A Human-Scaled Perspective of Integrative Urban Blue-Green Space Planning – Exemplified by the case of Oslo, Norway

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Abstract

Urban recreational space plays a vital role in the context of sustainable urban development. which is reflected in a considerable number of studies from the past. This thesis explores a human-scaled view on the challenges and opportunities of blue-green recreational spaces in the context of smart urban growth and compact city planning. A mixed methods approach is employed, starting with a comprehensive literature review to understand the theories and concepts behind inclusive management of urban blue-green spaces (UBGS). A case study of Oslo applies these concepts to real-life situations. Spatial analysis in ArcGIS is used to examine the distribution and accessibility of blue-green infrastructure (BGI), while a Cluster analysis identifies social patterns. Ethnographic field surveys provide insights into the socio-cultural characteristics and preferences of local communities. The key findings highlight the importance of future proof UBGS management. Recognizing the potential of these spaces and translating them into the local context is essential for urban ecosystems. Co-creative design approaches are important for inclusive and multi-scale governance and decision-making. Multifunctionality should be emphasized in the planning and design of BGI to adapt to changing urban conditions without compromising essential characteristics. Enhancing the social livability of urban landscapes, requires understanding people's preferences, ensuring easy access to blue-green spaces, and considering socioeconomic and cultural factors. Analyzing concentration of future housing development, population trends, and density can aid in prioritizing specific areas. This research contributes to the integration of blue-green spaces into compact city planning and the promotion of societal well-being.

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1. Introduction

By 2050, it is projected that approximately 70% of the global population will reside in cities (EC, 2020), presenting significant challenges for urban ecosystems due to trends of population growth, and densification. Particularly in Europe, trends in urban planning lean towards densification, often resulting in the loss of access to natural areas and open spaces within cities (Nordh, Alalouch and Hartig, 2011; Beatley, 2012; Næss, 2022). This is despite the fact that the COVID-19 pandemic has recently emphasized the importance of green spaces and outdoor recreation for the urban population, which has been proven by several studies (Day, 2020; Derks et al., 2020; Venter et al., 2021). Nevertheless, through fair allocation and design of blue-green space (BGS), this difficulty may also provoke ways for sustainable development in cities (Kabisch and Haase, 2014). A key principle for inclusive planning is to prioritize walkable accessibility of blue-green spaces (BGS). The human connection with the environment at eye-level, experienced while walking and engaging with surroundings, holds significant importance. This principle highlights the value of the immediate environment and the human senses' interaction and expression within that space (Sim and Gehl, 2019).

UBGS, as defined in this study, refer to publicly accessible land with natural or built-in vegetation, including trees, bushes, and water features. Various types of UBGS are encompassed, including parks, green corridors, and urban riparian zones with recreational amenities, each serving different functions. The importance has been well-documented in academic literature and aligns with the goals of the United Nations 2030 Agenda. Therefore, it becomes the responsibility of local and central authorities to ensure equitable access to high-quality public and green spaces, recognizing them as fundamental elements for societal well-being and recreation (United Nations, 2015). The scope of social livability and human well-being follows the popular definition provided by the Stiglitz Commission (2009) which includes various aspects such as cognitive evaluations of an individual‘s life, happiness, satisfaction, and experiences of positive and negative emotions. Inspired by this reasoning, the present thesis looks at opportunities to conquer the recent trends which are depicted above. This involves an investigation of a more integrated planning approach for recreative UBGS that are able to serve the demands by the urban population.

The thesis is organized in 8 chapters. It begins by exploring the relationship between UBGS and the Sustainable Development Goals (SDGs), highlighting the importance of integrating green spaces into urban planning on a global scale. It addresses the complexities behind smart urban growth and compact city design, as well as the notion of everyday public space and the

network city. The objectives of the research are stated in chapter 2, along with a problem statement that guides the study. Research questions are formulated to provide a framework for investigation. Chapter 3 describes the research design and scientific approach adopted for the study as well as the methods employed in the empirical part. Chapter 4 presents the theoretical and conceptual framework to provide a solid foundation for the study. It explores various theoretical considerations, including ecosystem services, with a specific emphasis on cultural and urban ecosystem services. The socio-environmental justice nexus is introduced to understand the relationship between environmental quality and social equity. The role of Blue-Green Infrastructure (BGI) planning and the importance of multifunctionality in UBGS are also discussed. A case study of Oslo is introduced in chapter 6 connecting theoretical conceptions with real-world issues. The results obtained from the ethnographic fieldwork, and data analysis are presented in chapter 7, whereas chapter 8 discusses these results. The study concludes with a brief reflection on the research and its key findings. The main points are summarized, and the significance of the study is highlighted. Areas for further exploration and critical reflection are provided in the last chapter.

2. Problem Analysis

2.1 Urban Blue Green Space (UBGS) and the Sustainable Development Goals (SDG)

Advancing migratory movements and population expansion are driving urban sprawl and densification processes (Angel *et al.*, 2011; OECD and European Union, 2015). This puts strain on our cities and threatens to displace urban blue and green areas (Zhou and Wang, 2011; Haaland and Konijnendijk van den Bosch, 2015). Yet, the amount of benefits and services that these blue-green domains are able to provide are crucial for urban residents, especially in the context of health and well-being (further developed in section 5, also see de la Barrera *et al.*, 2023).

Following the New Urban Agenda, a particular emphasis is put on the availability and access of UGBS highlighting the need to provide a wide range of ecosystem services (ES) for the well-being of urban environments and its metabolism. Linking this research with the UN's stance and taking into consideration the SDG framework, notably SDG 11 (sustainable cities and communities), provides a particularly relevant context for this analysis. More specifically, objective 11.7 requires cities to create and develop "universal, safe, inclusive, and accessible green and public spaces [...]" (United Nations, 2015) This perspective implies to focus on complementary approaches that are intended to confront inequalities in the system and power

structures of the urban matrix (more on this in the last part of this chapter). With a more integrated view on the SDG Framework, target 11.7 can be linked to further objectives within the SDG setting. SDG 3 (good health and well-being), among other things, emphasizes the importance of physical activity and access to green spaces for promoting health. Similarly, SDG 13 (climate action) recognizes the role of green spaces in mitigating the impacts of climate change, for instance through reducing the urban heat island effect. SDG 10 aiming for reduced inequalities as well as SDG 16 advocating peace, justice, and strong institutions are closely related to the ambitions of the environmental justice (EJ) debate. While target 10.2 aims to empower and promote the social, economic, and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status, target 16.7 seeks to ensure responsive, inclusive, participatory, and representative decision-making at all levels.

By considering the interconnections between these SDG guidelines, it becomes clear that promoting just UBGS is not only important for enhancing quality of life but is also essential for achieving broader sustainability goals (Scruggs, 2022). For example, ensuring that all members of a community are equally provided with green spaces can help to promote physical and mental health, reduce social inequalities, and enhance community resilience to climate change (Braubach *et al.*, 2017; Jennings and Bamkole, 2019). However, as De La Barrera et al. (2023) already noted, any implications drawn by planners and decision-makers from these goals must be handled with caution. The Sustainable Development Index created by Hickel (2020) is a good indicator for this argument. With Hickel's index, countries are assessed on how sustainable their production and consumption models are. It appears that several of the nations that have made the most progress toward achieving the SDGs (such as Norway and the UK) are also among the least environmentally sustainable. This concurs with the finding that there are several possible inconsistencies between economic growth, EJ, the SDGs, and the human right to a healthy environment (Hickel, 2019; Menton *et al.*, 2020). In this regard, Biermann *et al.* (2017) add that the SDGs are articulated in qualitative rather than quantitative terms, thereby leaving room for interpretation by national governments and local authorities. This underlines the need for cross-sectoral discussions to build planning coherence (Breuer, Janetschek and Malerba, 2019).

The principles discussed in this section emphasize the importance of building more efficient and sustainable urban environments that prioritize residents' needs while reducing environmental impacts. However, as with any strategy, there are hurdles and constraints to effectively implement these strategies. Current research indicates that, despite their important

significance, UBGS are frequently jeopardized by “ad hoc-” or so called “day-to-day planning” philosophies (Colding, Gren and Barthel, 2020) and the demand for housing or commercial development (Haaland and Konijnendijk van den Bosch, 2015; Mohammadyari *et al.*, 2023). As land becomes more valuable, green and open spaces are often sold to private lodging and organizations. To approach the issues and challenges attached to sustainable development as idealized by the UN framework and the new urban agenda, the next section will examine both the potential benefits and drawbacks of urban expansion and compact city design.

2.2 The Complexity Behind Smart Urban Growth & Compact City Design

Cities grow in different spatial patterns, often in the form of urban sprawl resulting from multidimensional drivers and affecting multidimensional aspects of economy, society, and ecology (Artmann, Inostroza and Fan, 2019). Approximately 60% of the area projected to be urban in 2030 has not yet been developed, according to Elmqvist *et al.* (2013). This puts enormous pressure on existing ecosystem services such as recreational opportunities for urban residents in the form of UBGS (EEA, 2010).

Smart Urban Growth against the backdrop of a compact urban design paradigm is increasingly seen as a solution for cities facing population densification (Bibri, Krogstie and Kärrholm, 2020). The compact city concept has emerged since 1990 (Commission of European Communities, 1990) and can be linked to Le Corbusier and Jacobs’ philosophies about dense city conceptualizations (Hall, 2002). Compact urbanism prioritizes the effective use of urban space by encouraging higher densities and diversified land use across urban districts, while simultaneously maintaining or enhancing green spaces and other natural or cultural resources. The aim of this approach is to promote sustainable urban growth by reducing sprawl, limiting the environmental impact of urbanization, and improving the quality of life for urban residents (Westerink *et al.*, 2013; Bibri, Krogstie and Kärrholm, 2020; Ogrodnik, 2020; Venter *et al.*, 2023).

There is broad consensus among researchers that this approach can lower commuting costs, create a more diverse, inclusive, and livable urban environment, and foster a stronger sense of community (see e.g., Bramley and Power, 2009; Ståhle, 2016; Mouratidis, 2018). This is also why international organizations, states, and municipal planning authorities often advocate for it (Venter *et al.*, 2023). Nevertheless, there also appears to be a controversial debate about potential trade-offs when it comes to [green,] compact city policies in order to achieve smart urban growth. In search of a systematic understanding of the compact city, Kain *et al.* (2022,

p. 138) claim that social benefits, in particular social diversity, proximity among people and better social interactions, are often seen as "self-evident outcomes" of increased density. This suggests that there are also challenges attached to the concept of compact cities. In line with Kain and colleagues, Venter *et al.* (2023) similarly argue that benefits of dense urbanism should not be taken for granted, as this may risk overlooking issues of environmental justice. Moreover, a recent study by Skrede and Andersen (2022) focused on inhabitants of Oslo's densely populated urban neighborhoods and discovered that densification might cause feelings of anxiety, fear, anger and melancholy due to lost homes or a changed sense of place identity. The rapid urban development that most cities face today brings with it undeniably complexities. De Roo (2000) supported by Neuman (2005) detect a phenomenon which they call the "compact city paradox". Densification presents a dilemma in that it aims to reduce the negative effects of urban sprawl while increasing environmental quality and reducing social disadvantages, e.g., a lack of green space. It seems reasonable when Artmann, Inostroza and Fan (2019) conclude that trade-offs between the demands of compact and green city design are almost unavoidable and therefore, need to be managed if cities want to maintain sustainable urban growth. According to Artmann, Bastian and Grunewald (2017), ecosystem functions are not being delivered at the level demanded by ecosystem services. Infill development and densification processes contribute to this imbalance, which may become even more pronounced in cities where compact urbanism is promoted. The considerations of opportunities and pitfalls outlined above illustrates once again the highly complex urban system that planners and decision-makers encounter. Consequently, smart urban environments require integrated views on how to promote compact development, particularly in regard to urban green spaces and densification (ibid.). Against this backdrop, critical urban studies can help broaden understandings of compact urbanism in ways that advance social and ecological justice (Haarstad *et al.*, 2022).

Overall, the concept of the compact city reflects a growing recognition of the need to rethink traditional models of urban growth and development in order to promote more sustainable and livable cities and thereby contributing to the SDGs. Through its many layers of influence, it draws on a wide range of disciplines, including urban planning, architecture, environmental science, and social policy, and has been the subject of extensive research and debate over the past decades. With regard to the reviewed literature, the different views on green, smart and dense urban design strategies also indicates the need for an integrated approach to a smart and soft growth of cities and a systematic understanding of the urban matrix and its

interdependencies. The following section reflects on the underlying sense of everyday life in cities to decode the complex interdependencies of the urban metabolism.

2.3 The Notion of Everyday Public Space and the Network City

To better grasp the rather intangible features of the issue at hand, the next section provides an overview of the role of public space networks and debates the use and potential implications of the term "blue-green domain."

The concept expands on the new public domain agenda that Hajer and Reijndorp presented in 2001. The idea is based on two parts – “the public” and “a domain”. The term "public" essentially implies a space that is free and accessible to everyone. However, this, e.g., does not necessarily translate every street, park or plaza into the notion of a public domain, even though those are all traditional public urban spaces. Hajer & Reijndorp (2001, p.11) therefore argue that it is more about a shared place, or rather a sphere where people from different backgrounds or with dissimilar interests are sharing experiences. In other words, this is about a place where mixed social groups are coming together, form meetings, and dissolve again. Reflecting on this definition in philosophical terms, the metaphor of a melting pot appears useful to apply. Having this multifaceted atmosphere means that a variety of interactions can occur as actors collide with each other, both consciously and unconsciously.

Looking at the current tendencies of our fast-paced modern life, we may conclude that we live in a network society. Inspired by Urry (2000), there are social, cultural, and identity-shaping effects of the ways in which contemporary dynamics re-configure our environment and vice-versa. The tendency towards densification in cities leads to a reduction in spatial dimensions, making people feel closer to each other and to the objects around them. Being near enough to the sensory system to perceive microscopic details, smell, touch, and identify little noises, amplifies sensations and encounters (Sim and Gehl, 2019). As a result of this setting, there is a variety of interfaces, implying overlap and exchange between numerous domains. Yet, it can be argued that each individual constitutes its own “bubble”, resulting in a series of “co-dependent systems” (Varnelis, 2008:15). Referring to Hajer & Reijndorp (2001) this is what touches on the heart of the public domain concept. If the modern city is viewed as an "archipelago of enclaves", any type of public domain appears to vanish if individuals are continuously focused on preserving their own tiny networks while minimizing friction with other groups (p.11). Nevertheless, there is this strange reality where many individuals are in need for that highly sensed shared space experience, indicating why the public domain is more

of an experience than a place. Essentially, Hajer & Reijndorp (2001) argue that the experiences in the public domain are associated with entering the private spheres of "others". In order to generate such experiences, one can argue that there is a need for "gateways" or "switches" connecting everyday networks. These switches may be related to the theory of Critical Points of Contact (CPC). They create complex and layered systems of power that are indicative of a new urban landscape composed of networks, sites, and flows (Graham and Marvin, 2001, Jensen & Morelli, 2011, p.39). But how does this conceptualization contribute to the topic of blue-green space?

This thesis is investigating the inclusive planning for blue-green recreational space in order to make a contribution to maintain high quality of life in densified cities. For this reason it seems helpful to take on a very basic understanding of public space, its web of interdependencies and parameters which create a sphere between public and non-public matters, socio-cultural groups, and individuals.

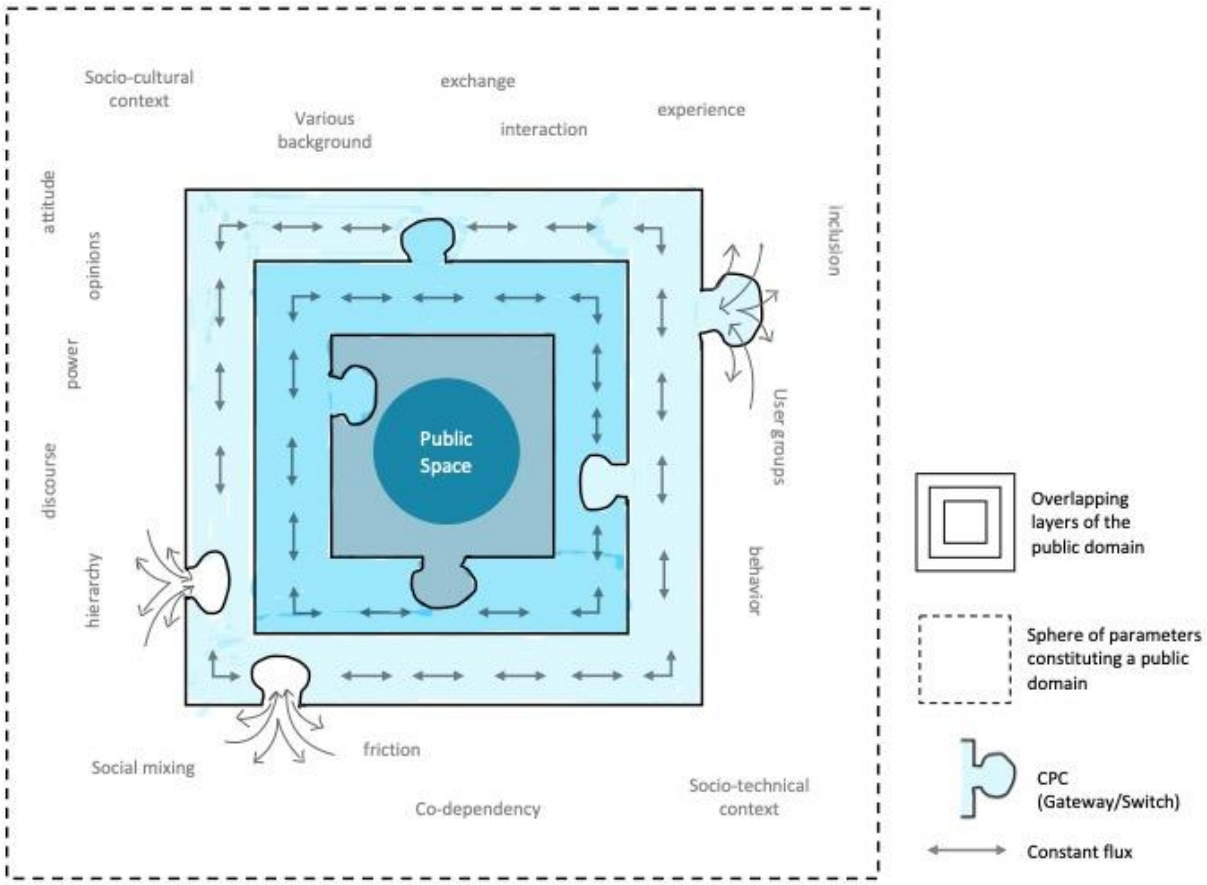

Figure 1: Author's own Reflections from an Urban Design Class by Ole B. Jensen (2022).

Based on the above literature on the public domain and critical points of contact, Figure 1 provides an overview of the key assertions as well as reflection on the system that constitutes public space and therefore also blue-green recreational space. This matrix is arranged in a

constant motion of drifting variables that are triggered by gateways or switches indicating the entry of an interface. At the node of these switches, friction is almost inevitable. The situation, as it is described, can be seen as part of the metabolism of a network society. It can take place in the urban realm of streets or parks but also through more privately managed collectives (Hajer and Reijndorp, 2001, p. 11).

The transfer of Hajer & Reijdorp's idea of a public domain into the context of blue-green infrastructure appears fertile for the further course of this study. Firstly, it emphasizes that blue-green spaces are not isolated entities but are part of a larger system that includes social, ecological, and economic dimensions. This approach recognizes that blue-green spaces are interconnected and that their development should be integrated into wider planning and policy frameworks. Secondly, seeing blue-green infrastructure as "public domain" highlights the need for a holistic and inclusive approach to planning and managing blue-green spaces. This approach involves engaging with diverse stakeholders and recognizing the multiple functions and benefits that blue-green spaces can provide, such as ecosystem services, recreational opportunities, and cultural values (Hajer and Reijndorp, 2001). Finally, an understanding of the idea of a (blue-green) "domain" emphasizes the importance of considering the dynamics and evolving nature of blue-green spaces over time (Iojă *et al.*, 2018). This approach recognizes that such spaces are subject to change and that their development should be adaptive, resilient, and responsive to volatile social, economic, and ecological conditions.

