% male, and no intersex/diverse were identified. Regarding nationality, 49% of them were Germans, 39% came from other countries in the EU, and 11% from other states. As far as the spatial distribution of homeless people is concerned, 67% of the homeless counted on that night lived in regions inside of the Ring Bahn (the extended downtown of Berlin demarcated by a ring of train lines) and 33% outside of it.

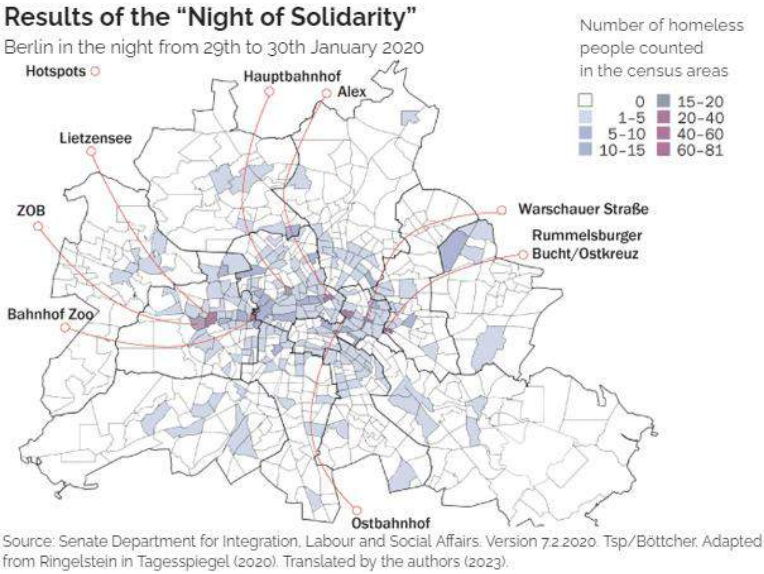


Figure 10: Results of the "Night of Solidarity".

On this map, the census areas with the largest number correspond to the ones around the main train, subway, and bus stations: Hauptbahnhof (Central Train Station), Alexanderplatz, Warschauer Straße, Ostkreuz, Ostbahnhof, Zoologischer Garten Bahnhof, Zentraler Omnibusbahnhof, and Messe Nord/ICC. Lietzensee and Rummelsburger Bucht were also central districts on this count due to the presence of homeless camping

in both parks. Since this research was conducted during a winter night, the distribution of homeless people in the city could be partly explained by the localization of these stations as big public facilities where they could find protection from the cold. Alongside that, in those places the large amount of circulation of people provides a better possibility of collecting materials and finding resources for eating, cleaning, and supplying basic needs.

Berlin sits in the transitional zone between oceanic and continental climates and enjoys a moderate air temperature in general. Over the past 150 years, the temperature averaged between 16 to 21 °C in summer and -7 to 5°C in winter (DWD Climate Data Center, 2023). In terms of precipitation, the city records more than 500 millimetres per year which distribute relatively evenly across seasons (DWD Climate Data Center, 2023). On a national scale, the Berlin-Brandenburg region ranked first in annual average temperature and second in total sunshine hours among all German states in 2016 (Berliner Morgenpost, 2016). However, some aspects regarding extreme temperatures are going to be mentioned[8].

Berlin, like São Paulo and London, exhibits some degrees of intra-city difference in temperature. Satellite data on land surface temperature (LST) suggest that central Berlin experienced a stronger heat than the outskirts in summer 2022 (see ***Figure 11***). Within the urban core, in particular, Tegel and Tempelhof registered averages over 43.9°C. Meteorological data on average air temperature indicate a similar trend. Between June and August 2022, Southeastern Berlin, comprising Tempelhof, Marzahn, and Schönefeld, was at least 0.7 °C warmer than the rest of the city. In winter, as shown in ***Figure 12***, the intra-city difference of LST appears much less obvious.

[8] The exact definitions of extreme temperature, especially the points beyond or below which the temperatures should be considered harmful, differ from one country to another. In Germany, the DWD describes apparent temperatures above 32°C (= air temperature 30°C) as severe heat warning and those above 38°C (=33.6°C) as extreme heat warning. In winter, severe and extreme cold warnings are issued when apparent temperatures drop below -26°C (=-19°C) and -39°C (=-32°C) respectively (DWD, 2023).

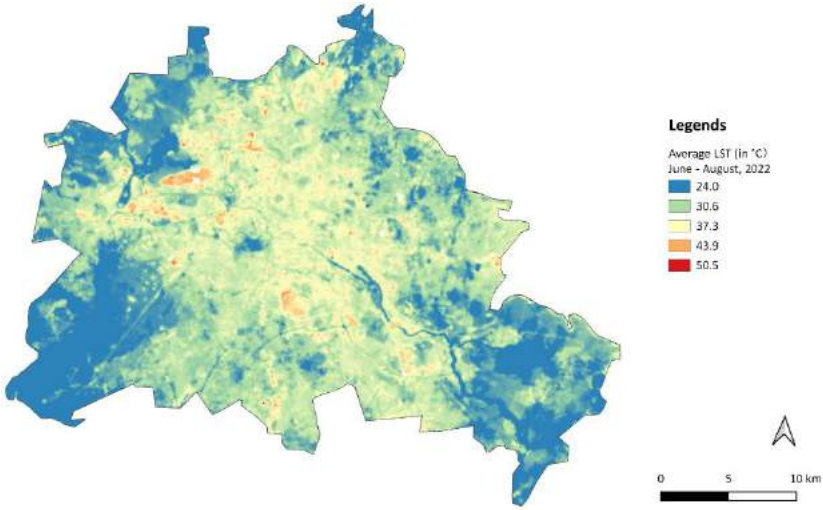


Figure 11: Average LST in Berlin, Jun-Aug 2022.
[Source: https://earthexplorer.usgs.gov/, mapped by the authors]

Long daylight hours, plenty of sunshine, and warm weather make summer the best time to visit Berlin. Between June and August 2022, the city's daily average air temperatures ranged from 14°C to 29°C, which were very pleasant (see ***Chart 4***).[9] However, our data on daily maximum air temperature in the same period indicate that heatwaves did occasionally strike and could go rather intense. Out of the 92 days of observation, 22 recorded a city-wide maximum over 30°C (June 18-19, June 23-27, July 3, July 19-21, July 25, August 3-4, and August 11-18) and 9 over 33.6°C (June 18-19, June 27, July 19-20, July 25, August 3-4, August 17).

In addition, records of excess heat were not evenly distributed across the city. As shown in ***Table 3***, weather stations of Buch, Marzahn, Schönefeld,

[9] In this section, city-wide air temperatures (including averages, maximums, and minimums) are determined based on meteorological data of ten weather stations in Berlin-Brandenburg (namely Ahrensfelde, Alexander Platz, Buch, Dahlem, Marzahn, Potsdam, Schoenefeld (Schönefeld), Staaken, Tegel, and Tempelhof) in the concerned time period.

Potsdam, and Tempelhof reported daily maximums above 30°C and/or 36.6°C more often than others. That said, the southern and eastern parts of Berlin were more severely impacted by the heatwaves.

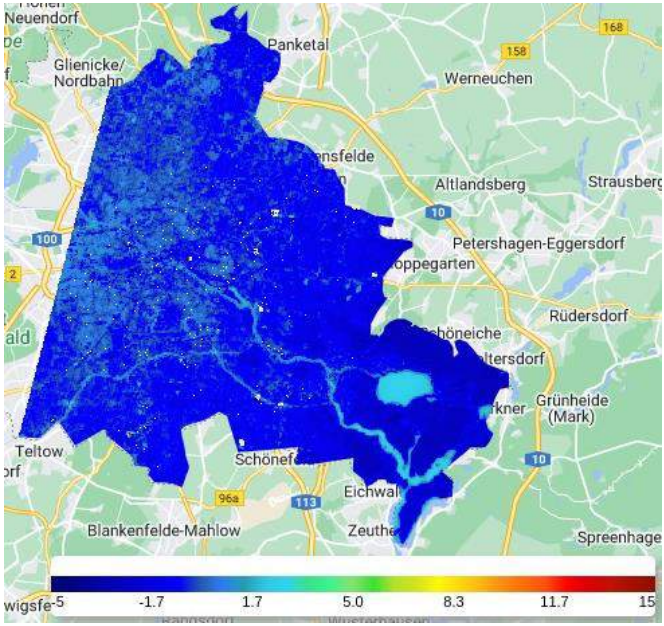


Figure 12: Average LST in Berlin, Dec 2022-Jan 2023.
[Source: https://earthexplorer.usgs.gov/, western Berlin data incomplete, mapped by the authors]

Berlin is less troubled with extreme temperatures in winter. Between December 2022 and February 2023, its average daily temperatures never dropped below -7°C, not to mention -19°C or -32°C. With regards to daily minimums, the lowest record was registered on December 15 at -12.3°C (see ***Chart 5***). Eastern Berlin, particularly Schönefeld and Ahrenfelde, presented lower temperatures than other districts.

In summary, while Berlin enjoys a temperate and mild climate in general, it sometimes undergoes severe and even extreme heatwaves in summer, which then impose a significant threat on the health of its inhabitants.

Southern and Eastern Berlin, including but not limited to Buch, Marzahn, Schonefeld, Potsdam, and Tempelhof, are areas of special concern.

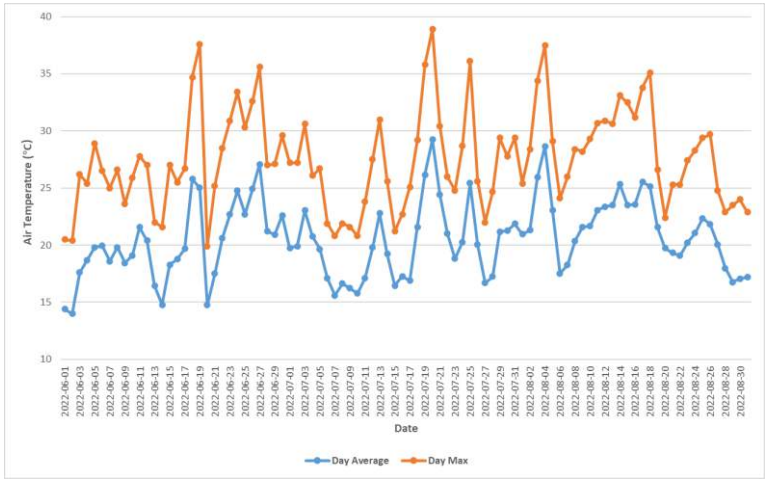


Chart 4: Daily Average and Maximum Temperatures in Berlin, Summer 2022. [Source: https://meteostat.net/en/, graphed by the authors]

Table 3: Number of Days under Extreme Heat at Various Locations in Berlin, Summer 2022. [Source: https://meteostat.net/en/, processed and mapped by the authors]

	Number of Days Max >=30°C	Number of Days Max >=36.6°C
Ahrensfelde	13	1
Alexander Platz	13	1
Buch	21	2
Dahlem	19	2
Marzahn	20	3
Potsdam	21	3
Schoenefeld	21	3
Staaken	12	0
Tegel	13	1
Tempelhof	21	3

In Berlin, there are long standing facilities and public policies for homeless people in low temperatures, whereas, for hot temperatures, some actions have been taken only in the last few years. These occurred

especially since around 2020, as a sign of the adaptation of the already existing organisations working with homeless populations in the city. Those initiatives are ruled by NGOs and financially supported by the Berliner Senate. In general, they work with homeless people all year long, not only during extreme temperature events. Some are also by religious institutions, such as Berliner Stadtmission, under the umbrella of the Evangelical Church Berlin-Brandenburg-Silesian Upper Lusatia.

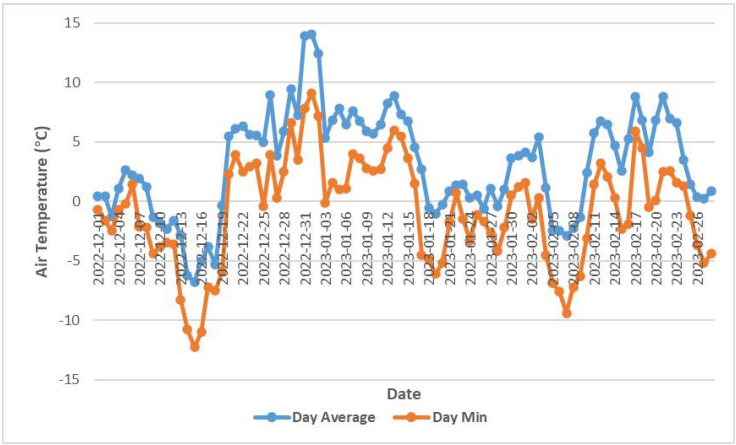


Chart 5: Daily Average and Minimum Temperatures in Berlin, Winter 2022/23. [Source: https://meteostat.net/en/, graphed by the authors]

In the cold periods of the year, there are two main policies. On the one hand, shelters for homeless people, either all day long or only during the night. Berliner Stadtmission runs a series of Kältehilfe (Cold Aid) facilities and a Kältebus (Cold bus) in Berlin from November to March of every year. Another important organisation is Berliner Kältehilfe, which provided 1426 places for homeless people to sleep in 2021, from which 624 could be used around the clock every day. In that same year, two metro stations were open all night for homeless people: Südstern and Lichtenberg.

On the other hand, there are Wärmebusse (Warm Busses), conducted by volunteers from the German Red Cross (DRK) or from Stadmission. They provide homeless people with blankets, sleeping bags, sleeping mats, hot tea, and even drive them to emergency shelters. The buses of some NGOs

also connect homeless people to shelters. Karuna Task Force, for example, runs both a 'warming hall' in Kreuzberg, where hot food, cake, coffee, and tea are served daily, and a bus that accompanies people to emergency shelters from 5 pm.

When regarding policies for homeless people in high temperatures, those for relieving the health consequences caused by the heat are being implemented, in a strongly experimental way. Three types of initiatives can be highlighted. First of all, shelters. Although homeless people in Berlin during the summer tend to stay in parks or green spaces or under bridges as in Ostbahnhof or Bahnhof Zoo, providing a shelter in other parts of the city can be fundamental for surviving the heat. The pilot project of IB Berlin-Brandenburg maintains in Schöneberg a shelter, where up to 90 homeless people per day were expected in 2022 (Lehmann, 2022). Homeless people may stay there daily from 10 am to 8 pm, take a shower, rest, and have access to laundry facilities and counselling services. Financed by the Berlin Senate with around €106,000, this shelter has 30 beds and also hand out items for heat protection, e.g. refillable bottles, sunscreen, hats, sleeping bags, toiletries, face masks, and fresh clothes. Berliner Stadtmission has since August 2022 also managed a Sommerhilfe (Summer Aid) and a shelter limited to half of this capacity during the warm season in Lichtenberg station. Alongside they also run a website that provides information on how to help homeless people in heat waves.

Second, facilities for combating dehydration. A fixed facility for this purpose is the Hygiene Center of Stadtmission at Zoo, where 600 to 1000 people come every day until 11 pm looking for a place of refreshment and protection. There they are provided with water, towels to cool their necks, caps, umbrellas, and sunscreen. Berliner Wasserbetriebe also plays a role on this task by publishing a list of all public drinking fountains on the Internet and by the implementation of a Refill sticker, found in many Berlin cafés, bars, and stores where anyone may have access to tap water free of charge.

Third, the cooling buses, where homeless people can temporarily stay and recover from heat stress. Operated since 2020 by Karuna, they cross the city distributing water, sunscreen, sunglasses, and toiletries to people without a home. The Berliner Senate has supported the Karuna initiative

with €400,000 annually and finances the positions of the pilots of those buses through the Solidarity Basic Income project.

Both for cold and hot temperatures there is a more permanent solution being implemented in Berlin: no more homelessness in the city until 2030 (Loevenich, 2022). The Project Housing First, and its branch Housing First for Women, is one of the main policies for this goal and it operates with the premise that first homeless people need to get an accommodation, only then the other problems (rent payments, therapy for addictions etc.) may be tackled. In its 2022/2023 budget, the Berlin Senate has expanded this project and set aside 6.1 million euros for this initiative.

3.3. London

London, as the largest metropolitan centre in the United Kingdom, has always had the highest number of homeless. Yet, due to a number of contributory factors, the figures have risen to dangerous levels in the last few years, which has forced the London Mayor's Office to increase its rough sleepers budget and independent homeless charities to appeal for more donations. It was reported by homeless charities that between June and September 2022, the number of rough sleepers increased by 24% in London, representing another 3,600 people on the streets (Booth, 2022). A report from Westminster council has shown that the number of families lodging in hotels has increased by 1,740% or 184 people, which is an increase from only 12 households placed into temporary accommodation in 2020/21 (Bloomfield, 2023).

It is predicted the issue of homelessness will continue to worsen as a consequence of the cost-of-living crisis created by rising inflation rates and the stagnation of disposable incomes. The rate of inflation tracked using the Consumer Price Index (CPI) as of March 2023 was 10.3%, which has led to soaring food prices, unaffordable energy costs, and high accommodation fees. The Combined Homeless and Information Network (CHAIN) predicts that such factors by preventing people from paying their rent or mortgage will increase the risk of individuals and whole families becoming homeless (Fox, 2023). Thus, the cost-of-living crisis is

a new catalyst that is accelerating the homeless crisis that will put added pressure on current programmes and services.

This rise was also a predicted consequence of the government's benefit cap on universal credit, which imposed a limit on the total amount of social welfare payment that can be claimed by out-of-work households. The current gap is £486.98 per week for couples in Greater London and £326.29 per week for single adults, but with the 11.59% increase in rents from £1381pcm to £1541 pcm means social income is being stretched to its absolute limits. Although the benefit cap is slightly higher for Londoners, the Department of Work and Pensions has shown that residents of the capital are more likely to have their benefits reduced than other regions, and the increased rents are putting additional pressure on housing options services and homelessness organisations.

Figure 13 shows the massive increase in rough sleepers after the pandemic to over 4000 and the current return to this trend of escalation in the last two years, which is once again approaching and is predicted to exceed this dangerous and sustainable level.

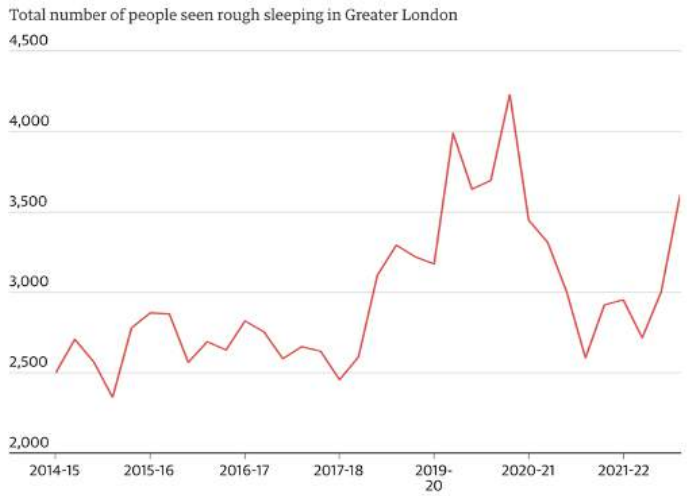


Figure 13: Total number of homeless people sleeping in Greater London Jun-Sep [Source: The Guardian and CHAIN Quarterly Reports (2022)]

In 2021/2022, the highest number of homeless in the capital are located in the core areas, most significantly the borough of Westminster with 1,968, followed by Camden and Ealing, with 666 and 448 rough sleepers (CHAIN, 2022). It is in these locations and other areas of central London that have the highest land surface temperature (LFT), which makes the homeless the most susceptible to issues related to global heating from human-induced climate change.

While once a predominately colder and temperate climate with short periods of heat, London's weather patterns have become increasingly polarised between hotter, drier summers and extremely cold, damp winters. The average temperatures for London was 19 degrees in the summer and 5 degrees in the winter, but the summer has seen highs of 40 and winters below freezing. In the UK for 2022, there were three serious storm threats, two heatwaves, torrential rainfall leading to floods, and icy weather with snowfall in November, making it the most unpredictable weather year on record. These extremes, according to the National Trust, will become 'the new normal' over the coming decades, with rough sleepers out in the open being most vulnerable to these rapid changes and requiring additional support (National Trust, 2022).

The most significant change has been the prevalence of heatwaves, which were once a rarity and have now developed into a yearly phenomenon. Their increased frequency and intensity in London and elsewhere in the UK have been recognised as poses a risk to the mortality of specific populations: the elderly, infants, outdoor workers, and those with preexisting health problems. The most affected group are the homeless, whose marginalised identity means they lack either the financial or environmental means of avoiding long exposure to the sun.

Increased exposure to heat can leave the homeless vulnerable to dehydration, heat strokes, overheating, and sunburn, which, if left unremedied, can be damaging to their heath and even fatal. Ramin and Svoboda have demonstrated that the homeless are already susceptible to disease processes, including chronic illnesses, respiratory problems, substance abuse, mental health disorders, and alcoholism, with the effects of climate change exacerbating and rendering them ever more vulnerable to these conditions (2009).

In 2022, London experienced one of the hottest summers on record (***Figure 14***), with temperatures exceeding 40 degrees leading the London mayor, Sadiq Khan, to trigger SWEP (the Severe Weather Protocol). This is typically used for when temperatures plummet below freezing, but with the severity of the heatwave, with even night-time temperatures not dropping below 27 degrees, the declaration of SWEP was a necessary strategy to ensure councils recognised their responsibility to provide essential accommodation to rough sleepers. During the heatwave, many homeless charities and shelters, including those in Stratham, Deptford, Camden, and other councils, extended their opening hours into the afternoon and evening to cope with the demand. There were appeals sent out to the local community for donations to buy water, sun cream, and offer their time to advise the homeless on how they can combat the worst effects of the heatwave.

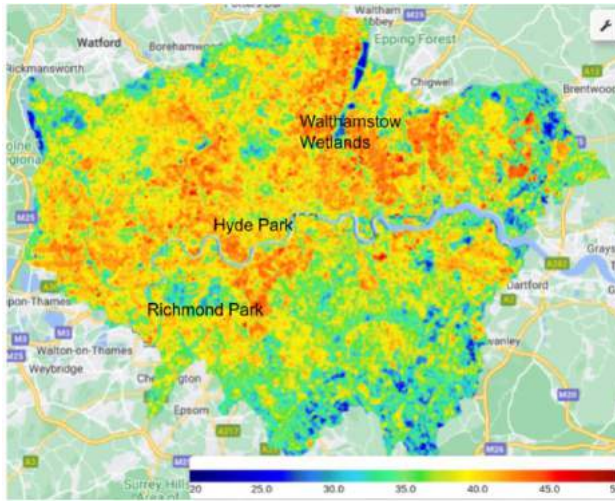


Figure 14: **.** London in Hot weather- July 2022. Some of the areas marked here are blue and green spaces, which are cooler than their otherwise hot surroundings. Inner boroughs, like Westminster, which tend to have more homeless population are hotter. [Source: Landsat-8 LST. Created by authors using Google Earth Engine]

London faces three major climate risks: flooding, drought and heating (GLA, 2022). London has already seen devastating effects of heatwave when a particularly deadly one killed around 600 people in 2003 (GLA, 2022). Figure shows the heatwave map of London, taken from LandSat images.

A project undertaken by GLA and Bloomberg Associates maps climate risks in terms of variables like heat, water cover, green cover and across various vulnerable categories and groups (GLA, 2022), which has then been converted into an interactive map. A snapshot of heat risk is shown in ***Figure 15***, which is organised between high and low heat risk areas. Maps like these can be important tools to guide policymakers to channel adaptation resources to vulnerable areas and communities. We however, note the absence of rough sleepers or homeless specifically in the map as they are lumped in with the others despite being the most at-risk category (GLA and Bloomberg Associates, 2022).

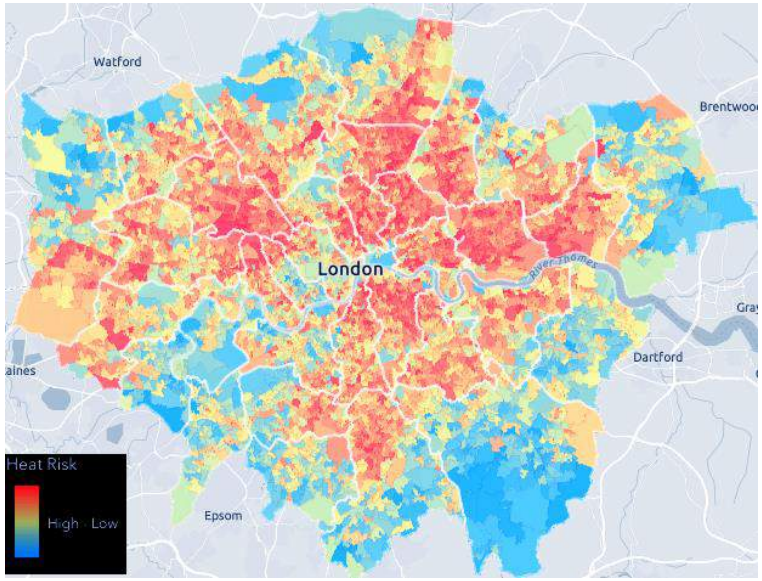


Figure 15: Climate risk map for heatwave. [Source: Climate Risk Mapping- GLA and Bloomberg Associates, 2022]

Heatwaves can especially be devastating on extremely vulnerable groups like the homeless. A study by the museum of homelessness found that the number of homeless people dying jumped from 80 in May to 120 in June 2019, making June the deadliest month for the homeless and contrary to the common perception that winters are usually the deadlier.

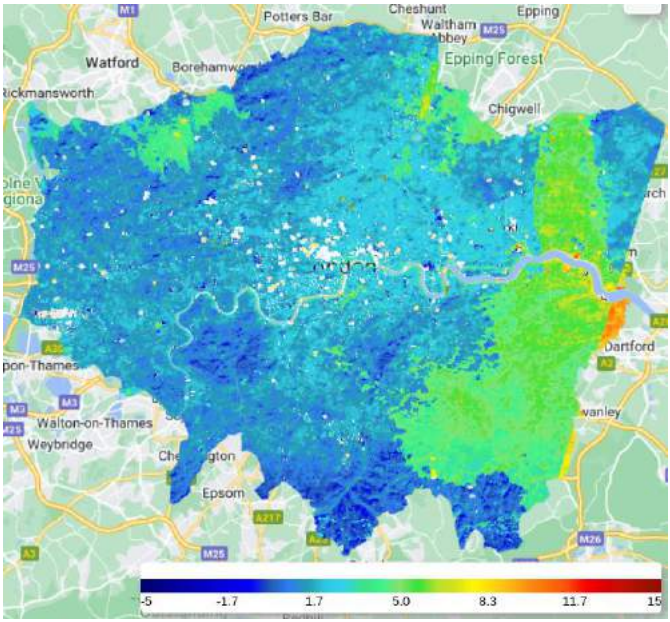


Figure 16: Winter of 2022 map of London (Dec 2022). [Source: Created by authors using Google Earth Engine]

London also suffers from frequent bouts of cold wave, as experienced last year in December (***Figure 16***). This was due to cold air being pushed from the Arctic into the UK. This was not caused by climate change though. In fact, studies suggest that climate change will result in reduction of intensity as well as frequency of cold waves as temperatures get warmer (Carrington, 2022; Met Office, 2021). That being said, the phenomenon of cold waves will continue to occur due to variations in weather patterns, and it is important to have plans for adaptation as well as plans to protect the especially vulnerable people from cold weather.

A report by BBC health and science correspondent meant to shed some light on the compound effects of cost of living, fuel poverty and effect of cold weather showed what the lack of proper heating does to a body. The conclusions are illustrated in the ***Figure 17***. While this was not specific to rough sleepers, we can conclude that the health effect on those lacking proper housing and insulation would be far severe.

Figure 17: Effect of cold on body [Source: BBC]

During his five years in office, the London Mayor Sadiq Khan has increased the rough sleeping budget from £8.45 million to £36.6 million per year, a figure that demonstrates the escalation of the homelessness crisis in British cities. While much of the funding goes towards rehousing, there are a number of programmes, policies, and services that are specifically designed or generally assist the homeless during times of extreme heat and cold. The increase in emergency weather events, particularly heat waves, has driven the Mayor's Office to fund initiatives to provide the homeless with access to clean water, locate cool spaces, and find temporary and long-term accommodation.

First, the 'Cool Spaces' initiative launched and funded by the mayor's department, provides a map of indoor and outdoor spaces where all

members of the public can find shelter during heatwaves. The project went live on June 1st and continued until September 2022 and will be reinitiated every year. Cool spaces are registered by local boroughs, charities, religious organisations, community groups, and others at various locations across the capital and then checked and verified against the established criteria and different classifications established by the project organisers. As well as outdoor and indoor cool spaces, the project uses a colour-coded method to show the location of water fountains, water courses (rivers, lakes etc.), tree canopy cover, and general cooler areas based on the average land temperature i.e. unbuilt up areas outside the urban centre.

Second, the 'In for Good' policy ensures that rough sleepers who have been placed in temporary accommodation will not be moved unless a suitable alternative living place has been arranged due to the severe risk to their health of them returning to the streets. It was first established by the Mayor following the use of the SWEP protocol, which guarantees accommodation to rough sleepers during the humanitarian crisis of extreme weather events, and the COVID-19 emergency accommodation drive known as the 'Everyone In' initiative. All London councils have agreed to this new policy, which means that once someone has been housed under the SWEP protocol a support plan for them will be drawn up and they will remain in sheltered accommodation even after the temperatures return to a more habitable level.

Third, Sadiq Khan has promised to increase the number of drinking fountains in the capital, which has seen many of its decorative, Victorian-era dispensers introduced as part of a public welfare drive in 1859 closed or left unused for years. The Mayor's office has partnered with Thames Water to deliver 100 drinking fountains in central London, which are principally being installed for sustainability reasons to reduce the use of plastic bottles yet will also offer the city's homeless a free and accessible means of keeping hydrated during heatwaves and throughout the year. However, many of the city's public fountains, such as those found in Hyde and Regents park have been switched off in recent years because of concerns that the homeless were using them for bathing and washing their clothes.

Fourth, the Streetlink website and mobile app funded by the Mayor of London allows members of the public who are concerned for the health and welfare of rough sleepers to report this to an outreach rapid response team who will offer support to the identified person. Information such as appearance, location, and reason for outreach are given in an online form that will assist the team in finding them and performing an assessment, which will involve them strategizing how best to end their time as a rough sleeper. During times when SWEP is in effect, the person in question will be immediately placed in accommodation as per the rules of the emergency protocol.

4. RECOMMENDATIONS

This discussion on the homeless resilience to extreme temperatures naturally invites questions on the possible actions focused on climate adaptation, which represents the adjustment to the current or expected climate and its effects (UNEP, 2022). For human systems, this adaptation process seeks to moderate the harm to which they are exposed or take possible beneficial opportunities (Pörtner et al., 2022). This will involve recognising that their vulnerability can be used to incentivise change in governance and policy-making practices for the creation of healthier and more environmentally resilient cities for everybody.

4.1. Universal Solutions

In the cities discussed, the built environment contains a number of solutions to ensure the climate adaptation of homeless people, which are universally applicable. If the presence of vegetation can help to mitigate extreme temperatures, cooling centres and transient structures, in turn, can provide safe spaces where people can feel comfortable when the weather is challenging. London and Berlin have cooling places throughout the city in both outdoor and indoor areas. For the former, these outdoor spaces are encompassed by water fountains, parks and vegetated areas (GLA, 2023), while for the latter, mostly indoor spaces are available (Exberliner, 2022). It is important to highlight that, for both cities, these indoor cooling places are mostly museums, shops, and private spaces, where homeless people do not have access and are not welcome, which emphasises how important outdoor and urban open spaces are for them to survive extreme temperatures.

While implementing vegetation across the urban fabric is the most effective and cost-effective way to manage rising temperatures (Stone, Jr, 2012), trees are the most suitable strategy to regulate the urban microclimate and to improve thermal comfort at the pedestrian level (Santamouris et al., 2018). Once the surface temperature is reduced in shaded areas, especially due to shading and evapotranspiration effects provided by trees, the air temperature and mean radiance also decrease (Erell, 2017). Thus, by increasing the urban canopy through the planting of more trees and parkland, especially in downtown areas, the heat island

effect can be vastly reduced (Akbari et al., 1997), and more shaded areas can be created to shelter the homeless, whose marginalised identity forces them to spend their time outdoors. We have also observed this correlation, as marked in the heat map of London, available in this document. Therefore, vegetation is a key element to promote adaptation and mitigation to climate change extreme events (UNEP, 2020), such as heat waves.