Building upon the concept of blue-green spaces as a public domain, it is important to consider how this approach can inform the design and management of these spaces. This involves not only recognizing the interconnected nature of blue-green infrastructure but also understanding the conditions necessary for social and cultural exchange to flourish within these spaces. In a similar understanding, Colding and Barthel (2013) coined the term "urban green commons" to join the debate on how to depict urban ecosystems with heterogeneous ownership that rely on communal organization and maintenance. In their community-based approach of green-space management, they highlight a subset of physical spaces in cities that show to address and include a number of social and ecological demands. Referring to the authors, multifunctional design of these urban amenities can evolve through diverse property rights that are based on collective organization. The idea of multifunctionality in such spaces is picked up in section 5.5. Individuals and groups participating in these organizational structures have a wide range of rights, in particular the right to form their own institutions and who will participate in these structures (Colding and Barthel, 2013). As Hajer and Reijndorp (2001) suggest, it is not so

much a matter of laying out separate areas, but rather a matter of analyzing the conscious scheme of interconnected spaces and a way to think about the general conditions under which cultural and social exchange - the lifeblood of society - can thrive (p.116).

3. Objectives

3.1 Problem Statement

Having access to green-blue spaces for recreation and health is crucial for urbanites as by 2050 the United Nations predict that about 70% of the world's population will live in cities creating a significant increase in urban density. While many cities have attained intrinsically sustainable growth, geographic and socioeconomic disparity remains a palpable and underlying burden for many communities. Cities and their urban ecosystems are increasingly challenged as urbanization, population expansion, and densification progress. When open public space becomes increasingly scarce, infill development threatens blue-green space, which provides vital services to cities and their residents. This thesis intends to investigate integrated views on how to promote compact development, particularly regarding to urban blue-green spaces and densified neighborhoods. Against this backdrop, critical urban studies can help broaden understandings of compact urbanism in ways that enhance urban ecosystems and their value for the city's metabolism. It is not the report's intension to critique compact urbanism as a such. Instead, this research will take a critical view on the way how BGI is developed and provided under these terms, how it can be (better) integrated in designing an inclusive public domain and how the local user profile of BGI is involved in the planning and design process. While it is essential to recognize the harmony between human and natural elements without giving either one precedence over the other, this research will concentrate on the human scaled view of ecosystem services and blue-green infrastructure (BGI) and the benefits they may employ for the urban metabolism and societal well-being.

The underpinning assumption of this study is that the abundance of UBGS alone does not immediately make cities "green" in the sense of transforming public space into a blue-green domain that serves the well-being of residents. Diligent planning and development of such amenities is anticipated so that blue-green ecosystems can realize their full service to urban residents while enhancing ecological benefits. For this reason, the city of Oslo is taken under examination. It is supposed to provide an opportunity to explore how decision-makers, even in

cities where a wide variety of blue-green properties, economic prosperity, and progressive social democratic city councils are present, need to integrate their blue-green properties while exploring a cross-sector policy and planning context for integrated solutions to urban challenges.

3.2 Research Questions

Based on the initial wonders and the derivation of the concerns indicated above, the following research question is intended to structure the further procedure of this thesis:

How can blue-green urban space be used as a strategic asset to keep urban landscapes socially liveable today and in the future?

In order to be able to answer this research question the following sub-questions are suggested:

1. What are the prerequisites for an inclusive blue-green space design that is adaptable to changing urban conditions?

2. What role do a city's socioeconomic and cultural characteristics play in a human-centred approach to UBGS Management?

3. How can a blue-green space be transformed into an ecosystem that effectively meets the needs of and is embraced by the local community?

4. Methods

4.1 Research Design & Scientific Approach

To address the research problem and analyze the issues raised above, the following Figure 2 is to outline the research design and its scientific approach. The present study is based on multiple methods. To start, scientific literature is examined for a foundation and theoretical framework. This leads to the examination of empirical data, which is collected and analyzed in the second part based on a case study. A literature review is laying out the backdrop and framing context of the problem. This initiates a discussion about smart urban growth and compact city planning, examining the benefits and drawbacks of densification schemes and the design of everyday public space providing reasons to formulate the problem of potential loss and degradation of urban blue-green recreational space under the advancement of compact cities.

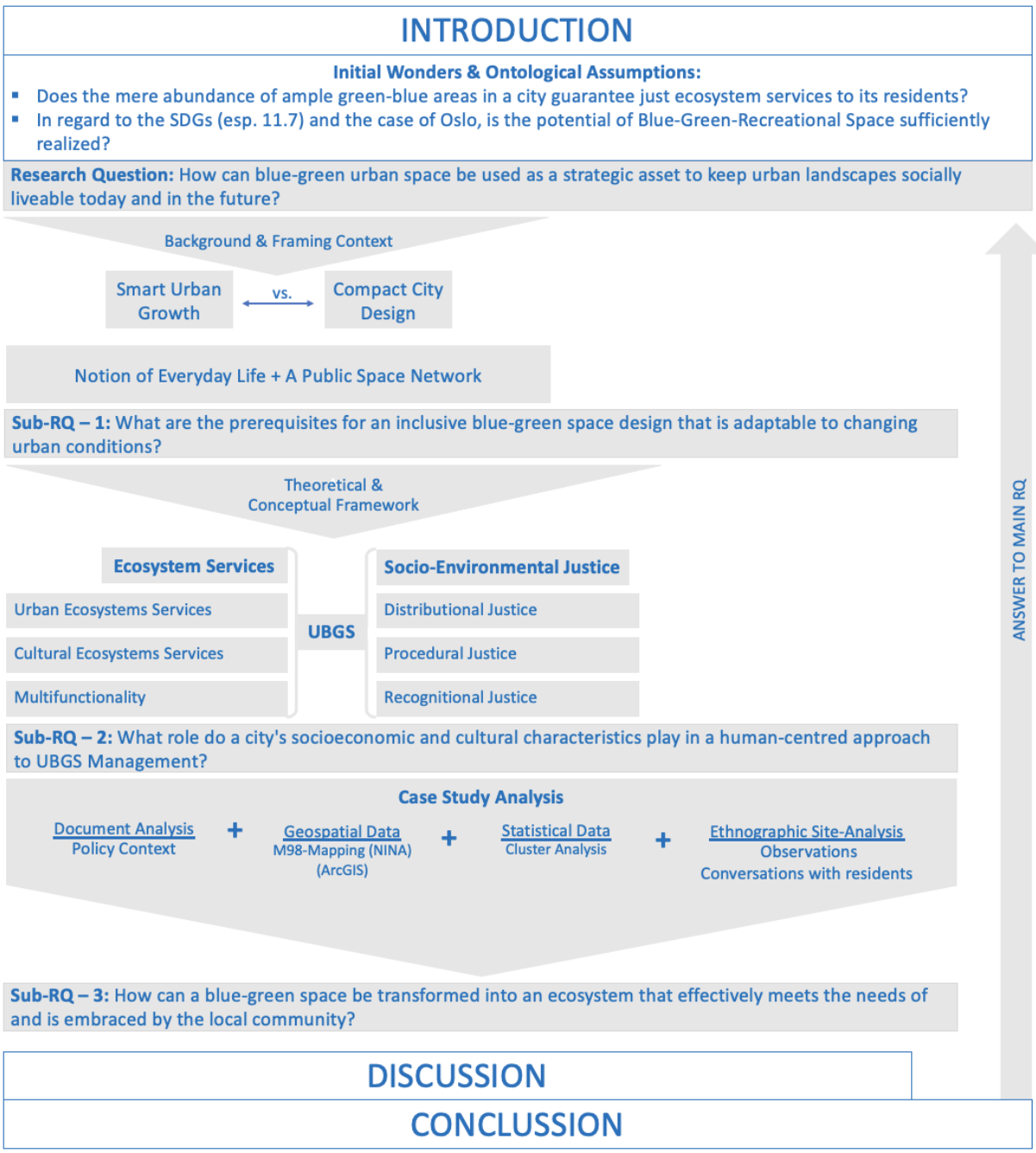

Figure 2: Research Design.

The study continues with a comprehensive analysis of associated theoretical considerations. Essentially, this constitutes a patchwork of frameworks to a) *better understand blue-green recreational space as an ecosystem* b) *its requirements for co-creative and multifunctional design*, ideally leading to c) *success in integrating blue-green urban space into compact city planning*.

4.2 Case Study Methods and Data Collection

The case study is used to connect the theoretical part to real-world issues related to Blue-Green Infrastructure planning. Oslo has achieved notable success in its efforts to create and enhance blue-green spaces. Among other things, it has been awarded as “Green City” in 2019. Furthermore, the city's transformation of former industrial areas into vibrant waterfronts and the revitalization of urban parks indicate inherently positive outcomes of its planning strategies. Studying these success stories in relation to socioeconomic and cultural disparity across the city can provide valuable insights in best-pactice examples but also make aware of possible pitfalls.

Oslo is known for its ample nature and blue-green spaces both within and surrounding the city. This is an asset that not many other cities can rely on. It will be interesting to see how this advantage is put to use. At the same time population growth and urban densification measures are prevelant challenges the city is currently facing. The presence of a high proportion of UBGS should also provide insight into the extent to which these spaces will meet the demands of the city's population, as well as what is required for UBGS to become an integral part of the city's ecosystem and how this may enhance societal well-being. Accordingly, the case study serves to critically reflect on the “greenness” of Oslo in regard to the SDG context and the need for integrated urban solutions due to the previously depicted challenges. The case study analysis will be based on a mixed methods approach. To develop an understanding of a) where the city stands in terms of providing green space for its residents from a planning perspective on a city-wide scale and b) how this is integrated into the overall policy context of urban densification, an overview of the city's current plans and policies as well as its historical cultural dynamics will be given first. This can also indicate where potential risks to environmental justice may be hidden. Two scales, city-wide and site-specific, provide a comparative opportunity to assess the overall perception of UBG management and the specific needs of local residents, as shown by previous research (Kabisch and Haase, 2014).

4.3 Spatial Analysis On A Citywide Scale Based On Sub-Districts

Mapping data was provided by the Norwegian Institute for Nature Research. This facilitated a city-wide examination of the distributional aspect of EJ. With the help of geospatial information, blue-green recreational space is processed in ArcGIS and examined according to Cimburowa and Barton’s (2021) definition of recreational ecosystem services. The M98-mapping project is a spatial modelling for urban ecosystem accounting and involves the following amenities:

• Green corridors (Grønnkorridorer)
• Agricultural landscape (Jordbrukslandskap)
• Playgrounds and recreation areas (Leke- og rekreasjonsområder)
• Peri-urban forest (Marka)
• Natural terrain (Naturterreng)
• Large hiking areas with facilities (Store turområder med tilrettelegging)
• Coastal zone and contiguous watercourses (Strandsone med tilhørende vassdrag)
• Exceptional quality areas (Særlig kvalitetsområder)
• Other recreation areas (Andre Friluftslivsområder)
(Cimburowa and Barton, 2021)

To narrow down the focus area, the analysis will be constraint to the urbanized built environment of Oslo as the overall scope of the present thesis is the investigation Blue-Green Recreational Space in urban settings. While a large spectrum of recreational opportunities is covered, it must be noted that the M98 data provided by NINA, does not necessarily include all urban spaces that may be perceived as valuable by individuals. For instance, street vegetation and gardens may be considered to provide recreational value, even if they are not taken into the definition of the present analysis.

4.4 Cluster Analysis

In the next step, socio-cultural and economic census data are fed into a statistic software. This is done to raise awareness of the fact that a holistic UBGS Management requires more than distance and distributive justice (i.e., accessibility to green space) and needs to incorporate socio-cultural and socioeconomic factors as well. A hierarchical cluster analysis is conducted to distinguish patterns of similarity or difference among people or groups based on their social traits, such as demographics, income, education, ethnicity, or culture. To better understand and target audiences, it aims to group individuals who share similar social profiles and to distinguish them from others. Knowing who is potentially using the space can provide valuable information for the design of the existing urban space and inform decision-makers how to adjust, e.g., a park to its local community (Kabisch and Haase, 2014; Schüle, Gabriel and Bolte, 2017). The statistical analysis is conducted in STATA 17, based on the WARD-Method with squared Euclidian distance. The final number of clusters is determined by the “elbow criterion” (see (Bielik *et al.*, 2019) for a similar procedure). Table 1 can be found below and gives an overview of the data applied in the present study.

Table 1: *Explanation of Data used in the Cluster Analysis (based on Statistikbanken Oslo Kommune 2020-2023)*

Variables Used*	Definition	Data Source
Population Density	Total Population/Square Kilometers	Statistikbanken Oslo Kommune (2023)
Country Background	Data distinguished by: "Norwegian"; "Western Countries" (incl. Australia & New Zealand); "Eastern-european" (EU); "Asia, Africa, Latin-America" Norwegian consists of persons where at least one of the parents was born in Norway. "The 'immigrant population' consists of immigrants and Norwegian-born to immigrant parents.	Statistikbanken Oslo Kommune (2023)
Educational Level	Data distinguished by: „Highschool Degree"; "University Degree"	Statistikbanken Oslo Kommune (2020)
Age	Population by administrative district and age. Data distinguished by age groups: Children (0-12); Teenager (13-19); Young Adults (20-29); Middle Aged (30-66); Elderly (67 +)	Statistikbanken Oslo Kommune (2023)
Average Income	Gross income includes salary income, business income, pensions and capital income. General income is income after special deductions and the basis for calculating municipal, county and joint tax.	Statistikbanken Oslo Kommune (2022)
Low-Income Households	Number and share of low-income households within different groups in Oslo by sub-district. Student households are excluded from the statistics. Numbers are according to the EU scale for low-income households: Household income after tax per consumption unit is below 60 percent of the median income for Oslo. Furthermore, the household income is scaled with consumption weights by giving the first adult in the household a weight of 1, the second adult a weight of 0.5 each, and each child a weight of 0.3.	Statistikbanken Oslo Kommune (2022)
Employment	Number of employed persons (15-74 years) regardless of place of work.	Statistikbanken Oslo Kommune (2023)

*Note: To achieve a representative overview relative numbers were used (%).

4.5 Ethnographic Field Survey

The ethnographic field survey is conducted to directly observe how people engage with urban a blue-green space, how they use it for various activities, and how such space contribute to their overall well-being and quality of life. The goal is to document patterns of usage, identify social interactions and community dynamics, and uncover the social and cultural meanings attached to these spaces. This qualitative approach allows for a nuanced understanding of the

multifaceted dimensions of urban green spaces beyond quantitative measures and experiences popularity among researchers (Pink, 2008; Wang and Groat, 2013; Salvia *et al.*, 2022). Furthermore, the field survey intends to capture the perspectives and voices of marginalized or underrepresented groups, shedding light on potential disparities in access to and use of urban green spaces. It can reveal how factors such as socioeconomic status, ethnicity, or cultural background influence individuals' experiences and perceptions of these spaces. This information is seen crucial for ensuring that the design and integration of urban green spaces are equitable and inclusive.

5. Theoretical & Conceptual Framework

"Nature in the culturalist approach is not only governed by cultural patterns and social interests, but it also exists in the human consciousness mainly in the form of its representations […]*"*
(Smagacz-Poziemska *et al.*, 2017)

The quote emphasizes the culturalist perspective on nature and its relevance to human awareness. Nature, according to this viewpoint, is regulated not merely by objective or scientific principles, but also by cultural patterns and social interests. Nevertheless, nature lives essentially in human awareness through its representations, which are influenced by cultural ideas, values, and behaviors. This viewpoint stresses the subjectivity and cultural construction of human knowledge of environment, as well as the ramifications for urban planning and decision-making. This ties to the scientific approach that is used in the thesis context. Inspired by Farthing (2016), it proposes that knowledge is not objective, fixed, or absolute, but rather created through interpersonal exchange, experience, and interpretation. Accordingly, knowledge is shaped by socio-cultural contexts, power dynamics, and individual perceptions (Nasir and Hand, 2006). From an ontological standpoint, in (social) critical constructivism, the socio-historic dynamics play a fundamental role in gaining an understanding of the project (or subject) under inquiry. In an epistemological sense, critical constructivism focuses upon how the context influences knowledge production surrounding the research (Manning, 2021). It implies that representations of nature in urban contexts are not neutral or objective, but rather reflect the cultural and social goals of those who create them, and that they must thus be critically scrutinized in the context of urban planning and design. The aim of this chapter is to provide a theoretical framework of urban green infrastructure planning based on ecosystem services.

5.1 A theoretical Consideration of Ecosystem Services

The ecosystem service (ES) framework has been widely recognized as a tool for comprehensive socio-ecological assessments in policy agendas since the Millennium Ecosystem Assessment in 2005. In this context, ES are defined as “the benefits people obtain from ecosystems” (Millennium Ecosystem Assessment, 2005, p.40). According to Bastian et al. (2012), this also includes presently consumed or desired ES that enhance people's lives and well-being. Following the conception of Fisher, Turner and Morling (2009), ecosystem "functions" are considered as an intermediary phase. Capacities or functions offered by structures and processes (e.g., cultural-aesthetic, biophysical) become ecosystem services (e.g., recreation, pollination) when there is demand from human beneficiaries (p.645). Figure 3 illustrates how ecosystem services can be distinguished by provisioning, regulating, supporting, and cultural services (Colding, Gren and Barthel, 2020). The cultural dimension appears to be particularly crucial for the context of this research because the current study employs an anthropogenic perspective on UBGS, looking into how they may generate value for urban residents and improve the quality of everyday urban life.

PROVISIONING SERVICES	REGULATING SERVICES	CULTURAL SERVICES
The "products" obtained from ecosystems	*Benefits obtained from the regulation of ecosystem processes*	*Nonmaterial benefits obtained from ecosystems*
Foods	Climate regulation	Educational
Fibers	Flood prevention	Recreational
Ornamentals	Erosion control	Sense of place
Medicines	Pest control	Spiritual
Biofuels	Pollination	Cognitive development
Fresh water	Seed dispersal	Stress relief
Genetic resources	Disease regulation	Gardening
SUPPORTING SERVICES		
Services necessary for the production of all other ecosystem services		
Biodiversity		
Nutrient recycling		
Primary productivity		

Figure 3: *Distinction of Ecosystem Services (Adapted from Colding, Gren and Barthel, 2020)*

ES first appeared in the 1970s to draw attention to a crucial omission in the realms of policy and decision-making, when it became apparent that there was very little to no understanding of how dependent the society is on natural ecosystems (Millennium Ecosystem Assessment, 2005). Current tendencies show the relevance of the ES framework and its value for understanding how human-environment relations are conceptualized and approached by policy-makers (Hirons, Comberti and Dunford, 2016). In fact the authors argue that “cultural

processes of meaning-making shape individual and societal values, and therefore, all ecosystem services are cultural to some degree“ (ibid., p.565).

The use of the ES framework is especially relevant to urban planning, as it bears potential to inform decision-makers regarding ES provision where economically, socially, and racially disadvantaged groups are often excluded (Ernstson, 2013), making procedural processes for UBGS more holistic. Although there is a growing concern about social and environmental justice, little has been done to place blue-green infrastructure into a justice framework that incorporates socio-cultural and -ecological trade offs and feedbacks (Marshall and Gonzalez-Meler, 2016). This provides a good reason to explore how the ES framework can strengthen the debate on social and environmental justice in urban planning (Kronenberg *et al.*, 2020). suggesting that the ecosystem service framework in an urban context and its application for analyzing an integrated planning perspective for UBGS should be explored in the following sections. At the same time, emphasis is put on the potential to address environmental justice and advance wider impacts of socio-ecological science. By providing a critical review of the literature, the chapter highlights the main challenges and opportunities for using the ecosystem services framework to enhance urban planning and management, ensuring that UBGS and its benefits are delivered equitably and sustainably to all social groups.

5.2 Cultural Ecosystem Services

As the above section discusses a rather general conception of ES and how they are embedded in the context of urban environments and planning for blue-green space, the next section is looking at the conceptualizations of rather intangible aspects of ES and their hidden values. This appears crucial for the study's overall setting, which highlights a shift away from growth with a focus on the production and consumption of marketed products and services toward inclusive thinking in urban planning with a people- and values-based approach.

The non-material benefits that humans derive from ecosystems, such as spiritual and recreational experiences, aesthetic qualities, and cultural heritage, are referred to as cultural ecosystem services (CES) (Hirons, Comberti and Dunford, 2016). In this sense, CES may be converted into a cultural good, explaining the output supplied, for example, by UBGS ecological functions such as biodiversity, that people appreciate since it provides some type of well-being benefit to their lives (Clark *et al.*, 2014). These services can further support local communities in developing a sense of place and belonging. However, because of their rather

intangible nature, CES tend to be hard to grasp, complex, and place-specific, which is why they are easily overlooked in rapid land management dynamics and difficult to evaluate through broad, top-down approaches (Jones *et al.*, 2020). According to Clark and colleagues, rather than each good having an identifiable universal value, individuals (or groups) place values on goods and are thus subject to both temporal and geographical fluctuation. Values can be 'use values' (e.g., we value using the good, such as wild bird diversity for bird viewing) or 'non-use values' (e.g., we appreciate the good's existence but do not directly use it, such as protecting rare species that we are unlikely to witness personally).