Access to clean and fresh drinking water is a particularly important initiative to protect the homeless from the health consequences of extreme heat. In London, the Mayor's office has already opened up more public fountains and created an online map showing where they are located, a strategy that should be replicated in the other cities. In Berlin, there are currently 201 public drinking fountains with more set to open, but they have yet to be mapped. As a result of recent crises, there are vast differences in the water availability between London and Berlin, and São Paulo. In São Paulo, a series of droughts in 2021 and 2014 led to the increasing shortage of water that resulted in secretive rationing that severely affected the poorest neighbourhoods, who experienced a rise in dysentry, dehydration, and dengue (Cohen, 2018).

The cities should also work harder on taking regular homeless censuses and gathering comprehensive information from both street sleepers and users of different kinds of shelters. Public authorities and other institutions are encouraged to collaborate in this mission. If they collect the data separately or through different means, it is important to exchange, compare, and combine the results with caution to grasp the full picture. In London, borough councils take the lead in collecting the information and have produced rather strong data. In Berlin, both the state government and some homeless shelters have worked in this direction, whereas communications between them appear to be limited. In São Paulo, similarly, the city hall and the Federal University of Minas Gerais perform separate surveys on the homeless and present different results.

Articulated with these measures, it is important to have policies in place for granting accommodation off the streets, ensuring that this population can be in a more comfortable and secure situation during periods of extreme temperatures. An important initiative is preventing people who

already are in shelters from going back into the streets. The "In For Good" principle implemented in London requires that no person placed in emergency accommodation is asked to leave it without an offer of support to end their situation of sleeping on the streets. As part of the response to Covid-19 pandemic, homeless people were taken into hotels and following this principle fewer than one in four returned to rough sleeping. Another crucial initiative is policies for housing for everyone. As Housing First in Berlin demonstrates, a coordinated plan for providing accommodation for the homeless population is crucial, particularly in the case of a city like São Paulo with a significant number of unsheltered individuals. This approach prioritises immediate housing solutions rather than relying on intermediate-term policies. Considering also the current rising in homeless populations in different cities, only with a housing vision can the homeless situation be solved in a sustainable way.

The improvement of public measure coordination at the municipal level is vital. One effective approach, inspired by the heat work group in San Diego County, USA, involves establishing proactive heat interventions ahead of critical moments (Baker, 2019). A central task of such groups would be information campaigns on what to do during extreme temperatures. In these campaigns, it is imperative to prioritise homeless populations in terms of accessing cooling places and free water resources, especially for those living in areas with limited green space or insufficient facilities (Baker, 2019). Another important dimension would be to inform the general population on how to recognise signs of health threatening situations under extreme temperatures and how they could be truly helpful with homeless people and other vulnerable populations.

4.2. Solutions Targeted at the Cities Discussed

4.2.1. São Paulo

Considering all the content on public policies and initiatives presented in the diagnosis section, some gaps must be discussed. Firstly, there is a lack of actions and initiatives focused on extreme heat. Maybe due to the tropical climate conditions and to consider that people are naturally used to the heat, the existing initiatives are mainly aimed at cold days. Moreover, this situation is aggravated by: (i) the inactivity of drinking

fountains and faucets, since having access to water is essential for controlling humans' body temperature, for hygiene and for increasing their sense of comfort; (ii) the lack of trees and urban vegetation throughout the city, especially in the city centre. Secondly, the new pattern of homeless concentration in different areas beyond the city centre, such as in the North and South zones, demands a new scheme of facilities, shelters, and initiatives focused on these regions.

Thus, the solutions proposed in this work aiming at extreme hot temperatures are: developing public actions on distributing free water, making water faucets and drinking fountains available and developing and implementing public policies and efforts aimed at this period. Another important solution is increasing the presence of trees and urban greening throughout these places, so plans and programmes related to it should be created and strengthened. Although this is a long term solution, it has been started already. During periods of extreme cold, the city hall plays a vital role in addressing the needs of homeless individuals by implementing measures such as establishing facilities, shelters, and targeted public policies that align with the geographic distribution of this vulnerable population.

For both periods of extreme temperatures, this work proposes the implementation of cooling and heating centres, transient structures where homeless people could feel sheltered, thermally comfortable and escape from the streets for a period of time. In addition to this, we propose more access to information, so that these people could be prevented from these extreme events, know where all these facilities are located and how it is possible to be protected and to escape from these extreme situations.

4.2.2. Berlin

As reviewed in Section 3.2.3, public authorities and social initiatives in Berlin have developed a number of solutions to protect the homeless from extreme temperatures. However, there are at least two gaps worth noticing. First, while meteorological records show that heatwaves are a more severe challenge than cold spells, most anti-heat measures at present are only experimental. Second, while homeless shelters and

other supporting facilities tend to concentrate near the Zoo (i.e. north-western part of the city centre), the homeless scatter across the city centre. The Southern and Eastern districts, in particular, register the highest temperatures during heatwaves and accommodate a considerable amount of the homeless population, but have almost zero shelters or facilities.

In light of these limitations, we propose the following solutions: the establishment of a coordination centre for high temperatures in Berlin, taking actions before and during the critical moments of the year; upscaling the facilities aiming at homeless population in heat waves, the amount of cooling places and of free access to water in the whole city centre and on southern and eastern districts, and also in the capacity of the facilities in the north-western areas; the implementation of measures to guarantee that the sheltered homeless population be maintained in shelters and not return to the streets, especially during heat and cold waves.

4.2.3. London

Although the Mayor's office has scaled-up its funding and coordination efforts by initiating a number of successful solutions to tackle the homeless crisis in London, there are still a number of ways that these can be improved upon. These solutions are principally related to the new policies initiated in the last few years to address the heightened vulnerability of the homeless during the recent summer heatwaves in London and, more specifically, the rise in LST in central locations like Westminster, where the majority of rough sleepers can be found. Due to this weather scenario of extreme high temperatures becoming the norm in the future, rather than being treated like an emergency event, as was the case in the past two heatwaves, preparations such as increased access to cooling centres, health services, and water fountains should be triggered much earlier to better shield the capital's most affected.

Our recommendations for London are merely to scale-up the existing policies to ensure they can assist the maximum amount of people across all metropolitan regions. In terms of water fountains, there are far too few, especially in Westminster and across West London, such as

Wimbledon, Fulham, and Hammersmith. There needs to more publicly funding drinking fountains across all areas of London especially during the high-points of summer to combat dehydration and other heat-related ailments, which will prevent the homeless desperately resorting to ornamental fountains. The same can be said for cooling spaces, in which West London is once again deficient, while the centre has a large concentration. Although the Mayor has committed to increasing tree canopy by 10% by 2050, this will likely be deficient and too late to hold any benefits. The priority lies in the expansion of canopy cover, extending beyond parks to include the streets, thereby offering a natural shading solution for the enjoyment of all Londoners. Lastly, it is crucial to maintain the 'in for good' policy and expand the SWEP initiative to provide year-round coverage, rather than limiting it to times of extreme weather.

4.3. Challenges for Implementing the Proposed Solutions

Pandemic and global economic crises have severely impacted net public spending in general. In Britain, the added effect of austerity related cuts and benefits restriction over the decade have rendered public services more fragile (Hoddinott et al., 2022). This has impacted funding for homeless initiatives as well, with a study finding a reduction of up to 50% in homeless spending by local authorities from 2008-09 to 2017-18 (Thunder and Rose, 2019). The budget for homelessness has been increasing under Mayor Sadiq Khan's compared to Boris Johnson. However, there has been a staggering 26% annual increase in rough sleeping in 2022 (Wilson and Barton, 2018). This has also been coupled with reduction of local council housing budget by 1.8% in 22-23 compared to 21-22 as well as housing benefits being cut by 9.9% (Dept of Levelling Up, Housing and Communities, 2022). This reduces efforts to being down rough sleeping and puts increased pressure on local Councils to provide homeless services. The homeless charity Crisis estimates that England is already set to miss the target of ending rough sleeping by 2024 (Murray, 2023). London Boroughs get around 60% of their funding from government grants, so the Chancellor's call for "asking all government departments to find additional efficiency savings", coupled with a £40 bn

gap estimated by OBR represent the financial challenges councils are up against (Hoddinott et al., 2022).

Census taking can be an expensive, time-consuming, and cumbersome business. The 2021 census for London, for instance, costed around 800 million pounds, which was almost 1% of the total public expenditure (Brien, 2018). Homeless censuses, though much smaller in scale, also require genuine financial support. In addition, censuses can only be delivered with a significant input of manpower. It usually takes weeks or even months to secure census takers and offer them proper training in data collection, correction, and maintenance. For homeless censuses, special training on interview and communication skills may also be a necessity.

Since some important solutions are not short term, an important question on their implementation is as state policies or government policies, i.e. policies that are bidding through different conjunctions in a city or ones related just to one government. The contemporary political conjunction in each city implies different tendencies on the amount of resources that most probably could be directed for implementing these solutions. Whereas there is a higher probability of the continuity of policies for homeless people and also the implementation of some of our solutions by the London government due to the city being currently ruled by a centre-leftist authority, the Labour party and its mayor Sadiq Khan, this is not the case for Berlin or São Paulo. The government of Berlin is currently under the lead of centre-right politicians, and São Paulo by a right-wing mayor and governor, who are implementing politics of violence and expulsion of homeless people from the city.

Public opinions regarding censuses and social surveys require careful consideration. Out of mistrust in authorities and/or strong intentions to protect personal data, at least some people remain sceptical about census taking and resist it by either avoiding the questions or giving out wrong information. The issue is particularly acute in countries like Germany due to historical reasons (Fuhrmans, 2011). While conducting homeless censuses, therefore, extra efforts may be needed in explaining the motives to the homeless and social workers, describing how the data gathered will be deployed, and encouraging them to participate and provide honest information.

5. CONCLUDING REMARKS

Recent decades have witnessed the surge and exacerbation of extreme weather events, natural disasters, and cost-of-living crises in many parts of the world. These challenges cry out for a systematic reflection on how sustainability can be promoted and realised in different and fast-changing socio-environmental contexts. This paper examines the impacts of extreme temperatures on the homeless population in London, Berlin, and São Paulo. It reviews key literature, surveys the current conditions, and analyses policies in operation. It contends that while public authorities and social organisations have offered realistic solutions to protect the homeless, additional efforts are needed to drive the mission forward. In all three cities, it is important to increase the coverage of vegetation, install and map more public drinking fountains, conduct regular homeless censuses, plan both emergency and long-term housings, guarantee the homeless' access to information, and improve coordination between institutions at different levels.

With regards to individual cities, we suggest the following. In London, it is essential to honor the funding commitments made by the mayor regarding access to clean water, cooling centers, and increased canopy cover, and if feasible, scale them up to address the growing number of homeless individuals and the changing weather patterns that have become the 'new normal.' The pan-London policy of SWEP should ensure they are prepared for an anticipated overflow of new cases during times of escalated temperature by increasing the number of centres, beds, and resources available. In Berlin, there is a need for improved coordination on a city level regarding initiatives for the homeless during extreme temperatures, particularly in higher ones. This enhanced coordination aims to scale up current policies and target neighbourhoods in the city with a high incidence of heat waves, but fewer supporting facilities compared to other areas. In São Paulo, actions and plans aimed at extreme heat are needed as well as the implementation of care centres, shelters and initiatives during cold days in those new areas where the homeless population is concentrated nowadays. When implementing the aforementioned plans, risks including budgetary restrictions, conflicting interests of different institutions and political parties, and public scepticism should always be carefully considered and assessed.

While it would be naive and ambitious of us to expect all of our recommendations to be accepted, we hope that at least some of our proposals for improving the adaptation, resilience, and welfare of the homeless in these three cities to extreme temperatures could be taken into consideration. This will involve a change in perception of the homeless as not just victims, but active participants for increasing policies and programmes on future sustainability to the benefit of all urban citizens.

Furthermore, our emphasis on the importance of addressing the ever-worsening crisis of homelessness, which is often ignored or left out of discussions on urban disaster management and climate change, could hopefully lead to further investigations. The solutions discussed in this work can only offer short-term relief to the homeless; larger questions, including housing shortage, social and income inequality, are beyond this article's scope. It is imperative that policymakers and stakeholders recognise the interconnectedness of these issues and work towards comprehensive and sustainable solutions that tackle the root causes of homelessness.

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REFERENCES

2021 Census – FAQs for councillors [Online], n.d. London Councils. URL https://www.londoncouncils.gov.uk/our-key-themes/local-government-finance/population-and-census/2021-census-%E2%80%93-faqs-councillors (accessed 4 April 2023).

Akbari, H., Kurn, D.M., Bretz, S.E., Hanford, J.W., 1997. Peak power and cooling energy savings of shade trees. Energy and Buildings 25, 139–148.

Altemeyer Junior, F., 2006. Compaixão em processos sociais e mudanças institucionais: o caso do vicariato episcopal do povo da rua em São Paulo.

Baker, M., 2019. Heat waves and homelessness: Analysis of San Diego and Recommendations. UC San Diego: Climate Science and Policy. URL https://escholarship.org/uc/item/3s49k58k

Benjaminsen, L., 2015. The variation in family background amongst young homeless shelter users in Denmark. Journal of Youth Studies, 19, 55–73.

Berliner Morgenpost, 2016. Berlin ist das wärmste und trockenste Bundesland. Berliner Morgenpost.

Bernardo, J., Romão, I, Alves, I., Novaes, I. 2022. Número de moradores em situação de rua aumenta até 6 vezes em periferias de SP. Agência Mural. [Online]. URL https://www.agenciamural.org.br/especiais/numero-de-moradores-em-situacao-de-rua-aumenta-ate-6-vezes-em-periferias-de-sp/ (accessed 12 Nov 2023).

Bloomfield, R., 2023. London's rental crisis see number of homeless families living in hotels reach a new record high. Yahoo Finance.

Booth, R., 2022. Number of people sleeping rough in London is up 24% in a year. The Guardian.

Brien, P., 2018. Public spending by country and region. Spending per person, by country and region 2019.

Carrington, D., 2022. Why is it so cold in the UK right now? The Guardian.

Castro, U. Alves de, 2022. Entre acesso e excesso - Investigação sobre o aquecimento urbano na cidade de São Paulo. Thesis (Bachelor's in Architecture and Urbanism) - School of Architecture and Urbanism, University of São Paulo, São Paulo, 2022. [Online]. URL https://www.researchgate.net/publication/366547761_Entre_acesso_e_excesso_-_Investigacao_sobre_o_aquecimento_urbano_na_cidade_de_Sao_Paulo (accessed 12 Nov 2023).

CGE, n.d. Quem somos. [Online]. URL https://www.cgesp.org/v3/quem-somos.jsp (accessed 28 April 2023)

CGE, 2021. Alertas Centro de Gerenciamento de Emergências Climáticas, 2021. Capital paulista tem a menor temperatura máxima do ano. [Online]. URL https://www.cgesp.org/v3/download.jsp?id=39414 (accessed 28 April 2023)

CGE, n.d. Baixas temperaturas [Online]. CGE. URL https://www.cgesp.org/v3/baixas-temperaturas.jsp (accessed 28 April 2023).

CHAIN, 2022. Rough sleeping in London (CHAIN reports) – London Datastore [Online]. URL https://data.london.gov.uk/dataset/chain-reports (accessed 28 April 2023).

Cohen, D.A., 2018. Water crisis and eco-apartheid in São Paulo: beyond naive optimism about climate-linked disasters. International Journal of Urban and Regional Research. "Spotlight on Parched Cities, Parched People" series. November.

Consultórios na Rua, 2014. Secretaria Municipal de Direitos Humanos e Cidadania.

Copernicus, 2023. 2022 saw record temperatures in Europe and across the world. [Online] URL https://climate.copernicus.eu/2022-saw-record-temperatures-europe-and-across-world (accessed 12 Nov 2023).

Cusack, L., van Loon, A., Kralik, D., Arbon, P., Gilbert, S., 2013. Extreme weather-related health needs of people who are homeless. Australian Journal of Primary Health, 19, 250.

Dept of Levelling Up, Housing and Communities, 2022. Local authority revenue expenditure and financing England: 2022 to 2023 budget. Department of Levelling Up, Housing and Communities, London.

Dias, A., 2021. Dados referentes ao fenômeno da população em situação de rua no Brasil-Relatório técnico-científico. Plataforma de Atenção em Direitos Humanos, Programa Pólos de Cidadania, Universidade Federal de Minas Gerais. Marginália Comunicação.

Di Liberto, 2020. August 2020: The warmest summer on record for the Northern Hemisphere comes to an end. NOAA Climate.gov. [Online]. URL https://www.climate.gov/news-features/understanding-climate/august-2020-warmest-summer-record-northern-hemisphere-comes-end (accessed 28 April 2023)

Duarte, D.H.S., 2016. Vegetation and climate-sensitive public places, in Rohinton, E. (ed): Urban Climate Challenges in the Tropics. Singapore: World Scientific, pp. 111–162.

Duarte, D.H.S., 2015. O impacto da vegetação no microclima em cidades adensadas e seu papel na adaptação aos fenômenos de aquecimento urbano. Contribuições a uma abordagem interdisciplinar. Universidade de São Paulo.

DWD Climate Data Center, 2023. Wetter und Klima - Deutscher Wetterdienst - Leistungen. Vorhersage von Gefühlter Temperatur und Schwüle. [Online]. URL https://www.dwd.de/DE/leistungen/geftempschwuele/geftempschwuele.html (accessed 28 April 2023).

Erell, E., 2017. Urban Greening and Microclimate Modification. In: Tan, P., Jim, C. (eds) Greening Cities. Advances in 21st Century Human Settlements. Springer Singapore, Singapore, pp. 73–93. https://doi.org/10.1007/978-981-10-4113-6_4

Evening Standard, 2022. When is the July 2022 heatwave set to end? London to hit 34 degrees on Monday. [Online]. URL https://www.standard.co.uk/news/uk/when-is-july-2022-heatwave-set-to-end-b1011770.html. (accessed on 28 April 2023).

Every, D., Richardson, J., Osborn, E., 2019. There's nowhere to go: counting the costs of extreme weather to the homeless community. Disasters, 43, 799–817.

Exberliner. Cool places in Berlin: Where to go when it's too hot to do anything [Online], 2022. Exberliner. URL https://www.exberliner.com/berlin/cool-places-in-berlin-where-to-go-when-its-too-hot-to-do-anything/ (accessed 28 April 2023).

Fitzpatrick, S., Pawson, H., Watts, B., 2020. The limits of localism: a decade of disaster on homelessness in England. Policy & Politics 48, 541–561.

Fox, A., 2023. Rise in rough sleeping in London 'shows full impact of cost-of-living crisis. The Independent.

Fuhrmans, V., 2011. Germany Tallies Concerns Over Census. The Wall Street Journal.

G1, 2022. SP tem madrugada gelada nesta segunda; CGE registra 0,7°C no Extremo Sul da cidade [Online]. G1. URL https://g1.globo.com/sp/sao-paulo/noticia/2022/06/13/cge-registra-madrugada-gelada-com-frio-de-2c-no-extremo-sul-de-sao-paulo.ghtml (accessed 28 April 2023).

G1 SP, 2021. Com -2,3oC no extremo sul, cidade de São Paulo registra menor temperatura em uma região em 17 anos. [Online]. URL https://g1.globo.com/sp/sao-paulo/noticia/2021/07/20/cge-registra-frio-intenso-e-com-temperaturas-negativas-em-sao-paulo.ghtml G1. (accessed 12 Nov 2023).

GLA, 2023. Cool spaces [Online]. London City Hall. URL https://www.london.gov.uk/programmes-strategies/environment-and-climate-change/climate-change/climate-adaptation/cool-spaces (accessed 28 April 2023).

GLA, 2022. Climate adaptation [Online]. London City Hall. URL http://london.gov.uk/programmes-strategies/environment-and-climate-change/climate-change/climate-adaptation (accessed 28 April 2023).

GLA, Bloomberg Associates, 2022. Climate Risk Mapping – London Datastore. [Online]. URL https://data.london.gov.uk/dataset/climate-risk-mapping

Heat, n.d. London City Hall. [Online]. URL http://london.gov.uk/programmes-and-strategies/environment-and-climate-change/climate-change/climate-adaptation/heat (accessed 28 April 2023).

Hoddinott, S., Fright, M., Pope, T., 2022. 'Austerity'in public services. Institute for Government, London.

Hundenborn, J., Hees, T., 2023. Neue Statistik untergebrachter wohnungsloser Personen in Deutschland: Methode, Inhalt und erste Ergebnisse für 2022. WISTA–Wirtschaft und Statistik 75, 15–26.

IBGE, 2023. [Online]. URL https://cidades.ibge.gov.br/brasil/sp/sao-paulo/panorama (accessed 28 April 2023).

INMET, 2021. Instituto Nacional de Meteorologia. [Online]. URL https://portal.inmet.gov.br/noticias/s%C3%A3o-paulo-capital-com-4-3-c-tem-menor-temperatura-em-5-anos-e-a-segunda-menor-em-21-anos (accessed 28 April 2023).

Instituto Nacional de Meteorologia, 2023. INMET: Clima [Online] URL https://clima.inmet.gov.br/GraficosClimatologicos/DF/83377 (accessed 28 April 2023).

SP Invisível, n.d. SP Invisível. [Online]. URL https://www.spinvisivel.org/inverno (Accessed 28 April 2023).

Lehmann, J., 2022. Unterkunft de "Hitzehilfe" ist im Kiez angekommen. Berliner Morgenpost.

Loevenich, J., 2022. Bis 2030 keine Obdachlosen mehr in Berlin? B.Z. – Die Stimme Berlins.

Lydall, R., Davis, A., Burford, R., 2022. Warmest night on record as temperatures expected to top 40C. Evening Standard.

Masson-Delmotte, V., Zhai, P., Pörtner, H.-O., Roberts, D., Skea, J., Shukla, P.R., Pirani, A., Moufouma-Okia, W., Péan, C., Pidcock, R., 2018. Global warming of 1.5 C. An IPCC Special Report on the impacts of global warming of 1, 43–50.

McGregor, G.R., Bessmoulin, P., Ebi, K., Menne, B., 2015. Heatwaves and health: guidance on warning-system development. WMOP.

Met Office, 2021. UK and Global extreme events – Cold. Met Office.

Murray, J., 2023. England likely to miss target to end rough sleeping by 2024, says Crisis. The Guardian.

National Trust, n.d. Press release. National Trust. [Online]. URL https://www.nationaltrust.org.uk/services/media/weather-and-wildlife-2022 (accessed 28 April 2023).

NOAA, 2020. August 2020 Global Climate Report. National Centers for Environmental Information (NCEI). [Online]. URL https://www.ncdc.noaa.gov/sotc/global/202008 (accessed 9 November 2023).

Nobre, C.A., Young, A.F., Salvida, P., Marengo, J., Nobre, A., Ogura, A., 2011. Vulnerabilidades das megacidades brasileiras às mudanças climáticas: região metropolitana de São Paulo: relatório final. São José dos Campos, SP: INPE.

Petty, J., 2016. The London spikes controversy: Homelessness, urban securitisation and the question of 'hostile architecture'. International Journal for Crime, Justice and Social Democracy, 5(1), p.67.

Pörtner, H.-O., Roberts, D.C., Adams, H., Adler, C., Aldunce, P., Ali, E., Begum, R.A., Betts, R., Kerr, R.B., Biesbroek, R., 2022. Climate change 2022: Impacts, adaptation and vulnerability. IPCC Geneva, Switzerland.

Ramin, B., Svoboda, T., 2009. Health of the Homeless and Climate Change. Journal of Urban Health 86, 654–664.

Richardson, J., 2014. Beyond vulnerability: Developing disaster resilience capacities to target household preparedness activities: Part 2. National Emergency Response 28, 4–7.

Sanders, B., Brown, B., 2015. I was all on my own': experiences of loneliness and isolation amongst homeless people. Crisis 1–9.

Santamouris, M., Ban-Weiss, G., Osmond, P., Paolini, R., Synnefa, A., Cartalis, C., Muscio, A., Zinzi, M., Morakinyo, T.E., Ng, E., Tan, Z., Takebayashi, H., Sailor, D., Crank, P., Taha, H., Pisello, A.L., Rossi, F., Zhang, J., Kolokotsa, D., 2018. Progress in Urban Greenery Mitigation Science – Assessment Methodologies Advanced Technologies and Impact on Cities. Journal Of Civil Engineering And Management. 24, 638–671.

Secretaria Municipal de Direitos Humanos e Cidadania, 2021. Operação Baixas Temperaturas. [Online]. URL https://www.prefeitura.sp.gov.br/cidade/secretarias/direitos_humanos/poprua/programas_e_projetos/index.php?p=269793 (accessed 20 March 2023).

Secretaria Municipal de Direitos Humanos e Cidadania, 2020. Operação Baixas Temperaturas. [Online]. URL https://www.prefeitura.sp.gov.br/cidade/secretarias/direitos_humanos/poprua/programas_e_projetos/index.php?p=269793 (accessed 20 March 2023).

Secretaria Municipal de Direitos Humanos e Cidadania, 2019. Operação Baixas Temperaturas. [Online]. URL https://www.prefeitura.sp.gov.br/cidade/secretarias/direitos_humanos/poprua/programas_e_projetos/index.php?p=269793 (accessed 20 March 2023).

Secretaria Municipal de Direitos Humanos e Cidadania, 2018. Operação Baixas Temperaturas. [Online]. URL https://www.prefeitura.sp.gov.br/cidade/secretarias/direitos_humanos/poprua/programas_e_projetos/index.php?p=26979 (accessed 20 March 2023).

Stone, Jr, B., 2012. The city and the Coming Climate. Cambridge: Cambridge University Press.

Oke, T. R.; Mills, G.; Christen, A.; y Voogt, J. A. (2017). Urban Climates. Cambridge, UK: Cambridge University Press, 509 pp.

The Associated Press, 2022. Sweltering streets: Hundreds of homeless die in extreme heat. CNBC.

Thunder, J., Rose, C., 2019. Local authority spending on homelessness: Understanding recent trends and their impact. London: St Mungo's and Homeless Link.

UNEP, 2020. Adaptation Gap Report 2020 [WWW Document]. UNEP - UN Environment Programme. [Online]. URL https://www.unep.org/adaptation-gap-report-2020 (accessed 9 November 2023).

Westaway, K., Frank, O., Husband, A., McClure, A., Shute, R., Edwards, S., Curtis, J., Rowett, D., 2015. Medicines can affect thermoregulation and accentuate the risk of dehydration and heat-related illness during hot weather. Journal of Clinical Pharmacy and Therapeutics 40, 363–367.

Wilson, W., Barton, C., 2018. Rough Sleeping (England). London: House of Commons Libray Briefing Paper research briefings. URL: https://researchbriefings.files.parliament.uk/documents/SN02007/SN02007.pdf (accessed 12 Nov 2023)

WMO, 2022. State of the Global Climate 2021. WMO: World Meteorological Organisation. [Online]. URL https://library.wmo.int/records/item/56300-state-of-the-global-climate-2021#.YoqDbajMK3A

3

PUBLIC PARTICIPATION IN THE CREATION AND MAINTENANCE OF URBAN PUBLIC SPACES: LESSSONS FROM SÃO PAULO, LONDON AND BERLIN

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ABSTRACT

Urban public spaces are an area of growing importance to communities, public planners and health professionals. They are focus points of conflicting priorities for land use. A key issue in the design and implementation of these spaces is public participation, particularly the reach and quality of this, which is fundamental to creating and preserving urban public areas in an increasingly disputed territory for real estate development. Through three cases of urban parks in London, Berlin and São Paulo, we examine the historical development and use of these modern green spaces in the context of three cities. Further, we focus on the role and scope of participation in the establishment and maintenance of these green spaces, looking at the actors and their conflicts that arise, examining these issues through the actor network theory. By doing so, we expect to better understand the importance of participation, the challenges faced in each context and how participation quality could be improved in future urban space projects.

ABBREVIATIONS

ANT: actor network theory

CDU: Christian Democratic Union of Germany, a political party in Germany

GRA: Global Research Academy

SenUMVK: Senatsverwaltung für Umwelt, Mobilität, Verbraucher- und Klimaschutz (Senate Department for the Environment, Mobility, Consumer and Climate Protection of Berlin)

SPD: Social Democratic Party of Germany, a political party in Germany

UK: United Kingdom

UN: United Nations

WHO: World Health Organisation

1. INTRODUCTION

Urban public spaces are an area of growing importance to communities, public planners and health professionals. They are focus points of conflicting priorities for land use. This report explores the role of public participation in such conflicts, drawing on site visits in São Paulo, Berlin and London, personal interviews with activists, extended background research, and the authors' personal knowledge of each city. The specific aim was to understand how public participation can be fundamental to creating new public spaces in urban areas, as well as their ongoing maintenance, in an increasingly disputed territory for real estate development. This action of creation is different from many disputes in urban areas, which often focus on the protection from development into often unaffordable housing.

Public space is here conceptualised as encompassing all spaces (including streets, squares and parks) that everyone can use and access in principle, regardless of who owns or manages the space. We focus on one particular type that has a growing evidence base for supporting social, economic and health outcomes: green spaces. The development and maintenance of these green spaces is important for many reasons, from supporting good mental and physical health, improving quality of life, supporting good social environments and providing areas for wildlife and flora to flourish in urban areas. However, with pressures on urban housing and financial sustainability, building new green spaces is not a zero-sum game.

Our investigation was guided by three research questions:

1) **To what extent has public participation shaped the outcome in each case study?**
2) **What were the challenges, barriers, and facilitators to public participation in each of these contexts?**
3) **How can we use these to improve public participation in new projects?**

We have explored three cases - Parque Augusta in São Paulo, Tempelhofer Feld in Berlin and East London Waterworks Park in London. We use these cases to understand the social processes that occurred or are occurring so that these public spaces could develop their

offering to the public, often at odds with private ambitions. Though each case is unique in many ways, and we cannot ignore the contextual elements of each park, it is the process that we are seeking to understand, and the defined spaces themselves are not the focus of this project. Rather, the analysis is oriented towards providing better support for participatory processes shaping urban spaces in a wider range of contexts in future.

2. CONCEPTS FOR ANALYSIS

Public space and green space

Public space has often been linked to various dimensions of urban sustainability. The concept of "public" encompasses the idea of accessibility, inclusivity, and accountability to the general public, and it plays a significant role in shaping various aspects of society, including governance, civic engagement, and public well-being. It is at odds with private space, which encompasses the idea of exclusivity, ownership, and confidentiality, and is typically associated with areas or matters that are not open or accessible to the general public, but rather reserved for private use or control by individuals or private entities.

Public spaces create the space for economic and social exchange, can improve health and wellbeing and offer space for ecosystems to thrive. They are a key part of the sustainable development goals and a focus of the World Health Organization (WHO) through the United Nations (UN) New Urban Agenda (World Health Organization, 2016). These spaces are essential to public life; "Public space is considered to be crucial principally because it guarantees the political dimension of city life: in particular, because it provides a theatre for discussion on public and civic matters, for organising debates, demonstrations, protests, etc." (Moroni, 2014). Here, we focus on one type of public space in particular, that is, green spaces.

The importance of green urban spaces for human wellbeing has been widely documented elsewhere, but includes evidence on improved physical health, reduced risk of death to increased exercise and better mental health (European Environment Agency, 2019). They have been shown to be crucial in providing the space for people to exercise and relax in otherwise busy environments, and for biodiversity and nature to live. There is some evidence that these health benefits are also seen across different aspects of society. Social cohesion was found to increase with greater frequency and duration of visit to green spaces, and use of the space for activities (Wan et al., 2021). Spaces can create a sense of belonging, place and community, and the development of such spaces can create economic improvements from health, employment, and help mitigate environmental costs e.g., from flooding (Dobson et al., 2019).

However, it is important to note that access to spaces is unequal. Creation of these spaces can often generate inward investment, which can mean increased economic value, but often at the cost of displacement of (often lower income) residents (Dobson et al., 2019). Considering the creation of spaces through a social equity lens can help identify and address these problems throughout the planning process - and participation is a key resource through which to do this.