In terms of the previously listed services, such as recreation and social cohesion, it is critical how wellbeing is defined. Reflecting on the definitions of ES, UBGS can only be deemed an ecosystem service if it serves a diverse share of the local community. This necessitates a comprehensive awareness of the socio-cultural fabric of a city. However, as section 2.3 illustrates, society and its individuals are never static but rather a fluctuated masse. This dynamic also confines culture and the values associated with it to a transient state (Pröpper and Haupts, 2014). It can provide an important insight, because if values change, any assessment of (cultural) ES will have only limited spatial and temporal relevance (Hirons, Comberti and Dunford, 2016). To support this, Plieninger et al. (2013) found bundles of CES and respective patterns in the perception of these bundles by their various socio-demographic groups within respondents. They conclude that CES follow specific patterns providing a fertile basis for the development of sustainable land management strategies. To give an example, a park may have a special historical or cultural significance to a particular community. However, this importance may vary depending on the background of the respondents. This will be further referred to in the case study below. In order to account for these diversified patterns, and to identify them across the city a cluster analysis will be conducted in chapter 7. The dynamics of diverse urban systems were also discussed by Folke *et al.*, (2010) which ties the discussion of diversity and culture back to socio-ecological systems. Defining resilience under these terms implies that a socio-ecological system (SES) is able to constantly adapt and change without losing its essential characteristics. By recognizing the cultural values associated with ecosystems, green-blue space planning can support the well-being of urban communities and enhance the cultural identity of the city (Vierikko and Niemelä, 2016).

Inspired by Dushkova et al. (2021) Figure 4 is used to reduce complexity of the above discussion about an (C)ES-framework. It is supposed to assist in determining what categories of CES should be actually incorporated into the framework, exploring cultural means and connected values in the context of inclusive planning for UBGS (ibid.). It may chart a path

towards a more holistic approach that respects diverse social backgrounds and values in the assessment of UBGS as a service capable of improving high-quality urban living for its citizens.

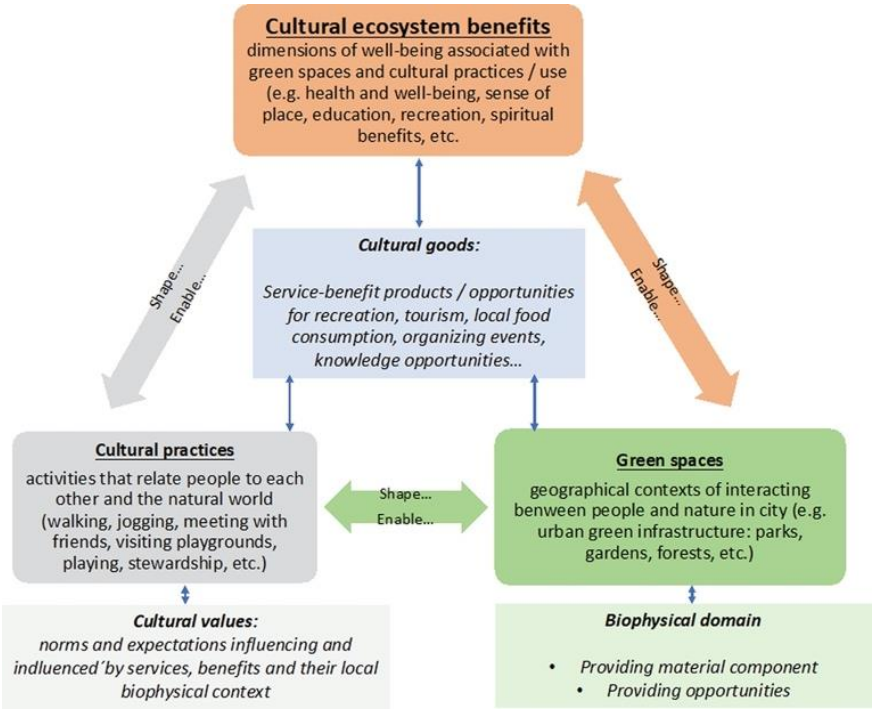

Figure 4: *UBGS in the context of CES (Adapted from Dushkova et al., 2021)*

Making cities socially inclusive is a major challenge. By reimagining forms of interconnectedness that embrace diversity and acknowledge it, the creative power to enhance sustainability and well-being may be harnessed (Janssens *et al.*, 2009). If cultural variety is not handled or taken into consideration by urban development strategies, it might turn from a city's hidden treasure to an incremental burden (Colding and Barthel, 2013).

5.3 Urban Ecosystem Services

Urban ES refer to functions and services related to cities and other urban areas (Artmann, Bastian and Grunewald, 2017), whereby "urban" refers to a specific but vague and de-politicized context, where ecosystem services or green infrastructure knowledge can be employed (Haase, 2017). These systems encompass all green and blue areas in a city and are often highly modified and dispersed. Yet, urban ecosystems represent more than just green areas. They may also include, for instance, street vegetation, waterfronts, gardens, green corridors, outdoor sports facilities, churchyards, and cemeteries among others (Gómez-Baggethun *et al.*, 2013, p. 177). These services can improve the quality of life for city dwellers while also promoting sustainable urban growth. As Artmann *et* al. (2017) conclude in their

study, UGBS is one of the most important suppliers of ES. This finding is especially valuable for the context of the present study as they further suggest that ecosystem benefits for the mental and physical health of residents are maximized when urban green areas are located at short distances from local housing. Similarly, it was found by (Annear, Cushman and Gidlow, 2009) that residents of a neighborhood with poor physical and social environmental quality were shown to be less likely to engage in leisure-time physical activity than inhabitants of a neighborhood with better environmental quality in the same city. Using this line of reasoning as rationale for delving deeper into the science of urban ecology, McPhearson *et al.* (2016) as well as Pickett *et al.* (2016) argue that attempts are required to build integrated urban monitoring concepts that represent the ecology of the city. Accordingly, it is necessary to look at the relationships between created and (semi-)natural structures, governance structures and processes, and the agency of urban actors in managing the city (ibid.). Understanding and managing urban ecosystem services is critical for fostering both human and environmental well-being in cities.

Given the interaction of services and functions that enables the urban metabolism to thrive, urban ecosystems may be viewed as complex, diversified, and dynamic systems (Lovell and Taylor, 2013). The idea of a city as an "ecosystem" with humans as one of its components offers a foundation for this context that strives to negotiate a balance between social requirements and environmental health (Spirn, 1984). What emerges from this thinking is a shift from a narrow and compartmentalized understanding of urban ecosystems to an approach that views cities as socio-ecological systems. To grasp these complexities, it becomes evident that one cannot describe a complex system without having a complex framework at hand. For this reason, the present study utilizes the approach illustrated in Figure 5, which relies on ecosystem properties, potentials, services, benefits/values, and beneficiaries. The five-pillar EPPS-framework was first proposed by (Bastian *et al.*, 2013).In the context of this report, it is intended to support the assessment of urban ecosystem services and blue-green infrastructure. The framework emphasizes the interconnectedness and interdependence of the ecological, societal, and economic factors in the provision and use of ecosystem services. In the context of urban ecosystems, the ecosystem properties, potentials and services (EPPS) framework highlights the importance of understanding the ecological processes and functions that underpin ecosystem services, as well as the social and economic drivers that influence their use and management. It also underscores the need to consider the governance structures and institutions that shape the management and design of ecosystem services. The graph below from Bastian et al. (2013) further suggests that a valuation phase is always included in the

analysis of ecosystem services. From an anthropogenic standpoint, this implies that scientific facts are converted into categories of values that are determined by people. The interaction of the numerous causal spheres in the relationship between civilization and nature is the deciding element.

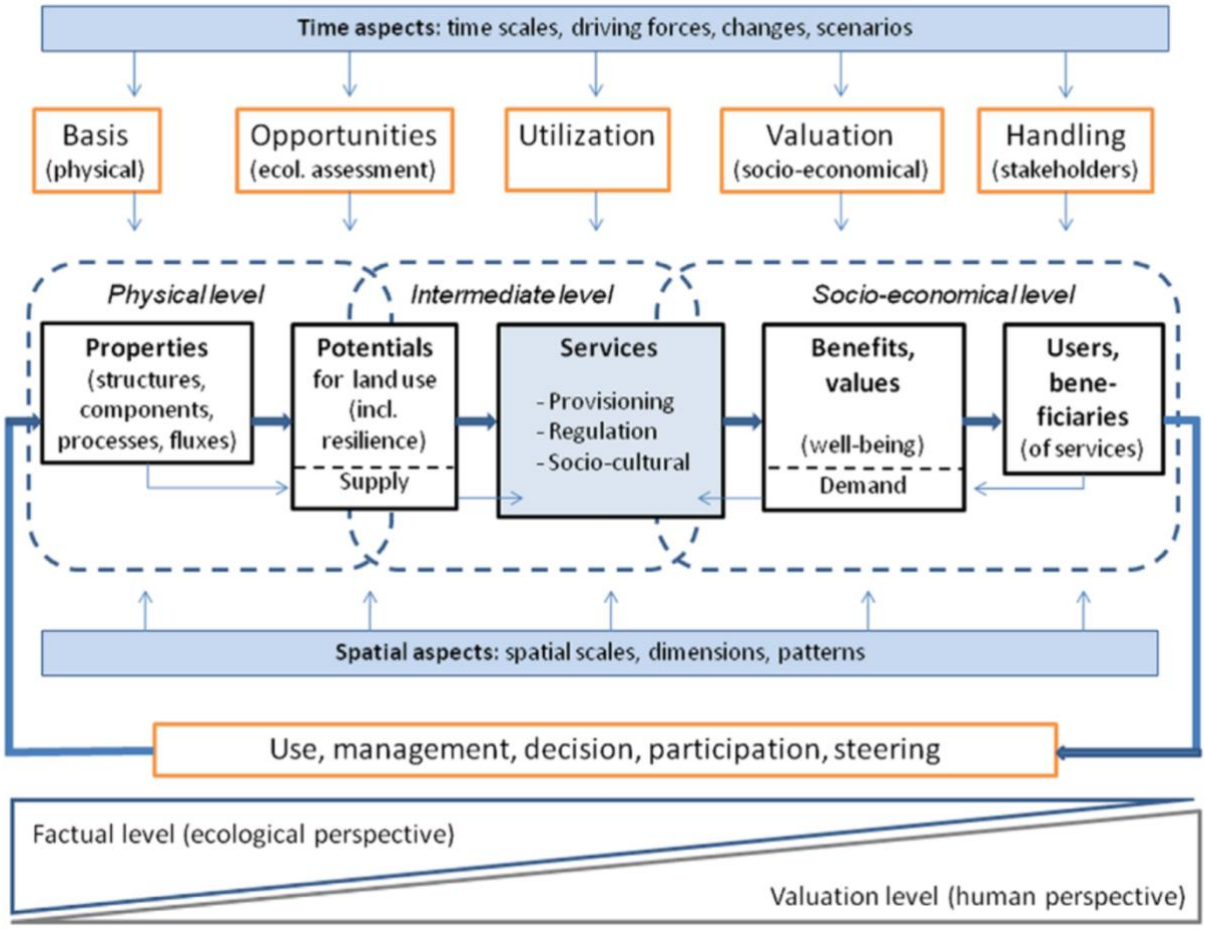

Figure 5*: The EPPS framework (Adapted from Bastian et al., 2013)*

The conception above recognizes the complex interactions and interdependencies between urban infrastructure, social systems, and the environment (Pickett et al., 2016; McPhearson et al., 2016). In this way, the focus on urban ecosystem services and blue-green infrastructure is no longer just about adding green spaces to a city but rather is an integral part of building sustainable and resilient urban systems that promote the well-being of both people and the environment. This also includes the assessment whether these UBGS provide equal benefits to any urban resident.

5.4 The Socio-Environmental Justice Nexus

The socio-environmental nexus refers to the interconnectedness between social and environmental factors, which are essential for sustainable development (Berkes, Colding and

Folke, 2001). The previous section indicates that there has been an increasing focus on the urban environment in discussions about urban ecosystem services (UES) and urban blue green infrastructure (UBGI) in recent years. However, there has been a lack of attention given to the existing inequalities and injustices within urban areas (Haase, 2017). In this context, the environmental justice framework adds a crucial dimension by recognizing that social resources and environmental burdens are often unequally distributed both on the individual and neighborhood level (Schüle, Gabriel and Bolte, 2017). In order to promote healthy city planning and high-quality urban life, it is important to identify vulnerable neighborhoods and population groups. Although indicators like spatial allocation and distance factors are crucial parts of the definition, the literature suggests that there are more layers. The significance of the qualitative elements (both artificial and (semi-)natural) and the appeal of those facilities was stressed in recent research that concentrated on urban ecosystems and their services for well-being and health (Iojă *et al.*, 2011; Hughey *et al.*, 2016; Gibson, Loukaitou-Sideris and Mukhija, 2019; Enssle and Kabisch, 2020; Rigolon *et al.*, 2022). This supports Artmann, Inostroza and Fan, (2019) who advocate for policies that consider the various facets that urban sprawl, compact and green cities can take on, as well as their connections beyond geographical boundaries. While there is a growing recognition of the importance of incorporating nature into urban development strategies, the trade-offs between environmental/ecological and social development are not always adequately addressed (McPhearson *et al.*, 2016; Haase, 2017). The next part aims to create a perspective that emphasizes a framework that accounts potential disparate exposure to environmental burdens and access to environmental benefits experienced by various social groups and distributed both on the individual and on the neighborhood level - a condition known as environmental justice (EJ) (Schüle, Gabriel and Bolte, 2017; Kronenberg *et al.*, 2020). It may be inferred from the literature that environmental justice has historically concentrated on the health effects of unequal exposure to pollution and environmental risks among low-income groups and minorities (Kabisch and Haase, 2014; Agyeman et al., 2016; Suárez et al., 2020). The evaluation of EJ frameworks and models is supposed to make a considerable contribution to answer the question of how green space can be developed more justly in cities. For a general overview, (Schlosberg, 2004) provides a basic explanation of what is meant by the term "justice" in the context of environmental justice. He introduces the distributive, procedural, and recognition dimensions, which, according to him, must be explored in order to solve EJ.

Distributive justice is a principle that involves the fair allocation of ecosystem services for all social groups involved (Kronenberg *et al.*, 2020; Suárez *et al.*, 2020), regardless of their race,

ethnicity, social class, gender, sexual orientation, disability status, and other characteristics (Rigolon *et al.*, 2022). This may include environmental costs and benefits, allocation of material goods such as resources, income, and wealth, and the distribution of social standing (Menton et al., 2020). Conversely, if certain demographic segments of urban residents are excluded from these benefits, environmental injustice is at hand. To assess the availability of UBGS and related ecosystem services, distance threshold values can be utilized to measure the accessibility of green space from residential areas. This approach can help to understand the potential benefits of UBGS for the health and enjoyment of inhabitants in the context of UBGS research (Kabisch and Haase, 2014; Enssle and Kabisch, 2020). While studying components of distributive justice, Rigolon and colleagues (2022) pay particular attention to the physical environment in their ecological model of environmental justice for recreation. This suggests, for instance, that both human-made and natural aspects are crucial to the composition of urban communities. Because of this, the distributive aspect of justice serves as the foundation for this research and emphasizes how individuals may access and utilize UBGS and its services.

Procedural justice refers to fair and equitable institutional planning procedures that entail the inclusion of all effected groups in decision-making processes involving public places (Kabisch and Haase, 2014, Kronenberg et al., 2020; Enssle and Kabisch, 2020, Menton et al., 2020). Identifying unfair distribution patterns and their underrecognition, as well as the connections between them in political and social processes, are part of this (Menton et al., 2020). This prompts Rigolon et al. (2022) to argue that marginalized people should be meaningfully included and represented in the allocation of service facilities (e.g., blue-green recreational space) and environmental risks (e.g. noise/air pollution). Accordingly, this also includes matters related to public and private initiatives that shape recreation settings and housing.

Recognition justice refers to the acknowledgment of the diverse needs, values, and preferences of all social groups and stakeholders in a safe, fair, and non-discriminatory environment (Kronenberg *et al.*, 2020; Suárez *et al.*, 2020). Within these terms, Rigolon et al. (2022) point to interactional justice, which refers to the quality of social cohesion in urban landscapes and public spaces, examining peoples experiences with public space. When studying parks or other recreational settings, for instance, this can provide valuable insights into determining the quality of these facilities and their performance. While the goal is to increase the use and quality of green spaces for marginalized people, this report shares the view of (Gibson, Loukaitou-Sideris and Mukhija, 2019) who emphasize the importance of making recreational spaces culturally appropriate and representative of the diversity of people they serve. At the same time it needs to be ensures that such spaces accommodate their preferences (p.399).

Figure 3 comprises the ideas and perspectives raised in this section. The literature review indicates that UBGI planning is very complex and encompasses many dimensions and levels of the urban landscape. In all of its forms, the analytical level may extend from the individual and interpersonal to the residential block, the neighborhood, and up to a city-wide scale. It therefore seems crucial to be aware of the different scales and to choose the right analytical level in which to operate for the research framework. In combination with the three dimensions of socio-environmental justice visualized in Figure 6, this entails a comprehensive approach to ecosystem and social services, blending cities into a socio-ecological construct.

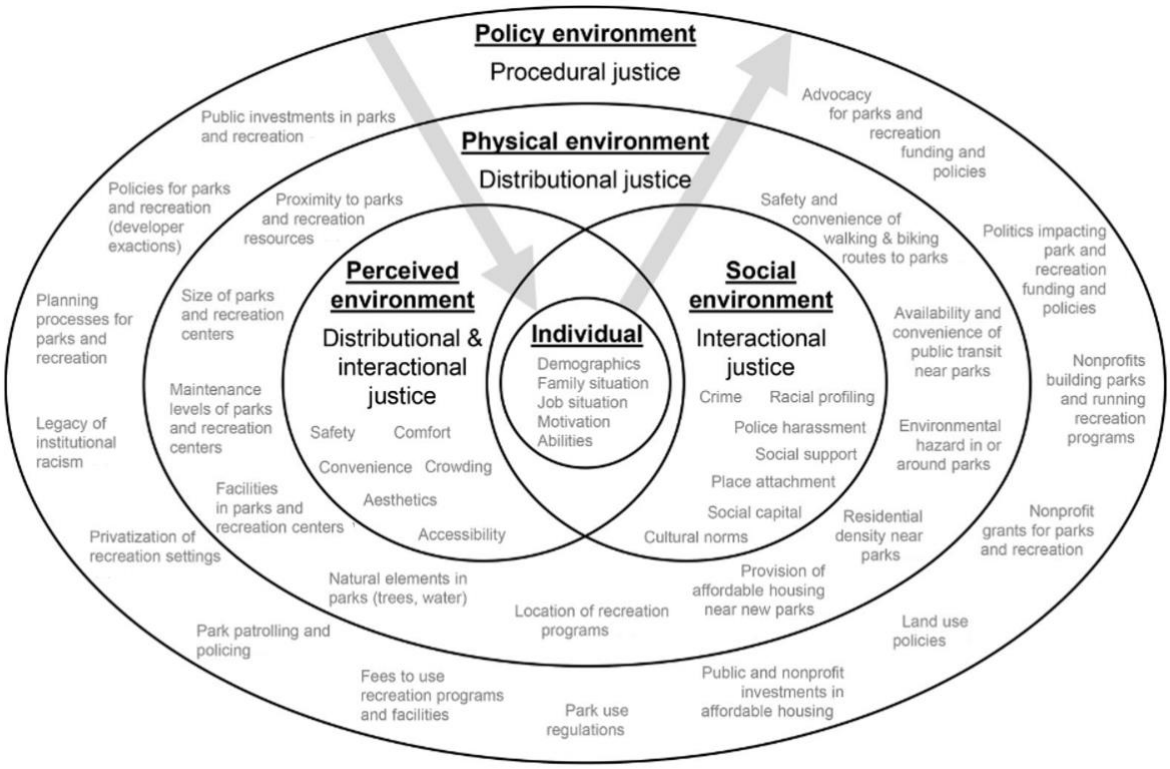

Figure 6: *The Umbrella Perspective of the Socio-Environmental Justice Debate in relation to UBGS (Adapted from Rigolon et al., 2022)*

The graphic above illustrates the umbrella perspective of an interdisciplinary research framework informed by recent debates about EJ in the context of equitable UBGS, while it attempts to compress the various scales and variables that enable this metabolism. The cross-cutting nature discussed here implies the need to design BGI planning in such a way that UBGS can accommodate a variety of functions. For this reason, the final section of this literature review contemplates the role of Multifunctionality in BGI-Planning.

5.5 Blue-Green Infrastructure (BGI) Planning and the Role of Multifunctionality

Planning for urban green infrastructure may be efficiently supported by the ecosystem services method. Such an evaluation, when combined with mapping, may create spatial analyses on a particular scale, assisting in the upkeep of multipurpose landscapes and the design of urban green infrastructure. In turn, green infrastructure can offer a wide variety of ecosystem services (Zhang and Muñoz Ramírez, 2019). The following section begins by exploring the notion of multifunctionality in the context of UBGS. This is intended to develop an understanding of how the term can be used to improve planning for equitable, green, and compact cities and to harness the potential of green urban capital.