Actor Network Theory

Michel CalIon (1986) and Bruno Latour (1987) initially developed and applied the Actor-network theory (ANT) in technology and information technology. It was intended as a guide to answering how things, people and ideas become connected and assembled into larger units (Czarniawska 2006). It is concerned with investigating the social and the technical taken together or, putting it another way, with the creation and maintenance of coextensive networks of human and non-human elements which, in the case of information technology, include people, organisations, software, computer and communications hardware, and infrastructure standards (Walsham 1997). In this way, all objects, human or non-human, can be a source of actions and be part of the network. It was at this point that nonhuman—microbes, scallops, rocks, and ships—presented themselves to social theory in a new way (Latour 1996).

The bridge between society and nature makes this theory applicable and broadly extended to diverse topics, like the analysis of the market (Callon 1999), cultural differences (Law, John & Hassard 1999) and geography (Murdoch 1998). Using a slogan from ANT, you have 'to follow the actors themselves', that is, try to catch up with their often wild innovations to learn from them what the collective existence has become in their hands, which methods they have elaborated to make it fit together, which accounts would best define the new associations that they have been forced to establish (Latour 2005). In this respect, our report uses it as a theoretical basis for discussion.

The heterogeneous network of interests in public participation, including people, organisations, government, green space and their standards, is our main focus. The interplay and power relationships between the

actors which impact the efficiency and effect of the participation are the perspectives that we choose to observe and analyse. Moreover, with the natural value of the urban parks, through the lens of ANT, the non-human actors, such as animals and plants, can be integrated into our broad framework. Through the netting, lacing, weaving, and twisting of ties stressed by Latour (1990), the ANT will be used as a framework for observing the different stakeholders during public participation, figuring out their roles in the network and offering insight into participation.

Public participation and prioritisation

Participation, or any process that directly engages the public in decision-making and gives full consideration to public input in making that decision, is the primary method through which decision makers (primarily those of local government) can listen and learn from the expertise of the population in which an action is due to be taken. It takes many forms, and can range from effective involvement, engagement and leadership of local groups on a project, to vague information leaflets, meetings held at unsociable hours or in hard-to-reach places, or through participatory events where no attempt is made to then 'close the loop' on action from previous involvement. For decades there has been a push for increasing the presence of meaningful participation through collaborative and partnership ideals.

However, beyond ineffectual governance, reality can collide with political, financial and social realities that face local governments. Projects such as creation of green space are all to be weighed up to the political motivations, the power of those involved and balancing of value and values against what is demanded and prioritised by society.

3. METHODS

Document, desktop research and semi-structured interviews are our primary methods of data collection. For the topic of public participation in these three cases, we review the official documents, news reports, posts on social media, and the existing literature. Meanwhile, first-hand material was collected through on-site observation and interviews with activists during their participation in each park's planning and construction, if possible. Answering the research questions satisfactorily required a more qualitative approach. All data was collected between September 2022 and April 2023.

Through reviewing evidence on participation and public spaces, our report identifies key information for each of the case studies in the three cities. We supported our initial case finding with content and discourse analysis and used this as a guide to the initial discussion around each case study. Word clouds - a way of presenting the information produced by each case study, are presented in the overview, demonstrating the communication priorities of each case study.

Next, we examined the three cases under the lens of the actor-network theory, highlighting the important actor groups and their current roles at this point in time as best understood with the information and context available.

Together, we then compared and contrasted each of these case studies, highlighting how participation was shaping, or had shaped each case. We utilise these key learnings and priorities for future participation and give recommendations for the diverse actors in the involvement of public space creation.

4. CASE STUDY OVERVIEW

The three case studies we have selected each vary in size, cost, age and crucially participatory action in their construction, planning or ongoing support. To capture each of these parks, ***Table 4*** and ***Figure 18*** provide an overview of each of the respective projects. ***Table 4*** introduces each and provides the key facts about the land and key stakeholders. ***Figure 18*** captures each of their websites in a word cloud, highlighting the thematic priorities projected by the outward documentation in each case.

OFFICIAL WEBSITE https://www.elwp.org.uk/Home.htm	OFFICIAL WEBSITE https://gruen-berlin.de/en/projects/parks/tempelhofer-feld/about-the-park	OFFICIAL WEBSITE https://www.prefeitura.sp.gov.br/cidade/secretarias/meio_ambiente/parques/regiao_centrooeste/index.php?p=317881
101 park 69 london 61 waterworks 60 east 41 water 34 project 31 community 31 nature 31 site 30 habitats	43 feld 43 tempelhofer 14 berlin 14 development 10 history 9 area 8 participation 7 areas 7 projects 6 citizens	35 species 21 tree 14 forest 14 palm 13 sp 11 park 10 augusta 9 addition 9 area 9 management
		

Figure 18: Official website and word cloud, generated from each case study's website. Numbers refer to word frequency from websites extracted content. References are ELWP (2023), Gruen Berlin (2023) and Prefeitura (2023).

Table 4: Overview of each of the case studies in the three cities of London, Berlin and São Paulo. Picture credit: Google Maps, East London Waterworks Park . *Budget figures from: ELWP: Business Plan version 1 (2022), Grün Berlin GmbH (2022), Parque Augusta, Revista

Projeto (2022). Photo credit: Nikki Osman, 2023, London. Photo 01. East London Waterworks Park's Forest School. Multiple, 2018, Berlin, Photo 02. Tempelhofer Feld. Daniel Ducci, 2022, São Paulo, Photo 03. Kruchin Arquitetura.

	London, United Kingdom	**Berlin, Germany**	**São Paulo, Brazil**
Key financial and political stakeholders	Crowdfunding from the public and support from NGOs and local businesses, Local and national NGOs and campaigns support the project, Local councillors and government back the project	Municipal government, Infrastructure company (Gruen-berlin), Civic organisations	Construction Companies Cyrela and Setin, Municipal Government, Local civic organisations
Budget*	Market value of site: c. €23 million Social value: €18.86 million + Proposed purchase price: c. €3.48 million	Market value of site: €608 million Implementation costs: €16.43 million (Residual costs from 2023) Management: €4.37 million in 2023	Market value of site: €20.91 million, payed by the construction companies Implementation costs: €2.09 million, payed by the construction companies Estimated value of building rights traded for the site and implementation: €38.97 million, ceded

			by the municipal government
Owner of land	National Government	Municipal government	Municipal Government
Space opened to public	NA	May 2010	November 2021
Beginning of planning of the space's current form	2019	2014[10]	2002

East London Waterworks (London)

East London Waterworks is part of Lea Valley marshes, a 36.7-hectare biological site of Special Scientific Interest. It is an unassuming space and was once common land for grazing and cattle. The site is now a concrete storage area and is blocking the connection of the rest of the Lea Valley marshes, now public green/blue space, together. It is designated 'Metropolitan Open Land', which affords it many legislative rights, protecting it from major development and ensuring public access going forward. It is currently managed by LocatED, the Department for Education's arms-length property company, and owned by the Department for Levelling Up, Housing and Communities (***Table 4***). The Lee Valley area is maintained by the Lee Valley Regional Park Authority,

[10] Although the Tempelhofer Feld has been open to the public since 2010, the discussion of planning the space's current form has been influenced by the referendum in 2014, which advocated maintaining the appearance and changed the development direction of this space.

with local governmental jurisdiction landing in the Borough of Waltham Forest council.

The East London Waterworks Campaign is the main public group looking to use the land and has ambitious plans for a park and community site. They are formed of local residents from the Waltham Forest area. They are supported by major charities and advocacy groups for the natural environment, such as CPRE, a countryside charity, as well as local businesses. They have successfully met their fundraising goal of £500,000 in February 2023 to fund the initial portion of the project.

The campaign itself uses a non-hierarchical, sociocratic structure. Seven circles conduct various parts of the campaign, from governance to social media to inclusivity and technology. They use consent-based decision making. Anyone is available to join meetings as a guest.

The initial aims of the project were to:

- Improve physical health
- Improve mental health
- Increase biodiversity
- Encourage visitors to come and stay and explore

The group has since issued two inclusivity reports, out of an expected three, where they have talked with other groups in the local area to help support the participation of all of society, beyond those actively involved. They are supporting habitats in the project, ensuring that non-human actors are considered in the process.

The project is particularly focused on two key components (Figure 1): firstly, what are the core elements of the site and what it can bring - water, habitat, nature. The second is community, highlighting the desire to produce something in the local area.

Tempelhofer Feld (Berlin)

Tempelhofer Feld is arguably one of Berlin's most distinctive large public spaces (***Table 4***). Since its opening in May 2010, the former airport ground has been used intensively and broadly. Beyond its function as a

park, this large space (covering up to 303 hectares) has a wide range of functions. From large-scale events like music festivals and kite festivals, to specialist sports like land-based sailing, skateboarding and roller skating. In addition, it offers sanctuary for animals, helping support biodiversity and it plays the important role of the “green lungs” of Berlin’s urban climate regulation. It also has cultural and historical significance. It has a complicated history as an airport but has become representative of modern Berlin, through utilisation for programmes like the Tempohomes for vulnerable refugees and attracts large swathes of tourists.

However, the diverse values of this space are built on citizen participation and their interaction with the municipal government. Dating back to 2008, the shutdown of the Tempelhof Airport in Berlin had generated an ongoing and intense public debate over the re-use of the field and the implementation of citizen participation (Genz 2015). From 2010, the politicians intended to develop the airport land for commercial, housing and other public use. However, the citizens' self-organised "100% Tempelhofer Feld" campaign strongly opposed these development proposals and successfully launched a referendum. Their protests engendered widespread public debate about how the space should be used after it ceased to function as an airport. In the referendum in May 2014, the citizens voted in favour of the "Law for the Preservation of Tempelhof Feld". From this, the previous appearance of the open space has been maintained and a comprehensive plan has been put in place to manage the site.

This landmark action made the subsequent participation of the inhabitants accessible in the planning of this space. However, currently, there is still controversy regarding how to best make use of this space, and there is tension between commercial development and conservation. The civic organisation and the citizens who desire to protect the Tempelhofer Feld are encountering challenges from the politicians and other voices.

Since the Russian-Ukrainian war began in 2022, there has been an energy crisis in Germany, including the capital Berlin. The pressure of housing and renting is increasing dramatically, which has been a contentious issue among citizens and politicians. Some politicians from CDU and SPD

have proposed new construction plans in this space and are dedicated to changing the law of preservation. This is contrary to the aims of the 100% Tempelhofer Feld campaign. This dominant association is adjusting their strategies of participation under these new circumstances. The dynamics of public participation and the complex relationships of the involved actors will be discussed in the next section.

Parque Augusta (São Paulo)

Located in a central and privileged part of the city, Parque Augusta has 24.000m2 of green spaces dedicated to sports, leisure and cultural activities.

According to researcher Paula Hori (2018), the land's first documented use was in 1902, when a small town-palace was built, preserving a small piece of forest in the remaining land. In 1906 the palace was turned into a catholic school, which lasted until 1969. By then, the city had already developed significantly in the surrounding areas and the land attracted significant interest from developers. The deed for the land had a clause that stated that, even if sold, the preserved part of the forest (roughly 16.000m2) had to remain open to the public. This inspired a decree of public interest made by the local government in 1970. In 1974, a developer bought the land to build a hotel, but the plans never came to fruition. In 1996 a banker bought the land to build a supermarket, but that also never came to be. All the while, the land was used informally, sometimes as a parking lot, sometimes occupied by a circus or cultural events.

In 2002, during the mandate of a progressive mayor, the intention of Parque Augusta was for the first time formally recognized in the city's master plan and a couple of years later, in 2004, the remaining forest and structures were declared historically relevant and subject to preservation laws, hindering the prospects of commercial use of the land. This sparked more interest towards the possibility of a park and motivating a group called "Allies of Parque Augusta" to form in 2006, dedicated to pressuring the local council into implementing the park.

In 2013 the land was sold for R$110million to Cyrella and Setin, two of the biggest construction companies in São Paulo, with the intention of building two multi-purpose tower blocks. Cyrella and Setin promised to keep the forest open to the public, but the public backlash was strong enough to draw the matter into the public eye. In response, they built a wall and closed off the plot of land, which prompted a new and more radical group called OPA (Parque Augusta Organism) to form. OPA had a more direct line of action, inspired by other public movements such as the Taksim Gezi Park movement (in Turkey) and the Ocupa Estelita (in Recife, Brazil), and repeatedly tore down parts of the wall, pressuring city hall to reopen the space to the public.

In 2014, during another progressive mayorship, Allies of Parque Augusta and OPA pressured the city hall to revise the masterplan and make the land a zone of special environmental protection, which further hindered the plans for the towers and favoured the prospects of a park. By then, the first drafts of the park's design started to be made.

Because in 2015 the city council had not been able to reopen the area, OPA started a three-month cultural and environmental occupation of the land, making the headlines and bringing the idea of Parque Augusta back into the public spotlight to the point that city hall started to try to buy the land back from the construction companies, offering progressively larger amounts of money and value in construction permits, but the offers were systematically rejected as the owners were still trying to find a legal loophole to build the towers. Public prosecutors had, at the time, determined that the walls be torn down, with hefty fines (half a million reais per day) in case the owners did not comply, but the order was ignored, and the walls remained in place.

In 2017 an open call for designs fueled public debate over how the park should be. A synthetic project, bringing together elements of all the final stage projects, was made by the architects at city hall (Bisterzo et al., 2022).

In 2018, a new mayor proposed trading the land for an estimated R$205million in building permits and the construction companies finally accepted (with approximately R$95million in profits). The land was reopened, and the park began to be implemented. At the end of 2021 the

park was inaugurated and has, since then, served as an important place of leisure for over 1.5 million people each year.

5. HOW PARTICIPATION SHAPED EACH PROJECT

East London Waterworks Park (London)

Participation is a focal point of the park and focuses on how the project can become more inclusive of the local population. Beyond fundraising and community outreach about the project, participation for the park plan has so far been focused on two inclusivity reports. Phase 1 provided desktop literature research on inclusion and ended with 8 principles of inclusivity. These were then brought to 12 local community organisations that represent groups that are often left out of environmental projects (e.g., people from a lower income background or representation from non-christian faiths).

They have also reached out and gained the support of substantial numbers of local business and political actors, as well as national organisations. This includes the Lee Valley Regional Park Authority, one of the key actors with authority of the whole park region. Their current work has leveraged and relies upon philanthropic work and organisations for social good. For instance, they have secured a philanthropic lender for the land purchase in Phase 1 of their project plan. They are also supported by specialists - the engineering report was produced by Expedition engineering.

The final inclusivity report will focus on 1-to-1 interviews with 50 members of the same identified groups above, exploring aspects of the park related to the main inclusivity principles (e.g., what is low cost for usage?).

Their current volunteers for each of the circles tend to be from academic or professional backgrounds. They have identified that their current volunteer pool is not reflective of the groups targeted in the inclusivity reports, so they also aim to work with an organisation (Voyage - a social justice charity) to make the project accessible to address this.

Participation so far is therefore through the lens of what the park will become and to gain support for purchase of the land, with a vision for the phase of transformation afterwards. Participation with outside actors is still to come but has already started with the philanthropic donors that will be needed for the transformation cost and for land purchasing, as

well as building alliances with key groups, such as the countryside charity (CPRE), building their political and social capital for the project.

The group have also considered non-human actors through their habitat planning rounds for each sector of the park and have included it as a key lens (e.g., sustainability, biodiversity, space for wildlife) whilst advocating it. They have not indicated how they seek to evaluate this inclusion or include them as a 'participatory' actor.

Figure 19 highlights the actors (both human and non-human) identified for this project, with further detail provided for each of these below.

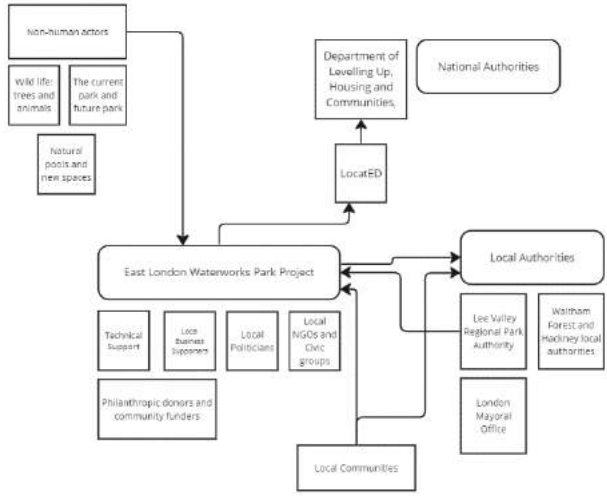

Figure 19: The actors in the case of East London Waterworks Park.

Human actors

East London Waterworks Park team and direct supporters

- The key actors are the East London Waterworks self-organised team and their efforts in bringing this project into existence

- They are directly supported by several organisations, have a philanthropic funding in place for the first phase of securing the site, and have thousands of individual actors supporting the project through the fundraising site
- They have local political support through several local councillors

National authorities

- LocatED, a property management company, is the current land manager and, with the current owner in the Secretary of State for Levelling Up, Housing and Communities, is the main antagonistic party, though it remains to be seen how much of a problem they will be for the first phase of this project (securing the site).
- If Phase 1 is carried out, it is likely that national authorities will only play a role in providing financial support

Local authorities

- The park authority is listed as a supportive actor for this project, and the group reports in support in principle for the London Mayor's office and the two local councils (Waltham Forest and Hackney)
- However, in phase 2 (planning and construction of the site), it is likely the local authorities will become the main antagonistic group as the project goes through planning

Community

- The local community that will use the park or live in the vicinity (both locally, and in terms of all of London) are actively being engaged by the ELWP team, but have a limited role at this time
- Their role is likely to expand as the project progresses, especially towards opening of the final park

Non-human actors

- The potential park and the space as it currently stands
- Wild animals

- Plants (trees, water plants)
- Architecture (planned buildings, forest school)
- Infrastructure (community spaces)

Tempelhofer Feld (Berlin)

In the case of Tempelhofer Feld, two elements of participation are crucial. One is the citizens' self-organisation 100% Tempelhofer Feld, which is still active today in the planning of the field's future. The other is the participation model, which was set up after the referendum under the leadership of the Berlin government, specifically the Senate Department for the Environment, Mobility, Consumer and Climate Protection.

Firstly, the 100% Tempelhofer Feld is an organisation initiated by citizens themselves to defend the field from commercial development and the reduction of green spaces. The organisation successfully launched a referendum in 2014 as mentioned above. This landmark event leads this civic association to become an important actor in the future public discussion of Tempelhof Feld's planning. To some extent, this association acts as the gatekeepers after an increase of social capital and power in the post-referendum period.

However, today, in the face of Berlin's increasingly tight housing stock, rising rents and energy constraints, voices for the redevelopment of this land are making a comeback, mainly from the politicians. This organisation has begun to reorient its engagement strategies based on a firm defence of the field against commercial exploitation in the first place. They have tried to create more debate with the governments and politicians. They aim to raise public discussion about these issues as part of their strategy, and to attract more people towards their view and to cope with the challenges of development. Part of the activists argue that they should be more aggressive in the campaign and supervise the relative departments of government more intensively.

Secondly, led by the municipal government, the participation model (Beteiligungsmodell) has been established. Because after the referendum, the following questions needed to be clarified: How should Tempelhofer Feld be used in the future? How is the permanent participation of citizens ensured finally: How are the development goals implemented sustainably? The result of this process is the current participation model (SenUMVK 2019). (see ***Figure 20***)

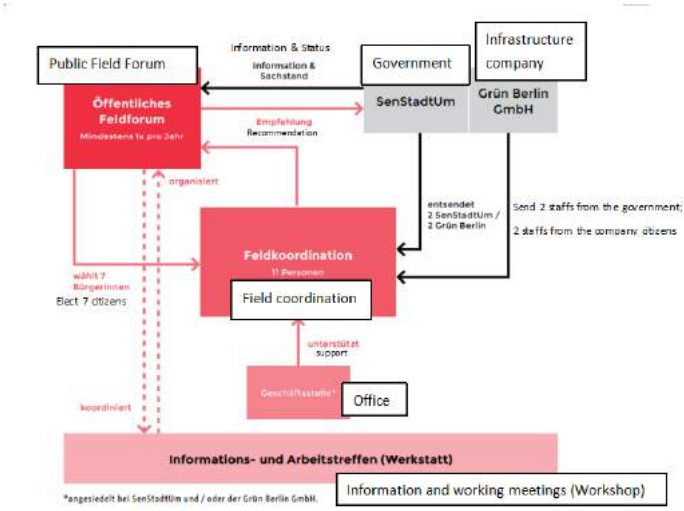

Figure 20: Participation Model for Tempelhofer Feld. Source: SenUMVK of Berlin (2019), English translation added by the authors.

This creative model put 11 field coordinators at the centre of the process. They consist of two government employees, two infrastructure company employees, and seven citizens. The coordinators of citizens are elected by the public field forum. The regular meetings discuss and consult on how to proceed with developing this unique area. The model, which tries to respect citizens and self-organisation, is still in operation currently. Some people in the association of 100% Tempelhofer Feld are active in the model. The efficiency and effectiveness of this government-led model of participation will be discussed in the subsequent section.

Based on actor-network-theory, the human actors and non-human actors can be categorised as follows:

Human actors:

Citizens:

- spend their leisure time in the space as they do in other parks
- involved in civic organisations, and concerned about the planning of the Feld

Civic organisations:

- 100% Tempelhofer Feld, an association for the democratic initiative of Tempelhofer Feld
- Torhaus, a self-organized and self-managed community space of the Feld

Development or infrastructure companies:

- Present in the Tempelhofer Feld for management and later construction, including Tempelhof Project Company and Gruen-berlin

Scientists and artists

- From natural sciences, social sciences, humanities
- Raise proposals for the planning and construction and evaluate the value of the feld in different levels (social, natural, economic).

Municipal government of Berlin:

- Office of citizen participation: Implementation concept of the 'Guidelines for Citizen Participation in Spatial Urban Development Projects and Processes'
- Senate Department for the Environment, Mobility, Consumer and Climate Protection (SenUMVK)

Non-human actors:

- Pets

- Wild animals
- Plants (trees, grassland)
- Architecture (the buildings of the previous airport)
- Infrastructure (amusement facilities, benches, toilets, roads...)
- Climate change here (air, humidity, temperature…)
- Feld itself

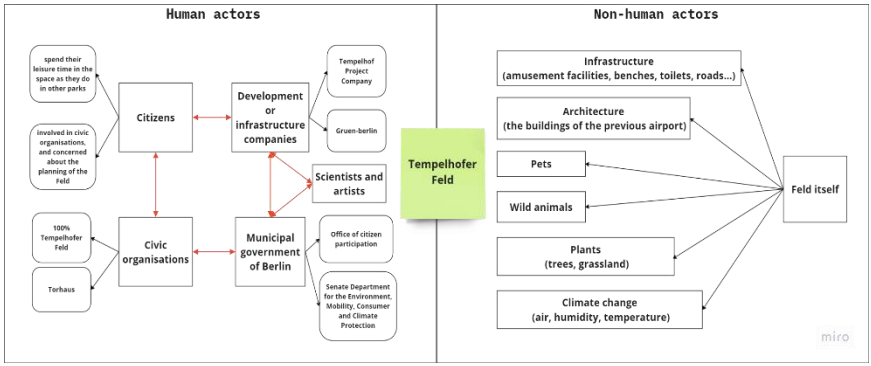

Figure 21: The actors in the case of Tempelhofer Feld

Drawing from the above, we can see that human actors have more complicated power relationships with each other, such as the gaming between the government and the civic organisation, and the tension between development and reservation. However, the human actors and non-human actors are intertwined and commonly impact the planning and construction of this space. The natural values of the open land as the green lungs and the wild animals as the symbol of biodiversity are crucial arguments for the civic association to protect this space. The complex merit of this park can not only be centralised from the human side.

Parque Augusta (São Paulo)

The main human actors involved in Parque Augusta were:

- Setin and Cyrella, the construction and development companies that owned the lot since 2013. They held the major economic power in the conflict.

- The two main local organised groups fighting for the park, Parque Augusta Organism (OPA) and Allies of Parque Augusta. Although composed of affluent and organised local residents, they did not have the footing or resources to implement the park.
- Local Government, both executive (City Hall, including the mayor and the city planners) and legislative (City Council, with the elected representatives), which held political and economic power to, if inclined, balance out the discussion with the construction companies.
- Regional Government, considering the Prosecutor's Office, which held political and legal power to sanction other actors and oversee that the public interest was upheld. Their actions were catalysed especially due to the presence of environmentally relevant green areas in the lot, along with environmental, historical conservation and urban land usage laws and clauses put into place by local government over the last century.

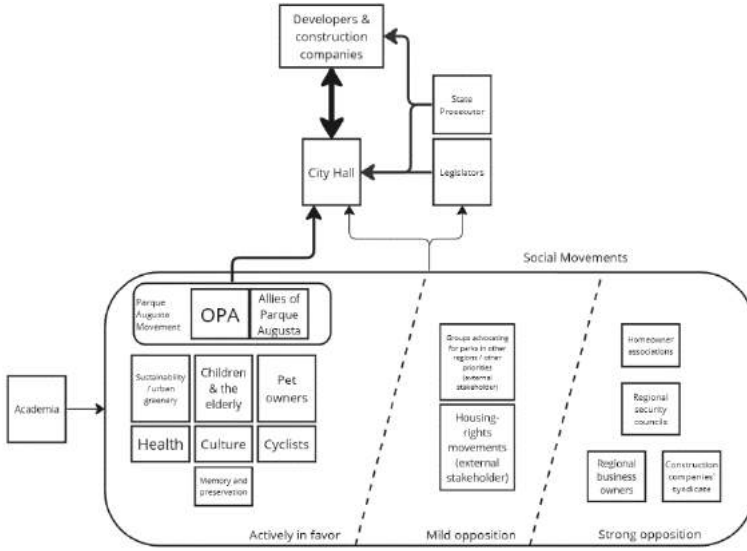

Figure 22: The actors in the case of Parque Augusta

Their involvement could be described as a direct opposition between the local organised groups and the construction & development companies. The resolution of this conflict was facilitated and then ensured by the actions and resources of the local government with the oversight of the regional government.

Other human actors involved during the design phase of the park were:

- Academia, participating mainly from a distance with advocacy, support and knowledge production about the historical, urban, economic and social aspects of the dispute.
- Other, less defined, social movements, advocating for culture, memory, cycling infrastructure, pet spaces, places for children & the elderly, sustainability & the environment and health-related matters, which saw the park as an opportunity to implement these ideas in the neighbourhood.
- Homeowners associations, regional business owners and local security councils, which generally oppose the creation of public spaces for the - even if unfounded - fear of crowds, criminality and maintenance issues that might arise.
- Structured social movements petitioning for housing, parks in other regions and other aspects of the right to the city in less affluent neighbourhoods, questioning the attention, resources and prioritisation that this park was receiving, in opposition to older and more pressing claims in less privileged parts of the city.

These actors entered the discussion in a much later stage, after the main conflict and ideas had already matured, and basically contributed with indirect inputs in the design phase of the park.

Non-human actors were marginally considered, in the sense that human actors advocating for environmental preservation and green spaces, sustainability, human health and places for pets might have had an indirect positive impact in the outcome for non-human actors, even though their perspective was not brought into the discussion directly and they were considered mainly in and instrumental perspective, i.e. how their presence could improve quality of human life.

6. LEARNING AND RECOMMENDATIONS

Learning 1: Legal protection of a new potential site can support development

In São Paulo, the presence of a preserved piece of original forest occupying two thirds of the lot and the existence of an old protective clause in the property's deed most likely were the most significant inhibiting factors for the commercial development of the lot prior to the recognition of its potential as a park in 2002.

A similar dynamic could be observed in the London waterworks initiative, as the contamination of the lot and the environmental legislation in place (it is designated as green space) do not allow for commercial development, a park is one of the few possible uses for the land.

In Berlin, legal protection was enshrined through a city-wide referendum following intense public discussion and active promotion of the civic organisation.

In all three cases, land legislation, the presence of native species and forest, environmental policies and protective clauses helped curb the developmental urges of the market and, in a sense, save spaces for future development as green or leisure spaces.

Recommendations:

Long-term (over ten years) city planning tools can be used to actively support the designation of future areas for leisure or green spaces. These tools might range from formal master plans to more specific and technical tools such as zoning designations, environmental legislation and budget plans, as long as they are iteratively updated - kept alive and relevant - and adequately monitored and enforced.

Through these tools, regional reserves of free spaces can be created and protected from short-term developments to give the public and planners time to develop the adequate uses for these spaces according to the

changing needs and dynamics of the city (territory, dynamics, humans and non-humans).

National legislation and prioritisation may also help support the development of new sites. The United Kingdom's Environment Improvement Plan (2023) may be one such legislative tool to help support the development of future sites, specifically as it includes the aim to ensure all people are within 15 minutes of a green space.

Learning 2: Local Government can influence the balance of power and support participation for groups that are less privileged.

In Parque Augusta, the groups that undertook the decades-long and organised actions petitioning for the park were mainly composed of local and nearby residents. This means that they were mainly affluent, well-connected individuals, with resources (money, time and connections) to mobilise towards their goal. In contrast, several other less powerful but well-organised groups constantly fight for housing, transportation, green spaces and other basic rights are seldom considered with such disposition by the government. This goes to show that the dynamics of class and power exert significant influence over the success of public participation. That said, their main opposition in the pursuit of implementing the park were the construction companies and developers. These are powerful actors in Brazil and are commonly able to win disputes over land usage by attrition, economic force or by outright changing legislation to match their interests. Local government not only acted as a mediator between the conflicting parties involved, they also allocated the funds and resources to buy the land and implement the park.

Without the policies and measures put in place by the local government, or its actions as the main executor of the project, not even the affluent and well-organised groups would be able to exert sufficient pressure to resist the initial development plans of the construction companies. It is evident that the local government, acting as a mediator, has the potential to balance out the distribution of power in these disputes.

In the case of Berlin, the government made citizen participation more formal and integrated it into the official administrative process. The voices of the public can be better expressed by the coordinators in the participation model. Moreover, the citizens who are interested in the park's planning and are dedicated towards long-term participation can be empowered with this model.

These organised processes, however, have created new obstacles to citizen participation. Firstly, more effective participation requires citizens to be familiar with the processes of public administration, for example reading documents, writing emails, and communicating with public servants. Not all positive citizens can hold these skills and contribute to the administrative affairs. Secondly, the system of electing coordinators makes this model its own democratic process. Its members need to obey the rules of operation to make their voices count. This democratic process in the model leads to some citizens not being motivated to participate and gradually stepping out. Therefore, for this innovative trial of the participation model, how to balance the power inside of the model and provide more support for everyone interested in the planning is still in the gaming stage.

For London, where the process is still ongoing, it remains to be seen how local governments (and other local authorities) will support the process. The Park Authority and other local players have already indicated support for this project. Sadly, the owner is currently the national government, which may limit local governmental influence as the project may hit an initial roadblock in the current political system.

The East London Waterworks park initiative themselves have identified that their own group does not represent people who are not normally involved in environmental projects. They have taken steps to address this by inviting organisations in to support discussions on how the project itself and the project team can adapt.

Recommendations:

In order to address the imbalances of power, is it paramount that the local government acts as the main mediator of the discussion, taking special care to reduce barriers for participation and ensuring diversity of narratives and actors that minimally reflect the local population and

interest groups. This might require investments in order to enable these groups to participate in the discussion (e.g. providing transport, outreach, information, professional mediation, etc.). Whilst electronic solutions may have some role in addressing this problem, these are not necessarily sufficient themselves and may even entrench inequality in participation, creating a 'participatory' class of citizen (Hovik et al., 2022).

This type of intentional and premeditated rebalancing of power requires a careful design of the discussion environment itself, considering social justice and rights to the city. Metadesign (design of the design process) is a useful framework to achieve this goal in collaborative processes. Planning of the discussion is as important as the planning of the solution itself, not only to ensure participation but also the quality of participation, providing adequate means for the general public and the different types of experts to understand each other and navigate the technical complexities inherent to urban projects.

Learning 3: Conflict between groups can take the whole stage. Local Government needs to show leadership with a City-wide strategy across green space and reflect all residents' views and priorities throughout a city's sustainable development

In São Paulo, after decades of local (and politically relevant) groups petitioning for the park, the dispute converged towards a business-tower vs. park axis. This left very little space for new elements to be considered when the design for the park was finally being discussed: a partial implementation of social housing, for example, was not considered even though it is one of the main urban challenges in São Paulo.