The ability of blue-green infrastructure (BGI) planning to link ecological and social aspects is well recognized (Mell, 2009). According to the European Commission (2013) the concept behind BGI is about a ‘‘strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services” (p.3). This is in contrast to grey or human-made infrastructures, which often serve a single objective (Escobedo *et al.*, 2019). However, Mell (2009) states that GI-planning represents more of a synthesis of different planning approaches, while Hansen and Pauleit (2014) describe it as a “melting pot for innovative planning approaches in the field of […] green space planning” (p.516). The benefits of these ideas and their potential to support associated measures for urban green spaces, biodiversity as well as health and urban inhabitants' quality of life have been thoroughly covered in literature on BGI, UES, and nature-based solutions (Haase, 2017). The proportions of green-blue space, in other terms, the green-blue capital, varies across geographies. For instance, most of the northern European cities tend to have greater proportions of green space compared to cities in other parts of Europe (Fuller & Gaston, 2009). Consequently, UBGS are among the most visited outdoor settings in the Nordic countries (Lindholst, Caspersen and Konijnendijk van den Bosch, 2015). The benefits of this (semi-) natural capital in cities are undeniable as they range from environmental and climate, economic and aesthetics to social and psychological services (Mell, 2009; Haq, 2011; Gómez-Baggethun *et al.*, 2013; Artmann, Bastian and Grunewald, 2017; Stessens *et al.*, 2020; de la Barrera *et al.*, 2023).

Multifunctionality of a landscape has the purpose to co-create and transform the city as socio-ecological systems. By considering social (cultural), ecological and economic aspects, opportunities to benefit all people and the environment may be created (Lovell and Taylor, 2013). This approach acknowledges and prioritizes the diverse functions that UBGI can provide, rather than leaving their benefits to chance (Hansen and Pauleit, 2014). According to

Lovell and Taylor (2013), multifunctional landscapes perform better when different functions are supported by a diverse set of landscape features. They further argue that a variety of successful design choices may be the result from stacking functions across those three dimensions.

Multifunctional landscapes in urban environments may be studied using three distinct methodologies, according to (Hansen *et al.*, 2019). The first method involves a spatial assessment of green space functions on various scales, where ecosystem services are understood as the provision of different functions. Yet, we learned from the previous sections that the correlations between different ES can be of non-linear nature, making this form of assessment more difficult. The second method focuses on the city or neighbourhood scale and is utilized as a guiding concept for urban green space strategic planning. To promote optimal outcomes for all parties involved, BGI planning must consider the multiple dimensions and functions of urban green spaces (see Lovell and Taylor, 2013). Finally, the third method pertains to the site level and involves the design and development of blue-green spaces. It is hereby referred to (Rode, 2016) who considers three approaches for achieving multifunctionality in this context: "tessellated multifunctionality" with a spatial segregation of functions within one area; "partial multifunctionality" by combining functions at the same location with one or two dominant functions; and "total multifunctionality" with an equal balance of different functions at the same location (p.327).

A brief interim conclusion on the exploration of the multifunctionality of BGI confirms that the preceding concepts and ideas elaborated on ecosystem services are fundamental for the development of multifunctional landscapes. Yet there are also certain limitations mentioned in the literature that need to be considered while investigating the multifunctionality of blue-green urban areas (Lovell and Taylor, 2013; Haase *et al.*, 2014; Charoenkit and Piyathamrongchai, 2019). According to Hansen and Pauleit's (2014) multifunctionality evaluation approach for green infrastructure, it is crucial to understand additional concerns, such as trade-off associations and the balance between ES supply and demand, in addition to locating the multifunctionality hotspots. Research by Charoenkit and Piyathamrongchai (2019) indicates that assessing the multifunctionality of urban green spaces is a complex task, as it requires the consideration of various factors that interact with each other. One limitation of such assessments is the difficulty in quantifying and valuing the multiple benefits provided by green spaces, which can vary depending on the context and the stakeholders involved. As a result, the assessment may not fully capture the potential conflicts and synergies between different ecosystem services, which can lead to suboptimal decision-making regarding the management

of urban green spaces. In this respect, Hansen and Pauleit (2014) argue that multifunctionality may not always be sufficient to ensure the delivery of multiple ecosystem services and that it can sometimes result in trade-offs between different services. For instance, a green space designed primarily for recreation may not provide sufficient habitat for biodiversity or ecosystem services such as carbon sequestration. Similarly, Hansen et al. (2019) argue that the construction of new housing or transportation infrastructure may result in the loss of green spaces or reduced access to green infrastructure. In such cases, there may be a need to prioritize certain ecosystem services over others, which can result in trade-offs. However, it is sometimes possible in densified urban areas to offset the declining quantity of UBGS by providing high quality, multifunctional services and carefully calibrating supply and demand (Haaland and Konijnendijk van den Bosch, 2015). A number of ways have been attempted to reach this high quality through multifunctional strategic planning for compact, green-blue cities. These methods refer to values and thereby create a structure for evaluating and distinguishing between what is considered an asset and what is not (Lindholst, Caspersen and Konijnendijk van den Bosch, 2015). At the site level, this can help us make more informed decisions about which choices are most beneficial for the target communities at hand. Examples include recreational experience mapping at small spatial scales (Lindholst, Dempsey and Burton, 2013), sociotype mapping (Ståhle, 2006), park character analysis (Nordh, Alalouch and Hartig, 2011), as well as perceived sensory dimensions. Although all of these strategies and tools are highly interesting and seem to have a lot of potential, it is beyond the scope of this literature review to go into detail about each of these methods. Nevertheless, the eight dimensions of recreational experience summarized by Lindholst, Dempsey, and Burton (2013) can particularly serve the purpose of this thesis, as their findings are based on Nordic studies from earlier research by Berggren-Bärring and Grahn (1995) and Grahn and Stigsdotter (2010). Their results, presented in Table 2, provide a clear set of categories and characteristics that can be used to guide UBGS planning and design and to translate such into values for an urban ecosystem. They can therefore be seen as more tangible indicators, complementing the less tangible considerations from the CES.

Table 2:*Dimensions of the recreational experience of urban green space (Adapted from Lindholst, Dempsey and Barton (2013)*

Nominal Name	Short description/interpretation	Important characteristics
Nature	Experience of the free-growing, untouched, vital, 'an encounter with nature'	No visible human-made facilities or traces, visible or audible. 'Natural areas'.
Richness in species	Experience of richness in plants, insects and/or animals	Presence of different or special plants, flowers, insects and/or animals. Possibility to gather mushrooms, fruits, etc.
Serene	Experience of an undisturbed peacefulness, to be on one's own, in safety and withdrawn, 'at one with natural surroundings'	No artificial noise (e.g. transport), few or no other humans, no litter, no paths/transport corridors.
Space	Experience of an independent, homogeneous, inter-connected and special 'universe'	No cross-cutting paths or disturbing features. At least two types: an 'avenue of old beech trees' or 'an open horizon', e.g. at a lake/the sea.
Refuge	Experience of safe surroundings and facilities for expression, play and interactions with other people	Demarcated and uncluttered space/place by trees, bushes, fences. Play facilities, tables/benches, meet animals, e.g. 'playground'.
Prospect	Experience of open and free surroundings for expression and activity	Open and accessible space with grass/sports fields. Supporting facilities such as lighting, changing rooms: 'the common'.
Social	Experience of an organised and entertaining scene and getting together with other people	Facilities, services, activities, cafe´, restaurants, benches, tables, barbeque and entertainment: 'a social scene'.
Cultural	Experience of cultivated, man-made surroundings formed by history and/or culture	Historical features and buildings, sculptures, statues, fountains, canals, flower stands, well-manicured bushes, formal elements: 'historical and cultural space'.

The dimensions illustrated in the table above also tie to the reflections of Sim and Gehl (2019). Although visual stimulation is crucial, in their reflection on public space design it is not simply about what one can see per se. Having ample opportunities to witness natural occurrences and human activities can greatly enhance the experience of a public space and therefore its value to the users. This includes the observation of the sky, the interplay of light and shadow, plants and trees, as well as birds and other animals (or organisms). The authors contend that seeing a range of colour and features, as well as a variety of patterns and ornamentation, is similarly essential to the "program" of urban space.

Reflecting the literature, the social aspect must be incorporated into the BGI idea. This is because the possibility for a person and a place to develop a stable, lasting, and good connection depends on both personal preferences and a location's characteristics (Łaszkiewicz, Kronenberg and Marcińczak, 2018). Nevertheless, Hansen and Pauleit (2014) criticize contemporary tendencies that commonly employ expert opinion or politically agreed upon norms to establish an understanding of demand. As argued by them, planners must be educated about the true need for ES in order to prevent activities that fail to meet norms and expectations.

As Hansen et al. (2019) describe it, planning is a “practice of knowing”. Modes of sustainable urban growth that "rise from below" through the active involvement and experimentation of residents have been advocated as an alternative to depending only on the judgments of governments and experts (Bendt, Barthel and Colding, 2013).

When cities undergo densification processes a thorough knowledge base is particularly important for making informed decisions regarding investments or maintenance of green areas (Haaland and Konijnendijk van den Bosch, 2015). This can be created by ‘layering’ data on the ecological and social functions for the whole city, e.g., with the help of geographic information software (GIS). A relatively new type of survey, called Public Participation GIS (PPGIS) for obtaining social values in BGI planning is presented by Rall, Hansen and Pauleit (2019). This tool can help discover conflict hotspots, undervalued areas, and popular park elements that should be safeguarded in a particular location. Also, it can assist a better understanding of functional synergies at the district and municipal levels, uncover locations that are challenging to map, and increase the representativeness of expert evaluations. Moreover, PPGIS may help with the application of other UGI planning tenets including green space networks and ensuring inclusive planning procedures (ibid.). In addition to PPGIS, photovoice is suggested by Hansen and Pauleit (2014), an approach where participants express their opinions that represent an individual or community concern. Following these strategies, Lovell and Taylor (2013) advise keeping an eye out for positive feedback loops to strengthen the social perspective in this situation. Accordingly, a community learns from its environment while optimizing ecosystem services, resulting in adaptive learning. As green spaces created and managed by local residents, community greening has the potential to engage citizens in the stewardship of their local environment (Tidball and Krasny, 2009; Middle *et al.*, 2014). This ties to the notion of "urban green commons" mentioned in section 3.2 where a diverse ownership and co-design form the basis of UBGS management. It shows that by engaging the whole local community while keeping an eye on its many cultural and ethnic backgrounds, BGI planning can be used as a platform for political mobilization and resistance against marginalization and neighborhood disinvestment. This plays a special role when a city's dominant paradigms of land use planning, urban development, and urban design are challenged by disadvantaged groups (Baker, 2004; Lovell and Taylor, 2013).

Looking back at the literature and the debate about BGI and their potential of providing a diverse range of ecosystem services to local communities, it has to be considered that the principle of multifunctionality alone will not be able to secure sufficient provision of green

spaces in densifying cities. This observation has also been made by Haaland and Konijnendijk van den Bosch (2015). The authors are pointing out the need to combine BGI with other principles. This includes conservation, securing green space quality, and increasing connectivity and the accessibility of UBGS. Overall, combining BGI and ES theory into a single framework may be a good decision since ES research tackles various significant problems for multifunctional planning, such as how to improve ES while minimizing trade-offs (Hansen and Pauleit, 2014). To be able to create and sustain just communities there is a need to design and plan smart, livable and attractive physical places (Akaraci *et al.*, 2016). Places that recognize the needs of people, taking care of the environment with protection, comfort, and pleasure in mind may create a public space that people will want to go to, go through, and spend time in (Sim and Gehl, 2019). Place-specific design should be at the center of attention when creating just cities and promoting socio-environmental justice in planning. This ties in with the earlier discussed notion of a public domain by Hajer and Reijndorp (2001), which emphasizes the need for highly sensed shared space experiences that connect everyday networks and create gateways or switches between them. Blue green spaces can play a crucial role in this, as they offer opportunities for sensory experiences and encounters with nature that can enhance well-being and social cohesion in urban environments. While strong, positive ties with a place improve the likelihood of remaining in a particular place for a long time, people who are not able to have satisfactory bonds with a place of living may become dissatisfied (Casakin, Hernández and Ruiz, 2015) which in turn can impact well-being both physically and mentally.

The literature review above presents a general frame to tackle the issues of compact urbanism and inclusive BGI Planning. However, due to the multifaceted nature of these conceptions, this still seems abstract in theory. The subsequent section will employ a specific case study designed to make the phenomenon at hand more tangible by applying the learned concepts to real-life situations. The EPPS framework from section 5.2 will help to lay the groundwork, while the umbrella view of the environmental justice nexus highlighted in Figure 6 will be incorporated to enable a socially inclusive approach. The notions about multifunctionality in BGI planning are supposed to assist in translating blue-green potentials into ecosystem services.

6. Case Study: Scrutinizing A 'Green' City – An Analysis of inclusive UBGS Management in Oslo, Norway

Oslo, the capital city of Norway, has seen a substantial increase in population over the last few decades, with a particular emphasis on urban densification. According to Næss (2022), Norway has, in fact, been leading the way in this regard among the Nordic countries. It has a predominantly monocentric urban structure with downtown Oslo as the main center and many local centers surrounding the inner part. Located at the end of the Oslo fjord, the city spreads out inland, north-eastwards and southwards along both sides of the fjord (Tiitu, Naess and Ristimäki, 2021). Currently, the city has a population of 709,037 inhabitants, which is expected to grow to almost 839,000 by 2040 (Oslo Municipality, 2019a). The number of residents in the inner area of the city alone increased by 50% between 2000 and 2020 (Statistikbanken, 2020). This increase in population growth has also led to an increased use of green areas in the city (Venter et al., 2023). In regard to the socio-cultural characteristics of the city, over one third (34%) of the inhabitants in Oslo are immigrants or Norwegian-born children of two immigrants (Oslo Municipality, 2019a). In relation to this, affluence segregation is a prevalent issue in Oslo, according to Haandrikman *et al.* (2023), who compared five Northwestern European capitals. They found that, while income differences are relatively low, Oslo still has a particularly strong and persistent pattern of spatial concentration of wealth. On the other hand, forested hills surround the city to the north, east, and west, creating a unique natural and cultural environment of high local and national value. According to Oslo Municipality (2019) the city provides 37m^2 green space per capita, while 98% of the Oslo residents live within 300m of green space. In recent years 3 kilometers of river streams were uncovered. Despite these facts, a study conducted by Barboza *et al.* (2021) found that approximately 55-76% of the Oslo population lives in areas that do not meet the World Health Organization's targets for exposure to noise and air pollution. This makes it all the more crucial to preserve and more importantly, enhance the blue-green character of the city's built environment, as noted by Oslo Municipality (2019). An overview of Oslo's distribution of blue-green properties with potential for recreation is provided below (Figure 7).

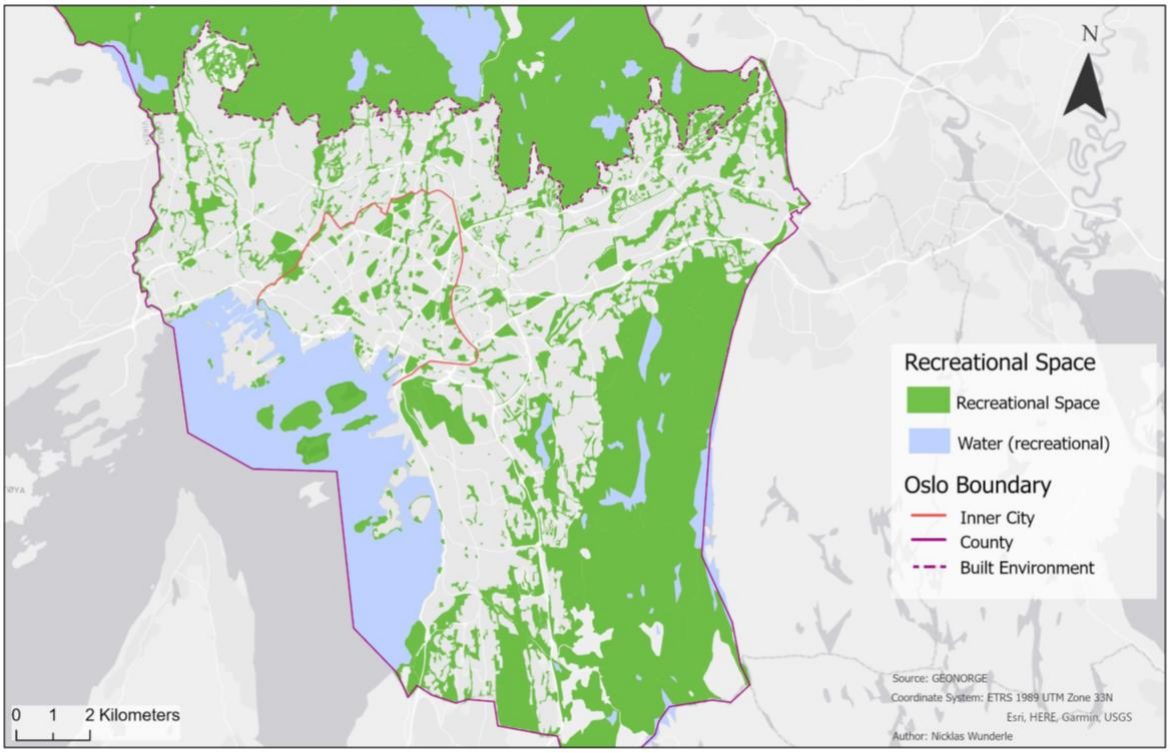

Figure 7: *Blue-Green Properties with Recreational Potential (Based on Data provided by Cimburowa and Barton, 2021)*

7. Results & Analysis

7.1 Socio-historical context of Oslo – A brief Overview

Oslo has had an established east-west divide since the nineteenth century, which is shown in figure xxx with Oslo's sub districts to the east and west of this line. The city's eastern parts, which has historically hosted a high amount of social housing developments, remains impoverished. In contrast, wealthier households predominate on the west side, with an exemption of an affluent strip along the eastern bank of the Oslo fjord (Myhre, 2017; Venter *et al.*, 2023). This division is known as "Østkanten" and "Vestkanten". In other terms, it represents the socioeconomic dynamics of Oslo's working class and bourgeoisie, or the city's (economically) lower class against higher societal communities of the city (Myhre, 2017). During the earlier period when Oslo was still known as Christiania, the affluent middle classes inhabited the central part of the city. They went westward, closer to nature, as the city developed, in places where many already had private holdings and residences. The city's two main watercourses, the Akerselva, which follows the convergence between east and west, and the Alna further east, were the sites of rapid development dominated by manufacturing

industries. This in turn led to a division of the city, with the less privileged classes tied to these industries and the wealthier classes residing in the west (Venter et al., 2023).

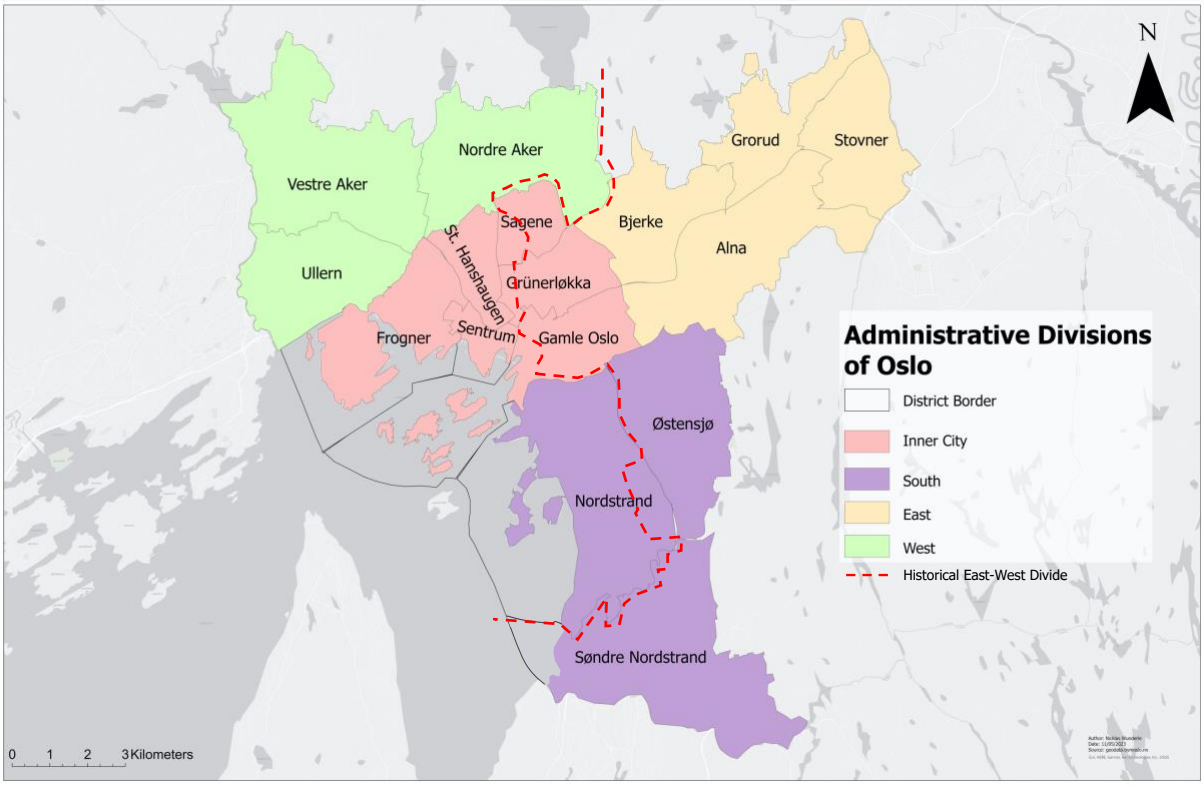

Figure 8: *Administrative Divisions of Oslo*

7.2 Policy Context of UBGS Creation and Management

The following section intends to give a brief overview of the general planning objectives and policy instruments used for steering urban development and UBGS Management. The first part therefore delves into how Oslo is handling densification development and compact urbanism startegies.

The city of Oslo is promoting densification as a way to reduce car travel and create a more walkable city with services located within short distances from people's homes. According to Næss (2022) this is in line with the overall hegemonic status that compact urban development has gained in the Nordic context over the years. The protection of natural areas through a green belt policy and the use of flexible master plans with room for negotiation have limited urban expansion, motivating developers to embark on brownfield transformation projects. The rocky terrain of the Marka hills has also prevented spatial expansion, while economic growth and in-migration have led to a rapid increase in urban population density (Tiitu, Naess and Ristimäki, 2021). Compact development, as it is proceeded in the case of Oslo, requires renewed investments in technical and social infrastructure, making inner-city life and job locations more attractive and facilitating further infrastructure improvements. In this regard, the city council

decided to allocate a total of NOK 226 million in the period between 2007 and 2023 to establish new, and further develop existing, squares and meeting places in all the districts in Oslo (Oslo Municipality, 2023). In the municipal plan of 2018 (Appendix 3), the municipality defines the main development areas focusing to a large part on the inner and outer west territories of the city. This also implies the importance of managing public blue-green spaces, which play a crucial role in the city's efforts to balance densification with access to nature and outdoor recreation (Oslo Municipality, 2018; Oslo Municipality 2023). As such, the green belt policy and master plans with room for negotiation are viewed instrumental in achieving sustainable urban development and promoting a high quality of life for residents. Another important planning tool is VPOR (Veiledende plan for offentlige rom), a guiding document developed by the City of Oslo, which provides a holistic perspective for the development of a larger area with multiple landowners and multiple zoning plans. It is a planning tool that specifies public spaces such as parks, squares, streets, and walkways necessary for the transformation of an area. Although it is not legally connected to the Planning and Building Act, it still applies requirements for land use early in the planning process and coordinates the establishment of measures with individual construction projects (Holdt and Johansen, 2018). Accordingly, VPOR is an integral part of the Oslo model, which guides the development of public spaces through a participatory process involving local residents, stakeholders, and developers.

At the national level, the Norwegian Environmental Agency's guide for managing blue-green structures highlights the need of incorporating green areas into municipal land use plans and mapping the population's preferences and values (Miljødirektoratet, 2014). Accordingly, user and community participation are critical for knowing how spaces are utilized and what attributes are appreciated. The document emphasizes the importance of universal design to ensure that outdoor areas and green structures are accessible to as many people as possible, including children, the elderly, and disabled people. Further, the guideline suggests to create a framework at the municipal level for preserving accessibility and conditions for various groups, as well as making sure that recreational places and amenities are accessible to all. Within the land-use objectives in the regulation plan, Oslo Municipality is referring to the Environmental Agency (Miljødirektoratet, 2014). Four different kinds of public UBGS are distinguished. (1) Natural Spaces ("Naturområder") are conserved and home to a diverse range of wildlife, while (2) tour areas ("Turdrag") connect green spaces to create a continuous ecosystem. (3) Recreational spaces ("Friområder") provide amenities for leisure and physical activities, whereas (4) parks ("Parker") are defined as human-made structures with architectural aspects that are utilized for social and cultural activities. When it comes to the coordination and

management of public space development, the Norwegian Environmental Agency along with the city districts are typically in charge of implementing the measures. The Property and Urban Renewal Agency serves as an interface between the municipality's agencies, districts, and individuals (Oslo Municipality, 2023).

On the municipal level, a general approach to achieve high living conditions is provided by the municipal partial plan for squares and meeting places ("*Kommunedelplan torg og møteplasser*"). It aims to create good outdoor public spaces that serve various user groups and activities while promoting multicultural urban life (de Vibe and Finess, 2009). Referring to the plan's guiding principles, these spaces should have an environmental profile, be inclusive and of high quality, and easily accessible. According to the plan, several squares and meeting places have been established and upgraded to provide new, open, and functional spaces for the city's residents. As the current study explores the value of the blue-green domain in the city, further research is needed to understand how it is managed. The city's most recent municipal plan, "Oslo towards 2030," lays the groundwork for it (see Oslo Municipality, 2015). This is particularly relevant considering that target 3.2 incorporates the goal of enhancing the city's blue-green identity, but also because the plan states that "there are significant variations in living conditions both between and within districts" (p.26, translated from Norwegian). In this context, the plan emphasizes Oslo's heterogeneous social makeup and the necessity of looking ahead, incorporating future immigration trends to avoid discrimination. This indicates that cultural, economic and political conditions are important circumstances that have facilitated Oslo's densification policies and therefore highlights the need for inclusive planning processes.

Along with the essential planning principles mentioned above, the municipality issued additional norms that appear to be supportive of UBGS management. For this report, two standards seem to be especially relevant. The "Norm for shared play and outdoor recreation areas for residential development" is one of them (Planning and Building Agency, 2022). According to the Planning and Building Agency, the standard is used throughout Oslo and applies to all new housing projects. The purpose is to ensure good outdoor space for those who will live there and solely applies to new housing development. The standard sets requirements for the size and shape of the outdoor areas, and for the distribution of the area on terrain, squares and roofs. It contains four different area classifications, each of which having a different set of requirements. In an area category, a project is classified according to its density, building structure, and program of existing or planned buildings.

Based on the above findings, it may appear that the urban development of Oslo has a big focus on the buildings themselves and not enough on what is happening between them, in the open

zones, parks and public spaces. The second standard refers to the blue-green factor (BGF) and can therefore be used as a supplementary planning tool. The BGF is a policy tool developed by Oslo and Bærum municipalities to evaluate the greenness and blueness of an urban space. Its main aim is to strengthen the presence of green and blue structures within the urban environment by setting a minimum demand for the area within building projects. Based on blue-green surfaces and additional green and blue qualities, the BGF is calculated as the ecological effective surface of the area (see Figure 9)*. Surfaces and additional qualities are entered into a spreadsheet (Appendix 1), which automatically calculates the blue-green factor according to the formula shown below.

Figure 9*: BGF Composition (Based on Ardila and de Caprona (2014).* Note: Additional qualities are less about ecosystem services in the socio-cultural sense and more about the quality and function of the surfaces in terms of stormwater management.*

The BGF score ranges from 0 to 1 and is calculated on a building site level. The higher the score, the more water surface, vegetation connected to subsoil, and permeable surfaces are present in the area. For instance, areas with a BGF score of 0.5, have 50% green or blue surfaces, while areas with a BGF score of 0.3 have 30% green or blue surfaces. The BGF is used to ensure that new development projects provide a minimum provision of green space and is adapted to the local environment (Ardila and de Caprona, 2014; Oslo Municipality 2019). While it is recognized by the municipality that the blue-green factor also implies an important health and well-being aspect, a predominant emphasis lays on the natural services and functions of blue-green ecosystems as well as climate adaptation measures and not on CES. This particularly involves enhancing biodiversity and counteracting runoff and dehydration, which is indicated by the following quote from Ardila and de Caprona (2014):

"High density is sustainable in terms of energy consumption and transportation but requires extra consideration for the spaces in between. Oslo currently faces a real need for space to manage stormwater from the city's many hard surfaces."
(p. 7 – translated from Norwegian).

Both the urban development strategy in the new community section of Oslo's municipal plan 2015 (Smart, Safe, and Green) and the goal of maintaining Oslo's blue-green identity have a focus of managing UBGS while densifying the city. The blue-green structure's significance to natural diversity, climate adaptability, stormwater management, recreation, and air quality is highlighted in the urban development strategy. However, because the current study opts for a human-centered approach to UBGS Management, the section that follows presents municipal initiatives and activities to support co-creative design procedures.

Efforts to engage Citizens in the design of a blue-green domain:

According to Oslo Municipality (n.d – a), most planning procedures begin with a notice of commencement and continue with a hearing once the proposal has been developed. Residents are invited to attend open meetings to voice their opinions as well as submit written suggestions and complaints. Between notification of commencement and public consultation of a planning proposal, some time may pass. This is because a lot of factors and viewpoints are taken into account before a proposal for the plan is made (ibd.).

When it comes to municipal publications on co-creative design of public green-blue spaces at the city level, "Sprouting Oslo – Room for everyone in the city's green spaces" (Spirende Oslo) deserves special attention. Urban agriculture is being emphasized as a strategic tool by the city government in order to become a beacon in environmental friendliness, justice, and creativity. With the ongoing increase in population and a high demand for outdoor spaces, the city is facing a competition for the public domain. The "Sprouting Oslo" strategy is the city government's roadmap towards 2030 to encounter this. It was published in 2019, after receiving feedback from the general public. One of the main goals is to increase the number of public spaces available for citizens to come together. To achieve this, the city plans to implement various programs, including exploring the integration of urban agriculture into social programming, creating more picnic areas, and introducing green care into healthcare facilities. Another target is to create green meeting places that are accessible to people of all ages, cultures, and social backgrounds. The municipality plans to use urban agricultural activities to improve the quality of life and public health in neighborhoods while providing work experience and training opportunities. Sprouting Oslo is undoubtably an ambitious strategy with a wide range of innovative ideas. Nevertheless, reflecting on its content, it lacks specific regulations or actions and reads more like an inspiration document than a practical implementation strategy, which makes it challenging to turn those ideas into tangible projects.

It is also unclear if the municipality alone or private entities would be in charge of the implementation process.

This leads the next section into an analysis of the various strategies and programs that the city is implementing to achieve its goals at the neighborhood level. What follows is an overview of initiatives and activities that have been published over the years. This is supposed to help to reflect the city government's commitment to invest in nature and create a sustainable city for its residents.

To start, a series of workshops, seminars, public meetings, and exhibitions were held under the Grorud Valley Project. Local residents were engaged in the planning process for four neighborhood parks in the eastern part of Oslo between 2007 and 2015. In addition, blue-green infrastructure investments date back to the year 2000. Blue-green corridors have been created by reopening streams and rivers, such as parts of the Hovinbekken in the Ensjø district or the Alna river further east, through which ecological, recreational, and aesthetic functions were restored (Oslo Municipality, 2019b). With support of the *FutureBuilt* program, the city has also renovated numerous parks and open areas and incentivized real estate developers to build climate-friendly buildings with upgraded outdoor spaces and green rooftops. The Fjord City Project (2008-2015) aimed to create attractive and accessible public spaces for pedestrians and cyclists. Through the relocation of the E18 highway into the new underground Opera Tunnel, surface traffic was reduced by 70% and significantly improved air quality and noise reduction.

In terms of active public engagement in development and planning procedures, the city government lists several opportunities for citizens to participate. These include various open meetings to provide information and updates on ongoing projects, as well as open office days where citizens can drop in to learn more and ask questions. Workshops are also organized to allow citizens to work on development-related concerns and challenges. To ensure that submitted proposals can cater to different needs and interests, the municipal government conducts surveys, including digital surveys and surveys aimed at specific groups such as children or elderly people (Oslo Municipality, n.d. - b). As these co-creative methods of public-space design are simply laid out by the municipality on their website, it was necessary to have a closer look if and how decision-makers and planners are putting these words into practice, especially in the scope of the present study and UBGS. When reviewing documents and publications regarding UBGS development, it became evident that there is a vast amount of small projects that have the aim of upgrading urban space. A full investigation of each of these micro-developments, however, would be beyond the scope and resources of this thesis project.

As a result, the document analysis concentrates on large-scale UBGS initiatives in Oslo, with a special emphasis on socio-cultural integration. In this regard, the project "child-friendly city", raised awareness as an example of active engagement. The Oslo city council has commissioned a survey to assess how urban spaces in Oslo are designed for children and young people. The task has been given to the Planning and Building Agency and the Urban Environment Agency, who are collaborating with landscape architects from the private sector to develop a method for mapping the urban spaces. The survey also aims to gather feedback from young people to understand their perspectives on how these spaces are arranged for them. For the project, 60 urban spaces in 15 districts are inspected. In addition, participatory sessions with children and young people across the city are conducted to gather their views on outdoor spaces. The project is currently halfway through. Preliminary results indicate that young people are generally satisfied with the outdoor spaces in their local area but have their preferences, and they want social zones where they can sit more freely. The young people mostly hang out in places close to where they live and not as often in the city center (see Kopperud, 2023a for more details). Another interesting case is the transformation development at Ensjø district. In 2000, the city council of Oslo decided to convert Ensjø from a city of cars to a residential district. The development of housing and establishment of parks, squares, and green-blue areas in the neighborhoods are being carried out in parallel, while it is stated that the developers are mostly responsible for the funding of UBGS Kopperud (2023b). While the Ensjø development focused on a balance between Housing and the green space in-between, the upgrade of the three neighborhoods of Tøyen, Grønland and Vestli was approached by a more socio-cultural perspective.

In the time between 2015 and 2018 the city government focused particularly on three areas, Tøyen (Gamle Oslo district), Grønland (Gamle Oslo district), and Vestli (Stovner district). The investigations aim to provide a comprehensive understanding of the social and cultural dynamics of these locations, as well as to provide practical answers to people's issues (Brattbakk *et al.*, 2015; Brattbakk *et* al., 2017; Andersen *et* al., 2018). In the case of public UBGS, this entailed considerations about how the local environment is used and appreciated. This also involved the physical and sociological qualities of the communities, the amenities and services offered, as well as potential conflicts of interest that may arise inside the neighborhoods.

7.3 UBGS on a City Wide Scale

7.3.1 Blue-Green Space Provision & Distribution

The first section presents the results of UBGS distribution and provision on a city-wide scale. Figure 10 illustrates the total area of urban recreational space and the provision of UBGS by recreation type.

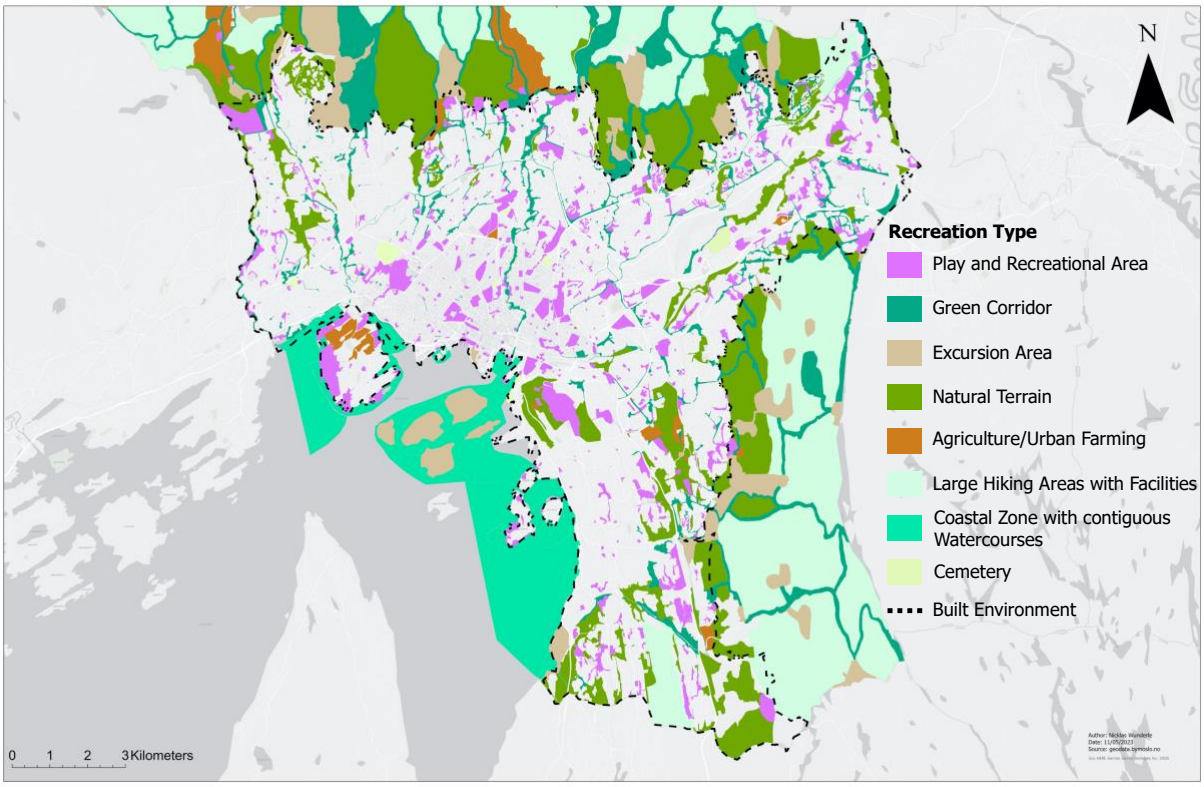

Figure 10*: Categorization of UBGS Recreation Type*

The first thing to point out is the context in that the city of Oslo is embedded. It is noticeable that large parts of the southeastern stretch of the city as well as the entire north are adjacent to the so-called Marka Zone. In fact, Barton et al. (2015) found that Oslo residents spend about 73 million hours here every year. With its numerous watercourses, (peri-urban) forests, running tracks, skiing and mountain biking trails, the Marka territory serves as an important year-round recreation area for the city's residents. In the summer season it provides space for hiking, running, berry picking, swimming, barbecuing and alike. In the winter season, the Marka offers mainly opportunities for skiing, ice-skating and -fishing. On the other end, the southwestern part of the city is characterized by an approximately 36-kilometer-long coastline stretching from Søndre Nordstrand in the south to the Ullern district in the west (please see Figure 8 for spatial reference of the various districts). The coastal zone and the fjord landscape involve a diverse range of recreational opportunities. The part that belongs to the inner-city shoreline has a big focus on cultural activities. This includes sauna-landscapes, the opera house, an art

museum and bathing opportunities. Another important and large recreational area in proximity to the city is the half island Bygdøy. As part of the Frogner district in the south west, it contains an area of 3,7 square kilometers. Especially during the summer season, the area provides a meeting place for the urban population, containing barbecue areas, sport facilities, and a yacht harbor. Besides the recreational aspects, parts of the area serve as farmland.

With regard to UBGS provision across the whole city, Figure 10 clearly shows that the type "*Play and Recreation Space*" along with "*Coastal Zone with Contiguous Watercourses*" is the most common form of UBGS supply in the city (i.e., within the built-up zone). The figures in Table 3 represent the area of each category within the built-up area of Oslo compared to the total area of the built-up environment.

Table 3*: Area Distribution for each Recreation Type in Oslo*

Recreation Type	**Area (km²)**	**Area as a percentage**
Coastal Zone with Contiguous Watercourses	19,4	32
Play & Recreational Area	14,0	23
Natural Terrain	13,2	22
Green Corridor	6,6	11
Excursion Area	2,9	5
Large Hiking Areas with Facilities	2,8	4
Agriculture/Urban Farming	1,0	2
Cemetery	0,7	1
Total Recreational Area	60,5	100
Total Area (City)	151,5	

7.3.2 Socio-Economic and Cultural Characteristics – Representation of Social-Clusters

As discussed in the literature review, socio-economic and cultural characteristics are essential factors to be considered when planning UBGS. Thus, the population profile of Oslo is analysed and the results are presented in the following section. Illustrated in Figure 11, the highest numbers of per capita space are mainly located within the inner-city area. With regard to Figure 12, this situation appears to shift within the next 7 years. With the exception of the inner-city district (*Sentrum*), population growth in the inner city is expected to slow down and shift to the adjacent outer districts of the inner city within the next 7 years. It is noticeable that especially the inner-west districts such as *Frogner, St. Hanshaugen* and *Sagene* will not experience any substantial growth in the near future, whereas the inner east districts such as *Grünerløkka* and *Gamle Oslo* will still become significantly denser. Again, please refer to Figure 8 for the spatial reference of these districts. This is striking since both Grünerløkka and Gamle Oslo are already

today among the top 4 densest districts in Oslo (Statistikbanken, 2023). The strongest growth rates are forecasted for the Bjerke district in the outer east. Here, the density increases from 4607 to 5407 inhabitants per square kilometer resulting in a growth rate of +17%. A similar scenario is shown for the Sentrum district developing from 898 to 1034 inhabitants per square kilometer resulting in a growth rate of 15%. The only district that shows a future net-decline in terms of population growth and density is the Grorud district with a -0.44% rate.