Another main criticism was the allocation of so many public funds in a region so well-served by public policies when the rest of the city is, by contrast, so underserved. This might be the symptom of the reactive nature of the government's involvement in this process: they only acted after intense provocation by the organised and powerful groups. If a more proactive approach was made towards land use, they might have

detected other possibilities of green spaces and other relevant public policies and, through more widespread means, decided the priorities and means of action together with the population, as was done in the case of Tempelhof. This might be evidence of the importance of local government guaranteeing more widespread public participation in earlier phases of planning discussions to determine the priorities of land use.

In London, the project is hoping to become a self-sustaining charity model of park management, and the site is unusable for housing, it is unlikely that such a project will divert resources from other needed areas. It is in line with the city's Local Environment Strategy (Greater London Authority, 2018).

From this angle, the Tempelhofer Feld of Berlin is relatively unique in its super large-scale green space in the city. The local government cannot ignore the voices and arguments that this greenland is precious for climate regulation and eco-friendly for the diverse species living in this Feld. The value of this Feld is thus integrated into multiple levels, including the possibilities of building the large-scale project, and the social and natural benefits for different actors (Brenck et al 2021).

The city-wide strategy of this Feld requires more consideration of various voices and standpoints from local communities, vulnerable groups, and non-human actors. How to balance them and give an accessible stage for all of them is challenging work for the municipal government. The participation model is a great and creative endeavour, but the additional democracy of its own has added a new complicated situation for engagement. For example, the interviewee expressed that residents who can not vote and speak German will struggle to be involved actively in this model.

Recommendations:

If citywide planning is done across a larger time frame, such as a 10-year masterplan, the long-term perspective can serve as an important reference point to situate local planning within the general strategy of the city.

City plans should be designed in an iterative and participatory fashion, so they can be more adherent to the population's needs and desires. An important goal is to organise the city's priorities across the different regions so, when regional and local projects are designed, they can refer to the larger plan or strategy.

The iterative aspect of the masterplan can be used to scale local projects into the main planning strategy (Mitlin, 2021), effectively creating periodic bottom-up flows in an otherwise top-down process. It can also serve to update the population's priorities on local directives and budgeting, and to keep the masterplan dynamic enough to remain relevant.

Learning 4: Non-humans can be a focal point of public communications, but they are not considered as individual actors, rather in terms of their value to humans.

Even though all three cases studies reference biodiversity, nature or wildlife as a focal point of their campaigns, none of them consider implementing non-human participation in the process. Instead, non-human actors are considered instrumentally in regards to their value or natural benefits they might provide to human beings.

Recommendation:

Non-human quality of life should be considered through the participation of scientists and specialists. This requires a new type of framework to be developed and integrated on traditional urban planning methods and will demand resources to be successful in situating non-human actors not only as mere tools towards biodiversity goals and human quality of life goals, but as actors in a participatory sense.

Learning 5: Civil organisations and citizens are the central actors during the participation process. Citizens themselves should be supported to take active and participatory roles in the development of their city.

In the case of Berlin, the active citizens and the association they established later are quite crucial and directly had a big influence on the final decision regarding how to use Tempelhofer Feld. Self-motivation and high interest in public affairs become the prominent characteristics of the participation of citizens. The members who invest more time and energy can hold more social and cultural capital in the association and impact the later discussions with the local authorities and other stakeholders.

For citizens, realising their capabilities and responsibilities in the co-creation of public spaces is vital, not only enjoying the fruits of other active communities' contributions. Knowing what to do in the participation model and understanding the system, including urban planning, public administration, and participation strategies, are the qualities desired by the civic organisations. A snowball of skills can arise, ensuring one particular civic organisation controls the narrative, holding the power to negotiate with other stakeholders.

In London, the local citizens themselves are leading the way in organising for the park and working to ensure that participation includes those beyond the self-selecting group. Though they are looking at ways to reduce barriers for groups that are often marginalised in environmental projects, the reality is that the charitable organisation they represent is now the only likely vehicle for development of the site into green space, meaning they must be careful to listen meaningfully to all.

Recommendations:

This process requires constructing the confidence and trust of citizens for the engagement, from the actors of local government and the mature self-organisations. Transparent information and open-access learning for participation are necessary. In this respect, the citizens who intend to contribute themselves in the public space will express and represent themselves more efficiently.

Local authorities can provide more accessible channels and pathways for the citizens. Local government has to situate the discussion and set the boundaries according to legislation, the larger plan and the resources available, but this must be done informing and including people in the discussions (accessibility of information, access to education).

The access can combine formal and informal ways, not only the serious and official meetings. Informal ideas and reflection in planning can generate creativity and more broad public opinions. The technological practice of "Using Minecraft for Community Participation" initiated by the UN-HABITAT (2016), for instance, provides more interesting and easier paths to participation that can attract and educate the younger generation to be curious about urban issues and planning and express their opinions. More importantly, making use of the existing resources, citizens can self-cultivate the capabilities of participation and take action positively for a convivial public space by themselves.

7. CONCLUSION

In this report we have examined three cases studies, one from each of the target cities (London, Berlin and São Paulo). Each of these cases is in a different stage of its life. In London, the project is still at an initial stage, having completed a successful crowdfunding round. In Berlin, the Feld was legislatively protected in the mid-2010s, a condition that will likely remain as such, even though there is a constant possibility of legislative revision and, in so, an uncertain future. In São Paulo, the longest running campaign, the park has been successfully implemented and is now open to the public in what is likely a permanent setting.

Participation in each of these projects was in many ways fundamental. None of these case studies were top down, local, or national authority led projects to build new parks; they were (or are in the process of) being fought for by local residents and campaign groups, standing up to often vested interests and business as usual political choices. From our analysis, all of these projects have a strong focus on modern sustainability issues, habitat, nature and the generation of new green space. Two of them have a strong focus on participation and community in their own literature, highlighting how crucial engagement has become in creation of new spaces.

Our analysis, using the actor network theory as a guiding lens, has highlighted five key learnings from our examination of participation in these projects. The first is that of legislation and how it can offer a route for community groups to stake their claim to what otherwise may be prime real estate. Second, we have two recommendations for local government; they must be active facilitators in the process and, as seen clearly in São Paulo, can act to balance the power that otherwise often lies with corporations or wealthy actors. Third, whilst all cases focused on nature, the role of non-human actors is an outstanding point of development. Lastly, we focus on citizens and the role and action that all citizens have to play in the development of new green spaces.

Our recommendations call on vested political structures (local authorities in many cases) to act. Turnhout et al., (2019) highlight how participation is often done; with framing set in place and with groups known to those in charge. Instead, those in power for planning must hold

meaningful participation, and scale up local participatory actions to a wider city level. This must recognise the expertise that citizens have of their local area and city and may value choices not necessarily aligned with their own - there is not necessarily a best solution as might be dictated by political or scientific viewpoints.

Our research here is somewhat limited by our own analysis, which is grounded in mainly desk based research based on just three cases in the vast cities of São Paulo, London and Berlin. It would be interesting to further examine participation grounded in recommendations 3 and 5, from a city-wide perspective, with research (and participation itself) following such plans from the initiation to completion of such a project, to further examine and learn how it can be done on such a large scale.

This would be a complex feat and requires cross-political support as it is likely to proceed well over the usual political election cycle. Another possible follow-up to this research would be to investigate, using ethnographic observation and the theoretical references suggested in this paper, one or more processes of public participation from start to finish. The London case presents an interesting opportunity for this, as it is in the early stages of design and implementation.

Research may also have benefits for groups actively seeking to develop their own green space and offer an opportunity for collaboration across fields. For instance, the health-based Implementation science field has extensive literature focusing on aspects of implementation that can help or hinder such programmes (e.g., Murphy et al., 2021). There are a multitude of tools to support such implementation, and these may be of benefit for groups seeking to assess and understand what needs to be done to achieve their aims, though may need slight adaptation.

Our final recommendation focuses on citizens themselves. All of our projects have shown the power of engaging and fighting for the green spaces that all citizens of cities use. Participation is not a one-way street and requires us all to get involved. Speculatively, recommendation 5 may help support such an endeavour and embodiment of recommendations 1-3. With more active engagement of citizens, politicians are more likely to be in tune with what local (and city wide) citizen would like in their cities and are less likely to prioritise other aspects, such as corporate

growth. Indeed, as politicians are citizens themselves, engagement with political systems could increase the participation of people in the political system who support the development of new green spaces.

In conclusion, we hope this analysis can help support participation going forward, to help act as a guide for local authorities and organisations working to support such efforts and hopefully, support the development of people-focused land-use to help cities be more sustainable going forward.

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REFERENCES

Brenck, M., Hansjürgens, B., Schröter-Schlaack, C., Tröger, U., Wessner, A., & Wittmer, H. (2021). Gesellschaftliche Wertigkeit des Tempelhofer Feldes: Qualitäten erfassen und sichtbar machen (Social value of the Tempelhofer Feld: Capturing qualities and making them visible) (No. 5/2021). UFZ Discussion Paper.

Callon, M. (1999). Actor-Network Theory—The Market Test. The Sociological Review, 47(1_suppl), 181–195.

Czarniawska. (2006). Book Review: Bruno Latour: Reassembling the Social: An Introduction to Actor-Network Theory. Organization Studies, 27(10), 1553–1557. SAGE Publications.

Department for Environment, Food and Rural Affairs (2023). Environmental Improvement Plan. Department for Environment, Food and Rural Affairs, London, United Kingdom.

Dobson, J., Cathy H., Eadson W., & Gore, T (2019). Space to Thrive 2019, A rapid evidence review of the benefits of parks and green spaces for people and communities. The National Lottery Heritage Fund and The National Lottery Community Fund, London.

European Environment Agency (2019). Healthy environment, healthy lives: How the environment influences health and well-being in Europe. Online: https://doi.org/10.1163/9789004322714_cclc_2020-0201-1126 (Accessed on 9th June 2023)

East London Waterworks Park (2023) East London Waterworks Park. Online: https://www.elwp.org.uk/Home.htm (Accessed on 15th April 2023).

East London Waterworks Park (2022) East London Waterworks Park Business plan, Version 1.1. Online: https://www.elwp.org.uk/Home.htm (Accessed on 15th January 2023).

Genz, C. (2015). "The Wide Field of Participation. An essay on the struggle for citizen participation and the future of the Tempelhof Field". Journal of Urban Life 3: 6–17.

Greater London Authority (2018). London environment strategy. Greater London Authority. Online: https://www.london.gov.uk/programmes-and-strategies/environment-and-climate-change/london-environment-strategy (Accessed on 9th June 2023)

Grün Berlin GmbH (Green Berlin GmbH). (2022) TEMPELHOFER FELD HAUSHALT Doppelhaushalt 2022 /2023 nach Senatsbeschluss (Double budget 2022 /2023 according to Senate resolution). Online: https://tempelhofer-feld.berlin.de/documents/689/Anhang1_THF_Haushalt.pdf

Grün Berlin GmbH (Green Berlin GmbH). (2023) Tempelhofer Feld. Online: https://gruen-berlin.de/en/projects/parks/tempelhofer-feld/about-the-park.htm (Accessed on 15th April 2023).

Hori, P. (2018). Práticas urbanas transformadoras: o ativismo urbano na disputa por espaços públicos na cidade de São Paulo. Dissertação de Mestrado, Faculdade de Arquitetura e Urbanismo, Universidade de São Paulo, São Paulo (Accessed on 29th April 2023)

Hovik, S., Legard, S., McShane, I., Middha, B., Reichborn-Kjennerud, K., Ruano, J.M. (2022). Participation and Influence in Urban Development: Does City E-Participation Strategy Matter?. In: Hovik, S., Giannoumis, G.A., Reichborn-Kjennerud, K., Ruano, J.M., McShane, I., Legard, S. (eds) Citizen Participation in the Information Society. Palgrave Macmillan, Cham.

Ingrid Bisterzo, Isabella Maria Davenis Armentano, Lucas Lavecchia de Gouvea & Paula Hori. (2023). A história do Parque Augusta: participação e articulação cidadã. 27 Nov 2022. In: ArchDaily Brasil. Online: https://www.archdaily.com.br/br/991839/a-historia-do-parque-augusta-participacao-e-articulacao-cidada (Accessed on 28th April 2023)

Latour, B. (1990). On actor-network theory. A few clarifications plus more than a few complications. Philosophia, 25(3), 47-64.

Latour, B. (1996). On actor-network theory. A few clarifications. Soziale Welt, 47(4), 369–381.

Latour, B. (2005). Reassembling the social: an introduction to actor-network-theory / Bruno Latour. Oxford University Press, Oxford.

Law, J., & Hassard, J. (1999). Actor Network Theory and After. Wiley-Blackwell. Oxford (England)

Lawson, D. V., Purohit, D. R., Samuel, F., Brennan, J., & Farrelly, L. (2022). Public participation in planning in the UK. UK collaborating centre for housing evidence. Online: https://housingevidence.ac.uk/wp-content/uploads/2022/04/220406-Public-participation-in-planning-in-the-UK_v3.pdf (Accessed on 9th June 2023)

Mitlin, D (2021) A framework to scale citizen participation in urban development: Learning from experiences of multi-stakeholder collaboration. GDI Working Paper 2021-058. Manchester: The University of Manchester. Online: https://hummedia.manchester.ac.uk/institutes/gdi/publications/workingpapers/GDI/gdi-working-paper-202159-mitlin.pdf (Accessed on 9th June 2023)

Moroni, S. Public Spaces, Private Spaces and the Right to the City. International Journal of E-Planning Research, 3(1), 51-65, January-March 2014. Online: https://www.academia.edu/42924233/Public_Spaces_Private_Spaces_and_the_Right_to_the_City?email_work_card=view-paper, (Accessed on 9th June 2023)

Murdoch, J. (1998). The spaces of actor-network theory. Geoforum, 29(4), 357-374.

Murphy, J., Qureshi, O., Endale, T., Miguel Esponda, G., Pathare, S., Eaton, J., De Silva, M. & Ryan, G . Barriers and drivers to stakeholder engagement in global mental health projects. Int J Ment Health Syst 15, 30 (2021).

Prefeitura (2023) Parque Augusta. Online: https://www.prefeitura.sp.gov.br/cidade/secretarias/meio_ambiente/parques/regiao_centrooeste/index.php?p=317881 (Accessed on 15th April 2023).

Revista Projeto (2022) Kruchin Arquitetura, Parque Augusta, São Paulo, SP. Online: https://revistaprojeto.com.br/acervo/kruchin-arquitetura-parque-augusta-sao-paulo-sp/url (Accessed on 20 January 2023).

Senate Department for the Environment, Mobility, Consumer and Climate Protection (Senatsverwaltung für Umwelt, Mobilität, Verbraucher- und Klimaschutz: SenUMVK. (2019).Participation Model of Temperlhofer Feld (Beteiligungsmodell Tempelhofer Feld). Available: https://tempelhofer-feld.berlin.de/beteiligungsmodell-thf/ (Accessed on: 09/06/2023)

Turnhout, E., Metze, T., Wyborn, C., Klenk, N., & Louder, E. (2020). The politics of co-production: Participation, power, and transformation. Current Opinion in Environmental Sustainability, 42, 15–21.

United States Environmental Protection Agency (2023). Public Participation Guide: Introduction to Public Participation. Online: https://www.epa.gov/international-cooperation/public-participation-guide-introduction-public-participation#:~:text=Public%20participation%20can%20be%20any,input%20in%20making%20that%20decision. (Accessed on 15th April 2023)

UN-Habitat. (2016). Using Minecraft for Community Participation. Online: https://unhabitat.org/manual-using-minecraft-for-community-participation (Accessed on 9th June 2023)

Verfahrenskoordination Tempelhofer Feld (Process coordination Tempelhofer Feld), Tilmann Heuser, Evelyn Bodenmeier. (2016). Tempelhofer Feld Entwicklungs- und Pflegeplan (Tempelhof Field Development and care plan)

Online: https://tempelhofer-feld.berlin.de/documents/74/160513_THF_Broschu%C3%AAre_Web.pdf (Accessed on 15th April 2023)

Walsham, G. (1997). Actor-network theory and IS research: current status and future prospects. In Information Systems and Qualitative Research: Proceedings of the IFIP TC8 WG 8.2 International Conference on Information Systems and Qualitative Research. Philadelphia, Pennsylvania, USA (pp. 466-480). Springer US.

Wan, C., Shen, G. Q., & Choi, S. (2021). Underlying relationships between public urban green spaces and social cohesion: A systematic literature review. City, Culture and Society, 24, 100383.

World Health Organization. (2016). Health as the pulse of the new urban agenda: United Nations conference on housing and sustainable urban development, Quito, October 2016. World Health Organization. Online: https://apps.who.int/iris/handle/10665/250367 (Accessed on 9th June 2023)

4

WATER JUSTICE IN THE CITY: A COMPARATIVE STUDY OF SUSTAINABLE FLAGSHIP PROJECTS IN BERLIN, LONDON, AND SÃO PAULO

C. MARQUES, G. ROBINSON, D. PEZZIN, Y. POZDNYAKOVA

ABSTRACT

This paper analyses the success of three schemes that have been identified by local governments as flagship projects for sustainability in Berlin, London, and São Paulo. We use the concept of water justice (Sultana, 2018) to conduct our analysis of how each scheme incorporates Blue-Green Infrastructure (Brears, 2018) as markers of sustainability and democracy relating to water access for leisure in urban areas. The case studies we have chosen are Potsdamer Platz in Berlin; Queen Elizabeth Olympic Park in London; and Pinheiros River in São Paulo. Each scheme promotes the use of water for leisure activities by local residents and visitors to the area. Using maps, existing reports, BGI (Blue-Green Infrastructure) analysis, and photographic evidence, we analyse the effectiveness of each case study in terms of how it responds to threats of climate change and considerations of water justice in its planning and delivery. Water justice involves the active participation and empowerment of local communities, vulnerable and disadvantaged groups that live in and access the sites of development on all stages of project planning, development and maintenance, sustaining and introducing biodiversity on project sites and in areas adjacent and influenced by the project. By using a water justice perspective, we critically analyse claims to sustainability of publicly-funded urban projects. We argue that more actions need to be taken to ensure

community development and involvement, and democratic access to water for leisure, especially among vulnerable and marginalised groups.

The remarkable thing about water is that seeps across all boundaries and all aspects of life, as it is simultaneously social, economic, political, institutional, cultural, spiritual and ecological (Sultana 2018).

1. INTRODUCTION

In July 2010, the United Nations recognised access to clean and safe water as a human right. The human right to water was declared an indispensable prerequisite for leading a life of dignity and realising other human rights (United Nations, 2015). However, the impacts of climate change (rising global temperatures and extreme weather events) have put increasing pressure on water availability and accessibility, known as water stress. By 2050, the United Nations estimates that 25% of the world's population will experience recurring water shortages (United Nations Development Programme, 2015). For this reason, water access constitutes one of the 17 Sustainable Development Goals (SDG) identified by the United Nations in 2015. Governments worldwide pledged to ensure safe water access and sanitation facilities to all by 2030. However, the increasing demand for fair access to safe and clean water and sanitation by a growing world population is triggering water crises that are being felt in both the Global North and Global South, especially in densely populated urban areas where demand for water is highest (Sultana, 2018). Subsequently we argue that water justice should be considered in the planning and delivery of sustainable urban development schemes.

The uneven global distribution of safe water for (domestic) use is turning water into a privatised commodity, rather than a human right. When limited water supplies come under threat by neoliberal forces attempting to privatise and control water access and distribution, the most vulnerable communities will inevitably suffer the most, further entrenching socio-economic disparities. From this observation arises the concept of water justice, which represents a response to the social and political issue of fair water access. Water justice considers questions of democracy, citizenship, and development, and is based on the principles of fairness, equity, and participation (Sultana 2018, p487). Sultana (2018) states that this issue is not isolated to a particular community or country, but represents a global problem that affects us all. Sultana argues that issues of water access should be context-sensitive; we should consider how site-specific conditions account that water stress affects groups of people differently in various places.

We argue that fair water access based on the principles of fairness, equity, and participation should constitute a foundational principle of sustainable urban development projects. These should include access to green spaces and waterways for leisure, as well as fair water access for drinking, domestic use, and sanitation. Access to water particularly in green and public spaces in urban areas caters to the 11th United Nations SDG regarding sustainable cities and communities. The UN pledges by 2030 to provide universal access to safe, inclusive, and accessible green and public spaces, in particular for women and children, older persons, and persons with disabilities in both Global North and Global South (United Nations Development Programme, 2015). Considering the urgency of recognizing that water justice and fair access to water for leisure should be a common consideration when planning and delivering sustainable urban projects in cities, we have adopted a comparativist approach to analyse the success of sustainable flagship urban schemes in addressing water justice under site-specific water stresses in three global cities: Berlin, London, and São Paulo.

This paper evaluates the success of three urban development schemes with water-based systems as part of their sustainability strategy in adhering to questions of water justice in the creation of public spaces. The schemes we have chosen to review are celebrated by local governments as flagship projects for sustainability: Potsdamer Platz in Berlin; Queen Elizabeth Olympic Park in London; and Pinheiros River in São Paulo. Each scheme's funding schemes, commitments and goals, public image and reception, demonstrate that these projects are forerunners in large-scale publicly funded sustainable developments. Potsdamer Platz received the German Sustainable Building Council City District Certificate in Gold and, in 2011, the DGNB Silver Sustainable Urban District Certificate for Newly Constructed Municipal Quarters. Queen Elizabeth Olympic Park's commitments, published in 2012, extend to 2030 and include a 7-themed sustainability scheme (London Legacy Development Corporation n.d.) Potsdamer Platz, with its key redevelopment, was the first city district to receive the DGNB (German Sustainable Building Council) Certificate for Newly Constructed Municipal Quarters. (German Sustainable Building Council, 2011). The Novo Rio Pinheiros Program in São Paulo is the city's largest project in recent history that works towards building the the connection between several crucial axes: sanitation and maintenance, revitalization, social

and environmental education. As listed on the front page of the project website, it "aims to revitalize this important symbol of the city of São Paulo through the action of various public agencies in partnership with society".

Each of these schemes includes the development of a river or waterway system that members of the public can access for leisure. We have chosen these sites considering the factors of interdependence in addressing the issues of climate change, and following various international agreements on sustainability (Kyoto Protocol, Sendai Framework, The United Nations Environment Programme (UNEP) 10-Year Framework of Programmes on Sustainable Consumption and Production, United Nations Sustainable Development Goals (SDGs). This research looks at wider geography for this comparative study in a beneficial context as it encompasses a cooperative approach and proposes the value of water justice as a shared goal and an underlying factor for sustainability in both Global North and Global South.

In this paper we will first outline the theoretical framework and methods used to conduct a critical analysis. This includes defining key terms – Blue-Green Infrastructure (BGI) and water justice. We then introduce each case study and the particular stresses and threats of climate change that are specific to the city, and how (if at all these have been considered in the planning and implementation of each site). For this purpose, we are examining each scheme's most effective BGI strategies and comparatively considering how these contribute to the water justice approach. In the second part of our comparative analysis, we critically review context-specific conditions of each site and project's sustainable planning approach in addressing these. A sustainable planning approach should consider the synergy between biodiversity, urban memory, and sustainable urban and architectural design of public spaces which incorporate blue and green elements (European Commission, 2019). We conclude by making recommendations for future schemes to ensure fair and equal access to water for leisure, taking into consideration the specific challenges relating to water stress and access in each city and selected water-justice approaches derived from our comparative analysis. By analysing BGI strategies and water-justice approaches (or lack thereof) in three cities, we synthesise knowledge and

complementary strategies that can be learned from each of the project case studies.

2. METHODOLOGY AND THEORY

This investigation uses a mixed methodological approach to assess the implementation of water justice in sustainable urban development projects in Berlin, London, and São Paulo. Our methods include a literature review; maps of land use at each site; fieldwork notes; photographic evidence of how the waterway has been incorporated into the scheme; and a sliding scale points system to evaluate the success of each scheme in terms of implementing water justice and Blue-Green Infrastructure (BGI). We use the concept of water justice (Sultana, 2018) as our key theoretical framework as well as Blue-Green Infrastructure (BGI) to assess the sustainability of each scheme in our chosen sites.

BGI refers to the integration of blue (water, or WSU– Water Sensitive Urban Design) and green (vegetation, or GI– Green Infrastructure) components as opposed to grey (urban) elements (European Commission, 2014). It is a multifunctional planning approach that aims to address different issues depending on whether the project is motivated by green or blue solutions and its synergetic use of resources. This concept is a strategically planned network of valuable natural and semi-natural areas with further environmental elements. Schemes that use BGI are designed and managed in such a way that a broad spectrum of ecosystem services is guaranteed in both urban and rural areas and biological diversity is protected (European Commission, 2019). In urban areas, the positive effects of BGI include sound insulation, air cleaning, fine dust binding, rain water retention, and aesthetic aspects (Pfoser et al., 2014). The combination of blue and green elements can also provide means to make cities more resilient to climate change (Klemm et al., 2017). This study critically evaluates each of our chosen sites in terms of how they implement BGI. We present evidence of how each scheme incorporates WSU and GIs, and the synergetic combination of these approaches to benefit water justice. In this way, our analysis of each scheme considers questions of biodiversity and resilience to climate change as key success criteria of sustainability.

In terms of water justice and for the purposes of comparative analysis, we have identified the following criteria to assess each scheme in terms of its sustainability: democracy (fair access to water); inclusive participation (community involvement in decision-making and

consultation pre- and post-construction); biodiversity; legacy and memory; housing, sanitation and urban planning (primary users of the scheme); and placemaking (branding/identity, aesthetic urban design and architecture). We examine each scheme according to these criteria by reviewing the literature available for each site, and by using our observations during site visits. From this, we create a sliding scale points system to critically analyse and compare the effectiveness of each project as a flagship scheme for sustainability in terms of how it incorporates water justice and BGI (Tables 1 and 2). We do this by asking whether each scheme considers questions of water justice, community involvement and participation, biodiversity, and resilience to climate change. If we consider the scheme addresses these issues effectively, based on our definition of water justice as fair and democratic access to water for leisure, we award it more positive points (ranging from + to +++). Our points system facilitates comparison between the three case studies and our overall evaluation of which scheme most effectively promotes water justice as a central consideration for sustainable urban projects.

3. CASE STUDIES

3.1. Queen Elizabeth Olympic Park, London

Plans to construct the Queen Elizabeth Park began in 2005 when London won the bid to host the Olympic Games in 2012. The London Olympic games cost almost £9 billion and promised to deliver a lasting legacy which includes making the Olympic Park "a blueprint for sustainable living"(London City Hall, 2008). This legacy was meant to provide more jobs, housing, and leisure facilities for residents in a historically socially deprived area of East London. However, the scheme has been criticised by locals for failing to improve their standard of living and represent their interests in favour of those of big business, corporations, and tourists (Roman Road LDN, 2023). The Clays Lane housing estate was demolished as part of the redevelopment scheme and 450 residents were rehomed in temporary housing that has not improved their quality of life (*The Guardian*, 2021). Although national sporting bodies and local governments were consulted in the planning of the site, there is little evidence of local, grass-roots community participation in the consultation process (London Legacy Development Corporation n.d.). Here we will present evidence to assess if and how the Queen Elizabeth Olympic Park has succeeded in addressing water justice and Blue-Green Infrastructure in its claim as a blueprint for sustainable living. The key piece of literature we draw our analysis from is the Olympic Legacy Waterways Framework, produced by the London Olympic Development Committee and Canal River Trust, which outlines the history of the Bow Back Rivers and its role in the legacy left by the Olympic Games in East London.

The Park is located in East London which lies at the intersection of the Bow Back rivers and River Lea. The Bow Back Rivers are a 16km (10 mile) system of waterways which feed into the River Lea Navigation and the Thames in East London. During the early 1900s, these waterways served an important means of powering mills at Three Mills and City Mills and in servicing local industries (London Legacy Development Corporation n.d.). However, with the post-industrial decline and reduction in canal freight and waterside industries in the latter half of the twentieth century, this area became a site of neglect, social deprivation and industrial wasteland. The 1968 Transport Act classified the Bow

Backs as "Remainder Waterways'' effectively labelling them as no longer viable for leisure or commercial use (London Legacy Development Corporation n.d.). This remained the case until 2005 when construction began for the Queen Elizabeth Park (***Figure 23*** & ***24***). The scheme involves a 6km network of disused canals and rivers that have been reconnected to the 2,000-mile inland waterway network owned by the Canal & River Trust. Working in tandem with the Trust, the London Legacy Development Corporation developed a Framework to ensure the continued maintenance and development of the waterways in the Queen Elizabeth Park and the lower reaches of the River Lea Valley. In the Framework document, waterways are identified as key to economic growth, social engagement and community participation, and opportunities for investment. The Waterways Framework identified objectives which indicate an awareness of the need to implement water justice and fair access to water for leisure in sustainable urban planning schemes. These include promoting the use of the waterspace and associated public realm recognising the diverse needs of different users, security, environmental and commercial considerations; creating a "sense of place" and focus for the waterways, that respects their rich heritage whilst bringing life and vitality to the waterfront and encouraging high quality, integrated and sustainable development; offering a high level solution to infrastructure provision which can facilitate flexible use of the waterways over the next 20 or so years and ensure their sustainability; recommending an appropriate balance between commercial and public benefit to ensure sustainable long term maintenance and stewardship of these waterways for future generations; and securing stakeholder commitment to the continued

renaissance of these waterways (London Legacy Development Corporation n.d.).

Figure 24: Pudding Mill Lane 2003. This river is now buried under the current Olympic Stadium. [Source: https://www.londonslostrivers.com/bow-backs-rivers.html]

Figure 23: Olympic Park Site 2022. Photo courtesy of the London Legacy Development Corporation (LLDC). [Source: https://romanroadlondon.com/ten-years-on-queen-elizabeth-olympic-park/]

Between 2005-2012, local Government agencies invested over £50 million to transform the waterways in the Lower Lea Valley. Work included a new lock and water control system at Three Mills to prevent tidal flooding in the Park; refurbishing an abandoned lock on City Mill River; dredging deeper channels to improve navigability for commercial and leisure traffic on the water; transforming a 5.6km flood-relief channel into a navigable watercourse that integrates a regenerated waterside, parklands, wetlands, and wildlife areas; rebuilding waterway walls and towpaths for walking and cycling through the park; and installing infrastructure, such as mooring posts and landing stages, for boat trips. The Framework claims that these improvements will ensure that the canals and rivers contribute to a thriving legacy for London. The natural soft banks, reedbeds and wetlands to the North of the Park are evidence of an effective use of BGI to encourage biodiversity and address both sustainable land use management and attempts to address flooding due to climate change.

The development of the Bow Back River Waterways System responds to the need to facilitate access to water which has been proven to improve people's health and wellbeing, especially for those living in urban areas (White *et al*., 2020). The cooling effect of proximity to green spaces has also been documented as an effective strategy for cities to become more resilient to climate change, such as providing relief from heat islands produced in densely populated urban areas (Liu *et al.*, 2022). For this reason, BGI is essential in identifying and planning sustainable urban schemes that are both climate resilient and benefit the health of local populations. London's population is expected to increase to 3.4 million by 2050 (London Assembly Environment Committee). This means that demand for water will outstrip supply by 20% by 2040, which is exacerbated by low rainfall and drought. Other challenges that face London's water management and distribution are pollution in rivers and waterway systems, and inefficient water management through leaking pipes. While not directly addressing the increasingly urgent issue of access to water for drinking and sanitation, the Queen Elizabeth Olympic Park site does present important opportunities for people to access blue and green spaces which can improve their general health and wellbeing and provide a cooling effect from rising temperatures due to climate change.

However, the fair and democratic access for all has been contested by studies such as Snaith (2015) and Davis (2012). In her study, Snaith finds that, although ethnic minority groups are the majority demographic in the Olympic Park catchment area, they are the least represented users of the park. This discrepancy is typical of development plans by spatial design 'elites', who do not realistically provide welcoming and safe spaces for UK ethnic minorities to use (Snaith 2015). Juliet Davis (2012) argues that inequalities are commonly found in large-scale *tabula rasa* development schemes, effectively creating a "blank slate" through wholesale demolition of disused brownfield sites[11]. Davis states that, "Whilst the urban condition of *tabula rasa* may be said to create an image of futurity and promise, it simultaneously creates an image of uncertainty and risk – for present users, in terms of the value of land which is erased in order to be recreated through 'cataclysmic' investment, and in terms of the ability to deliver on promises related to plans."[12] This failure to deliver on promises of community inclusion and development for present and local users is common with other Olympic development projects. This has given rise to doubts about the unsustainability in both social and economic terms of hosting such large-scale, internationally public-facing events[13].

3.2. Pinheiros River, São Paulo

The Pinheiros River (Rio Pinheiros) is originally a meandering river that extends twenty kilometres from south to north reaching into the Tietê River.[14] Straightened in the 1950s and later serving as an axis for marginal avenues connecting the city in a car-based planning model, the river runs between the west and the expanded central area of the city. By the 1970s, the river's pollution had reached extremely high levels, and,

[11] Source: https://blogs.lse.ac.uk/politicsandpolicy/community-impact-of-the-olympics-davis/
[12] Source: https://blogs.lse.ac.uk/politicsandpolicy/community-impact-of-the-olympics-davis/
[13] Source: https://www.cfr.org/backgrounder/economics-hosting-olympic-games
[14] The Tietê river is known as a natural feature dividing São Paulo between the north and central areas and also as the main river of the Alto Tietê basin, comprising almost the whole São Paulo metropolitan area, flowing into the Paraná river (Seabra, 2015).

similarly to all rivers in the city, Pinheiros lost its sport and leisure public function (Fix & Arantes, 2022; Seabra, 2015).

Today, the areas surrounding the Pinheiros River are mostly known for their infrastructure – power plants, train lines, subway crossing under the river, industrial sheds, big stores, bridges, and large-scale public and private institutions, such as the University of São Paulo. Many of the building complexes and some neighbourhoods, however, are surrounded by green areas (Hirata & Quintão, 2020; Prefeitura do Município de São Paulo, n.d.). This variety of urban land use has one common characteristic: it requires large-scale land allocation for limited purposes while depriving the neighbouring areas of connected and diversified public land use. This spatial requirement implies a very challenging urban scenario where diversification of public features for a people-centred approach, such as walkability and cycling, as well as provision of multispecies conviviality necessary for sustainable and fair use of the city's resources becomes problematic and often unattainable due to top-down management of cities (Fix & Arantes, 2022; Fracalanza *et al.*, 2022; Momm *et al.*, 2020).

Within São Paulo the Pinheiros River mainly divides two regional administrations – Pinheiros and Butantã. Despite sharing some of the same areas with favelas close to tributaries of the Pinheiros River, Pinheiros and Butantã are known as medium and high-income boroughs. With this, both have better social vulnerability indexes than the city's average (Prefeitura do Município de São Paulo, 2015). Considering this disjunction of social indexes and zones with favelas, the areas around the Pinheiros River can be seen as an exemplary case for the urban inequality in the city. One of the features of this precarious positioning is that people working in low-income jobs in these areas have a long-distance commute and are deprived of accessible services.[15]

In this scenario the city launched in 2019 the Novo Rio Pinheiros Program (***Figure 25*** & ***26***). The project features a series of interventions: a program on de-pollution of the Rio Pinheiros and its tributaries; a strategy for desilting the river and containing its banks; it aims at reducing the emission of greenhouse gases by planting native trees along

[15] More details on the current situation of the Pinheiros river area can be found in Annexes.

13 km of the river and allocating a Linear Park with cycling lanes, floating bridge and boat decks, sites for public art, social interactions, and cultural interventions, along the river bank. A large part of the planning consists of a retrofit project for the Usina SP building to host various programs, including co-working spaces, entertainment facilities, and the biggest open-air cinema in Latin America (Governo do Estado de São Paulo, n.d.; Hirata & Quintão, 2020, Hirata *et al*. 2022). Most importantly, however, in the São Paulo Novo Rio Pinheiros Program context and the city's needs, an expected sanitation provision for five thousand households, mainly in favelas close to Pinheiros River and its tributaries, becomes a prominent water justice goal.

Figure 25: Pinheiros River 2020 (pre-development).
[Source: https://apnews.com/article/brazil-sao-paulo-pollution-13d993df5329ed76e22a567f96107443 (Andre Penner)]

The total estimated cost of the first stage of the Novo Rio Pinheiros Program was R$ 4 billion in 2019 (US$ 1 billion), later divided between the São Paulo State Government (R$ 2 billion), the Inter-American Development Bank (R$ 1 billion), World Bank (R$ 0.5 billion), and Usina SP Private Consortium (R$ 0.3 billion)(Governo do Estado de São Paulo, n.d.). Responsibilities were framed among many public and private agents: the São Paulo State Government and its companies: SABESP (providing sanitation and cleaning the river), CETESB (measuring the water and air quality), among others; the São Paulo municipality (offering land use licences and urban arrangements for the linear park);

Figure 26: Pinheiros River today (post-development). [Source: https://commons.wikimedia.org/wiki/File:Ciclovia_da_Marginal_Pinheiros.JPG/]

Private companies (Usina SP consortium for the retrofitting; Votorantim, planting native trees; Santander, and Telefonica, providing infrastructure and social activities inside the linear park)(Governo do Estado de São Paulo). In 2023 some results of the Novo Rio Pinheiros Program could already be seen: the government claims that the oxygen demand below 30 mg/l of the Pinheiros river was achieved - despite recent data shows it is a true only in certain areas - (Governo de São Paulo, n.d.) - and more than 500 thousand households have been connected to the sewage system. The Linear Park was launched in 2022, and the Usina SP building was granted for a private partner for the retrofitting (Governo do Estado de São Paulo, n.d.; Hirata *et al.* 2022). Also there is now a noticeable reduction in the unpleasant odour in the area.

3.3. Potsdamer Platz, Berlin

Potsdamer Platz, located in central Berlin, is renowned as an exemplary sustainable development scheme because it synthesises water-sensitive design, architecture, and urban space. It is also celebrated for its iconic

architecture that forms the largest construction project in Europe in the 1990s. The ICLEI European Secretariat report lists the project as a flagship sustainability project regarding water management (Salian & Anton, 2010). Other sources celebrate its exceptional public space (Gleason & Casiano, 2020; Dreiseitl & Grau, 2006). In 1991, a competition for redesigning Potsdamer Platz was announced, and the process of transformation of the site into a new urban paradigm took root. Due to the urgency of rebuilding the site, and the determination of the State to re-brand this significant Berlin site, the masterplan was divided into sections and sold to Daimler, Sony, Beisheim, and Park Kolonnaden, marking the public-private funding of public projects and setting in motion further segregation in the city.

Architecturally, the project is celebrated for its public space around waterways, connected to the more extensive, highly efficient scheme that manages rainfall and the grey water system embedded within its innovative design. The project is located in an architecturally important area of Berlin, next to the Kulturforum, which features buildings from architects Hans Scharoun and Mies Van der Rohe. Within this context, the extensive competitions, designs, and planning decisions resulted in nineteen buildings at Potsdamer Platz being designed by internationally renowned major architects. Moreover, each building also became part of the project's stormwater management, harvesting and recycling system: green roofs and other rain-harvesting infrastructure provides a retaining function, then releases water to the buffer ponds equipped with five underground storage tanks.

Most buildings on site are high-rise towers home to shopping arcades, hotels, stores, restaurants on the ground levels, offices above the commercial zones, and exclusive residential buildings. The initial program that resulted in a certain target audience for the site, consists of 50% office, 20% residence, and 30% shopping area, with the current visitor rate of 100,000 people per day (Velazquez, 2018). Residents engage with the site as a source of employment, entertainment, leisure, touristic and cultural activities, as well as using its transportation infrastructure. Additionally, due to its location, many people engage with the site as they visit its surrounding attractions – Kulturforum, with its two libraries; museums and performance venues, and Tiergarten park. However, the majority of Potsdamer Platz's attractions are at a cost, and

their pricing policy excludes many socially-vulnerable, segregated, and marginalised groups. Due to the pricing policy of the surrounding activities, site visits made evident a distinct gap between the areas surrounding Potsdamer Platz and the project itself. Potsdamer Platz clearly represents the abundance of products and services through the lifestyle it promotes, while the neighbouring Gleisdreieck park provides an informal alternative by a vast open-air green park surrounded by more affordable leisure activities. According to Häußermann & Kapphan (2000), the roots of this social segregation go back to the 1990s when the combination of changing historical eras and policy-making prompted projects like Potsdamer Platz to emerge and illustrate this division.

After the fall of the Berlin Wall in 1989, Berlin - which had previously been marginalised - became prone to international cooperation. Reunification and processes that followed this event gave way to new public-private partnerships in Berlin, resulting in projects like Potsdamer Platz. Many of the site's visitors are tourists who are accommodated in luxury hotels, who visit cultural events at Kulturforum, and shop in Potsdamer Platz's arcade. Considering Potsdamer Platz's historical importance, many tourists also visit the site to learn about the history of the area that lasts for centuries. Carrying the legacy of commerce and entertainment, from the mid-nineteenth century Potsdamer Platz was viewed as a symbol of cosmopolitan, industrial, and progressive Germany (Dempsey, 2007). In the 1920s, the area was known as Europe's centre for entertainment and commerce (Ladd & Steinisch, 1997). During WWII, Potsdamer Platz carried an exceptional strategic importance for Hitler's masterplan, and from 1939 at Leipziger Platz, adjacent to Potsdamer Platz, accommodated the office of Propaganda Minister Paul Joseph Goebbels. Subsequently Potsdamer Platz (***Figure 27***) and its neighbouring area were primary targets during air raids in WWII (Hammond, 2014).

After the site was cleared of the post-war ruins, Potsdamer Platz was left empty until the reunification. However, on June 17, 1953, Potsdamer Platz hosted people's riots against the government and communism (Balfour, 1900 p147). In 1961, the overall plan to divide Berlin was accomplished – the Berlin Wall was built at Potsdamer Platz marking the death strip. For more than thirty years, the Potsdamer Platz wasteland became an important zone in discourse on the importance of urban

nature as a vital component of the city's ecosystem and a subject of active ecological debates and activism. Since the 1970s, urban planning in Berlin has been complemented by a systemic policy of "biotope protection," brought about by scientific research around urban nature, and was adopted by a reunified Berlin (Lachmund, 2013). The areas around Potsdamer Platz were an essential set of sites within this network. As a large wasteland, the area of Potsdamer Platz connected the network of smaller intermediary biotopes with the more extensive greenbelt from the central Tiergarten to the Südgelände and down to the southern part of Berlin. In his research, Luchman specifies that the program that attempted and advocated the protection of biotopes that were "profoundly industrial and urban, yet with regard to their species characteristics were considered particularly valuable" (Lachmund, 2013).

Figure 27: Potsdamer Platz after WWII (1945). Author: Michael M. Dean (Canada. Dept. of National Defence)
[Source: https://commons.wikimedia.org/wiki/File:Potsdamer_Platz_1945.jpg]

With scientists who studied the program and various activist groups, the Potsdamer Platz project faced numerous propositions that attempted to highlight the importance of biotope environments on the site and their impact on Berlin's multispecies ecology (***Figure 28***). Many of the proposals that were listed in the environmental impact statement (AU Arbeitsgemeinschaft Umweltplaung Berlin and Büro für Kommunal- und Raumplanung, 1993) were met with resistance from developers and the

Senate and eventually were rejected (Lachmund, 2013). Among those were modifications to the size and shape of the buildings in order to make the project more climate-friendly. With an existing thriving landscape viewed by scientists as an asset to urban ecology, Sukopp *et al*. cautioned that architectural development, accompanied by factors common for preparation to construction, cause lowering groundwater levels, levelling, and accumulation of soil and are threatening to urban biodiversity (Hammond, 2014).

The Project's stormwater management, harvesting, and recycling system is designed in response to Berlin's 21 inches of annual rainfall. Every added degree of warming predicates 7% more water vapour absorption, resulting in more rain. At the same time, the number of days with normal precipitation levels is expected to be replaced with periods of concentrated heavy rainfall. This provides more days with less precipitation than during the warm seasons, resulting in intensified consequences from the heat islands and floods at other times. Given this context, Potsdamer Platz's green roofs, stormwater ponds, and rainwater management focus on the urgency of closing the water cycle as a climate change mitigation measure. This considerably reduces the effects of the urban heat islands and thus aids as a relief measure for climate stress in cities (Gleason & Casiano, 2020).

Figure 28: Potsdamer Platz 2017.
[Source: https://www.nuernbergluftbild.de/luftbilder/1702-potsdamer-platz-kulturforum-berlin]

Potsdamer Platz's water system consists of a series of features: a narrow channel in the north (1070 m^2), a large main water body (9378 m^2), a small water feature in the south on Reichpietschufer (1878 m^2), and a series of water features near the piazza in front of the Musical Theater (716 m^2).

Considering that many of the urban areas in Berlin are almost completely paved or semi-permeable with little or no vegetation, Gleason & Casiano, 2020 point out the importance of harvesting rainwater for evaporation should be one of the priorities in urban areas. Urban waterscape, which has contributed to making Potsdamer Platz one of the most visited places in Berlin (MIT, 2005) covers approximately 1.2 hectares with a volume of ca. 15000 m^3 and is closely linked to the rest of the project's buildings as they accommodate harvesting and circulation for the rainwater that then feeds the public pools. Project's central urban water body, or Piano-see, is located between the Landwehr Canal, Kulturforum, and Tiergarten, opening up its public space to residents and visitors to Potsdamer Platz (da Rocha, 2019).

One of the central aims of the Project was to ensure water quality and clarity. To provide the expected water quality, a technologically advanced and expensive system was put in place at Potsdamer Platz. The Project's water system ensures that solid particles settle in cisterns while the water is then fed into the southern pool through seepage facilities. From there, it travels through a biotope with vegetation – its place of treatment. The water from the northern pool flows through a similar system – through seepage into treatment biotopes with vegetation – then reaches the main water body with its deepest levels. The project uses an organic cleansing agent that sustains a cleansing biotope system. This microorganism lives in symbiosis with the plant's root structure in the porous substrate layers. The system operates the following way: plants oxygenate the substrate, encouraging the propagation of microorganisms that nitrify the ammonia. The Project's 1900 m^2 of wetland is planted mainly with Phragmites. This non-chemical approach has many advantages for the environment: the biotope cleansing system does not use any chemicals. It provides a low level of maintenance, which also reduces costs in sustaining the public space. The required maintenance sums up to mowing and weeding once a year with a periodic adjustment to the pH balance. Very rarely, racking is necessary

to prevent the substrate from choking with fine sediments. During the summer months, it is ensured that filters are added to the cleansing process to prevent suspended algae from floating up. Project maintenance ensures constant measurement of oxygen, nitrogen, carbon, phosphor, and pH values, ensuring water's excellent quality.

4. CASE STUDY ANALYSIS: FINDINGS

The tables below represent our findings using a sliding scale points system (ranging from + to +++) to indicate the success of each of our case studies in implementing water justice and BGI in their sustainability approaches. We include comments to justify the points we have awarded each scheme.

Table 5: Blue-Green Infrastructure analysis.

BGI (+++/++/+)	Queen Elizabeth Olympic Park	New Rio Pinheiros Project	Potsdamer Platz
Blue	(++)	(+)	(+++)
Green	(+++)	(++)	(+)
Synergy	(++)	(+)	(++)
Comments	Green areas (gardens, parks, wetlands) are connected with water bodies which is a sign of synergy between BGI. Greywater treatment and different uses of water is a resilient water management, e.g. treated sewage water is used for irrigation, bioremediation solutions, etc. The scheme includes a considerable amount of green areas; however it lacks the vertical approach of green infrastructures, such as vertical gardens and green spaces on building rooftops.	The focus of the Pinheiros project is on blue-green concepts: providing linear urban parks, cleaning the river and revitalising the river banks and surrounding areas. However, the scheme lacks blue infrastructure for some of the surrounding areas and will not provide sanitation systems to some lower-income neighbourhoods (judicially irregular). There is little synergy between blue/green infrastructure, e.g. no plans for a bioretention system, no integration between the green	The strength of the scheme is its attention to blue concepts, because, even though the green elements are present, they act subordinately. The rainwater management scheme is excellent as it reduces runoff to zero, which means that the whole recharge system is efficient and there is a small controlled water cycle. Also, biotope cleansing systems remove particulates from the water, increasing its quality. The scheme clearly demonstrates a successful rainwater management system, which is corroborated by a high level of synergy

		infrastructures and water systems (e.g. rain gardens).	between the blue infrastructure and green elements present.

Each of the case studies has different contexts, priorities, budgets, and pressures from key stakeholders which could limit the effectiveness of the scheme, however, some of the successful approaches that were implemented (or have been planned) could be applied from one scheme to another. Queen Elizabeth Olympic Park is the most optimal case for green infrastructure due to its inclusion of green space and attention to biodiversity with the creation and preservation of wetlands, reedbeds and natural floodplains. This focus on green infrastructure which plays a major role could be addressed for Potsdamer Platz, where the attention to the green elements is mainly focused on rainwater management, not including social and climatic benefits of the green infrastructure itself. The New Rio Pinheiros Project is the least effective scheme in implementing BGI, especially for blue-motivated projects. It could learn from the water management project in Potsdamer Platz which indicates how blue infrastructure can improve not only the quality of water but also quantity (water storage), reducing losses from surface runoff. This would be crucial to Pinheiros's river surroundings areas and banks. Lastly, one suggestion for Queen Elizabeth Olympic Park would be to commit to a rainwater harvesting system like that present at Potsdamer Platz which could be connected to the irrigation system of the area and, therefore, increase natural recharge effectively.

The table below shows the scores we have given each of our case studies according to how far they implement water justice in their planning as flagship schemes for sustainable living. We understand water justice to mean the equal and democratic access to water for leisure. We also consider water justice to include community participation and inclusivity; development and education; biodiversity; legacy and memory; housing, sanitation, and urban planning; and placemaking. These are indicators of sustainable planning and living which urban development schemes should take into account. We have awarded the points below to each scheme after analysing literature available for each site, and using our own critical analysis of annotated land use maps, and photographic evidence from site visits, to assess the effectiveness of each

scheme in adhering to water justice in its plans. Our findings are explained in more detail in the written analysis and annotated diagrams below.

Table 6: Water justice analysis

WATER JUSTICE ANALYSIS (+++/++/+)	**Queen Elizabeth Olympic Park**	**New Rio Pinheiros Project**	**Potsdamer Platz**
Democracy (fair access to water for leisure)	(++)	(+)	(++)
Participation and inclusivity (community involvement in decision making; consultation pre-construction and long and short-term planning)	(+)	(+)	(+)
Development/education	(+)	(+)	(+)
Biodiversity	(++)	(+++)	(+)
Legacy and memory	(+++)	(+)	(+)
Housing, sanitation and urban planning (primary users of the scheme using maps)	(+)	(++)	(+++)
Placemaking (branding/identity, aesthetic urban design and architecture)	(+++)	(++)	(+++)

5. ANALYSIS: QUEEN ELIZABETH OLYMPIC PARK IN LONDON

The Legacy Corporation Waterways Framework outlines initiatives to maintain and continue developing the Elizabeth Olympic Park site post-2012. These initiatives incorporate biodiversity; heritage and habitats; community engagement; leisure and recreation; sport and healthy living; and connectivity and access. Examples are upgrades to towpaths, boater facilities and improved connections to River Lea navigation; continued boat trip operations; fishing platforms with wheelchair access (including engagement with local communities, artists, and angling stakeholders); restoration of tidal gates, involving local students and volunteers; and partnership with Land Prop (developers of Strand East) to explore mooring opportunities. Although these schemes appear to consider water justice in terms of democracy, community participation and development and education, the success of these schemes in catering for the most vulnerable local communities is unclear. It can be assumed, however, that local residents would use the park for recreation and leisure activities (running, walking, family outings, etc.). When planning the Framework, the Legacy Corporation and Canal and River Trust consulted local stakeholders, including neighbouring boroughs, national governing bodies of sport and waterways advisory groups (London Legacy Development Corporation n.d.). However, there is no mention in the Framework document of consultations with residents and users of the park, which would be a clear indicator of the principles of fairness, equity and participation which define water justice and fair access to water for all. The main strength of the Park in adhering to water justice is its creation of a lasting legacy and identity of the site as an historical, largely due to the fact that the site was viewed on the world stage during the 2012 Olympics and has been upheld as a blueprint of sustainability by local governments and developers. The site receives 6 million visitors per year with locals forming the majority of those who visit (Green Flag Award, 2019). This is due to its lasting legacy, branding, and effective planning of the park as a leisurely destination for families, school groups, local residents, and tourists. But the site lacks visible grass-roots intervention and collaboration with local communities which is a common characteristic of many large-scale urban projects trying to recruit investors and promote a sanitised, public image.

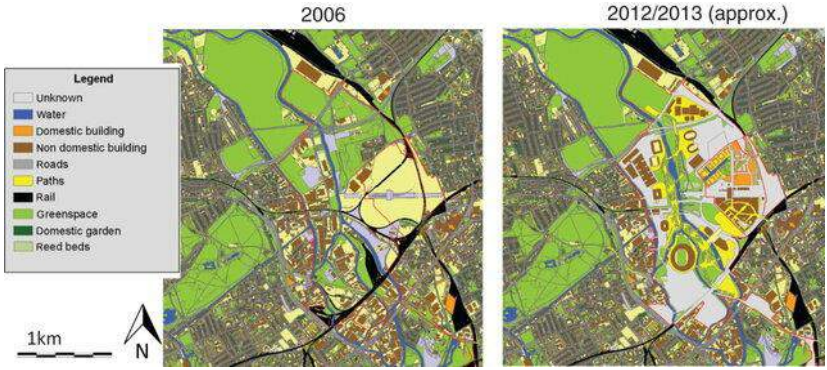

Figure 29: Change in land use in the Olympic Park 2006-1013. [Source: Hamilton et al (2014)]

Figure 29 shows the change in land use before and after the Olympic Park development. In the 2012-2013 image, we can see more greenspace either side of the River Lee, more paths to encourage public access to the waterside, and reed beds planted to provide for flora and fauna (see also ***Figure 30*** below of wetlands to the North of the Olympic Site). There are little domestic buildings, however, in both land use maps. The majority of buildings in 2006 would have been disused factories and warehouses; and in the 2012 image these buildings are the sports facilities and stadia that were built to host the Olympic games. The largest development of domestic buildings (in orange) in the 2012 map is the Olympic Village to the East of the site. This housing was initially provided for athletes, however today the majority of properties sold in the Olympic Park are flats for an average £493,477[16]. Arguably, these properties are inaccessible for the majority of low-income earners in the local area. Instead, land users are residents and retail companies that have moved into the area following the inevitable gentrification and rising house prices in Stratford and other parts of East London as a result of the Olympic Park development.

Further analysis is given of current land use of the Olympic Park in the annotated diagram below, using images taken by the authors during a

[16] https://www.rightmove.co.uk/house-prices/olympic-park.html

visit to the site in January 2023 (***Figure 30***). A list of descriptions for each of the Figures is given below:

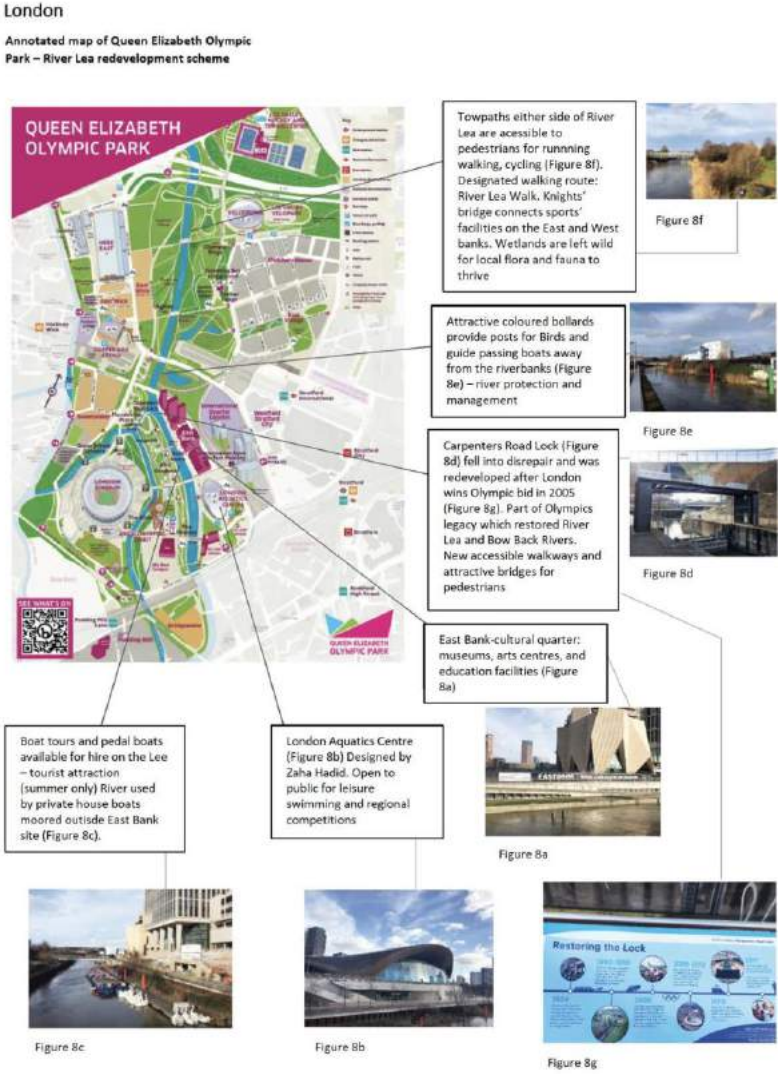

Figure 30

Key to Figures:

Figure 30-8a. East Bank: current cultural centre under construction on the banks of the River Lea. Includes new annex to V&A museum and Sadlers Wells Dance Centre
Figure 30-8b. London Aquatics Centre
Figure 30-8c. River use outside East Bank Centre
Figure 30-8d. Carpenters Road Lock
Figure 30-8e. Coloured bollards to protect banks of Lea
Figure 30-8f. Towpath and wetlands to North of Olympic site
Figure 30-8g. Panel explaining restoration of Carpenters Road Lock. [Source: https://canalrivertrust.org.uk/about-us/where-we-work/london-and-south-east/queen-elizabeth-olympic-park-waterways/carpenters-road-lock]

6. ANALYSIS: NOVO RIO PINHEIROS PROGRAM IN SÃO PAULO

After many attempts to depollute the Pinheiros river, in 2019 the Novo Rio Pinheiros Program (NRPP) was launched by the São Paulo State Government, proposing a series of interventions to transform the site as a depoluted and revitalised area to be enjoyed by the city's population (***Figure 31***). São Paulo Basic Sanitation Company (SABESP) indicated that the project's success should include proper disposal of sewage as a mandatory process to remove pollution from the river. Furthermore, they carried out three public hearings at accessible days and times. As much as it could mean that water justice in the lens of social participation is being considered, the reason for the relatively weak score was that forms of social participation in the project's communication and advertising means were characterised by consultive and informative processes, with passive features and little or no possible action and/or decision-making by the population (Paz & Fracalanza, 2020). With regard to water democracy, an essential factor for the low-income sites covered by the NPRP is that part of the households are judicially irregular; therefore, they can not receive infrastructure of any sort as they affront the law for the protection of water sources (State Law no. 9.866/1997). In such cases, the residential units in socially and environmentally vulnerable positions will not be aided by NPRP as only small treatment plants (Water Quality Recovery Units) will be provided. This means water will be treated directly at water streams before flowing into the Pinheiros River. This is a palliative solution as most vulnerable groups will continue living with pollution from sewage even if they are located within the area of NPRP. At the same time, more well-off residents at the Marginal Pinheiros neighbourhood covered by NPRP will have access to treated downstream water for leisure, culture, and other consumption methods (Alves et al., 2020).

The goal of improving water quality and clarity – a process that takes time and maintenance – allows for wild species to return and is expected to create urban nature that ensures biodiversity and conviviality which justifies the high rating addressed. Moreover, the private sector supports the environmental and landscape recovery of the banks of the Pinheiros River. An example demonstrating this interest is a landscape project by the company Reservas Votorantim, which planted 13 km of native tree

species along the west bank of Pinheiros River. The reverse effect of such initiatives, however, is green gentrification. It is evident that improvement in general conditions that ensure pleasant environments and safe spaces intensifies the valorization of urban sites at Marginal do Rio Pinheiros. Due to public–private partnerships, the program limits its actions to drainage implementation and sewage system improvements in the low-income neighbourhoods within the same river's basin territory (SABESP, 2019). Therefore, while the de-pollution program intends to improve sanitation and provide green public spaces that ensure biodiversity and social engagement, in reality, the program deprives low-income neighbourhoods of water justice and leaves marginalised groups in vulnerable positions, widening social inequality.

The Pinheiros river scenario is completed with medium-high income dwellers in the inner side of the Pinheiros borough, living in well provided and protected blocks (most part in yellow colour of ***Figure 32***), and in the other side, slums with people in vulnerable conditions living close to the big avenues (Marginal Pinheiros), with no sewage nor access to fresh water, as well as any necessary condition for decent dwelling (mostly in red colour of the ***Figure 31***). In addition, it is important to mention the "Águas Espraiadas" Urban Consortium (OUCAE), a special area close to the Pinheiros river defined by law since 2001 for new urban and real estate developments.

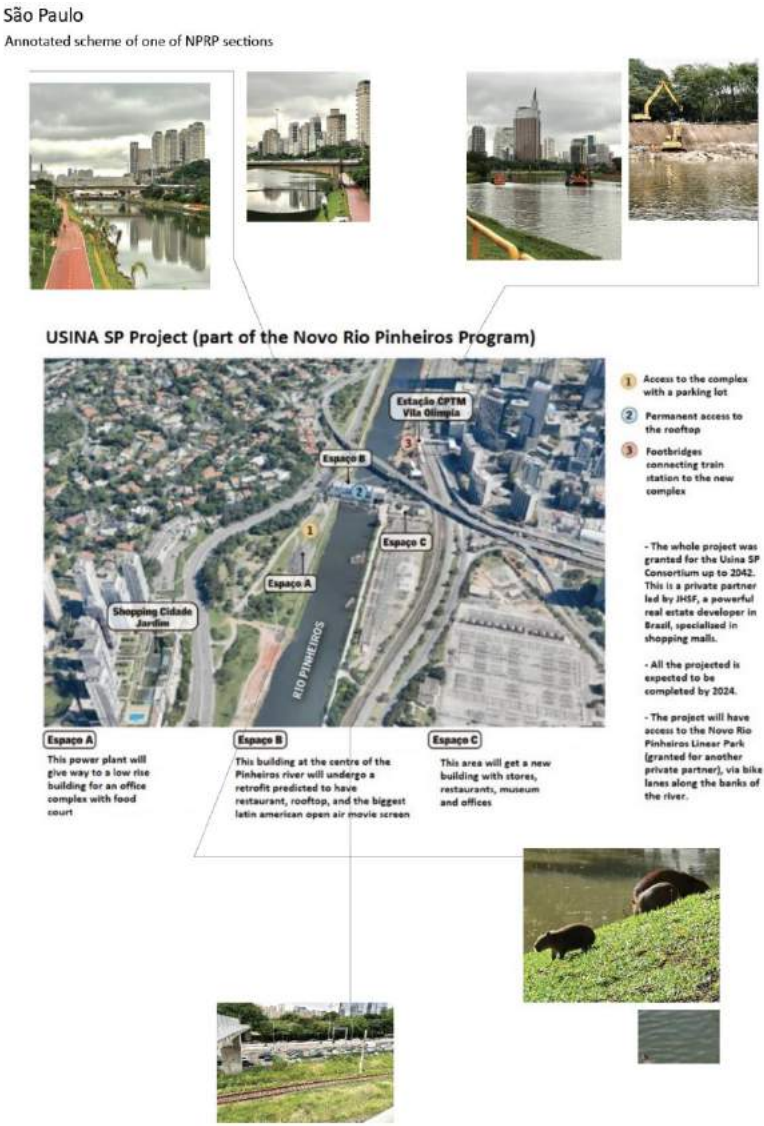

Figure 31: Annotated scheme from Usina SP (one of the projects within the Novo Rio Pinheiros Program) [Source: Hirata et al., 2022, and photographic material from the site visits]

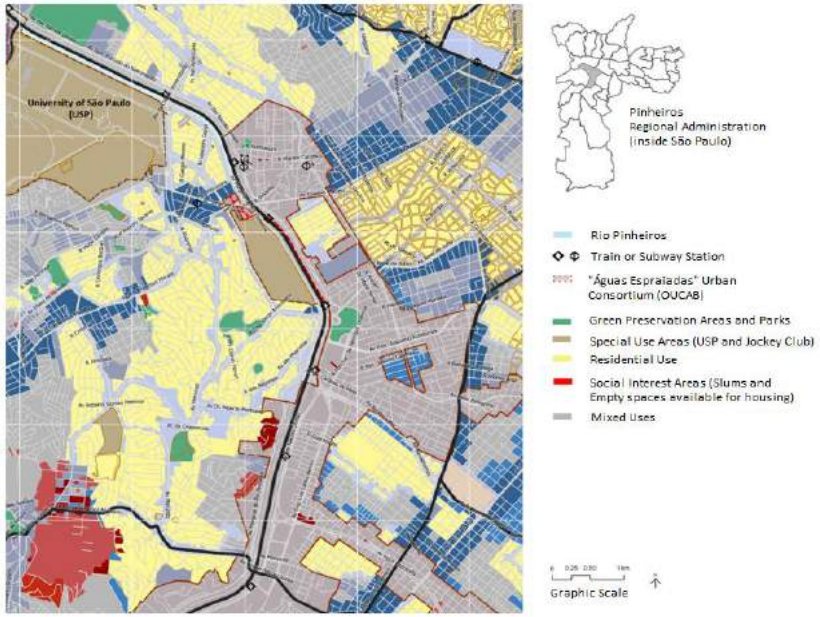

Figure 32: Land Use Map for Pinheiros and Butantã Regional Administration (São Paulo) – 2016 [Source: Generated with GeoSampa Open Source Map (Prefeitura de São Paulo, n.d.)]