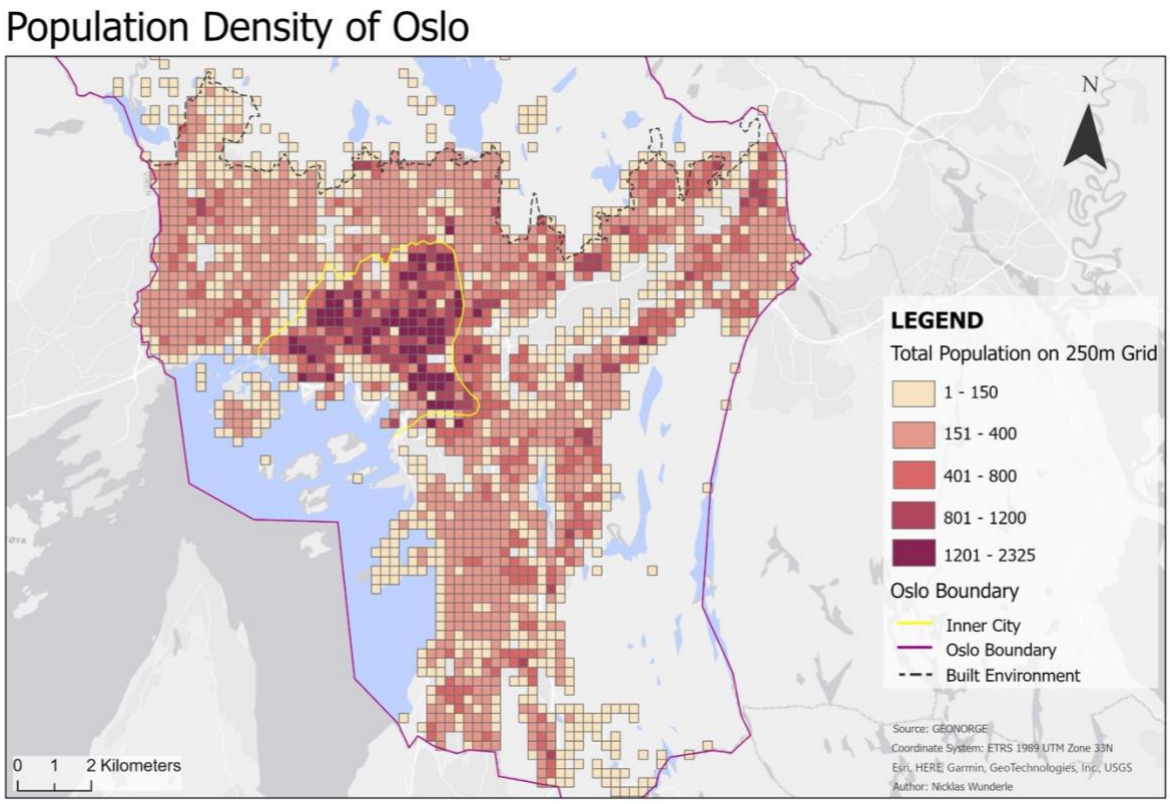

Figure 11: *Population Density of Oslo*

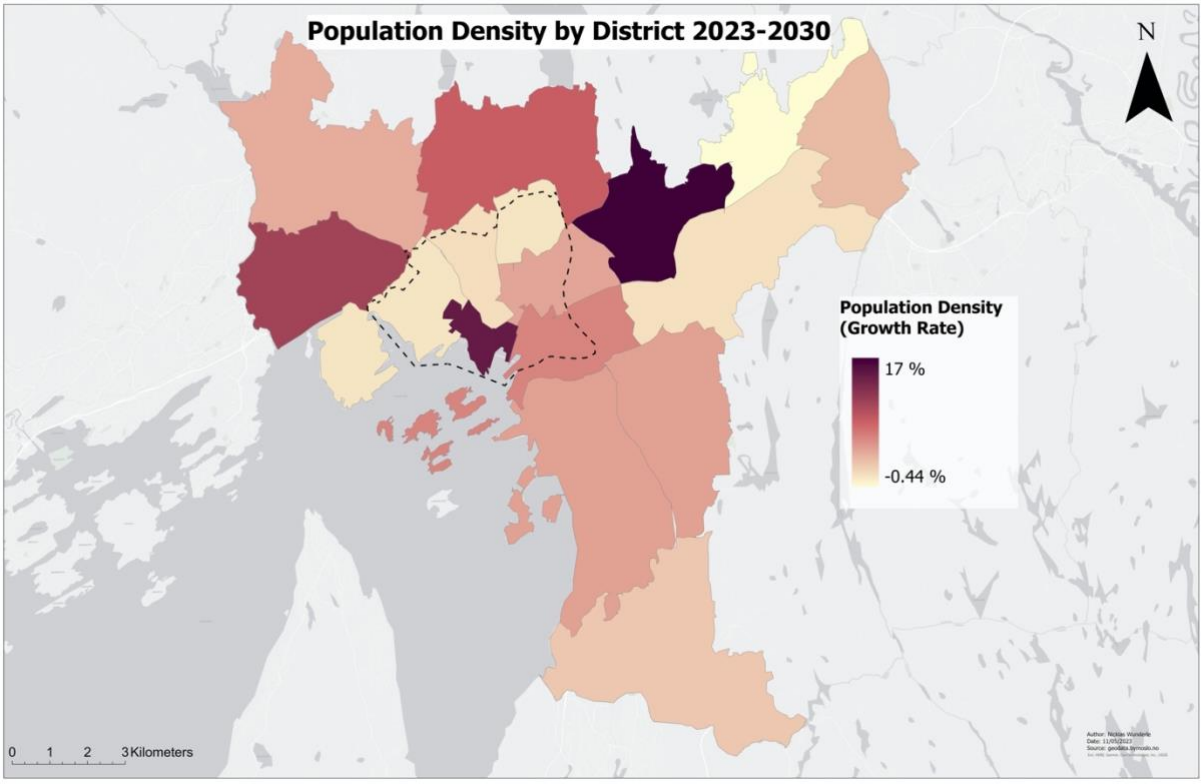

Figure 12: *Population Density (Growth Rate 2023-2030)*

In order to find out the socio-economic and cultural characteristics that are present in these dense districts a cluster analysis is conducted. The cluster analysis identifies six significant clusters, as identified by the "elbow criterion" (Appendix 2). Each subdistrict represents one of the six clusters, which is illustrated in Figure 13. The table below (Table 4) provides an overview of mean parameter values of the variables forming each cluster.

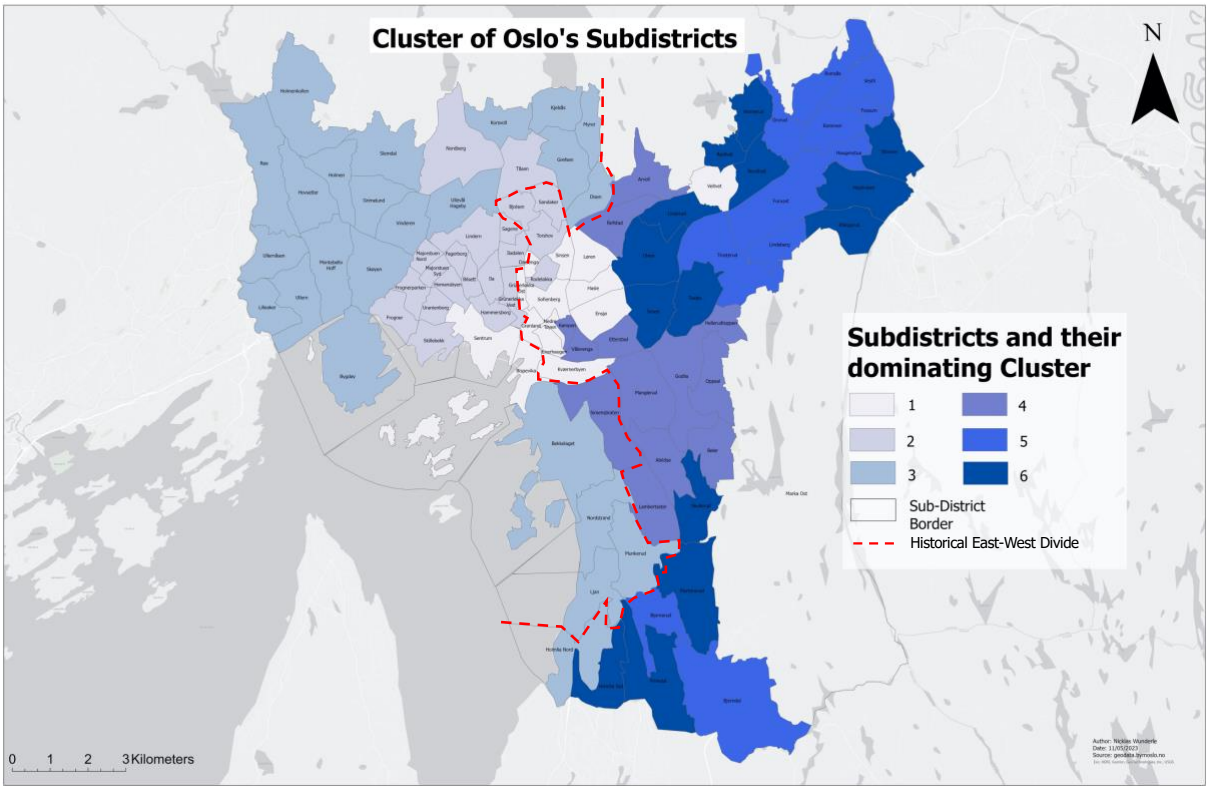

Figure 13*: Distribution of Clusters based on Socio-cultural and Economic Variables*

Table 4: Description of Clusters

	C1	C2	C3	C4	C5	C6
Population Density (inh./km2)	14.292	13.729	4.127	5.033	4.539	3.778
Country Background						
Norway	58%	71%	82%	74%	32%	51%
Western Countries (incl. Australia & New Zealand)	8%	9%	6%	4%	3%	4%
Eastern-european (EU)	5%	4%	3%	4%	6%	6%
Asia, Africa, Latin-America	29%	17%	9%	18%	59%	38%
Age Group						
Children (0-12 years)	10%	9%	16%	16%	16%	15%
Teenager (13-19 years)	4%	4%	9%	8%	10%	8%
Young Adults (20-29 years)	26%	27%	11%	11%	13%	13%
Middle-Aged (30-66 years)	55%	50%	49%	53%	50%	52%
67 plus years	5%	9%	16%	12%	11%	13%
Educational Level/ Degree						
School	36%	31%	29%	39%	55%	49%
University	49%	56%	49%	39%	21%	30%
Other	15%	14%	22%	22%	23%	22%
Average Income (NOK)	500.800	565.454	794.583	540.538	364.583	444.933
Low Income Households	9%	8%	3%	4%	8%	6%
No of Employed People	65%	64%	53%	54%	45%	50%

To start, Cluster 3 (C3) comprises 23 subdistricts which are mainly located in the outer western parts of the city as well as the southeastern shoreline along the fjord and therefore on the left side of the historical east-west divide. The inhabitants living in this cluster are the most affluent people with an average yearly income of 794.583 Norwegian Kroners (NOK). At the same time, the cluster has the largest share of Norwegians (82%), while those of migrant origin are

underrepresented. Furthermore, elderly people are represented with 16% which is the highest percentage compared to the other clusters. Cluster 2 (C2) comprises 19 subdistricts and has a similar share of Norwegian people at 71%, but a higher share of young people are represented. C2 has the second highest average income (565.454 NOK) and shows a high population density (13.729 inh./km^2). From a spatial perspective, the majority of those subdistricts is located in the inner-west of the city and on the left side of the historical divide. Staying within the central parts of Oslo, Cluster 1 (C1) comprises 14 subdistricts and has the highest population density. Moreover, a higher share of immigrants from *Asia, Africa, Latin-America* are represented here (29%) compared to the previous described clusters. This cluster shows a similar mean age pattern as C2 and has a high employment rate (65%) which seems reasonable since the central business district is among this cluster. The majority of the sub-districts of C1 are located on the right side of the historical divide. A little further east, adjacent to the inner parts of the city, Cluster 4 (C4) is represented, comprising 13 subdistricts. This cluster has a high proportion of middle-aged people (>50%), with the ratio of Norwegian natives (74%) and the Asia, Africa, Latin-America group (18%) distributed very similarly to C2. The two most eastern clusters are cluster 5 (C5) and 6 (C6). C5 comprises 14 sub-districts and has the second lowest population density. 59% of the inhabitants belong to the *Asia, Africa, Latin-America* group which represents the highest share among all cluster. At the same time C5 has the lowest mean income (364.583 NOK) while the educational attainment is also rather low compared to C1 to C4. 55% only have a high-school degree and no further educational degree. C6 includes 14 sub-districts and shows similar characteristics as C5. It has the lowest population density and the second lowest mean income (444.933NOK). Furthermore, a noticeable high share of inhabitants belong to the *Asia, Africa, Latin-America* group (38%). Compared to C1-C4 the educational attainment is significantly low as 49% of the inhabitants only have a high-school degree.
Overall, the distribution of the clusters and their characteristics is based on the mean values of the variables.

7.4 UBGS on Site-Level

During the ethnographic fieldwork, data was collected through observations, note taking and pictures. For the analysis of UBGS on site-level two parks have been chosen: Bjerkedalen Park in the Bjerke district as well as Tekleverksdammen/Hovin Dammen, the largest green area in the Hasle subdistrict. Both sites belong to one of Oslo's biggest development areas called Hovinbyen which, according to the city's strategic plan, will experience a lot of change during the next decade (for spatial reference see figure below). The observations were carried out in

May 2023 on a Wednesday and a Saturday. Throughout both days the weather was sunny with temperatures between 15 and 20 degrees. For the analysis a general set of questions has been a guiding instrument for the investigation of the place. This included:

- *how is the landscape designed and for whom?*
- *What qualities are valued by the park users*?
- *Is there a dominating function or rather a heterogenous set of functions*?
- *Does this meet the local needs?* and
- *is the area part of a bigger BGI-network or does it rather appear isolated/detached from the surrounding neighbourhood*

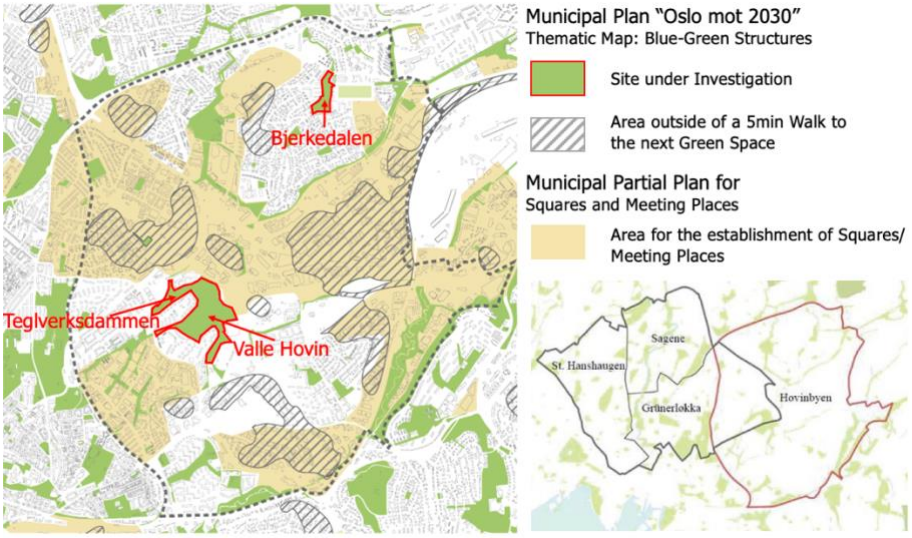

Figure 14: Location of the Study Area for Ethnographic Fieldwork (Planning and Building Agency (2017)

7.4.1 Bjerkedalen

The study of Bjerkedalen begins by looking at the overall context in which the park, redesigned in 2013, is embedded and how this is communicated to the public. Considering its geographic location, the social catchment area of the park is characterized by cluster 5 and 6 which historically can be assigned to the so called "*working class*" population of Oslo. The sign postings illustrated in Figure 15, indicate several important aspects. Image 1 introduces the park by presenting the historical context of the built-up area. Image 2 communicates the Hovinbyen development context of which Bjerkedalen is a part. Image 3 explains the park users how Bjerkedalen is integrated into a loop providing a variety of ecological and cultural attractions. The signposting can help to better understand and use the place. The explanations clarify the function of this specific part of the area and its connectedness to the surrounding environment.

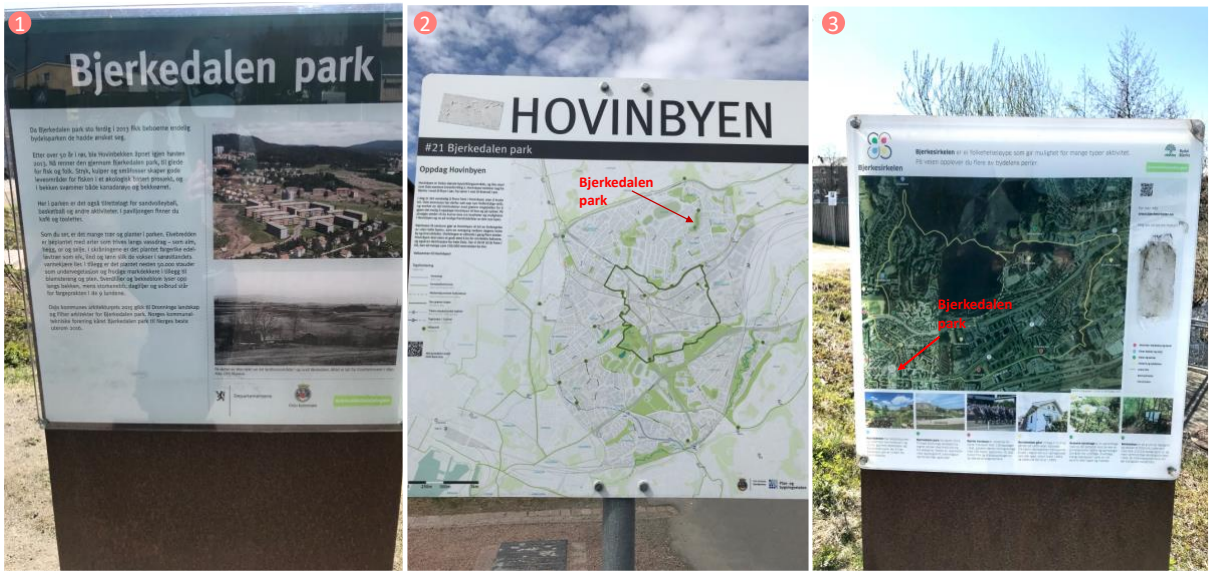

Figure 15: *Park Context and Signposting*

The results presented above indicate how the developers have put effort into communicating the cultural heritage as well as the overall context of the park and its surrounding development. From this point of view, Bjerkedalen seems to have been successfully plugged into the existing suburban fabric while it shows the recreational opportunities that the local residents can harness, even if they are not familiar with them.

Uses and Activities in Bjerkedalen

The next section will focus on the question of who is using the place, how is it used and for whom it is designed. It will present the services and functions that belong to the UBGS design. That is to identify potential provisioning, regulating and socio-cultural services through which Bjerkedalen may create value to its users and the neighborhood.

Overall, the area facilitates a variety of artificial and constructed features that can be used by the site-visitors. Figure 16 illustrates the different features. As many people did not want to be photographed, most of the spots appear unused in the pictures, even though they have been observed to be in use during a different time being there. This involves (1) a café/restaurant, (2,6) playfull elements such as a basketball/soccer court and a beach volleyball field, (3,5) a barbecue/fire place with benches and tables, (4) a large wooden seating area overlooking the whole stretch of Bjerkedalen, (7) a reopened duck pond with a small beach, as well as (8) a biodiverse stream running from top to bottom in the valley of the constructed blue-green space. All these blue, green, artificial and natural elements combined provide room for people to roam.

Figure 16*: Observations of Bjerkedalen Park – Uses and Activities*

The site was first observed between mid-day and late afternoon on a Wednesday. The park appeared to have a frequent exchange of people and almost all of the elements illustrated above were observed to be in use. The majority of park users have been found to be dog walkers, runners and elderly people from the local neighborhood using the paths leading through the blue-green area. Some of them were just passing through and some were doing one or two loops. The wooden seating (image 4) was used during lunch by 3 carpenters who were enjoying the sun and the first warm temperatures of the year during their break. Another day, a young visitor was using the same seating area as a skatepark obstacle and gave the benches a playful character (picture 4 in Figure 16). The second largest user group were single parents with their

babies or small children pushing their stroller. Three of them stopped occasionally to feet or just observe ducks and goose bathing in the water. In addition, two health related user groups could be observed. One referred to nurses using the park as a close-by recreational area to walk with their patients (both beyond their sixties) as the "calm corners" and the "nature-like features" of the park seem to have a positive effect on their attitudes and mental moods (a nurse, 08.05.2023). Similar to the young children, watching birds and squirrels filled them with great joy. The other health-related user group was a class of teenager with mental and physical disabilities. One of the caretakers stated that they visit this park on a weekly basis to get some fresh air with the students. They also use the area for educational purposes, such as learning about different plant species. On this particular day, though, the emphasis was on cleaning up the park's litter as part of the Waste-Week initiative. The last group of visitors belonged to a local elementary school. Children were mainly playing ball sports on the basketball court. Others were climbing in an old pine tree or played along the small watercourse and two kids were observed playing beach volleyball.

Experience, Valuation and Sense of the Place – Conversations with site-users

The final section of the Bjerkedalen analysis presents a synthesis of reflections and impressions of the atmosphere received through conversations with park users but also through simply observing and listening. The focus lays therefore on the cognitive dimensions which include subjective opinions to some degree.

The first impression to be noted is the cleanliness and high maintenance of the area. Trash bins are installed strategically close to areas where people are expected to produce the most trash. This includes a special bin for disposable grills which are very common to use among park visitors in Norway. In addition to the cleanliness, it felt like a very safe place to spend time. Although both entrances of the park are next to a traffic road, the green-blue elements and the topography of the area reduce noise, provide screen and protect children from getting too close to the road. This was also confirmed by a conversation with a parent who visits Bjerkedalen regularly:

"*The fact alone that I don't have to be worried that any second my children could be run over by traffic, enhances the value of this place and makes me more relaxed*. […] *I can easily meet friends at Paviljongen [the Restaurant/Pub] while our children can play and run around in the park.*" (A local mother, 20.05.2023)

In regard to social meeting places and interaction, the location and context of the restaurant/pub appears to play an important role for social events and interaction. This results from a conversation with a local site-user who lives in this area for 30 years.

"*…they* [the planners of Bjerkedalen] *could not have done it any better, … Paviljongen became a real local institution – well integrated*."

"*…this is a place where people have stories to tell, and where memories are created*."

(A local site-user, 08.05.203)

The owner appears to be rooted within the community and knows a lot about the people and the neighborhood, which according to the owner was also the reason he was given the job to run the restaurant. With his facility, he provides opportunity for social gatherings (private and public) in the form of art exhibitions, pub-quizzes, or small concerts. The place has therefore multiple functions depending on the time of the day and the season.

As another important element, two elderly site-users valued the water course in particular. In the words of one local, "*the natural features are like a realization of a childhood memory* of *the blue natural space* [he] *had experienced growing up on one of the small islands in the Oslofjord*." Cultural heritage, induced by water elements, native plants and trees that mimic the natural environments of Southeastern Norway's landscape enhance not only biodiversity and ecological well-being but also a feeling of belonging that make people connect with the area.

Nobody in the conversations said they would choose to visit a different park because they couldn't come up with a better option that had the same number of amenities and was also within walking distance. The only alternatives they were naming for outdoor recreation was the Marka territory for activities that require wider space such as long runs, cycling or hiking.

Overall, the park has a lot of different activities to offer, enhancing a diverse and socially inclusive appearance of the area. Multifunctionality has been found in a variety of features provided by the park. This involves social interaction through the design of constructed space, such as the pub, the ball court, the barbecue areas, the volleyball field. Furthermore, the incorporation of ecological design evokes a sense of nostalgia and belonging, fostering a deeper connection between individuals and the park.

7.4.2 Teglverks Park and Valle Hovin

The second site analysis presents the Valle Hovin area located in the south of the Hovinbyen circle in the Hasle subdistrict (see Figure 14). The first part of the analysis begins by looking

at the overall context in which the park area is embedded and how this is communicated to the public in the same was as for the previous case of Bjerkedalen. Considering its geographic location, the social catchment area of the park is mainly characterized by cluster 1, representing one of the densest populated areas of Oslo. Being the largest green space in the development area, the park is an important stopping point for *The Green Ring*, a hiking route that will connect parks and green spaces in the various districts in Hovinbyen. Teglverksparken belongs to a central and important park and stream opening project completed in 2015 in the heart of the developing core area of the sub-district Hasle. The municipality's own brickworks produced bricks for municipal buildings here for 100 years. In the 1960s, the polluted stream was piped to remove unpleasant smells and rubbish. Despite this significant historical backdrop, there was just one signposting in the entire area, at a fairly random location, mentioning the historical significance of this relic. What also seems to be missing is an overview map with a spatial reference to help park users find their way around, especially beyond the context of Teglverksparken. The signposting defines the area as a recreational area for walking, barbecuing, playing and sunbathing. However, it is not marked where those activities, e.g., barbecuing, or seating areas are facilitated. The lacking orientation may lead to the impression of a rather isolated place like an oasis surrounded by grey space and high rise buildings. Only by having access to online GPS services, site-visitors would be able to see that the park is connected to the large Valle Hovin green area through a path up the hill.

There is room for improvement regarding signposting to inform about the place, especially for user groups who are not familiar with the place and/or have no access to mobile GPS. Furthermore, to successfully embed the area into the existing suburban fabric cultural and historical context as it is provided in Bjerkedalen may be helpful to (1) shape place identity, (2) extent the recreational opportunity spectrum of the park, and (3) increase accessibility and connectivity.

Uses and Activities in Tegleverks Park and Valle Hovin

The next section will pick up on the question of who is using the place, how is it used and for whom it is designed. It will present the services and functions that belong to the UBGS design. That is to identify potential provisioning, regulating and socio-cultural services through which the site may create value to its users and the neighborhood. The site was observed between mid-day and late afternoon on a Wednesday. The park appeared to have a frequent exchange of people. The majority of park users have been found to be runners, dog walkers and single parents with their babies or small children pushing their stroller.

Figure 17: *Teglverksdammen - a) Blue Space design b) Meeting Places for Social Interaction*

The equipment and layout of Teklverks Park is illustrated in Figure 17 above. The area is dominated by a large pond (Teklverksdammen, image 1a-4a) providing predominantly aquatic fauna and flora. This serves as refuge for ducks, swans and smaller species enhancing ecological diversity between high rise building blocks. Several wooden piers were found along the shore of the pond, as well as a large section of wooden seating, providing an opportunity to sunbathe or take a short break. Unfortunately, it is prohibited to swim in the water, because of a lacking water quality. The steppingstones in picture 3a connect both sides of the pond and at

the same time allow users to connect even more with the biotope, gaining completely new insights into the water landscape and observing animals. Image 1b-3b illustrate the two barbecue areas. However, they have not been seen at use, even on a weekend with nice weather. Particularly, the spot in 1b does not seem very appealing. This was also confirmed by a conversation with people who were out for a walk, saying they never really see anyone using this spot for a barbecue, but rather "shady looking" young people when it gets dark sometimes use this amenity (local dog walker, 13.05.2023).

Experience, Valuation and Sense of the Place

The final section of the site-analysis presents a synthesis of reflections and impressions of the atmosphere received through conversations with park users but also through simply observing and listening. The focus lays therefore on the cognitive dimensions which include subjective opinions to some degree. It was striking for this site that the majority of potential respondents stated that they were simply passing through or didn't have time to respond, while three individuals stated that they don't know English and hence declined to participate in a conversation.

The first impression that stands out is the pollution and rather low maintenance in this area. This was accompanied by an unpleasant smell, which was most likely induced by the unclean water of the Teglverks basin. As Figure 18 already indicates, large parts of both, Teglverks Park and the adjacent Valle Hovin Park were characterized by a considerable amount of degraded space. Especially for the case of Teglverksdammen it appears unfortunate since this is a rather newly developed blue space and is mainly caused by a lack of maintenance, missing trash bins and vandalism (image 1a-3a). Particularly image 2a shows a sad impression of a swan breeding between litter of park-users. Valle Hovin Park (Fig. 1b-5b) gave a similar impression. Generally, the observation showed that many people are moving through the area. With the exception of picture 3b, it appeared to be a fast-paced and restless environment. One cause for this may reside in the park's scarce equipment, which leaves a monofunctional image of the location behind, but also the missing elements maintaining cultural heritage to shape place identity and to foster people's connection to the area. The ladder was shared by an elderly dog walker looking at Teglverksdammen, "*I grew up in this area. But I sometimes don't even recognize the place anymore. I guess change and transformation is normal (and also necessary) these days. But I miss the effort here, to integrate parts of the history and the old identity of the place*." (Site-user, 13.05.2023)

Figure 18: *Vandalism and Degraded Space - a) Teglverksdammen b) Valle Hovin Park*

8. Discussion

In the following section, a discussion of the design, management, and integration of blue green space (BGS) and how this can enhance high quality and inclusive urban life is carried out. The findings in the previous sections provide an overview of both city-wide BGS planning, including procedural, distributional and socio-cultural aspects, and a more detailed insight into two specific cases in Oslo, where endogenous and exogenous factors of the current state of

blue green spaces were examined. This also means identifying possible weak points/key areas where even an inherently green city like Oslo does not currently live up to the qualities it strives for. The case study is discussed in further depth to understand the role of the blue green domain in the context of densification, ecosystem services and environmental justice.

8.1 Abundance of blue green space (BGS) – Rough Diamonds in the Making

To begin, the distributional aspect of justice is used as a starting point to tackle the inherent green status that Oslo achieves. From the city-wide analysis, it becomes evident that indicators such as proximity and accessibility to park areas is well distributed across the city as 98% of the urban population lives within a 300-meter walkshed to the next green space with a minimum of 1km^2. However, this number must be treated carefully, since it does not consider any quality aspects of the specific space. In addition, a deeper examination at the data underlying Figure 10 in the appendix indicates that there are still some significant discrepancies between the administrative areas' per capita BGS and in terms of the historical east-west divide. Parts of Grünerløkka and Gamle Oslo (inner east), for example, have a very low per capita value for BGS (11 m^2). Particularly when comparing this number to sections in the inner west (Frogner, St. Hanshaugen, Sentrum; 41m^2) or the outer west districts (Ullern, Vestre Aker, Nordre Aker) with a mean value of 56m^2/inhabitant, the low magnitude becomes more pressing. The cluster also shows that this trend is proportionally associated with financial wealth as the mean income in the western part ranges from 565.454 NOK to 794.583 NOK, whereas the majority of Grünerløkka and Gamle Oslo has a mean income of 500.800 to 540.538 NOK. Moreover, the majority of the inner east belongs to the densest areas of the city with an expected further increase in the next years, as the cluster analysis reveals. This is in line with the key planning agenda illustrated in Appendix 3, which defines the most ambitious goals for future growth in the housing development to be concentrated to the inner and outer east areas. Albeit the city government is planning to preserve the existing green areas (see section 7.2), the ongoing development further risks decreasing the per capita BGS. This may ultimately result in an enormous pressure on the structure of local recreation areas and leads to the conclusion that the current BGS must be set up in a very effective manner to be able to accommodate and ultimately serve a diverse set of inhabitants.

In addition to these dynamics, the distribution of income trends across the city is an interesting phenomenon to observe. Especially when looking at the inner and outer west districts of the city, the continuous distribution of affluent households is striking. Along with the concentration of financial wealth goes the high percentage of Norwegian natives that the inner and outer west

share together with the outer south neighbourhoods along the fjord. Taking both variables together it becomes evident that the districts with the best access to the recreation type “coastal zone with contiguous watercourses” (i.e., the fjord landscape) are predominantly a combination of wealth and Norwegian natives, with exception of the three sub-districts Sentrum and Bispevika belonging to cluster 1. In this regard, the fact that Oslo is to a large extent surrounded by the preserved greenbelt “Marka” cannot be left out. Geographically, the western districts from clusters 2 and 3 are thus in a very privileged position as people from this area can choose from a wide range of recreational opportunities north and south from their neighbourhood. In general, the Marka forests provide a relatively large close-by peri-urban recreational space for Oslo. Nevertheless, despite the public accessibility of the "Marka" forests, which is persistently promoted by the city government, it may be argued that they are still located at a considerable distance from several sub-districts, potentially posing a challenge for certain citizens to reach them easily. This may depend on several rationales. One understanding from the conversation with a park-user confirms that activities and the mobility of individuals can vary a lot, even within the same household.

“… *Myself, I use the Marka quite frequently for cycling, running or skiing in the winter*…”

“… *After a surgery three years ago, my wife is no longer good at walking. But she still wants go outside and stay active. So, we come here on a regular basis because it’s so close to where we live … and it’s easier to walk for her here than in the hilly Marka terrain*.” (local site-user at Bjerkedalen, 08.05.2023)

The quotes are in line with the studies of Gundersen, Tangeland and Kaltenborn (2015) as well as Gurholt and Broch (2019) concluding that distance may act as an obstacle for vulnerable segments of society, such as children and individuals with limited mobility. Translating these arguments into the context of the SDGs (section 2.1.), the example indicates that it would be negligent to rely only on the mere existence of the abundance of peri-urban recreation belt surrounding the city. Following the ambition of making human settlements inclusive, safe, resilient, and sustainable (SDG 11) a city government needs to distinguish between intra-urban and peri-urban blue-green space and that one component cannot simply compensate for the other (Venter *et al.*, 2023).

The line of argumentation above, opens room for a debate about quantity versus quality of urban blue-green space. A basic premise of this chapter is that the existence and quantity of blue-green space within and around a city is only as valuable as our capacity to utilize it and thereby derive benefits for the urban life. The question then is, how to translate these blue-

green spaces (the rough diamonds) into ecosystem services that include everyone (i.e., minorities, vulnerable groups etc.) in the city?

8.2 From Properties and Potentials To Services and Beneficiaries

Picking up on Bastian‘s et al. (2013) EPPS-framework from the literature review, the properties, i.e. the blue green structures, are discussed in relation to the densification and population dynamics that the city is facing. The physical environment was screened for potential land uses for recreation in order to identify what types of BGS is available across the city. Embedded in facts and data through cluster analyses and document review, this forms the starting point for an investigation of human driven value categories, i.e., the services and user beneficiaries that may possibly derive for the urban domain and its stakeholders.

From the previous discussion it may be argued that merely the quantity of and physical distance to blue-green structures is not sufficient for an inclusive planning approach to UBGS. The findings regarding quantity and distribution of BGS steers the debate towards a more qualitative perspective on recreational space in the city. In this regard, it seems that the municipality of Oslo is trying to compensate densification by implementing planning tools such as the BGF (presented in section 7.2). However, this mainly deals with the mitigation of climate risks such as heat or stormwater centred around climate resilience and less with cultural ecosystem services. The socio-cultural dimension is mostly mentioned in guiding papers and is presented as planning philosophies and guidelines, but not with concrete actions or regulations leaving room for interpretation by planning agencies, private developers and firms. This can be compared to the approach of the SDG’s which provide a broad framework on solving social challenges. The SDGs are well known and applied by various organizations in their strategies, however, often used without actually providing a clear set of specific targets to achieve the SDGs, respectively. The city of Oslo is taking a similar approach, by considering the broad goals in their planning and decision-making. On their website the city explicitly states that they “broadly” work with all 17 SDGs (Oslo, n.d. - b), without actually stating **how** to achieve them. Environmental challenges are considerably easier to quantify than social challenges as evidenced by the existence of the EU (environmental) Taxonomy (on a macro level) and the presence of the BGF (on a micro level) previously mentioned. Given that there is no widely accepted definition for “social” sustainability, it is not unexpected that Oslo lacks precise benchmarks for meeting socioeconomic and cultural goals. One remedy could be the

extension of the EU[1] (environmental) Taxonomy towards a Social Taxonomy, providing a clear definition on which activities constitute as "socially" sustainable. Target 3 "Inclusive and Sustainable Communities and Societies" of the proposed Social Taxonomy with the sub objective "Promoting community-driven development with decision-making de-centralized" (p. 34 of the PSF Report, 2022) is particularly relevant in this context. While the main goal of the EU Taxonomy is to redirect capital flows towards sustainable activities, it could still be used as a foundation for cities like Oslo (if implemented) when attempting to quantify concrete policies in this regard.

Furthermore, the issue of broad goals is also reflected in the findings of Oslo's strategy to involve citizens in the development of public space. The approach appears to be rather conventional, facilitating public input in a formal way through hearings and informational events. An exception is the survey "child-friendly city" that the city council has commissioned for accounting public space design (see section 7.2). The fact that children use their neighborhoods to meet and do not rely on public transportation or other forms to get to a more attractive location clearly shows the importance of the locality and walkability of a place. In other terms, a child-friendly blue-green meeting place on Bygdøy (the peninsula to the west) would not really increase the quality of life for a child living in the Ulven or Trosterud neighborhoods to the east, far from walkable accessibility and a familiar environment where the child knows every rock and corner.

It is therefore argued in the further course that the local context of an urban landscape such as a BGS must be focused on. The two examples of Bjerkedalen Park and Valle Hovin/Teglverksdammen are presented in more detail in section 7.4. These are two urban blue-green plots with a high demand as they are located in an area with ambitious goals for future residential development and change. Regarding the present scope of this thesis, the focus lies hereby on the socio-cultural dimension of ecosystem services. A comparison of the field studies can be useful to comprehend and show what it takes to change an area from a basic BGS into an ecosystem that delivers services to its surroundings.

One of the first insights that can be drawn from the two field studies is that quality can vary greatly between such blue-green spaces and more importantly even within the same park. Based on the ethnographic study and the conversations with site-users, it can be argued that Bjerkedalen Park is a best practice case of inclusive park design for the local community.

[1] The EU Taxonomy is implemented in Norwegian Law

Indicators of success help to understand who will use the park, what the physical environment provides - including strengths and weaknesses (natural potential) -, and what values are implicated as a result, both historically and socially. The example clearly shows that the design of public space does not necessarily require extravagant and fancy design of individual park elements to satisfy the beneficiaries. For instance, despite the park's lack of a playground, numerous families and a nearby school frequently use it. The simple design of wooden seating serves as a place for people to rest and at the same time it is interpreted by a child as a skatepark obstacle. By using ecological design features, biodiversity can thrive while creating nostalgic memories or a chance to watch birds. In addition, the ball court replaces a playground, enabling children to come up with their own ideas for how to use the space, attracting a wider variety of users and activities (like soccer, basketball, rope skipping, play tag, etc.) and encouraging social interaction. Such flexibility/multifunctionality of space as provided in the Bjerkedalen Park does not only seem to make sense under the aspects just mentioned but also in regard to the potential increase in population density as described in section 7.3. An increasing population means that more people will use the green space, suggesting that green spaces must provide this flexibility to adjust for an increasing demand. This also implies that spaces, which are open and give people flexibility to use them according to their needs are important as these spaces can adjust for changing needs. For instance, a playground with predetermined uses (swing, slide, seesaw) has a rather limited capacity of people which it can accommodate. The amenities at Bjerkedalen Park appear to be a good fit for this prerequisite, with the argument that additional people could even fertilize the functions of the park's existing state. For example, the ballcourt at Bjerkedalen not only lets children use their own creativity but also becomes increasingly interesting with an increase in population density. The more people who use this space, the higher is the potential it brings as, e.g. teams can be formed for a certain ball game. Additionally, in the light of the restaurant at Bjerkedalen, also such amnenities “thrive” with an increasing usage as the more people use the café/bar, the better is the atmosphere it can bring to the park, generating a place of socializing and well-being. The scenario as described in these examples matches the idea of a blue-green domain inspired by Hajer and Reijndorp (2001) in section 2.3. It illustrates how flexible public space design may also induce multifunctionality, being operationalized to prepare a park for future challenges. Referring to the literature (section 5.4) limitation of such assessments is the difficulty in quantifying and valuing the multiple benefits provided by green spaces. These can vary depending on the context and the stakeholders involved as illustrated by Hansen and Pauleit (2014). However, as it was already noted by Haaland and Konijnendijk van den Bosch (2015) multifunctionality

alone is not sufficient to create an inclusive ecosystem thorugh a BGS. Aspects of cultural heritage and historical context (like native fauna and flora or signposting in Bjerkedalen) may shape the identity of a certain plot, which can be critical for making people bond with a certain place. This is also in line with Sim and Gehl's (2019) perspective represented in section 5.5.