7. ANALYSIS: POTSDAMER PLATZ IN BERLIN

With the growing focus on sustainability in public projects, many reviews of the scheme point to the productive combination of recreation and efficiency. Several papers look into Potsdamer Platz's sustainability as a public space for recreational purposes and aesthetic qualities. One such account indicates that "pools are designed artfully to invite public interaction." (Gleason & Casiano, 2020). However, during the site visits, the public space was depicted as lacking the vitality, formal and conforming to the high-cost entertainment and leisure activities on the site.

While the project responds to efficiency in BGI-approach, such notions of sense, identity, and attraction lack representation in the project. For instance, the long list of descriptive details in most sources lacks evidence of how water is accessible to various groups, including vulnerable and socially-marginalised populations – the urban space around the lake lacks public playgrounds or evident urban design that caters to children or the elderly. In terms of identity and emotional connection to the public(s), the site remains primarily focused on upper-middle class and upper class clients.

The Piano Lake is situated within the industrially-produced and aesthetically high-tech design area, and lacks human-scale urban and interactive elements. Moreover, the size of the lake is overpowered by the surrounding environment and creates the sense of its presence as a secondary feature to the high-rise buildings around it. As part of the recreational strategy, water bodies accommodate public art objects. Large-scale sculptures within or around the public area do not allow for direct interaction with art and serve as a form of symbolism and branding for the project's identity. Considering that one of the objectives of the project was to give Potsdamer Platz back to the city as a joyful space, Nowobilska and Mahtab Zaman write, "whether those efforts were effective remain doubtful" (Nowobilska & Zaman, 2014). The symbolic power of urban form is evident and suggest top-down decision-making with lack of community involvement in the matter (Brakhan, 1996). Key problems that have arisen from such top-down planning are the space´s location in a prestigious part of town mostly used for entertainment and high-end accommodation which disregards the needs of local citizens.

Considering that the Potsdamer Platz so widely promoted as flagship sustainability project is also emblematic of "New Berlin" depicted in its architectural, historical and cultural reference (***Figure 33***), this project's examination of water justice has to be conducted through the lens of public inclusion on the level of development and construction, as well as its role as a site that carries historical and cultural legacy important to its citizens. The misguided approach to the development of Potsdamer Platz concerning the ecological conditions of the site and surrounding areas are widely discussed in Lachmund's "Greening Berlin." His research also points out that in the years after unification, the provision of office space in the city widely exceeded existing demand, therefore pointing to misjudgment in the provision of programs and user schemes. This, in part, was due to the urban policy narratives that pictured the city's image as a "New Berlin" and promoted fantasies of its future role as a national and global centre, disregarding the character of Berlin's marginal nature that citizens attempt to preserve to this day. Today, when the media widely promotes Berlin's image of the new Silicon Valley (BBC News, 2014), Potsdamer Platz and its image only exacerbate social and economic inequality in the city. Nevertheless, the project received the German Sustainable Building Council City District Certificate in Gold, and, in 2011, the DGNB Silver Sustainable Urban District Certificate for Newly Constructed Municipal Quarters.

The role of Potsdamer Platz in the history of Berlin's environmental and political activism is also one of great significance and that has been largely ignored by the developers. Due to its marginality, and prior to the project's construction in the 1990s, West Berlin became a fruitful terrain for countercultures and political protest movements. This substantially affected the emergence of ecological and planning policies that, as described in this analysis, propose the importance of environmental justice and urban memory for the city to manifest sustainably through its planning and architecture. Since the 1960s and 1970s, this public and activist-led discourse was inclusive of the scientific community and activists that addressed the ecological importance of the area as it continued to transform until the mid-1990s. In the discourse surrounding the biotope sites in the 1980s, scientists were urgently concerned with protecting these urban ecologies. As a result, to save the green wedges from redevelopment as a new freight railway zone, activist groups have formed, for instance, Förderverein Natur-park Südgelände

(Häkli, 1996: 130) (Hammond, 2014). In Potsdamer Platz's development, very few accepted recommendations achieved limited modifications to the planning schemes. For instance, it includes preserving the lime trees of a former avenue that survived on the site. As Luchmand adds when describing what has been left from the original biotope environment on the site of Potsdamer Platz: "Although their ecological value and connection to the original riches of urban nature was heavily contested, these compensatory landscapes can be regarded as phantom biotopes in which the former riches of urban nature survived in the form of minor attempts at urban greening" (Lachmund, 2013 p205). The remedy of the negative impact on an urban climate, was as it is widely presented in media as the main achievement, provided by the greening of roofs and providing the water-sustainable strategy with a long-term effect on the environment.

In the context of biodiversity, our research has pointed us to only a limited amount of information on present day biodiversity at Potsdamer Platz. One of the private sources points to biotopes playing a significant role in promoting the resettlement of natural habitats with ducks, waterfowl, and other unnamed plants and species, stating that some of them are rare but without indicating any further details. (Greenroofs, 2022). During the field study, we detected koi carp fish in the urban pond, however, it is important to note that populating urban ponds and indoor pools with koi fish is often made for aesthetic purposes. The construction of the Potsdamer Platz, as it was expected, also had a drastic effect on surrounding areas and the quality of neighbouring residents' lives. It has to be noted that the environmental impact statement proposed a specific greenery promotion scheme for the adjacent neighbourhood, which was rejected. It has to be noted that in proposing the newly created green spaces that were meant to provide space for plant and animal species, a critical remark was in highlighting that these measures were primarily meant to compensate for the negative effects that the project had on the climate, the regeneration of the groundwater and the landscape scenery (Lachmund, 2013 p295).

The legacy of activism is carried on site to this day. On 17 January, some 20 000 people gathered at Potsdamer Platz to protest the EU's planned negotiations of the Transatlantic Trade and Investment Partnership with the United States, even though the agreement promised to generate

economic growth strengthening Europe's global influence, standing against those very values that Potsdamer Platz represents.

Most importantly, public spaces in historically significant parts of a city are necessary as markers of the site's legacy. In her work on the architecture of Potsdamer Platz, Cynthia Hammond brings up an important account of the cultural memory that is inevitably embedded in the urban fabric. When speaking about the transformations in Berlin and its site loaded with traumatic history and the approaches that redevelopment projects take on, Hammond brings up the quote from Andreas Huyssen that can be related to Potsdamer Platz: "Politics of wilful forgetting as a form of power that is strongly at work in the historicist or cultural reconstructionist approach to rebuilding Berlin, post-1989"(Hammond, 2014). According to Alexandre Tölle, the identity that was achieved by the project attracted tourists and investors rather than people who could establish an "emotional connectivity" with the significance of the site from a historical perspective (Tölle, 2010). Considering the importance of the emotional connectedness of the public, the spaces shaped their cultural memory, and such features as the sense of belonging must certainly be considered within the planning and architectural solutions to the sites. The emotional connection of the citizens with the site can only be established if there is inherent respect and consideration of the cultural and historical legacy that the place bears and becomes an examination criterion for the environmental justice on site. The accounts of major architects that witnessed Potsdamer Platz's development support these observations. In early 1996, a renowned Berlin architect Hans Kollhoff expressed his concern for the high-technological development by pointing out that the developer's plans for the urban space to reflect the turn of the century's technological era proved a misguided aim. "..architecture and urban design is just something that develops at a much slower pace than technology," he claimed (Brakhan, 1996).

Figure 33: Annotated scheme from Potsdamer Platz Project. The scheme illustrates the approach to sustainability and design that emphasises the innovation, globalisation and BGI-approaches in its design.

8. CONCLUSIONS

Throughout history, waterways have been known for their importance in forming settlements and sustaining communities. It is for no other reason that the Lea and Pinheiros rivers are defining features of the cities of London and São Paulo. Within the context of a rapidly changing climate, water bodies affected or created by urban development, such as the Potsdamer Platz, continue to play a crucial role in shaping environments. The importance of water systems created at Potsdamer Platz demonstrates that we value and work towards learning from natural cycles and resources. The projects analysed in this paper, however, remind us that beyond promoting infrastructure-based solutions or catering to the privileged citizens or for the privilege of the city's image, the vital resources of water should be shared by the community at large (human and non-human). As evidenced by our water justice analysis, aspects of environmental justice advocate for this convivial relationship and require the sustainable approach to include environmental justice in its strategies.

The value of this critical review is in learning from the expanded geography of the research, with site-specific definitions of the city and context-specific conditions that each project works with.

The Berlin example promotes the role of ecologists, naturalists and activists in shaping the interest, knowledge and awareness of the nature-culture relationship after World War II and post-unified Berlin. By creating an ecological understanding of urban space with a convivial relationship between communities (human and non-human), this has influenced policy surrounding the projects in years to come and brought about effective change.

Examples from Modatina (Chile) and El Alto (Bolivia) movements could be viewed as productive precedents for the São Paulo context. They defend access to water and land, and contribute to environmental protection by bringing attention to issues regarding environmental action and putting pressure on local governments to increase the visibility and dialogue surrounding water scarcity and commodification of essential resources (Harvey, 2013). These movements point to paths of resistance and work towards water justice through organising local

populations to strengthen a "commoning" perspective of urban water resources. This presents an alternative to urban regeneration that is purely market- oriented, thereby avoiding unforeseen or uncontrollable effects after the implementation of the project, such as green gentrification and real estate speculation.

This study seeks to reveal why water justice should be included in urban development schemes that promote sustainability. This is particularly important for projects that are publicly funded; developers have a responsibility to represent the interests of local residents and communities who are affected by and should enjoy free access to the scheme in question. Fair access to water and community participation in urban planning is central to questions of water justice, sustainable community development, and resilience to climate change. While some attempts have been made by governing bodies to address questions of water justice in the urban development schemes we have analysed in Berlin, London, and São Paulo, we recommend that more bottom-up, community-based approaches be implemented to ensure the agency and empowerment of disadvantaged and vulnerable groups. Developers should rethink narratives about sustainability and consider whose lives are impacted by the urban development projects. More consultation and collaboration are needed in the planning stages between different stakeholders: local residents, local council members, property developers, tourists, nature conservationists. The schemes we have analysed could implement techniques used from other urban schemes that integrate water justice and collaboration with local communities, such as the use of rain gardens in São Paulo (Pereira *et al*., 2021). The Thames 21 Campaign is a good example of a grassroots charity organisation that connects people with each other and with their environment through river conservation projects in London[17]. Furthermore, developers could learn lessons from political pressure from environmental activism.

Drawing from the concept of "hemerobia" –the extent to which an ecosystem is shaped by human influence–to make sense of the peculiar features of nature in the city," Lachmund suggests that works of

[17] https://www.thames21.org.uk/

historians, geographers, and sociologists that argue that cities are socio-cultural fabrications rather than purely man-made artefacts, should come to the foreground (Lachmund, 2011 p. 214). Most importantly, therefore, the array of issues brought up in this study as part of water justice analysis, such as community needs, urban memory, biodiversity, identity and ecological activism, point us to the urgency of interdisciplinary scientific and community-led cooperation in sustainable managing natural resources.

By studying and learning lessons from schemes that advocate water justice in both the Global North and Global South, it becomes evident that citizens, governors, businesses, and scientific communities should cooperate and learn from each other. Considering the stresses of climate change will predominantly affect marginalised citizen groups, the focus on developing publicly funded urban projects has to shift to catering to vulnerable communities, empowering agency and civil positions, promotion of environmental education and awareness, provision of social mobility, and working towards ensuring socio-economic equality that lies at the heart of any sustainable urban scheme.

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REFERENCES

Alves, E.M., Paz, M.G.A. da and Fracalanza, A.P. (2021). Green Gentrification and Environmental Injustice: A Discussion Based on the New Pinheiros River Program, São Paulo, Brazil. Frontiers in Sustainable Cities, 3.

Atkins, C. (2013). The social cost of Brazil hosting the World Cup 2014. https://bleacherreport.com/articles/1663701. [Online access 22 June 2023].

Brakhan, N. V. (1996). Potsdamer Platz and development in reunified Berlin (Doctoral dissertation, Massachusetts Institute of Technology).

Balfour, A. (1990). Berlin. The politics of order 1737-1989, Rizzoli, New York.

Brears, R. C. (2018). Blue and green cities: the role of blue-green infrastructure in managing urban water resources. Palgrave Macmillan, London.

Davis, J. (2012). The Impact of the Olympics: making or breaking communities in East London. Available from: https://blogs.lse.ac.uk/politicsandpolicy/community-impact-of-the-olympics-davis/. [Online access 22 June 2023]

Dempsey, A. M. (2007). Berlin's Hackescher Markt: Gentrification, Cultural Memory and the New Public Square. In Local/Global Narratives (pp. 255-279). Brill.

Demosthenous, P. (2023). Ten years of the Olympic Park: were promises met? Roman Road LDN. https://romanroadlondon.com/ten-years-on-queen-elizabeth-olympic-park/ [Online access 9 April 2023].

Dreiseitl, H. and Dieter Grau (2009). Recent waterscapes: planning, building and designing with water. Boston: Birkhäuser.

European Commission (2014). A greener infrastructure for Europe. Luxembourg: Publications Office.

European Commission (2019). Guidance on a strategic framework for further supporting the deployment of EU-level green and blue infrastructure. Brussels: Publications Office.

Evans, B. S. (2014, March 30). Next Silicon Valley? Berlin's battle to be a tech hub. BBC News. https://www.bbc.com/news/technology-26770568 [Online access 9 April 2023]

The Environmental Sustainability of the Olympic and Paralympic Games (2008). London City Hall.

https://www.london.gov.uk/sites/default/files/gla_migrate_files_destination/2012-sustainable-olympics.pdf [Online access 9 April 2023]

England - World Parks Week feature park: Queen Elizabeth Olympic Park, London. (n.d.). https://www.greenflagaward.org/news/england-world-parks-week-feature-park-queen-elizabeth-olympic-park-london/ [Online access 9 April 2023].

Farhana Sultana (2018). Water justice: why it matters and how to achieve it. Water International, 43:4, 483-493.

Fix, M. & Arantes, P. (2022) São Paulo, one hundred years of an urban growth machine. Estudos Avançados (USP), 36 (105): 185-208.

Fracalanza, A., Paz, M., Alves, E., and Silva, G. (2022) Programa Novo Rio Pinheiros (São Paulo, Brasil): falta de participação, gentrificação verde e injustiça ambiental. Anais do V Encontro Internacional Participação, Democracia e Políticas Públicas, Natal (RN).

Governo do Estado de São Paulo (no date). Programa Novo Rio Pinheiros. https://novoriopinheiros.sp.gov.br/ [Online access 9 April 2023].

Gleason Espíndola, J. A., & Casiano Flores, C. A. (2020). International Rainwater Catchment Systems Experiences: Towards sustainability. IWA Publishing.

Harvey, D. (2013) Rebel cities: from the right to the city to the urban revolution. London and New York: Verso Books

Hamilton, I., Stocker, J., Evans, S., Davies, M., and Carruthers, D. (2014). The impact of

the London Olympic Parkland on the urban heat island. Journal of Building Performance Simulation.

Hammond, C. I. (2014). The Thin End of the Green Wedge: Berlin's Planned and Unplanned Urban Landscapes. In Urban Forests, Trees, and Greenspace (pp. 207-223). Routledge.

Häußermann, H., Kapphan, A., Häußermann, H., & Kapphan, A. (2000). Die Transformation von Berlin. Berlin: Von der geteilten zur gespaltenen Stadt? Sozialräumlicher Wandel seit 1990, 1-3.

Häussermann, H., & Kapphan, A. (2004). Berlin: from divided into fragmented city. Επιθεώρηση Κοινωνικών Ερευνών, 25-61.

Potsdamer Platz - Greenroofs.com. (2022, October 5). https://www.greenroofs.com/projects/potsdamer-platz/ [Online access 9 April 2023].

Hirata, T., Quintão, C., and Fucushima, L. (2021) Usina São Paulo (da Traição) terá desafio urbanístico de inclusão. Valor Econômico, 20 December. Online: https://valor.globo.com/empresas/noticia/2020/12/15/usina-sao-paulo-da-traicao-tera-desafio-urbanistico-e-de-inclusao.ghtml [Online access 9 April 2023].

Hirata, T & Quintão, C. (2020). Urbanistas têm muitas ressalvas ao projeto. Valor Econômico, 15 December. Online: https://valor.globo.com/empresas/noticia/2020/12/15/urbanistas-tem-muitas-ressalvas-ao-projeto.ghtml [Online access 9 April 2023].

Human right to water and sanitation | International Decade for Action "Water for Life" 2005-2015. (n.d.). https://www.un.org/waterforlifedecade/human_right_to_water.shtml [Online access 9 April 2023].

Klemm, W., Lenzholzer, S., van den Brink, A., (2017). Developing green infrastructure design guidelines for urban climate adaptation. Journal of the Japanese Institute of Landscape Architecture 12 (3), 60-71.

Ladd, B., & Steinisch, I. (1997). The ghosts of Berlin: confronting German history in the urban landscape. Urban History Review, 26(1), 64.

Lachmund, J. (2013). Greening Berlin: The co-production of science, politics, and urban nature. Mit Press.

Liat M. And Alexander R, (2007). Living Systems, Innovative Materials and Technologies for Landscape Architecture. Birkhäuser.

Liu, W., Zhao, H., Sun, S., Xu, X., Huang, T., & Zhu, J. (2022). Green space cooling effect and contribution to mitigate heat island effect of surrounding communities in beijing metropolitan area. Frontiers in Public Health, 10.

Matera, E. (2021, July 21). How will climate change impact Berlin? Berliner Zeitung. https://www.berliner-zeitung.de/en/how-will-climate-change-impact-berlin-li.172154 [Online access 9 April 2023].

McBride, J. and Manno, M. (2021). The Economics of Hosting the Olympic Games. https://www.cfr.org/backgrounder/economics-hosting-olympic-games. [Online access 22 June 2023].

Momm, S., Kinjo, V., and Frey, K. (2020) Tramas do planejamento e governança na transformação dos rios em metrópoles globais: uma reflexão sobre casos internacionais e em curso na Macrometrópole Paulista (Brasil). Cadernos da Metrópole, 22 (48): 499-525

Nowobilska, M., & Zaman, Q. M. (2014). Potsdamer Platz: the reshaping of Berlin. Springer International Publishing.

Ng, L., & Syariffudin, E (n.d.). The Holistic Design of Rainwater Harvesting Systems in Three Urban Projects. https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=62c25932090c93aaf01bef6288ddb4fad117fd38 [Online access 9 April 2023)

Naughton, C. (2021, November 19). Displaced by London's Olympics. The Guardian. https://www.theguardian.com/uk/2008/jun/02/olympics2012 [Online access 9 April 2023].

Nicholls, A. (2014, November). London 2012 legacy: Olympic park waterways. In Proceedings of the Institution of Civil Engineers-Civil Engineering (Vol. 167, No. 6, pp. 40-45). Thomas Telford Ltd.

Paz, M. G. A., and Fracalanza, A. P. (2020). Social control in basic sanitation at Guarulhos (SP): The Municipal Council of Urban Policies. Ambiente & Sociedade, 23.

Pereira, M.C.S., Martins, J.R.S., Nogueira, F.F., Magalhães, A.A.B. and Silva, F.P. da (2021). Melhoria da qualidade da água de rios urbanos: novos paradigmas a explorar – Bacia hidrográfica do rio Pinheiros em São Paulo. Engenharia Sanitaria e Ambiental, 26, pp.577–590.

Pfoser, N., Jenner, N., Henrich, J., Heusinger, J., Weber, S., (2014). Gebäude Begrünung Energie: Potenziale und Wechselwirkungen. Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau FLL, Bonn.

Potsdamer Platz. (no date). DGNB – German Sustainable Building Council. https://www.dgnb-system.de/en/projects/potsdamer-platz [Online access 12 June 2023].

Prefeitura do Município de São Paulo (2015). Atlas Socioassistencial da Cidade de São Paulo. https://www.prefeitura.sp.gov.br/cidade/secretarias/upload/assistencia_social/arquivos/atlas_socioassistencial_sp_2015.pdf [Online access 9 April 2023].

Prefeitura do Município de São Paulo (no date). GeoSampa. https://geosampa.prefeitura.sp.gov.br/PaginasPublicas/_SBC.aspx [Online access 9 April 2023].

Salian, P., & Anton, B. (2010). Making urban water management more sustainable: Achievements in Berlin. SWITCH–Managing water for the city of the future. Freiburg: ICLEI European Secretariat.

SABESP (2019). São Paulo Basic Sanitation Company. Projeto Tietê. Available online at: http://site.sabesp.com.br/site/interna/Default.aspx?secaoId=115 [Online access 9 April 2023].

Seabra, O. (2015) Urbanização e industrialização: rios de São Paulo. Labor e Engenho, 9 (1): 37-48.

Snaith, B. (2015) The Queen Elizabeth Olympic Park - whose values, whose benefits? A case study exploring the role of cultural values in ethnic minority under-representation in UK parks. https://www.bbbc.org.uk/wp-content/uploads/2018/12/PhD-Summary-small.pdf. [Online access 22 June 2023].

Sultana, F. (2018). Water justice: why it matters and how to achieve it. Water International, 43(4), 483-493.

Sustainable Development Goals | United Nations Development Programme. (n.d.). UNDP.

https://www.undp.org/sustainable-development-goals/clean-water-and-sanitation [Online access 9 April 2023].

Sustainable Development Goals | United Nations Development Programme. (n.d.-b). UNDP. https://www.undp.org/sustainable-development-goals/sustainable-cities-and-communities

[Online access 9 April 2023].

Talling, P. (n.d.). London's Lost Rivers. https://www.londonslostrivers.com/bow-backs-rivers.html. [Online access 22 June 2023].

Tölle, A. (2010). Urban identity policies in Berlin: From critical reconstruction to reconstructing the Wall. Cities, 27(5), 348-357.

Till, K. E. (2004). Emplacing memory through the city: The new Berlin. GHI Bulletin, 35(Fall), 73-83.

Urban Nature. (2005). Contemporary Urban Waterscapes: Designing Public Spaces in Concert with Nature. MIT. https://web.mit.edu/nature/archive/student_projects/fmr/project_cases_platz.htm [Online access 9 April 2023].

Velazquez, L. (2018). Greenroofs.com Project Week June 19, 2017: Potsdamer Platz greenroofs. [online] Greenroofs.com. Available at: https://www.greenroofs.com/2017/06/17/greenroofs-com-project-of-the-week-june-19-2017-potsdamer-platz . [Online access 9 April 2023]

Waterways and Rivers | Queen Elizabeth Olympic Park. (n.d.). London Legacy Development Corporation. https://www.queenelizabetholympicpark.co.uk/the-park/venues/parklands-and-playgrounds/waterways-and-rivers [Online access 9 April 2023].

White, M. P., Elliott, L. R., Gascon, M., Roberts, B., & Fleming, L. E. (2020). Blue space, health and well-being: A narrative overview and synthesis of potential benefits. Environmental Research, 191, 110169.

5

SUSTAINABLE INTERVENTIONS TO MANAGE RETAIL FOOD WASTE IN SÃO PAULO AND LONDON

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ABSTRACT

Food waste (FW) remains a growing issue affecting global economic growth, sustainability, food insecurity and the climate. According to the United Nations, 14% of food produced is lost between harvest and retail, and an additional 17% after consumption. As globally connected hubs of retail and consumption, cities are a significant site of FW. Although strategies to avoid, reduce or mitigate FW already occur, little research addresses the practices most appropriate for tackling the issue in the food retail sector. This report therefore explores strategies for tackling FW currently used in London and São Paulo's retail sector. It presents a scoping review, used to identify and categorise retail FW interventions worldwide, followed by the results of our document analysis to classify interventions found in London and São Paulo. It also presents the dissemination portion of our project, which illustrates these findings in an accessible and legible storytelling tool for consumers and retailers.

1. PROBLEM STATEMENT AND CONTEXTUALIZATION

Food waste and sustainability – why does it matter?

Food waste has become an urgent matter over the last few years. Growing concern about food security and socio-environmental impacts attributed to food waste have put the issue on the agenda of national and international policy makers, NGOs and scientists. The Food and Agriculture Organization of the United Nations (FAO) warns that food loss and waste account for 8-10% of total global greenhouse gases, so they are a major factor in tackling climate issues and sustainability on a global, national and local scale (FAO, 2022).

Food waste occurs along the entire spectrum of the food chain, starting with production: from the farm to distribution to retailers to the consumer. Reasons include losses from mould, pests, or inadequate climate control; losses from cooking; and inadequate storage systems. The United Nations states that around 14% of food produced globally is lost between harvest and retail, while an estimated 17% of total global food production is wasted after consumption (UN, 2021).

Following the definition by the Harvard School for Public Health (2023), FW is categorised differently based on where it occurs: (1) Food "loss" occurs before the food reaches the consumer as a result of issues in the production, storage, processing, and distribution phases; (2) Food "waste" refers to food that is fit for consumption but consciously discarded at the retail or consumption phases.

Here one can identify different national and regional patterns in the Food Waste Index and Food Loss Index, developed by the FAO (2020) to tackle and monitor the Sustainable Development Goals of responsible consumption and production. The UN Environment Program Food Waste Index Report (2021) estimates that food waste from households, retail establishments and the food service industry totals 931 million tonnes each year, 61% of which came from households, 26% from food service and 13% from retail. However, there is a lack of data to do cross-country analysis for food waste in the retail sector, especially when it comes to comparison between high-income and middle/low-income countries. "Global food waste data availability is currently low, and measurement approaches have been highly variable. The report identified only 17

countries [18] with high-quality data reporting in at least one sector" (UNEP, 2021).

Sustainability and cities – where is the connection?

Currently, more than half of the global population lives in a city and, by 2050, it is estimated that this will increase to two-thirds (UN-Habitat, 2022). These urban hubs are places where sustainable mitigation and adaptation strategies can have a significant impact. United Nations Habitat estimates that while cities only account for less than 2% of the Earth's surface, they consume 78% of the world's energy and produce more than 60% of greenhouse gas emissions (UN-Habitat. 2016).

Further, our cities are also incredibly vulnerable to climate emergencies or other crises, as we have seen recently during the Covid-19 pandemic and the impact on global health, security and food systems. Cities are fuelling some of our greatest challenges, as stated in The World Cities Report 2022 (UN-Habitat, 2022):

> *Building economic, social and environmental resilience, including appropriate governance and institutional structures, must be at the heart of the future of cities. To meet this challenge, sustainable urban futures must prioritise reduction in poverty and inequality; foster productive and inclusive urban economies that provide opportunities for all; adopt environmental policies and actions that mitigate and adapt to climate change, promote clean energy and protect ecosystems; integrate public health into urban development; – facilitated by responsive urban planning and governance systems in which with finance, innovation and technology play overarching roles.*

So, there are multiple layers to take into consideration when one speaks of sustainable cities and the future of urban areas. Therefore, this project applies a multiscalar and structural approach which understands

[18] Australia, Austria, Canada, China, Denmark, Estonia, Germany, Ghana, Italy, Malta, the Netherlands, New Zealand, Norway, the Kingdom of Saudi Arabia, Sweden, the United Kingdom and the United States.

sustainability as a concept with many dimensions. On a structural level, it is not only economic growth, technology and available resources that should be taken into consideration, but also socio-environmental justice, fair working conditions, less extractive practices, and cultural situatedness are all relevant for the future of sustainable cities.

One must look beyond economic development and environmental protection and put people's quality of life in the centre of strategy and planning: "Without a thriving urban landscape that puts the planet first while providing inclusive opportunities for its citizens, no city can position itself for long-term success, and its prosperity cannot, therefore, be sustained" (Arcadis, 2022). Another aspect is the question of scales; there are significant differences between cities in different world regions due to historical development and power dynamics. One should neither understand cities as a homogeneous category, nor underestimate the heterogeneity within them – e.g., between urban centres and periphery.

Food waste and sustainable cities – why must we think about this together?

In many approaches and strategies for sustainable cities, the food system and its impact on economy, climate and community is rather a marginal topic, or only started to get more attention recently. The focus is more so on public transport and infrastructure, green areas and housing to tackle climate crisis, poverty, inequality, and other forms of marginalisation and exclusion. However, the recent developments of growing food insecurity and food shortages due to the Covid-19 pandemic and the Russian attack on Ukraine made clearly visible that cities need a resilient food system to be sustainable (Kakaei et al., 2022). So, the question arises, how can cities become more sustainable and resilient when it comes to food?

First, in production, by exploring possibilities of food production in and around the city to create more circular and local food cycles (Deelstra & Girardet, 2000; Azure et al., 2019). Second, in distribution, by reorganising their supply systems within cities by considering scalar inequalities and injustices (Wrigley, 2002; Shannon, 2014). Third, in preparation and consumption, by creating diverse and creative interventions against food waste that occurs in retail, gastronomy and on

household-level (Esmaeilian et al., 2018; Dubbeling et al., 2016). While many studies explore the causes of food waste during food production and consumption processes, relatively little attention is put on the retail sector. This shows a blind spot when thinking of the potential of (already existing) sustainable intervention in this stage of the food system.

This report is structured in four parts. First, a short introduction discusses food waste as an urgent matter of (urban) sustainability research and politics and offers a problem statement of food waste in cities in general. Second, the research design and methodology are described, including; (1) a scoping review which identifies categories and patterns of interventions to manage food waste in retail which are already discussed in academic research; (2) a document analysis on food waste management in São Paulo and London; and (3) a storytelling visual comparing interventions in both cities. Third, the categories and findings on interventions in retail from the scoping review are briefly described. Fourth, these categories are applied to the case study of the two metropoles in the centre of this research: London and São Paulo. In this section, we will compare the findings from both cities and explain how to further use the identified categories to approach sustainability and food waste to make these cities more sustainable. We finish this report with a short conclusion that looks to possible futures of food waste interventions.

2. RESEARCH DESIGN AND METHODS

The research design is organised according to three main methods: scoping review, document analysis and storytelling. The scoping review (research objective 1) is oriented by the research question: What interventions to manage food waste in supermarkets and markets (retail) worldwide can be identified in the literature? The document analysis and storytelling situate this broad research question in the contexts of São Paulo and London. To identify pre-existing strategies and interventions around food waste in these two cities (research objective 2), the project analysed reports, news articles, corporate bulletins and research papers, and conducted informal conversations with two experts from NGOs and other researchers from the Global Research Academy. Research objective 3 involves visualising the data on London and São Paulo through a video, following the categories from the scoping review.

Scoping review

A scoping review is a type of synthesis that can systematically identify and map the available evidence on a specific topic across contexts. Our investigation summarises broadly the academic research published about food waste interventions in retail. There exist only a small number of studies about retail, since most of them focus on the individual consumption level (Schanes et al., 2018). Hence, this review did not include findings concerning other stages of the global food chain: production, preparation, distribution, and consumption. The scoping review was designed and executed in accordance with the JBI Methodology for Scoping Reviews (Peters et al., 2020). Before starting the review, a protocol was made available online at OSF Registries (Castro et al., 2022). A separate peer reviewed publication of the Scoping Review is planned for 2024[19].