Despite the very positive impressions described above, the findings of Valle Hovin and Teglverksdammen show that such positive outcomes in relation to BGI design should not be taken for granted. Although the part of Teglverksdammen has been redeveloped in 2015 in the same context as Bjerkedalen in 2013 (i.e., the re-opening of the Hovinbekken stream) the outcome can not be considered as qualitative equivalent. The Valle-Hovin, which accounts for the majority of the overall park land under consideration, was not even included in the restoration, and it does not appear that this will change in the future. As described in section 7.4.2. the area clearly represents the impression of a degraded and to some degree also lost space. This is unfortunate, as the local conditions represent similar potentials as in Bjerkedalen, which includes several water courses, ample open spaces, biodiversity, and ecological design elements. Furthermore, historical context is given by the former industrial landscape on whose area the BGS was developed. However, all these components do not seem to have been put together successfully to form a complete picture, which is particularly evident through the conversation with site-users and own observations (see section 7.3.). It is therefore argued that this case is an example of how existing potentials of the physical environment alone cannot automatically transform a blue-green space into a functioning ecosystem. Reason to believe is, for example, the littering of teglverksdammen that may represent a negative feedback loop. It is suggested that if users felt a stronger connection to the place, they would behave more respectfully. Expanding on the argument of possible feedback loops, an increasing amount of litter can be the result of an increased use of the space as it is suggested by Salvia *et al.* (2022). With the forthcoming housing development expected to take place in the coming years, an additional challenge arises. As the population increases, the diversity of demands for a specific location rises as well. This challenge becomes particularly crucial in the case of Valle Hovin. The available planning documents indicate high concentration of development in this area which will result in a significant influx of people, leading to a increased demand for flexible and multifunctional space. This will also be accompanied by possible trade-offs, planners and decision makers will have to face. Nevertheless, it is argued that there is hope for Valle-Hovin. The park area is large which provides a lot of potential for different design elements to integrate.

8.2 A Critical View On The Scientific Value Of The Case of Oslo

The case study of Oslo offers valuable insights into the question of how blue-green urban areas can be utilized as strategic assets to maintain socially livable urban landscapes, both in the present and the future. Oslo, known for its ample green spaces, egalitarian government, and wealth, initially appears as a city that is well-positioned in terms of becoming even greener in a spatial sense and promoting livability for all residents. However, a closer examination reveals that Oslo is not without its challenges and divides. While the city has good intentions and "the right mindset" regarding its green initiatives, the case study highlights the potential pitfalls and complexities that arise at the individual site-level. Although overarching road maps and guiding documents acknowledge the importance of green space within the urban landscape, the case study underscores the significance of design considerations in achieving successful integration.

The scientific value of the Oslo case lies in its identification of key factors that contribute to the success or failure of blue-green areas. It emphasizes the importance of recognizing the socio-cultural dimension and the hidden values associated with urban landscapes. Understanding the diverse socio-cultural backgrounds and their interpretations of the landscape is crucial in addressing potential trade-offs between user groups. To address these challenges, the case study suggests a solution-oriented approach that incorporates simplicity, flexibility, and multifunctionality in design. By adopting a people-centered approach and implementing co-creative measures, Oslo can better navigate the complexities of diverse user needs and expectations. This is particularly important for citizens living in high-rise apartments to the east, who may have limited access to private green spaces and are relatively more reliant on public blue-green areas.

Finally, the role of the nearby Marka should be considered in the context of the city as well. This is particularly important if the findings of this study are to be applied to other cities, but also to the urban area itself. The abundance of extensive recreational areas directly outside the city can have a significant influence on the general perception of the availability of local recreational opportunities. It is therefore important for planners and decision-makers not to be deceived by this image and to equally preserve the quality of inner-city green spaces. This becomes especially important in the context of possible cultural barriers to make use of a certain area as identified by Figari et al. (2009). Accordingly, such barriers may derive from different interpretations of the landscape itself and come back to an individual background, everyday life and outdoor life.

Overall, the case study of Oslo offers valuable scientific insights into leveraging blue-green urban areas as strategic assets for social livability and well-being. It highlights the importance

of design considerations, understanding socio-cultural backgrounds, and adopting a people-centered approach to address the challenges to support a successful integration of blue-green spaces in urban landscapes.

9. Conclusion & Critical Reflection

9.1 Conclusion

Against the backdrop of urban change characterised by migration, population growth, and urban densification, the present thesis shed light on the importance of future proof management of blue green space in cities. The focus was placed on the assumption that the mere existence of such prospective recreational plots for citizens can only fully unfold as an asset, when the potential of these properties is recognized and translated into the respective local context. It was investigated how urban blue green spaces can be developed to meet the social needs of their local community, even under continuously changing conditions. The following section presents a summary and concluding remarks of the analysis and the discussion, with the intention of answering the main research question of *how can blue-green urban areas be used as a strategic asset to keep urban landscapes socially livable today and in the future?*

To answer the first sub question, a general framework was established through an extensive literature review, which formed the basis for the analysis of a specific case study. The present thesis suggests a multi-layered consideration of the concept of ecosystem services, finding that both tangible and intangible components are important elements of an ecosystem. At the level of value transmission, a people-centered design approach in terms of co-creative processes stresses the socio-cultural dimension. There is a need to manage the various scales, which involves the physical, political, perceived, and social domains. Hence, conceptions of socio-environmental justice must be integrated if egalitarian planning and decision-making are to be improved. In inclusive and multi-scale governance, this integration may act as a guiding concept for planners and decision-makers. Essentially, this is the situation where bottom-up and community-driven place-making initiatives are important to consider. In turn, synergies between ecosystems and beneficiaries as well as possible trade-offs may be recognized. With this starting position, multifunctionality should be addressed as the third constituent in a multiscalar framework for BGI planning and design. The study finds this particularly important considering that cities are in a constant state of change, necessitating the ability of BGS to constantly adapt to that change without losing its essential characteristics.

In response to the second sub-question, it is concluded that socio-economic and especially cultural characteristics within a city are imperative to consider. This is particularly important at the individual site level to ensure that potential conflicts and synergies between different ecosystem services and beneficiaries are captured and understood, which will minimize trade-offs. The social fabric of a city can vary greatly across individual districts, as can be seen in the example of Oslo. An analysis of social characteristics on a city-wide scale facilitates a first overview on the macro trends across the different districts. However, the two site-analysis showed that ethnographic research gives more detailed knowledge about people's diverse backgrounds and needs on a micro scale (on-site). Connecting the local user profile with the cultural heritage of a particular area can help shape the identity of the place, but also avoid possible social and cultural barriers to outdoor recreation. This in turn may allow for an understanding of how to develop a stable, lasting, and good connection between a person and a place.

The ladder touches upon the third sub-question. It comes back to the initial wonders of this report. To turn a simple blue-green plot into a place that is accepted and used by local residents, several steps can be taken at both, the city-wide and individual site levels. To enhance the social livability, i.e., the quality of living in society, it is crucial to take into account people's preferences for specific types of environments, ensuring easy access to such spaces by foot, and considering the overall socioeconomic and cultural status of the entire population. To priorities certain areas on a city-wide scale, it is suggested to analyze concentration of future housing development in combination with population trends and density. The development of UBGS should not solely rely on broad cultural and economic factors at a city-wide level. Instead, it is argued that the local context holds significant importance, encompassing cultural heritage and the overall conditions of the surrounding neighborhood and its residents. Therefore, factors such as age, gender, physical and mental health, as well as daily habits influenced by these factors play a critical role in individual demand for blue green spaces. To gain a better understanding of these characteristics, future research should focus more on studying practices and preferences of both minority and majority groups, as well as cultural distinctions.

9.2 Critical Reflection & Implications for Further Research

To end this report off, a comprehensive reflection is presented. It is crucial to recognize that this research approaches urban green space design from a human-centered perspective. This

may create the appearance that human interests take precedence over environmental factors such as biodiversity or climate resilience measures. However, this is not the intention of this investigation, and is only done to narrow down the scope of the research.

This report focuses on a Norwegian city, with Norwegian policies and development plans. The author of this report is an international student from outside of Norway, who only has basic Norwegian language skills and is not fully familiar with the Norwegian system of politics and planning in advance. Policies and plans, as well as green space information, have been translated before the analysis. The language can therefore be considered a barrier and a limitation for the report and the project. On the other hand, this may be considered as an opportunity. It allows researchers from the outside to study and scrutinize the current situation in Norway maybe more objectively and with different perspectives. Another limitation of the report is the timeframe. The project was executed within three months (from March until the end of May). The short amount of time, for such an excessive project, calls for critiques in itself. Moreover, the observations and perceptions of the two sites can be critisized, which comes down to a limitation in resources. It must be taken into account that the study was conducted by a single person. This means that only small samples could be collected, which may affect the representativeness of the overall picture.

The role of the Marka territory around the city, which attracts a large number of people regardless of the season, was only marginally addressed. This choice was made because of the study’s primary focus on urban green spaces within walking distance of the city's residents. More research might now be conducted to build a qualitative user profile for the Marka. It would be interesting to investigate what groups of people use the UBGS, from which part of the city they come from, why they go to this place (and e.g. do not choose a place closer to home) as well as how often they use it and what the place means and constitutes to them. The results could then be placed in the context of the inner-city findings. This approach might enhance the knowledge of how and to what extent the attractiveness of urban green spaces has to be improved in order to better meet people's needs but also to what extent urban green spaces are even capable of doing so in comparison to recreational places outside of the city. Therefore, going forward, it is proposed that further research should be done by conducting a survey, which is targeted to reflect the opinion of the vast majority of the citizens of Oslo. This results in a larger sample size and a holistic picture of the needs and values of citizens. However, as

this requires a lot of time and effort, the city itself should perform it since they have the most resources available to carry out a thorough study.

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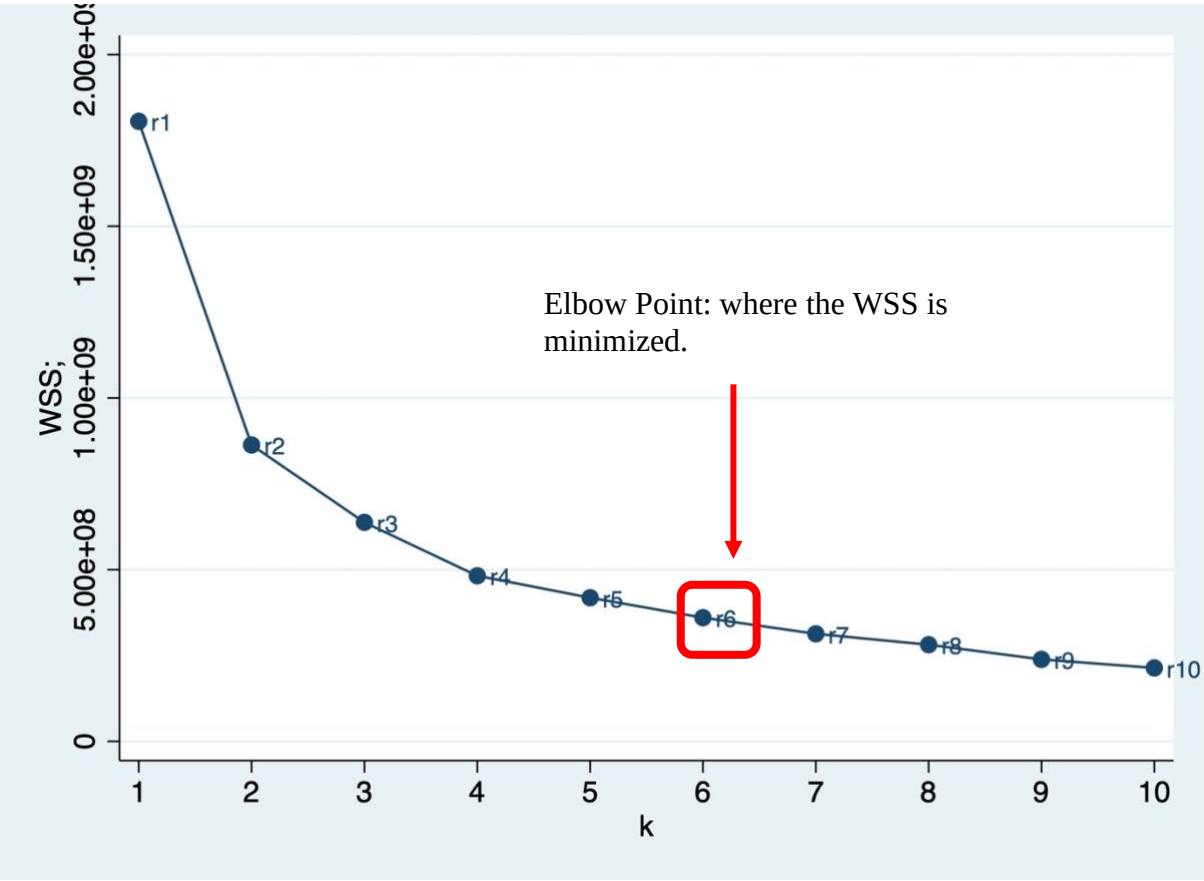
Appendices

Appendix 1. Blue-Green Factor Calculation Template by Ardila, P., De Caprona, M. (2014).

BLÅGRØNN FAKTOR (BGF) Samarbeidsprosjekt mellom Bærum og Oslo kommune som del av programmet Framtidens byer.
Utarbeidet for Bærum og Oslo kommune av Dronninga landskap, COWI og CF Møller. Revidert Oslo kommune 28.01.2014.

Verdi	Symbol	Faktor	Beskrivelse	Areal m²	BGF
			TOMTENS AREAL (INKLUDERT BEBYGD AREAL). FYLL UT TOMTENS AREAL:	0	
		1. BLÅGRØNNE FLATER			
1		ÅPENT PERMANENT VANNSPEIL SOM FORDRØYER REGNVANN	Permanente vannspeil som tilføres regnvann fra tomten, uansett om dette er en kanal med betongbunn, bekk med grønne bredder eller annet type vannspeil. Kun selve vannspeilet regnes.	0	0
0,3		DELVIS PERMEABLE FLATER SOM GRUS, SINGEL OG GRESSARMERT DEKKE	Harde overflater med permeabilitet, som sørger for infiltrasjon. For eksempel gressarmering av betong, grus eller singel. Gjelder ikke flater over underliggende harde dekker dersom jorddybden er mindre enn 80 cm.	0	0
0,2		IMPERMEABLE OVERFLATER MED AVRENNING TIL VEGETASJONSAREALER ELLER ÅPENT FORDRØYNINGSMAGASIN	F.eks. betong, asfalt, takflater og belegningsstein. Beregnes for areal tilsvarende størrelsen på vegetasjonsflaten som mottar vannet. Fordrøyningsmagasin må ha kapasitet iht. kommunale krav til påslipp til offentlig avløpsnett.	0	0
0,1		IMPERMEABLE OVERFLATER MED AVRENNING TIL LOKALT OVERVANNSANLEGG UNDER TERRENG	F.eks. betong, asfalt, takflater med avrenning som ledes til anlegg under terreng for fordrøyning og rensing av overvannet. Dette gjelder også underjordiske løsninger med kombinert vanning av trær. Hele arealet teller forutsatt at fordrøyningsmagasinet er iht. kommunale krav til påslipp til offentlig avløpsnett.	0	0
1		OVERFLATER MED VEGETASJON FORBUNDET MED JORD ELLER NATURLIG FJELL I DAGEN	Vegetasjon som vokser i jord og har kontakt med jorden under. Gunstig for utvikling av flora og fauna og for vann som kan trekke ned til grunnvannet. Punktet gjelder også for naturlige fjellknauser og svaberg.	0	0
0,8		OVERFLATE MED VEGETASJON, IKKE FORBUNDET MED JORD >80 cm	Vegetasjon som vokser i jord på min. 80 cm dybde, men som ikke har kontakt med jorden/grunnen under; f.eks. oppå et garasjeanlegg eller tak. Dybden er stor nok til at større trær kan vokse.	0	0
0,6		OVERFLATE MED VEGETASJON, IKKE FORBUNDET MED JORD 40-80 cm	Som over, men med 40-80 cm jord for at hekker, store busker og små og mellomstore trær kan vokse.	0	0
0,4		OVERFLATE MED VEGETASJON, IKKE FORBUNDET MED JORD 20-40 cm	Som over, men med 20-40 cm jord for mulig vekst av stauder og små busker.	0	0
0,2		OVERFLATE MED VEGETASJON, IKKE FORBUNDET MED JORD 3-20 cm	Som over, men med 3-20 cm jord, for mulig vekst av sedum, gress, og markdekkere.	0	0
		2. BLÅ OG GRØNNE TILLEGGSKVALITETER. GIR EKSTRAPOENG. DET SAMME AREALET KAN DERFOR TELLES FLERE GANGER.			
		BLÅ TILLEGGSKVALITETER			
0,3		NATURLIGE BREDDER TIL VANNSPEIL	Åpent vannspeil med naturlige bredder telles med i denne kategorien dersom det er tilgjengelig for flora/fauna i bakkenivå og har naturlig bunnsubstrat og kantsone. F.eks: bekk, kanal og dam med grønne bredder. Arealet som regnes er bredden til vannspeilet.	0	0
0,3		REGNBED ELLER TILSVARENDE	Vegetasjonsareal som fungerer som regnbed eller tilsvarende beplantet infiltrasjonsløsning som samler opp, fordrøyer og infiltrerer regnvann ned i jorden/grunnen. Dette gjelder ikke permanente vannspeil og fordrøyningsbasseng som telles i blå flater.	0	0
		GRØNNE TILLEGGSKVALITETER, PUNKTENE UNDER (TRÆR) SKAL FYLLES INN SOM STYKK		**STK**	
1		EKSISTERENDE STORE TRÆR >10 m	Eksisterende store trær; over 10 m. Faktor: 25 m²/tre.	0	0
0,8		EKSISTERENDE TRÆR SOM FORVENTES BLI >10 m	Eksisterende trær som blir over 10 meter høye. Skogstrær, edelløvtrær og parktrær, som f.eks; alm, ask, bjørk, eik, lind, lønn, kastanje, furu og mange flere. Det forventes at treet skal ha nok jord til å vokse (min 100 cm). Faktor: 25 m²/tre (x 0,8).	0	0
0,6		EKSISTERENDE TRÆR SOM BLIR SMÅ/MELLOMSTORE (5-10 m)	Eksisterende trær som er 5-10 meter høye. Prydtrær og frukttrær, f.eks; apal, kirsebær, magnolia, pæretre, robinia og mange flere. Gjelder også formklipte trær. Det forventes at treet skal ha nok jord til å vokse (min 60 cm). Faktor: 16 m²/tre (x 0,6).	0	0
0,7		NYPLANTEDE TRÆR SOM SOM FORVENTES BLI >10 m	Trær som blir over 10 meter høye. Art: Se to spalter over. Det forventes at treet skal ha nok jord til å vokse (min 100 cm). Faktor: 25 m²/tre (x 0,7).	0	0
0,5		NYPLANTEDE TRÆR SOM FORVENTES BLI SMÅ/MELLOMSTORE (5-10 m)	Trær som blir 5-10 meter høye. Art: Se to spalter over. Det forventes at treet skal ha nok jord til å vokse (min 60 cm). Faktor: 16 m²/tre (x 0,5).	0	0
		PUNKTENE UNDER SKAL FYLLES INN SOM m²		**Areal m²**	
0,6		STEDEGEN VEGETASJON	Etablering eller verning av overflater med stort innslag av verdifulle plantearter som inngår i det lokale, historiske natur- og kulturlandskapet.	0	0
0,4		HEKKER, BUSKER OG FLERSTAMMEDE TRÆR	Hekker, busker og flerstammete trær beregnes maksimalt for dryppsonen til busken, kronens utstrekning.	0	0
0,4		GRØNNE VEGGER	For klatreplanter og andre grønne vegger regnes veggarealet som forventes å være dekket i løpet av 5 år (maks 10 m i høyde for klatreplanter).	0	0
0,3		STAUDER OG BUNNDEKKERE	Gjelder ikke plen eller sedum.	0	0
0,1		SAMMENHENGENDE GRØNTAREALER OVER 75 m²	Sammenhengende grøntareal som er større enn 75 m², som for eksempel store gressplener, plantefelt eller annet.	0	0
					0
		PUNKTENE UNDER SKAL FYLLES INN MED TALLET 0,05		**0,05**	
0,05		KOBLING TIL EKSISTERENDE BLÅGRØNN STRUKTUR	Dersom blå og/eller grønne elementer i området kobles til eksisterende blågrønn struktur utenfor området. Sammenhengen skal være tydelig. For eksempel en bekkeåpning, en kobling til eksisterende kanal eller vannspeil, flomvei, forlengelsen av en allé eller et skogholt, sammenslåing av flere gårdsrom med fri ferdsel mellom dem. Dette gir et generelt tillegg på 0,05 i BGF.	0	0
		TOTAL BLÅGRØNN FAKTOR (BGF)			###

Appendix 2. Calculation of the Elbow Criteria to determine the Amount of Clusters to be chosen



Appendix 3. Main Development Areas within the Municipal Plan 2018-2030