Document analysis

[19] A first draft of the peer reviewed article was sent to the Journal Resources, Conservation and Recycling in March 2024.
https://www.sciencedirect.com/journal/resources-conservation-and-recycling

The document analysis of reports, guides, legislation and other grey literature about food waste interventions in London and São Paulo was a useful method to identify local interventions. The results will compose the second and third part of this project. The document analysis was guided by the following questions: (1) How much food waste is generated in these cities and their supermarkets and markets? (2) What policies are in place regarding food waste (about reduction, destination, donation, sale)? (3) What solutions can be identified and who are the leading actors? (4) What are the differences and similarities between London and São Paulo?

Storytelling

In a final step, we created a video comparing the identified interventions in the two cities. The goal was to easily present the food waste management strategies adopted. We chose to use visual storytelling – the art of communicating messages, emotions, narratives and information in a way which reaches viewers at a deep and lasting level – due to its easy engagement and accessibility to attract as many people as possible (Williams, 2019).

3. FOOD WASTE INTERVENTIONS AND THEIR POTENTIAL FOR SUSTAINABLE CITIES

The scope of food waste interventions investigated and published by researchers

After the protocol was published, we searched four electronic literature databases relevant to the topic: Scopus, Web of Science Core Collection, GreenFILE and Embase. They resulted in 1,316 references. The final scoping review includes 43 studies.

The data collection of included studies was performed using an extraction form piloted by all reviewers in a sample of studies (Appendix B). Besides publication data, we collected information regarding the study's objectives, the context of implementation (location, scope), who was responsible for implementation, the target population, the features of the intervention (methods of delivery, materials, duration etc.) and the results relating to food waste. This data has been analyzed in depth in the article "Sustainable interventions to manage retail food waste: a scoping review" which will be published soon.

Final categories of food waste interventions

For grouping and standardising, we followed the waste hierarchy adapted by the European Commission's Knowledge Centre for Bioeconomy (2020). Accordingly, our categories can be assigned to the main strategies of prevention, re-use, recovery and disposal.

Prevention interventions are those that aim to, directly or indirectly, avoid food waste. The category of re-use mainly encompasses interventions that involve repurposing food that would be wasted, either for human consumption or animal feed. The third category recovery represents an opportunity to rescue the organic value of food waste; one can recycle to recover nutrients and energy (e.g. anaerobic digestion) or only nutrients (e.g. composting).. The last category disposal (e.g. landfill) is, according to the EU Waste Hierarchy, the least preferred strategy to manage food waste.

We applied these categories to the document analysis of food waste interventions in London and Sao Paulo. The results will be presented in the following section.

4. SÃO PAULO'S AND LONDON'S FOOD WASTE INTERVENTIONS IN RETAIL

The following section discusses the findings of our document analysis of food waste interventions in the food retail sector in São Paulo and London. As discussed above, almost three quarters of the relevant literature studies initiatives occurred in European food retail settings. Therefore, as we looked to explore the issue in greater detail, we felt it important not to use a second European case study, particularly since the London and Berlin cases are somehow similar.

Indeed, despite their differing contexts, London and Berlin are evaluated similarly in their handling of sustainability issues. In their total scores, as well as their scores on environmental measures, the Sustainable Cities Index ranks Berlin in fifth place and London in sixth (Arcadis, 2022). Both London and Berlin also fall out of the top 10 for their scores concerning people and profit. Furthermore, until recently, both were subject to European Union legislation on key environmental issues. As such, elaborating upon contexts in both cities would likely produce similar outputs, which we chose to avoid.

In selecting between London and Berlin as a comparative to São Paulo, we looked at the countries' political systems. São Paulo and Berlin are both cities in federal states where environmental law and its enforcement is the responsibility of the federal sub-unit (Elspaß and Feldmann, 2021; Milaré et al., 2021). In practice, this means that the legislative framework concerning environmental issues can be made more locally specific, more so in Berlin's case since it is a self-governing city-state. On the other hand, London is a major city in an essentially unitary state, with its legislation written at the national level and broadly the same across the UK. London's municipal authorities may promote certain policies and, given its size, have significant power to shape the national discourse but its inability to autonomously instate laws means that authorities have less influence over progress in local context.

Therefore, in order to compare the effects not only of development and global positionality but also of varying legislative environments, London was selected over Berlin as our second case study. This global South-

North comparison also forces us to reckon with the reality of two very different economic and developmental contexts (***Table 8***).

Table 7: Key numbers on demographics and waste for Sao Paulo and London

Indicators	São Paulo	London
Inhabitants	12.396 million (IBGE, 2021)	8.797 million (GLA, 2023a)
GDP	£10,809 per capita (CEIC, 2022)	£59,855 per capita (ONS, 2023)
Gini coefficient	0.56	0.7
Municipal solid waste	3.4 million tons (Cidade de São Paulo, 2023)	7 million tons (GLA, 2023b; ReLondon, 2021)
Food waste	Not identified	1.456 million tons (GLA, 2023b; ReLondon, 2021)

London has a robust and well-developed economy with a high standard of living. Its GDP is the highest of Great Britain's regions, at £59,855 per capita, more than £25,000 above the national average (ONS, 2023). It scores highly in urban sustainability metrics and is generally viewed as a politically progressive environment, which offers a sound economic and social platform on which to prioritise sustainability issues relating to food systems.

São Paulo, on the other hand, is large and rapidly developing, which comes with challenges as well as opportunities. As Brazil's largest city and major economic hub, it attracts economic opportunities. Although the largest GDP among Brazilian cities, it remains relatively low at 68,111 BRL (approximately £10,809) per capita in 2021 (CEIC, 2022). São Paulo's Gini coefficient of 0.56 represents a lower level of income inequality than London's, which at 0.7 is still the most unequal region in

Britain (UN-Habitat, 2010; ONS, 2020). Relative to its context though, São Paulo has proven a leader in sustainability issues, holding the second highest ranking of South American cities on environmental metrics, and 84th place overall in the Sustainable Cities Index (Arcadis, 2022).

Within these different environments, the goals of food sustainability look different which is illustrated through the initiatives found in our research. In the following, we will present the information found on São Paulo and London's various initiatives to manage food waste at the retail level. We then discuss the categories found in the two cases and compare the food waste management environment across the two cities.

Food waste management in São Paulo – what's there, what's missing?

São Paulo is located in the Southeast region and is the most populous city in Brazil, with an estimated population of 12,396,372 inhabitants in 2021 (IBGE, 2021). In 2022, around 3.4 million tonnes of municipal solid waste (MSW) were collected in the city (São Paulo, 2023). Considering the average waste gravimetric composition for Brazil, which indicates that about 45.3% of municipal solid waste is organic (Brasil, 2022), we estimate that in São Paulo, the generation of organic waste can be around 1.5 million tonnes per year, including food waste, garden waste, among others.

With regard specifically to food waste, the total amount generated in São Paulo or in the retail in the city was not found in the literature or on official websites. However, the research carried out by Brancoli et al. (2022) in four street fairs in São Paulo helped to understand the types of waste generated in these places. The authors found an average generation of 23.7 kg of waste per tent, of which 12.8 kg were classified as unavoidable food waste (e.g., bagasse, coconut and peels), 7.4 kg as avoidable waste (e.g., fruits, vegetables, flowers) and 3.6 kg as packaging.

Regarding policies and legislation related to food waste, waste management in São Paulo and other Brazilian municipalities is regulated by the National Solid Waste Policy (*Política Nacional de Resíduos Sólidos* – PNRS), which established a hierarchy to be followed: non-generation, reduction, reuse, recycling, treatment and final disposal (Brasil, 2010). In

addition, the PNRS established that all municipalities must prepare a Municipal Plan for Integrated Solid Waste Management (PMGIRS), which must diagnose and govern the management of all waste in the city, including those generated in supermarkets and other commercial establishments (Brasil, 2010).

São Paulo published its PMGIRS in 2014; until 2023, it was not revised. The plan's diagnosis presented only three pieces of information about retail food waste: some stores in the *Pão de Açúcar* and Walmart supermarket chains centrally composted their organic waste; *Companhia de Entrepostos e Armazéns Gerais de São Paulo (Ceagesp)* had a food bank; *Feira Limpa Program* was a program of selective collection of organics in street markets (Cidade de São Paulo, 2014).

The plan proposed creating a new program, *Feira Sustentável*, starting in 2014 and based on the experiences learned at *Feira Limpa*. The proposal was to implement the program in 883 street markets by 2016 and to compost all organic waste collected, including food (Cidade de São Paulo, 2014).

Regarding other food waste policies, Municipal Law nº 17.755 was created in 2022, which authorises the donation of surplus food by establishments dedicated to the production and supply of meals, including supermarkets. The food to be donated must be within the expiration date, the storage conditions specified by the manufacturer must be observed, and the integrity, sanitary safety and nutritional properties must be maintained (Cidade de São Paulo, 2022a).

Another relevant legislation is Municipal Law nº 13.478/2002, which establishes that all commercial establishments that generate more than 200 litres of waste/day, called large generators, must hire a company for waste collection and destination (Cidade de São Paulo, 2002). Other establishments that generate less waste and street markets have their waste collected along with the rest of the municipal waste, which is the responsibility of the public authorities.

In short, retail food waste management in São Paulo needs to respect the national policy and its hierarchy, and food donation is permitted by law. Regarding disseminating information, there is a lack of official data that allows an understanding of how much food waste is generated and its

destination. The following section will present the retail food waste initiatives identified in the city.

Retail food waste initiatives in São Paulo

We identified 14 initiatives in São Paulo, corresponding to 23 actions (***Table 9***). Interventions of the 4 strategies found in the scoping review (***Table 7***) were identified in São Paulo, but the one that stood out the most was **re-use** (n=13), including the categories **donation to food bank**, **unspecified donation**, **preparing ready-to-eat food**, and **animal feed**. The second most popular strategy was **prevention** (n=7), with **price reduction**, **packaging strategy**, **quality control** and **stock management** initiatives. Recovery and disposal strategies only appeared once each.

Table 8: Retail food waste management initiatives found in São Paulo.

Strategy	Category	Assaí	Banco de alimentos NGO	Carrefour	Casa Santa Luzia	CEAGESP	Connecting food	Dia	Food to save	Fruta Imperfeita	GPA Group	Mesa Brasil SESC	Municipal Program to Combat FW	Municipal composting plants for markets FW	São Paulo Food Bank
Prevention	Packaging strategy			■											
	Price reduction			■					■	■	■				
	Quality control			■											
	Stock management			■											
Re-use	Animal feed			■											
	Donation (unspecified)				■		■						■		
	Donation to food bank	■	■	■		■		■			■	■			■
	Preparing ready-to-eat food			■											
Recovery	Nutrient recovery			■										■	
Disposal	Landfill					■									

Carrefour was the supermarket with more information on food waste on its website. Some food waste **prevention** initiatives found were using dedicated shelves that minimise the risk of crushing or injuring the products and packaging loose products in new packaging. The **price reduction** was also practised, offering a discount for products outside the aesthetic standard and those expiring, avoiding the waste of 1,852 tons of food in 2019 (Carrefour, 2023).

Re-use actions in *Carrefour* involved preparing other products, such as juices and flours, sold or offered in tastings. In 2020, they avoided 25.9 tons of waste with these co-products. In addition, another initiative practised was the **donation** in partnership with *Sesc Mesa Brasil* and other food banks. The organics not prevented or reused were used for **animal feed** or composting. In 2020, more than 8 thousand tons of organic waste were destined for **nutrient recovery** via composting, and another 1,034 tons were destined for animal feed or rendering (Carrefour, 2023).

Another case of **recovery** identified in São Paulo was the Sustainable Fair project, for composting waste from street markets. Five composting yards are located in Lapa, Sé, Mooca, Ermelino Matarazzo and São Mateus. From December 2015 to December 2021, the yards received 31,544 tons of waste, resulting in approximately 6,308 tons of compost over the six years (Cidade de São Paulo, 2022b).

Among the initiatives listed in the table, we sought more detailed information directly from the NGO Banco *de Alimentos*, which made itself available for a conversation. The NGO was created in São Paulo in 1998 and works by collecting and distributing food that has lost value for those who sell it but which can still be consumed. It links the generators (industries, rural producers, wholesalers, supermarkets) and the institutions that prepare and **donate** food to those in need, managing the donation logistics.

Currently, around 25 people work at the NGO, most working remotely, which reduces the environmental impact due to the avoided transport of these employees to the headquarters. Some retail partners that donate to the initiative are *Assaí Atacadista, St Marche Supermercado, Sonda Supermercados, Makro Atacadista, and Merqueo*. The interviewee

reported that they do not receive any kind of support from the government.

The NGO activities include urban harvesting (collection and distribution of food), nutritional education activities, lectures and workshops. They also received and transferred food that would not be discarded, but that was needed due to specific situations such as the pandemic in 2020 and the natural disaster response in São Sebastião, SP due to heavy rains in early 2023.

Between 1998 and 2022, they **donated** 16 thousand tons of food, benefiting around 25,000 people daily (ONG Banco de Alimentos, 2023). Despite the high numbers showing a good performance by the NGO, one significant challenge mentioned during the interview that is limiting their impact is that they are not exempt from *INSS Patronal* (Employer's contribution taxation)[20] as it is the case for most NGOs which work directly with social aid. Still, they are trying to change the law together with other NGOs in this field to achieve the recognition of food related actions as part of social aid.

Food waste management in London – what's there, what's missing?

London is the capital of the United Kingdom, situated in the southeast of the country. It is the country's largest city, with 8.797 million inhabitants (GLA, 2023a). The city produces around 7 million tons of waste annually, with 1,456,000 of this deriving from food loss and waste (GLA, 2023b; ReLondon, 2021). Across the UK, an estimated third of food bought is wasted, though most of it remains edible (London Environment Strategy, 2018).

The majority of this wastage occurs at the household level, with consumers in London responsible for around 64% of total food waste (ReLondon, 2021). As a result of the city's reliance on imports, which make up 99% of its food supply, food results in an estimated 10% of

[20] The *INSS Patronal* is the Social Security Contribution paid by the employer to ensure the social security of the population, funding some basic services, such as health, social security and social assistance.

London's greenhouse gas emissions (ReLondon, 2021; GLA, 2018). In 2021, *ReLondon* conducted a material flow analysis of London's food systems and found that its consumption-based emissions total 15,483 kt CO2eq.

Food waste at the retail level is estimated to constitute only 2.9% of the UK's total food waste (Jackman, 2023). However, London's figures put this wastage as a much higher proportion of urban food waste, amounting to 246,000 tons, or around 17% of the city's food loss and waste (ReLondon, 2021). Part of this disparity may be attributed to the inclusion of wholesale retail in these figures. Still, it appears that London's retailers waste food at a much higher level than the national average. Furthermore, only a small proportion of edible food waste appears to be redistributed for human usage. Just 4,600 tonnes of the 246,000 tons of food lost at retail level are redirected through food rescue and redistribution (ReLondon, 2021).

Table 9: Key numbers on food waste in London

Amount of food loss and waste of total waste production	1,456,000 tons
Share of food loss out of all food bought in UK	One third
Area with highest food loss in UK	Household level
Household waste share of total waste in London	64%
London's food import share	99%
London's Co2 emissions share from food	10%
Share of UK food waste from the retail sector in total UK food waste	2,9%
Share of London food waste from the retail sector in	17% (246,000 tons)

total London food waste	
Amount of food rescued in London retail sector	4,600 tons of 246,000 tones

These numbers (***Table 10***) belie the reality of the city's food insecurity challenges, which are a critical component of the Mayor's London Food Strategy (GLA, 2018). Of all London's food waste, deriving from the household, food services, processing-manufacturing and wholesale-retail levels, the majority is still disposed of through incineration (821,000 tons) and landfill (122,000 tons) (ReLondon, 2021).

As of November 2021, the UK Environment Act changed policy concerning food waste disposal for households and businesses nationwide. A legal requirement came into force, beginning 2023, for all food waste to be collected separately to other waste streams to enable more efficient and environmentally friendly disposal (Environment Act, 2021). Businesses can only be exempted from this law if they produce less than 5kg of waste per day, or if they are rurally located (Bergmann Direct, 2022). As such, most of London's food retailers are now beholden to a much more stringent policy environment; prior to this, only hygiene and cross-contamination guidelines were mandated (DEFRA APHA, 2014).

The Department of Environment, Food and Rural Affairs (DEFRA, 2023) have since updated guidance for businesses to help them abide by their statutory waste hierarchy duty (***Table 11***). This move followed the London Environment Strategy's (2018) requirement for all London boroughs to institute separate food waste collection. The same document set targets for London to reduce its food waste by 50% before 2030 and to avoid sending biodegradable waste to landfill by 2026 (ibid). However, no legal commitment is associated with these goals.

Table 10: Guidance for businesses on statutory waste hierarchy by the DEFRA. Source: DEFRA (2023)

Guidance	**Required by Law**
1. *Prevent* surplus and waste in your business	5. Recycle – *anaerobic digestion and composting*
2. *Redistribute* surplus food and drink	6. Recover waste by *landspreading*
3. Make *animal feed* from former food	7. *Recover energy* from waste
4. Process surplus food to *make biomaterials*	8. Dispose – send to *sewer and landfill*

Retail food waste initiatives in London

Table 11: Food waste management initiatives (yellow indicates trials). *includes: sale of impaired quality products, promotion optimisation, and best before/use by removal

Strategy	Category	Aldi	Asda	Borough Market	Co-op	Lidl	M&S Food	Morrisons	New Covent Garden Market	New Spitalfields Market	Sainsbury's	Tesco	Waitrose
Prevention	Corporate social responsibility practice	■	■		■	■	■	■			■	■	■
	Purchasing management												■
	Packaging strategy	■	■								■	■	
	Price reduction	■	■		■	■	■	■			■	■	■
	Supplier cooperation	■			■	■						■	
	Other initiatives*	■	■	■	■	■	■	■	■	■	■	■	■
Re-use	Animal feed		■	■							■	■	■
	Donation (unspecified)	■	■	■	■	■	■	■	■	■	■	■	■
	Preparing ready-to-eat food			■			■	■			■		
Recovery	Recycling			■								■	
	Energy recovery	■	■	■	■	■	■	■	■	■	■	■	■

The search for retail initiatives in London explored interventions taking place in 12 organisations: 9 national supermarket chains, 2 major wholesale markets and 1 major general market. The search yielded a total of 74 actions (***Table 12***). Most were considered **prevention** (n=37) strategies. Two categories were in place at all the organisations: **donation** to unspecified sources and **energy and nutrients recovery** through anaerobic digestion. **Corporate social responsibility practice** and **price reductions** were common, both practiced by nine organisations each. No disposal strategy was identified.

In the UK, food retail is dominated by supermarkets. The largest chains occupy 96.4% of the national grocery market share (Kantar, 2023). As a result, the vast majority of retail food waste is managed through strategies developed in a corporate structure that aligns across all a retailer's branches nationwide. Consequently, initiatives are comparable across the food retail sector and many initiatives are widely practised. For example, all nine of the country's largest supermarket chains are signatories of the *Courtauld Commitment*, an agreement that establishes concrete goals to tackle issues of food waste, water stress and greenhouse gas emissions across the food system (WRAP, 2017). It aims to halve national food waste by 2030 against a baseline set in 2007 (ibid). Due to this commitment, many retailers have set and reported internal targets that align with, or intend to surpass, the goals of Courtauld 2030. Furthermore, all nine retailers reduce the price of food nearing expiry for quick sale and send food waste for anaerobic digestion. Several supermarkets therefore report a 'zero landfill' food waste policy.

Food **donation** is another key initiative found across the sector. In its most basic form, food stores connect with a local charitable organisation to redistribute edible food to those in need. Organisations may use donations to cook meals, stock food banks or community fridges, or resell at reduced cost. However, the logistical and administrative challenge of carrying this out in individual stores means that various food waste distribution organisations are now involved in linking supermarkets to worthy causes. In 1994, *Sainsbury's* partnered with homelessness charity Crisis to found *FareShare*, a national network of food redistributors (Sainsbury's, 2021). *FareShare* have since partnered with several supermarket chains to redistribute edible food waste to charities nationwide and now operate five regional hubs in the Greater London

area with the support of London-based food redistribution charity, *The Felix Project*.

Food **donation** is one of few key initiatives also found in London's markets, which are a less dominant player in the food retail scene. Wholesale markets like New Covent Garden Market and New Spitalfields Market have partnered with *City Harvest London*, a local charity, to redistribute food waste, while Plan Zheroes redistribute from smaller markets like Borough Market (Covent Garden Market Authority, 2021; Spitalfields Market Tenants' Association, 2019; Plan Zheroes, n.d.). However, participation in redistribution schemes is optional and market tenants may refuse collection when offered.

One challenge for market traders, and other smaller businesses, looking to redistribute food waste is the associated cost. Many organisations operate solely on **donations** but some request payment from retailers to partner with them. As such, it is the onus of the market authority to support such schemes, meaning there remains limited information on food waste initiatives from most of London's markets. Campaigning by *FareShare* helped introduce DEFRA funding to support offsetting the costs of redistribution organisations, therefore enabling more retailers to divert their food waste for human consumption (FareShare, 2023b).

Redistribution processes have also largely migrated to more flexible digital platforms. *FareShare Go* launched in 2015 and has since streamlined the **donation** process for retailers and donation receivers. Now, supermarket food waste goes through *FareShare*'s digital channels while its regional hubs mainly manage surplus stock (FareShare, 2023). The Co-operative supermarket chain has also launched a similar platform, designed to be used by any retailer (Co-operative Group, 2022).

Another major player is *Neighbourly*, a digital platform that manages redistribution processes. The platform traces retailers' donations down to branch level, enabling retailers to assure statutory compliance and improved reporting (Neighbourly, 2023). *Olio*, a sharing app, also works with supermarkets to redistribute surplus and waste. Volunteers partner with wholesalers and retailers to collect end-of-day food waste, then add it to the app so it can be requested and collected (Olio, 2023a). Their Food Waste Heroes programme partnered with *Tesco* to plug the gap in areas

without charities to receive **donations**, and helped increase the level of food waste that could be redistributed by 65% (Olio, 2023b).

The Greater London Authority is also in the process of leveraging more corporate funding for members of its *London Food Alliance (City Harvest, The Felix Project* and *FareShare*) to support the operation of their **re-use** hubs (ReLondon, 2023). The GLA and *London Food Alliance* have also recently collaborated with environmental charity *Hubbub* and *Southwark Council* to launch Food Connect, a pilot project aimed at making food redistribution more efficient in the borough (ibid). This scheme focuses on smaller local businesses, for whom redistribution may be more challenging, and aims to link them up with the local network of community fridges. In its first six months the scheme has redistributed around 104 tons of food, and the potential for scaling the scheme up to support the whole of London is currently being investigated (ReLondon, 2023:8). However, larger models of redistribution are challenging to manage and some retailers offer the option to distribute end-of-day food waste to staff and customers for free (Tesco PLC, 2022; Asda, 2020).

A newer **prevention** initiative seen in each of the nine major supermarkets is the removal of use by and best before dates on certain products' **packages**. *Tesco, Sainsbury's, Asda, Aldi, Morrisons, Waitrose* and *Co-op* have removed best before dates from several fruit and vegetable lines, while *M&S Food* is currently trialling this. *Use by* dates are being changed to *best before* dates on yoghurts and milk at *Asda, Morrisons* and *Co-op*. Although the advertised aim of these initiatives is to reduce household waste by encouraging consumers to assess products based on their quality, these initiatives also reduce retail food waste by making sure **price reductions** are based on quality control rather than arbitrary dates by which the store must be rid of the products.

Another food waste **prevention** initiative growing in popularity in recent years has been the sale of imperfect – popularly known as 'wonky' – produce ranges. Up until 2008, European Union policy limited the standards of many fruits and vegetables but as this legislation has loosened and consumer opinion has improved, more supermarkets are offering produce of differing standards to reduce food waste (Wright, 2008). Many supermarkets offer permanent ranges of imperfect produce, while others sell a limited number of produce boxes containing

a variety of imperfect fruit and vegetables for a significantly **reduced price**. In a similar vein, *M&S Food* has begun selling overripe bananas which would otherwise be wasted in 25p bags with recipes on the **packaging** to inspire customers to make use of them (M&S, 2022). Some retailers sell these using external platforms like *Too Good to Go*, an app where businesses can offer surprise bags for collection by nearby users.

Retailers have long considered the **optimisation of stock** and cool chain management crucial to preventing food waste within their business. Many retailers now avoid multi-buy offers, particularly on fresh fruit and vegetables, to reduce overstock issues. For some retailers, taking a whole chain approach and increasing **cooperation with suppliers** has created new opportunities for managing surplus stock challenges while reducing waste. For example, *Tesco* sold 500,000 additional cauliflowers at half price in a single month, a glut acquired from suppliers due to a delayed harvest (Tesco PLC, 2022:3). *Waitrose*, on the other hand, intentionally buys whole animals from its livestock suppliers to ensure 'forgotten cuts' like pig cheek, beef short ribs and calves' livers are not wasted, a move to promote more sustainable choices and awareness amongst its customer base (Waitrose & Partners, 2023).

Other retailers have made interventions in **packaging** design to increase shelf life. For example, *Sainsbury's* now use vacuum packaging in their meat and fish lines which has at least tripled items' longevity (Sainsbury's, 2019). *Tesco* and *Asda* have also trialled a novel food technology treatment called Apeel in some fruit and vegetable lines to increase shelf life. *Asda* found that Apeel's imperceptible plant-based protective coating decreased their citrus waste by 36% year-on-year and avocado waste by 10% (Crowe, 2022). *Tesco* is also trialling the sale of unwashed potatoes, which is expected to double their shelf life (Tesco PLC, 2022).

Valorisation and **re-use** are also happening within food stores. Many supermarket chains have restaurants, cafes, and bakeries, to which they divert food waste to be **cooked into meals/ready-to eat food** for sale. More than 100 *Sainsbury's* branches bake banana bread for sale using unsold bananas from the shopfloor (Sainsbury's, 2019). *M&S Food* has begun making frozen garlic bread from its unsold fresh bakery baguettes and boules, extending the shelf life of fresh bread by 30 days, and using

surplus fruit and vegetables to make smoothies (M&S, 2022). **Creation of new products** is even more popular at markets, where fresh produce is the main good for sale and retailers have more flexibility to try new things. At *Borough Market*, one greengrocer, Turnips, uses its food waste and surplus to make ready-to-eat goods like pizzas and risottos, and pickled and fermented goods and sauces that can then be sold throughout the year (Borough Market, 2021).

Retailers are also **recovering** food waste to make non-food products, and food products not for human consumption. *Biobean* collects coffee grounds from Borough Market's coffee traders to be resold as 'coffee logs', which can be used in place of chopped wood logs for fuelling fires (Borough Market, 2021). Food waste is also **re-used** by some supermarkets to make **animal and pet feeds**, although this requires additional waste separation since animal by-products cannot be used in them. *Sainsbury's*, Tesco, and *Asda* all use this as part of their food waste management strategy, and *Waitrose* has recently begun trialling it too. However, there is increasing recognition that more energy efficient feed could be made using food waste by relying instead on insect protein, which is more nutrient dense than standard food waste or soybeans and fishmeal. *Entocycle*, which operates at *Borough Market*, collects market food waste to feed its insects before drying them after 12 days and grinding them into a protein flour (ibid). This then gets turned into **animal feed**. Tesco has also been trialling a similar model since 2021 using black soldier flies (Tesco PLC, 2022:2).

Two cities in comparison – where are the similarities, differences, interesting innovations?

Comparing the results found in the two cities, London stands out for disclosing more information on the subject. Many retailers quantify and publicise relevant data on retail waste generation, as well as detailed information about the interventions they conduct in their supermarkets. On the other hand, in São Paulo, quantitative data on food waste generation was not found, and there was difficulty in accessing supermarket information. Sites with data were not very detailed; some of them only said that they donated without identifying to whom, how much, or how it worked.

The difference in access to intervention information in the two cities may be related to the existence of local legislation. In the case of London, there now exists a specific law on food waste, which encourages compliance and disclosure of data. Further, there is more involvement at the municipal political level in encouraging better management of food waste. Besides that, London's retail sector has a more developed corporate structure for managing food waste, with longstanding initiatives like the Courtauld Commitment setting industry-wide goals and reporting requirements. São Paulo, on the other hand, relies more heavily on individual organisations and initiatives to manage food waste.

All four food waste strategies found in the scoping review (prevention, re-use, recovery, disposal) were identified in São Paulo, while no disposal intervention was detected in London. Although in London the variety of preventive interventions is higher, both cities have a similar amount of re-use interventions active, such as **animal feed, donation,** and **food preparation**. Concerning recovery, in London it was common to perform anaerobic digestion (**energy and nutrient recovery**). In São Paulo, a few initiatives aiming at nutrient recovery were in place through composting.

The category that showed the greatest similarity between the two cities, with many examples found, was **donation**. Despite the socioeconomic differences between the two cities, and their variability in terms of social inequality and food poverty, both demonstrated well-developed donation initiatives. In São Paulo, the food banks *Mesa Brasil* and the NGO *Banco de Alimentos* stand out, which both have partnerships with the largest supermarkets in the city. In London, donation was a popular initiative identified in all supermarkets evaluated, as well as some of its markets. This commonality across the two cities is somewhat unsurprising, since the visibility of food waste in the retail sector triggers an almost knee-jerk reaction amongst consumers who often feel that surpluses should be redirected to those who lack sufficient food resources. Where there are people in need, it stands to reason that retail food waste is considered a low-cost and low-waste way of filling this gap.

On the other hand, a large divergence was found in results relating to the changes in 'best before' and 'use by' labelling of products. Most UK supermarkets are now trialling this, to a greater or lesser degree, but this was not seen at all in São Paulo. One explanation for this could be the

differences in the food sector composition between the two cities. Supermarkets dominate food sales in London and labelling of **food packaging** with 'best before' and 'use by' dates has been commonplace to **prevent** food waste for many years. Now, in relation to fruit and vegetables in particular, London's supermarkets are reintroducing what was usual when consumers bought produce at daily markets: evaluating quality and appropriateness of a product on an individual basis. At markets, which are more popular in São Paulo, this has always been the case so there is less need for intervention within this context.

Furthermore, removal of such labelling requires consumer trust. Customers must be comfortable that the unlabelled foods that they are purchasing have been correctly handled at every stage of the food chain so as not to be concerned about the food safety standards of what they are consuming. It is possible then that consumer opinion has not sufficiently aligned with this practice to introduce it in São Paulo's supermarkets, so more interventions to enhance **consumer awareness** might be needed.

Another category found in both cities, but in smaller quantities, was **price reduction**. In São Paulo, it was carried out by the *Carrefour* and GPA supermarkets, which sold products at a discount to avoid food waste, by the company *Fruta Imperfeita*, which sells baskets at a cheaper price made up of food that would otherwise be discarded, and the *Food to Save App*, which allows establishments register and offer cheaper products. In London this was a strategy adopted in 9 of the 12 supermarkets considered. Price reductions are both a norm of purchasing management, and an additional innovation where supermarkets are utilising digital platforms to expand their reach and make sure as much food waste as possible is salvaged for consumption.

In terms of **recycling**, the two cities showed opposite results. In London, anaerobic digestion (AD) was identified in all analysed supermarkets and some markets. This is a process that allows the recovery of **nutrients and energy generation**, but despite all its benefits and wide use in Europe, it is not a common treatment for organic waste in Brazil. A cheaper option for recycling organics is composting, which is an appropriate alternative for São Paulo considering the local climatic conditions. However, only one local initiative was found for

decentralised composting of waste from fairs, managed by the city hall. Prioritising AD has enabled many of London's major retailers to claim a "zero landfill" policy. This demonstrates that the established waste hierarchy is being prioritised in London. However, little information was found on food waste disposal in São Paulo, suggesting that most of it is being **disposed** of in dumpsites or **landfills** as is common across Brazil, in non-compliance with the hierarchy.

A final note should be made about innovation in food waste management strategies. London's food retailers and private sector organisations are making smaller scale but novel steps towards thinking about new ways to **re-use** food waste, and to put London's food waste towards a more circular waste model. Turning coffee grounds to wood-burning logs and adding insects as a vector in the process of making more energy efficient animal feed are the types of innovations enabled by an open business environment. London is a popular city for start-ups due to the availability of venture capital, and the popularity of environmental, social and governance investing in recent years. Therefore, it offers an opportunity for these kinds of small businesses to test the effectiveness and profitability of their unique ideas before they are scaled up to wider populations.

5. SUMMARY OF FINDINGS

The results of the scoping review highlight the importance of **prevention** interventions to manage retail food waste in the published literature. Although most studies included in the review describe European scenarios, our document analysis showed that this is also relevant to a Latin American metropolis. In summary, São Pauldo and London are making worthy strides towards prevention and better handling of food waste, although challenges remain.

As a point of priority, we recommend that actors in the two cities invest in increased dissemination of food waste data and relevant initiatives, to contribute to a greater exchange of knowledge on this topic, especially in São Paulo, where little data was found. This has potential to increase awareness of the topic and enable consumers to make more sustainable choices. Both should focus their actions on the food waste hierarchy, which London is already doing. São Paulo can be inspired by the good examples found there and try to apply what is feasible and suitable to its reality. A strong first step would be increasing investment in composting, since it requires fewer financial resources, and is a simpler process to manage.

6. POSSIBLE FUTURE(S) OF FOOD WASTE IN CITIES: INTERVENTIONS TO CO-CREATE MORE SUSTAINABILITY

In sustainable cities of the future, there are several possible futures for food waste. Based on our findings in the scoping review and the document analysis, promising concepts and scenarios we would like to mention in this outlook are:

1. *Zero waste cities*: Cities could aim for a zero-waste goal, where all waste, including food waste, is eliminated. This would involve a complete overhaul of the current waste management system, with a focus on reducing waste at the source, increasing recycling and developing new technologies to deal with any remaining waste.
2. *Circular economy*: Cities could adopt a circular economy model, where waste is treated as a resource and reused as much as possible. In this scenario, food waste would be composted and used to grow more food or converted into energy through anaerobic digestion.
3. *Smart waste management*: Cities could leverage technology to create more efficient waste management systems. For example, smart bins that use sensors to monitor waste levels and optimise collection routes could be used to reduce food waste and increase recycling.
4. *Food recovery programs*: Cities could implement food recovery programs to redirect surplus food to people in need. This should involve partnerships with food banks and non-profits to collect excess food from restaurants, grocery stores, and other sources, and distribute it to those who are food insecure.

Overall, the future of food waste in sustainable cities will depend on a range of factors, including policy, technology, and public awareness. However, with the right political strategies, citizen engagement and corporate investments, it is possible to create cities where food waste is minimised, and resources are used more efficiently.

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REFERENCES

Arcadis. (2022). The Arcadis Sustainable Cities Index 2022: Prosperity beyond profit. Retrieved 26 April 2023, from https://www.arcadis.com/en/knowledge-hub/perspectives/global/sustainable-cities-index

Azunre, G. A., Amponsah, O., Peprah, C., Takyi, S. A., & Braimah, I. (2019). A review of the role of urban agriculture in the sustainable city discourse. Cities, 93, 104–119. https://doi.org/10.1016/j.cities.2019.04.006

Bergmann Direct. (2022). Environment Act 2021 Comes Fully Into Force In 2023. Bergmann Direct. Retrieved 25 April 2023, from https://www.bergmanndirect.co.uk/articles/new-food-waste-regulations-in-2023

Borough Market. (2021). Virtuous Circles: Reducing Food Waste. Borough Market Blog. Retrieved 25 April 2023, from https://boroughmarket.org.uk/market-blog/virtuous-circles-reducing-food-waste/

Brancoli, P., Makishi, F., Lima, P.G. & Rousta, K. (2022). Compositional Analysis of Street Market Food Waste in Brazil. Sustainability, 14, 7014. https://doi.org/10.3390/su14127014

Brasil. (2010). Lei nº 12.305, de 2 de agosto de 2010. Institui a Política Nacional de Resíduos Sólidos; altera a Lei no 9.605, de 12 de fevereiro de 1998; e dá outras providências. Retrieved 21 April 2023, from

ttp://www.planalto.gov.br/ccivil_03/_ato2007-2010/2010/lei/l12305.htm

Brasil. (2022). Plano Nacional de Resíduos Sólidos. Retrieved 21 April 2023, from https://www.gov.br/mma/pt-br/acesso-a informacao/acoes-e-programas/agendaambientalurbana/lixao-zero/plano_nacional_de_residuos_solidos-1.pdf

Carrefour. (2023). Combate ao desperdício de alimentos. Retrieved 27 April 2023, from

https://www.grupocarrefourbrasil.com.br/sustentabilidade/economia-circular/combate-ao-desperdicio-de-alimentos/

Castro, A. M. R. C., Luquine, C. D., Jr, Conde, D. S., Zentgraf, L. L., & Metaferia, R. (2022). Food waste interventions in retail: a scoping review protocol. OSF Registries. https://doi.org/10.17605/OSF.IO/2RDUA

CEIC. (2023). Brazil GDP per Capita: Metropolitan Region of São Paulo: Current Price. CEIC Data. Retrieved 27 April 2023, from https://www.ceicdata.com/en/brazil/sna-2008-gross-domestic-product-per-capita-southeast-so-paulo/gdp-per capita-metropolitan-region-of-so-paulo-current-price

Chalak, A., Abou-Daher, C., & Abiad, M. G. (2018). Generation of food waste in the hospitality and food retail and wholesale sectors: Lessons from developed economies. Food Security, 10(5), 1279–1290. https://doi.org/10.1007/s12571- 018-0841-0

Cidade de São Paulo. (2002). Lei nº 13.478, de 30 de dezembro de 2002. Dispõe sobre a organização do Sistema de Limpeza Urbana do Município de São Paulo. Retrieved 21 April 2023, from http://legislacao.prefeitura.sp.gov.br/leis/lei-13478-de 30-de-dezembro-de-2002

Cidade de São Paulo. (2014). Plano de Gestão Integrada de Resíduos Sólidos da Cidade de São Paulo. Retrieved 21 April 2023, from https://www.prefeitura.sp.gov.br/cidade/secretarias/upload/servicos/arquivos/PGIRS-2014.pdf

Cidade de São Paulo. (2022a). Lei nº 17.755, de 24 de janeiro de 2022. Dispõe sobre a doação de excedentes de alimentos pelos estabelecimentos dedicados à produção e fornecimento de refeições, e dá outras providências. Retrieved 21 April 2023, from https://legislacao.prefeitura.sp.gov.br/leis/lei-17755-de-24-de-janeiro-de-2022

Cidade de São Paulo. (2022b). Pátios de compostagem da Prefeitura são referência internacional e recebem visita de gestores de resíduos orgânicos. Retrieved 27 April 2023, from https://www.capital.sp.gov.br/noticia/patios-de compostagem-da-prefeitura-sao-referencia-internacional-e-recebem-visita-de-gestores-de-residuos-organicos

Cidade de São Paulo. (2023). Quantitativos. Resíduos coletados no município. Retrieved 21 April 2023, from https://www.prefeitura.sp.gov.br/cidade/secretarias/spregula/residuos_solidos/index.php?p=185375.

Co-operative Group. (2022). Leading brands set to launch a major new platform to tackle food waste. Co-operative Group. Retrieved 25 April 2023, from https://www.co-operative.coop/media/news-releases/leading-brands-set-to-launch-a major-new-platform-to-tackle-food-waste

Covent Garden Market Authority. (2021). Our zero to landfill commitment. New Covent Garden Market. Retrieved 25 April 2023, from https://newcoventgardenmarket.com/blog/our-zero-to-landfill-commitment/

Crowe, E. (2022). Asda Turns to Apeel to Help Reach Its Food Waste Reduction Goals. Progressive Grocer. Retrieved 25 April 2023, from https://progressivegrocer.com/asda-turns-apeel-help-reach-its-food-waste-reduction-goals

Deelstra, T., & Girardet, H. (2000). Urban agriculture and sustainable cities. In Growing cities, growing food: Urban agriculture on the policy agenda. A reader on urban agriculture (pp. 43–65). Deutsche Stiftung für Internationale Entwicklung (DSE), Zentralstelle für Ernährung und Landwirtschaft.

Department for Environment, Food and Rural Affairs(DEFRA). (2023). Food and drink waste hierarchy: deal with surplus and waste. GOV.UK. Retrieved 25 April 2023, from

https://www.gov.uk/government/publications/food-and-drink-waste hierarchy-deal-with-surplus-and-waste/food-and-drink-waste-hierarchy-deal-with-surplus-and-waste

Department for Environment, Food and Rural Affairs and Animal and Plant Health Agency (DEFRA-APHA). (2014). How food businesses must dispose of food and former foodstuffs. GOV.UK. Retrieved 25 April 2023, from https://www.gov.uk/guidance/how-food-businesses-must-dispose-of-food-and-former-foodstuffs

Dubbeling, M., Bucatariu, C., Santini, G., Vogt, C., & Eisenbeiss, K. (2017). City region food systems and food waste management: Linking urban and rural areas for sustainable and resilient development. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.

Elspaß , M. and Feldmann, F. (2021). Environmental law and practice in Germany: overview. Thomson Reuters: Practical Law. Retrieved 27 April 2023, from https://uk.practicallaw.thomsonreuters.com/4-503-0486

Environment Act 2021, c. 30. Retrieved 25 April 2023, from https://www.legislation.gov.uk/ukpga/2021/30/contents/enacted

Esmaeilian, B., Wang, B., Lewis, K., Duarte, F., Ratti, C., & Behdad, S. (2018). The future of waste management in smart and sustainable cities: A review and concept paper. Waste Management, 81, 177-195. https://doi.org/10.1016/j.wasman.2018.09.047

European Commission's Knowledge Centre for Bioeconomy. (2020). Brief on food waste in the European Union. European Union. Retrieved 26 April 2023, from https://food.ec.europa.eu/system/files/2021-04/fw_lib_stud-rep-pol_ec-know cen_bioeconomy_2021.pdf

FareShare. (2023a). Getting Food. FareShare. Retrieved 25 April 2023, from https://fareshare.org.uk/getting-food/

FareShare. (2023b). Our History. FareShare. Retrieved 25 April 2023, from https://fareshare.org.uk/what-we-do/our history/

Food and Agriculture Organization of the United Nations - FAO. (2020). Technical Platform on the Measurement and Reduction of Food Loss and Waste. Food and Agriculture Organization of the United Nations. Retrieved 28 November 2022, from https://www.fao.org/platform-food-loss-waste/flw-events/international-day-food-loss-and-waste/en

Food and Agriculture Organization of the United Nations - FAO. (n.d.). Food Loss and Waste Database. Technical Platform on the Measurement and Reduction of Food Loss and Waste. Retrieved 6 April 2023, from https://www.fao.org/platform food-loss-waste/flw-data/en/

GeoSampa Mapa. (2023). Mapa Digital da Cidade de São Paulo. Prefeitura de São Paulo. Retrieved 27 April 2023, from https://geosampa.prefeitura.sp.gov.br/PaginasPublicas/_SBC.aspx

GLA (Greater London Authority). (2018). London Environment Strategy. Greater London Authority. Retrieved 25 April 2023, from https://www.london.gov.uk/sites/default/files/london_environment_strategy_0.pdf

GLA (Greater London Authority). (2023a). London's Population – London Datastore. Greater London Authority. Retrieved 25 April 2023, from https://data.london.gov.uk/dataset/londons-population

GLA (Greater London Authority). (2023b). Waste and recycling | London City Hall. Greater London Authority. Retrieved 25 April 2023, from https://www.london.gov.uk/programmes-strategies/environment-and-climate-change/waste-and recycling

Harvard T. H. Chan School of Public Health. (n.d.). Food Waste. The Nutrition Source. Retrieved 26 April 2023, from https://www.hsph.harvard.edu/nutritionsource/sustainability/food-waste/

Holweg, C., Teller, C., & Kotzab, H. (2016). Unsaleable grocery products, their residual value and instore logistics. International Journal of Physical Distribution & Logistics Management, 46(6/7), 634–658. https://doi.org/10.1108/IJPDLM 11-2014-0285

IBGE. (2021). São Paulo. Panorama. População estimada em 2021. Portal Cidade. Retrieved 21 April 2023, from https://cidades.ibge.gov.br/brasil/sp/sao-paulo/panorama

Jackman, J. (2023). Food Waste Facts and Statistics. The EcoExperts. Retrieved 25 April 2023, from https://www.theecoexperts.co.uk/home-hub/food-waste-facts-and-statistics

Kakaei, H., Nourmoradi, H., Bakhtiyari, S., Jalilian, M., & Mirzaei, A. (2022). Effect of COVID-19 on food security, hunger, and food crisis. In COVID-19 and the Sustainable Development Goals (pp. 3–29). Elsevier.

Kantar. (2023). Great Britain: Grocery Market Share (12 weeks ending). Kantar World Panel. Retrieved 25 April 2023, from https://www.kantarworldpanel.com/grocery-market-share/great-britain/snapshot/19.03.23/

LondonMap360. (2023). London boroughs map. LondonMap360. Retrieved 27 April 2023, from https://londonmap360.com/london-boroughs-map

M&S. (2022). Sustainability Report 2022. Marks and Spencer Corporate. Retrieved 25 April 2023, from https://corporate.marksandspencer.com/sites/marksandspencer/files/marks-spencer/sustainabilty-at-m s/sustainabilityreport2022-new.pdf

Milaré, É., Milaré, L. T., Loures, F. R., Mattei, J. F., Artigas, P., Franco, R. M. B., de and Morais, R. J. (2021). Environmental law and practice in Brazil: overview. Thomson Reuters:

Practical Law. Retrieved 27 April 2023, from https://uk.practicallaw.thomsonreuters.com/w-014-7503

Mullick, S., Raassens, N., Haans, H., & Nijssen, E. J. (2021). Reducing food waste through digital platforms: A quantification of cross-side network effects. Industrial Marketing Management, 93, 533–544.

https://doi.org/10.1016/j.indmarman.2020.09.021

Neighbourly. (2023). Donating surplus to local charities and community groups. Neighbourly. Retrieved 25 April 2023, from https://www.neighbourly.com/service/product-surplus

Office for National Statistics - ONS. (2020). Analysing regional economic and well-being trends. Office for National Statistics. Retrieved 27 April 2023, from

https://www.ons.gov.uk/economy/nationalaccounts/uksectoraccounts/compendium/economicreview/february2020/anal ysingregionaleconomicandwellbeingtrends

Office for National Statistics - ONS. (2023). Regional economic activity by gross domestic product, UK: 1998 to 2021. Office for National Statistics. Retrieved 27 April 2023, from https://www.ons.gov.uk/economy/grossdomesticproductgdp/bulletins/regionaleconomicactivitybygrossdomesticproductu k/1998to2021#gross-domestic-product-per-head-for-uk-local-authorities-1998-to-2021

Olio. (2023a). What is Olio?. Olio. Retrieved 25 April 2023, from https://olioapp.com/en/getting-started-on-olio/what-is olio/

Olio. (2023b). Tackling food waste at Tesco: Olio and FareShare's collaborative approach to surplus food redistribution. Olio. Retrieved 25 April 2023, from https://olioapp.com/business/case-study/food-waste-tesco/

ONG Banco de Alimentos. (2023). Retrieved 27 April 2023, from https://bancodealimentos.org.br/

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. Systematic Reviews, 10(1), 89. https://doi.org/10.1186/s13643-021-01626-4

Peters, M. D. J., Godfrey, C. M., Khalil, H., McInerney, P., Parker, D., & Soares, C. B. (2015). Guidance for conducting systematic scoping reviews. International Journal of Evidence-Based Healthcare, 13(3), 141–146. https://doi.org/10.1097/XEB.0000000000000050

Plan Zheroes. (n.d.). Food market collections. Plan Zheroes – The Zero Food Waste Heroes. Retrieved 25 April 2023, from https://planzheroes.org/food-market-collections/

Pulker, C. E., Trapp, G. S. A., Scott, J. A., & Pollard, C. M. (2018). Global supermarkets' corporate social responsibility commitments to public health: A content analysis. Globalization and Health, 14(1), 121. https://doi.org/10.1186/s12992- 018-0440-z

ReLondon. (2021). London's food footprint. ReLondon. Retrieved 25 April 2023, from https://relondon.gov.uk/wp content/uploads/2021/11/ReLondon_Londons_food_footprint_online.pdf

ReLondon. (2023). London's food footprint: progress towards a low carbon circular food system. ReLondon. Retrieved 25 April 2023, from https://relondon.gov.uk/wp-content/uploads/2023/01/ReLondon_Londons-food-footprint-progress report_FINAL.pdf

Sainsbury's. (2019). Tackling food waste in UK homes and stores. Sainsbury's. Retrieved 25 April 2023, from https://www.about.sainsburys.co.uk/sustainability/plan-for-better/our-stories/2019/09072019-tackling-food-waste-in-uk homes-and-stores

Sainsbury's. (2021). Sainsbury's partners with Neighbourly to donate surplus food to local communities. Sainsbury's. Retrieved 25 April 2023, from https://www.about.sainsburys.co.uk/sustainability/plan-for-better/our-stories/2021/08-09- 2021-sainsburys-partners-with-neighbourly

Schanes, K., Dobernig, K., & Gözet, B. (2018). Food waste matters—A systematic review of household food waste practices and their policy implications. Journal of Cleaner Production, 182, 978–991. https://doi.org/10.1016/j.jclepro.2018.02.030

Schinkel, J. (2019). Review of policy instruments and recommendations for effective food waste prevention. Proceedings of the Institution of Civil Engineers - Waste and Resource Management, 172(3), 92–101. https://doi.org/10.1680/jwarm.18.00022

Shannon, J. (2014). Food deserts: Governing obesity in the neoliberal city. Progress in Human Geography, 38(2), 248–266. https://doi.org/10.1177/0309132513484378

Spitalfields Market Tenants' Association. (2019). Market's relationship with City Harvest helps to feed vulnerable Londoners. New Spitalfields Market. Retrieved 25 April 2023, from https://newspitalfieldsmarket.co.uk/markets relationship-with-city-harvest-helps-to-feed-vulnerable-londoners/

Tesco PLC. (2022). Factsheet: Food waste and redistribution. Tesco PLC. Retrieved 25 April 2023, from https://www.tescoplc.com/media/759108/food-waste-and-redistribution-factsheet.pdf

Todd, K. (2020). How Asda is working to reduce food waste. Asda Corporate. Retrieved 25 April 2023, from https://corporate.asda.com/20201016/how-asda-is-working-to-reduce-food-waste

United Nations - UN. (2021). Stop Food Loss and waste, for the people, for the planet. United Nations; United Nations. Retrieved 28 November 2022, from https://www.un.org/en/observances/end-food-waste-day

United Nations Environment Program - UNEP. (2021). UNEP Food Waste Index Report 2021. Nairobi: UNEP.

United Nations Human Settlements Programme - UN-Habitat. (2010). São Paulo: A Tale of Two Cities. Retrieved 27 April 2023, from https://unhabitat.org/sites/default/files/download-managerfiles/Sao%20Paulo%20A%20tale%20of%20two%20cities.pdf

United Nations Human Settlements Programme - UN-Habitat). (2016). World Cities Report 2016: Urbanization and development: Emerging futures. UN-Habitat.

United Nations Human Settlements Programme - UN-Habitat). (2022). World Cities Report 2022: Envisaging the future of cities. UN-Habitat.

Waitrose & Partners. (2023). Food Waste. Waitrose & Partners. Retrieved 25 April 2023, from https://www.waitrose.com/ecom/content/sustainability/food-waste

Williams, W. R. (2019). Attending to the visual aspects of visual storytelling: Using art and design concepts to interpret and compose narratives with images. Journal of Visual Literacy, 38(1–2), 66–82. https://doi.org/10.1080/1051144X.2019.1569832

Waste and Resources Actions Programme (WRAP). (2017). The Courtauld Commitment 2030. The Waste and Resources Action Programme. Retrieved 25 April 2023, from https://wrap.org.uk/taking-action/food-drink/initiatives/courtauld commitment

Wright, C. (2008). EU set to ease laws on wonky veg. The Grocer. Retrieved 25 April 2023, from https://www.thegrocer.co.uk/eu-set-to-ease-laws-on-wonky-veg/194916.article

Wrigley, N. (2002). 'Food Deserts' in British Cities: Policy Context and Research Priorities. Urban Studies, 39(11), 2029– 2040. https://doi.org/10.1080/0042098022000011344

APPENDICES

Appendix A - List of studies included in the scoping review

1 Alexander, C., & Smaje, C. (2008). Surplus retail food redistribution: An analysis of a third sector model. Resources, Conservation and Recycling, 52(11), 1290–1298. https://doi.org/10.1016/j.resconrec.2008.07.009

2 Alexander, K. (2021). Old abattoirs and new food politics: Sharing food and eating together at the meat market of Brussels. Food and Foodways, 29(3), 223–242. https://doi.org/10.1080/07409710.2021.1943611

3 Arnold, N. (2022). Standards and Waste: Valuing Food Waste in Consumer Markets. Worldwide Waste: Journal of Interdisciplinary Studies, 5(1), 2. https://doi.org/10.5334/wwwj.84

4 Bech-Larsen, T., Ascheman-Witzel, J., & Kulikovskaja, V. (2019). Re-distribution and promotion practices for suboptimal foods – commercial and social initiatives for the reduction of food waste. Society and Business Review, 14(2), 186–199. https://doi.org/10.1108/SBR-11-2017-0094

5 Beitzen-Heineke, E. F., Balta-Ozkan, N., & Reefke, H. (2017). The prospects of zero-packaging grocery stores to improve the social and environmental impacts of the food supply chain. Journal of Cleaner Production, 140, 1528–1541. https://doi.org/10.1016/j.jclepro.2016.09.227

6 Blanke, M. (2015). Challenges of Reducing Fresh Produce Waste in Europe—From Farm to Fork. Agriculture, 5(3), 389–399. https://doi.org/10.3390/agriculture5030389

7 Busetti, S. (2019). A theory-based evaluation of food waste policy: Evidence from Italy. Food Policy, 88, 101749. https://doi.org/10.1016/j.foodpol.2019.101749

8 Cakar, B. (2022). Bounce back of almost wasted food: Redistribution of fresh fruit and vegetables surpluses from Istanbul's supermarkets. Journal of Cleaner Production, 362, 132325. https://doi.org/10.1016/j.jclepro.2022.132325 9 Cannavò, D., Cigna, G., Manzoni, S., Mazzi, A., & Saporito, S. B. (2019). Policies for the disposal of agri-food waste in the green economy sphere: Sustainable management of food waste in large-scale organized distribution. Procedia Environmental Science, Engineering and Management, 6(1), 45–50.

10 Chalak, A., Abou-Daher, C., & Abiad, M. G. (2018). Generation of food waste in the hospitality and food retail and wholesale sectors: Lessons from developed

economies. Food Security, 10(5), 1279–1290. https://doi.org/10.1007/s12571-018-0841-0

11 Chen, C., & Chen, R. (2018). Using Two Government Food Waste Recognition Programs to Understand Current Reducing Food Loss and Waste Activities in the U.S. Sustainability, 10(8), 2760. https://doi.org/10.3390/su10082760

12 de Hooge, I. E., van Dulm, E., & van Trijp, H. C. M. (2018). Cosmetic specifications in the food waste issue: Supply chain considerations and practices concerning suboptimal food products. Journal of Cleaner Production, 183, 698–709. https://doi.org/10.1016/j.jclepro.2018.02.132

13 Evans, A., & Nagele, R. (2018). A lot to digest: Advancing food waste policy in the United States. Natural Resources Journal, 58(1), 177–214..

14 Fassio, F., & Minotti, B. (2019). Circular Economy for Food Policy: The Case of the RePoPP Project in The City of Turin (Italy). Sustainability, 11(21), 6078. https://doi.org/10.3390/su11216078

15 Filimonau, V., & Gherbin, A. (2017). An exploratory study of food waste management practices in the UK grocery retail sector. Journal of Cleaner Production, 167, 1184–1194. https://doi.org/10.1016/j.jclepro.2017.07.229 16 Garrone, P., Melacini, M., & Perego, A. (2014). Opening the black box of food waste reduction. Food Policy, 46, 129–139. https://doi.org/10.1016/j.foodpol.2014.03.014

17 Gollnhofer, J. F. (2017). Normalising alternative practices: The recovery, distribution and consumption of food waste. Journal of Marketing Management, 33(7–8), 624–643. https://doi.org/10.1080/0267257X.2017.1301982

18 Gustavo, J. U., Trento, L. R., de Souza, M., Pereira, G. M., Lopes de Sousa Jabbour, A. B., Ndubisi, N. O., Chiappetta Jabbour, C. J., Borchardt, M., & Zvirtes, L. (2021). Green marketing in supermarkets: Conventional and digitized marketing alternatives to reduce waste. Journal of Cleaner Production, 296, 126531. https://doi.org/10.1016/j.jclepro.2021.126531

19 Hermsdorf, D., Rombach, M., & Bitsch, V. (2017). Food waste reduction practices in German food retail. British Food Journal, 119(12), 2532–2546. https://doi.org/10.1108/BFJ-06-2017-0338

20 Holweg, C., Teller, C., & Kotzab, H. (2016). Unsaleable grocery products, their residual value and instore logistics. International Journal of Physical Distribution & Logistics Management, 46(6/7), 634–658. https://doi.org/10.1108/IJPDLM 11-2014-0285

21 Horoś, I. K., & Ruppenthal, T. (2021). Avoidance of Food Waste from a Grocery Retail Store Owner's Perspective. Sustainability, 13(2), 550. https://doi.org/10.3390/su13020550

22 Marques, P. A., Carvalho, A. M., & Santos, J. O. (2021). Improving Operational and Sustainability Performance in a Retail Fresh Food Market Using Lean: A Portuguese Case Study. Sustainability, 14(1), 403. https://doi.org/10.3390/su14010403

23 Marrucci, L., Marchi, M., & Daddi, T. (2020). Improving the carbon footprint of food and packaging waste management in a supermarket of the Italian retail sector. Waste Management, 105, 594–603. https://doi.org/10.1016/j.wasman.2020.03.002

24 Mattsson, L., & Williams, H. (2022). Avoidance of Supermarket Food Waste—Employees' Perspective on Causes and Measures to Reduce Fruit and Vegetables Waste. Sustainability, 14(16), 10031. https://doi.org/10.3390/su141610031

25 Moggi, S., Bonomi, S., & Ricciardi, F. (2018). Against Food Waste: CSR for the Social and Environmental Impact through a Network-Based Organizational Model. Sustainability, 10(10), 3515. https://doi.org/10.3390/su10103515

26 Mullick, S., Raassens, N., Haans, H., & Nijssen, E. J. (2021). Reducing food waste through digital platforms: A quantification of cross-side network effects. Industrial Marketing Management, 93, 533–544. https://doi.org/10.1016/j.indmarman.2020.09.021

27 Mura, G., Castiglioni, I., Borrelli, N., Ferrari, M., & Diamantini, D. (2019). Recycling Food to Promote Social Inclusion. An Empirical Evidence. Revista de Cercetare Si Interventie Sociala, 65, 325–337. https://doi.org/10.33788/rcis.65.20

28 Ng, K. S., Yang, A., & Yakovleva, N. (2019). Sustainable waste management through synergistic utilisation of commercial and domestic organic waste for efficient resource recovery and valorisation in the UK. Journal of Cleaner Production, 227, 248– 262. https://doi.org/10.1016/j.jclepro.2019.04.136

29 Pulker, C. E., Trapp, G. S. A., Scott, J. A., & Pollard, C. M. (2018). Global supermarkets' corporate social responsibility commitments to public health: A content analysis. Globalization and Health, 14(1), 121. https://doi.org/10.1186/s12992- 018-0440-z

30 Reitemeier, M., Aheeyar, M., & Drechsel, P. (2021). Perceptions of Food Waste Reduction in Sri Lanka's Commercial Capital, Colombo. Sustainability, 13(2), 838. https://doi.org/10.3390/su13020838

31 Ribeiro, A., Rok, J., Harmsen, R., Rosales Carreón, J., & Worrell, E. (2019). Food waste in an alternative food network – A case-study. Resources, Conservation and Recycling, 149, 210–219. https://doi.org/10.1016/j.resconrec.2019.05.029

32 Schinkel, J. (2019). Review of policy instruments and recommendations for effective food waste prevention. Proceedings of the Institution of Civil Engineers - Waste and Resource Management, 172(3), 92–101. https://doi.org/10.1680/jwarm.18.00022

33 Sewald, C. A., Kuo, E. S., & Dansky, H. (2018). Boulder Food Rescue: An Innovative Approach to Reducing Food Waste and Increasing Food Security. American Journal of Preventive Medicine, 54(5), S130–S132. https://doi.org/10.1016/j.amepre.2017.12.006

34 Shrivastava, C., Crenna, E., Schudel, S., Shoji, K., Onwude, D., Hischier, R., & Defraeye, T. (2022). To Wrap Or to Not Wrap Cucumbers? Frontiers in Sustainable Food Systems, 6, 750199. https://doi.org/10.3389/fsufs.2022.750199

35 Sisson, L. G. (2016). Food Recovery Program at Farmers' Markets Increases Access to Fresh Fruits and Vegetables for Food Insecure Individuals. Journal of Hunger & Environmental Nutrition, 11(3), 337–339. https://doi.org/10.1080/19320248.2015.1112757

36 Souza, M., Pereira, G. M., Lopes de Sousa Jabbour, A. B., Chiappetta Jabbour, C. J., Trento, L. R., Borchardt, M., & Zvirtes, L. (2021). A digitally enabled circular economy for mitigating food waste: Understanding innovative marketing strategies in the context of an emerging economy. Technological Forecasting and Social Change, 173, 121062. https://doi.org/10.1016/j.techfore.2021.121062

37 Strotmann, C., Niepagenkemper, L., Göbel, C., Flügge, F., Friedrich, S., Kreyenschmidt, J., & Ritter, G. (2017). Improving Transfer in the Food Sector by Applying a Target Audience-Centered Approach—The Development of a Nonprofit Marketing Campaign Guide Based on a Case Study of the LAV Platform. Sustainability, 9(4), 512. https://doi.org/10.3390/su9040512

38 Trewern, J., Chenoweth, J., & Christie, I. (2022). Sparking Change: Evaluating the effectiveness of a multi-component intervention at encouraging more

sustainable food behaviors. Appetite, 171, 105933. https://doi.org/10.1016/j.appet.2022.105933

39 Tröger, K., Lelea, M. A., Hensel, O., & Kaufmann, B. (2020). Re-framing post-harvest losses through a situated analysis of the pineapple value chain in Uganda. Geoforum, 111, 48–61. https://doi.org/10.1016/j.geoforum.2020.02.017 40 Warshawsky, D. N. (2016). Food waste, sustainability, and the corporate sector: Case study of a US food company: Food waste, sustainability, and the corporate sector. The Geographical Journal, 182(4), 384–394. https://doi.org/10.1111/geoj.12156

41 Watanabe, E. A. de M., Nascimento, C. R. do, Freitas, M. G. M. T. de, & Viana, M. M. (2022). Food waste: An exploratory investigation of causes, practices and consequences perceived by Brazilian supermarkets and restaurants. British Food Journal, 124(3), 1022–1045. https://doi.org/10.1108/BFJ-01-2021-0045

42 Werderits Silva, D. E., da Silva César, A., & Conejero, M. A. (2021). Prevention of food waste and alternative destinations for unused food in Brazil. Journal of Cleaner Production, 318, 128545. https://doi.org/10.1016/j.jclepro.2021.128545

43 Wu, Q., & Honhon, D. (2023). Don't waste that free lettuce! Impact of BOGOF promotions on retail profit and food waste. Production and Operations Management, 32(2), 501–523. https://doi.org/10.1111/poms.13884

Appendix B - Template data collection form

Dimension	**Item / Data**
Identification	Article Reference APA 1st Author Year of publication
Aims	Objectives of publications as stated by the authors Is food waste a primary or secondary outcome in the study?

Context of implementation	Location (which city, region, country) Enterprise (supermarket, market) Scope (international, national, regional, local, individual)
Population	Emitting/responsible population (who built/proposed the intervention) Target population (who receives/benefits from the intervention)
Intervention	Types of intervention (strategies, materials, delivery, duration etc.)
Results	Positive Negative Ambivalent Did the intervention reduce/minimise/prevent food waste in retail?
Final decision	Decision (Include/Exclude) Reason for exclusion Other comments and observations